TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS INFORMATION AND SUPPLEMENTAL OPERATING, MAINTENANCE AND REPAIR PARTS INSTRUCTIONS)

FOR

TRUCK, FORK LIFT, GASOLINE ENGINE DRIVEN, PNEUMATIC RUBBER TIRES, 6,000 LB CAPACITY, 180 INCH LIFT HEIGHT ARMY MODEL MHE 233, ALLIS-CHALMERS MODEL ACP-60-PS NSN 3930-01-052-5050

HEADQUARTERS, DEPARTMENT OF THE ARMY

This copy is a reprint which includes current pages from Change 1.

OCTOBER 1981

WARNING

It is normal for the battery to generate hydrogen gas which is explosive when mixed with air. Never expose the battery to an open flame or to an electric spark. Do not remove or install battery cables while vent plugs are removed. Battery fluid is a sulfuric acid solution-avoid getting it on skin, clothing, painted surfaces, etc. Should any of the solution come in contact with your clothing or skin, flush the area immediately with cold water. If the solution gets on your face or in your eyes, flush the area with cold water and get medical help immediately.

WARNING

Checking the various ignition switch circuits with test lamp probes can be dangerous work. Electrically-it is always wisest to disconnect the battery when any troubleshooting or maintenance is performed on the electrical system.

WARNING

When removing the drive wheel, be certain that the axle housing is properly blocked prior to wheel unit removal. Improper blocking can result in injury or death.

WARNING

Be certain that hoist chain and lift are adequately rated for estimated counterweight mass density. Do not attempt to lift, remove, or install a counterweight with a hoist rated below estimated counterweight mass.

WARNING

Always provide adequate ventilation of the working area during cleaning operation to avoid possible toxic effects of the cleaning spray.

WARNING

When removing or replacing any or all of the exhaust system, be absolutely sure that the engine has not been running for at least an hour or two. This will ensure that the exhaust system has cooled enough for safe handling.

WARNING

Be certain that the axle housing is properly blocked prior to wheel unit removal. Improper blocking can result in injury or death.

WARNING

Do not place the service jacks under the counterweight. Be certain that the service jacks are properly positioned under the frame. Improper placement of the service jacks can result in injury or death.

CHANGE

No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., *9 January 1990*

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS INFORMATION AND SUPPLEMENTAL OPERATING, MAINTENANCE AND REPAIR PARTS INSTRUCTIONS)

TRUCK, FORK LIFT, GASOLINE ENGINE DRIVEN,
PNEUMATIC RUBBER TIRES, 6000 LB CAPACITY,
180 INCH LIFT HEIGHT
ARMY MODEL MHE 233
ALLIS-CHALMERS MODEL ACP-60-PS
NSN 3930-01-052-5050

Current as of 1 May 1989

TM 10-3930-645-14&P, 20 October 1981, is changed as follows:

1. Remove old pages and insert new pages.
2. New or changed material is indicated by a vertical bar in the margin and by a vertical bar adjacent to the TA number.

Remove Pages	Insert Pages
i and ii	*i and ii*
2-49 through 2-52	*2-49 through 2-52*
2-55 and 2-56	*2-55 and 2-56*
3-5 and 3-6	*3-5 and 3-6*
3-143 through 3-146	*3-143 through 3-146*
3-149 and 3-150	*3-149 and 3-150*
O through R	*O through R*
25 and 26	*25 and 26*
47 and 48	*47 and 48*
101 through 108	*101 through 108*
141B and 142	*141B and 142*
5-3 through 5-8	*5-3 through 5-8*
A-1/(A-2 blank)	*A-1/(A-2 blank)*
B-7 through B-10	*B-7 through B-10*

3. File this change sheet in front of the publication for reference purposes.

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

WILLIAM J. MEEHAN II
Brigadier General, United States Army
The Adjutant General

Distribution:
To be distributed in accordance with DA Form 12-25F (Block Nos. 2218, 2219, 2220), Operator, Unit and Direct Support and General Support maintenance requirements for Fork Lift, 6000 LB Capacity, Pneumatic Tire, Gas (Model MHE-233).

INTENDED USE

A lift truck is a mobile, self-propelled machine intended to lift, stack and carry material within its rated capacity in and around plants, warehouses, yards, loading platforms, docks, railroad cars and highway trailers over paved and well graded, semi-prepared surfaces for short distances. It is usually associated with manufacturing or warehousing and is not intended for such uses as earth moving, snow removal or over the road hauling. Any unintended use may seriously affect its operational safety, reliability and longevity.

OPERATION REQUIREMENTS FOR STOCKING UNITS FOR EXTENDED PERIODS.

IT IS REQUIRED THAT AT INTERVALS OF AT LEAST EVERY 30 DAYS, THE UNIT IS TO BE STARTED, BROUGHT UP TO OPERATING TEMPERATURES, AND ALL OPERATING FUNCTIONS PERFORMED.

WARRANTY

WHEN A WARRANTY CIRCUMSTANCE ARISES, CONTACT ALLIS-CHALMERS SERVICE ADMINISTRATION (312/747-5151 Ext. 377) INFORMING MODEL, SERIAL NUMBER, CONTRACT NUMBER RELATING TO THE PARTICULAR UNIT, AND A SUMMARY AS TO THE NATURE OF THE PROBLEM.

TECHNICAL MANUAL
No. 10-3930-645-14&P

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *20 October 1981*

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS INFORMATION AND SUPPLEMENTAL OPERATING, MAINTENANCE AND REPAIR PARTS INSTRUCTIONS) FOR TRUCK, FORK LIFT, GASOLINE ENGINE DRIVEN, PNEUMATIC RUBBER TIRES, 6,000 LB CAPACITY, 180 INCH LIFT HEIGHT ARMY MODEL MHE 233, ALLIS-CHALMERS MODEL ACP-60-PS NSN 3930-01-052-5050

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2, located in the back of this manual, direct to: Commander, U.S. Army Tank-Automotive Command, ATTN: AMSTA-MB, Warren, MI 48397-5000. A reply will be furnished to you.

CHAPTER II-Continued

CHAPTER III-Continued

CHAPTER III-Continued

This technical manual is an authentication of the manufacturer's commercial literature and does not conform with the format and content specified in AR 310-3, Military Publications. The technical manual does, however, contain available information that is essential to the operation and maintenance of the equipment.

OPERATING INSTRUCTIONS

STANDARD VALUES						
	POUNDS FOOT					
	GRADE 2		GRADE 5		GRADE 8	
CAPSCREW SIZE	NC	NF	NC	NF	NC	NF
1/4"	5-7	6-8	9-11	11-13	12-14	14-16
5/16"	11-13	13-15	18-20	21-23	25-27	28-30
3/8"	18-21	19-22	28-33	30-35	41-46	43-48
7/16"	30-33	32-35	44-49	50-55	69-74	72-77
1/2"	45-50	45-50	68-73	68-73	95-105	95-105
9/16"	60-65	60-65	95-105	95-105	130-140	130-140
5/8"	75-85	75-85	125-135	125-135	170-190	170-190
3/4"	125-135	125-135	210-230	210-230	290-310	290-310
7/8"	105-115	105-115	290-310	290-310	450-500	450-500
1"	140-150	450-475	380-410	600-630		

SPECIAL VALUES		
DESCRIPTION	THREAD SIZE	TORQUE LBS. FT.
Cylinder Head Mounting	1/2 - 13	110-120
Cylinder Head Mounting	1/2 - 13	110-120
Cylinder Head Lifting	1/2 - 20	110-120
Thermostat Housing and Cylinder Head	1/2 - 13	110-120
Water Outlet	3/8 - 16	18-21
Manifold, Intake and Exhaust	7/16 - 20	32-35
Main Bearing Mounting	9/16 - 12	120-130
Connecting Rod	3/8 - 24	45-50
Crankshaft Pulley Retaining	1 - 16	240-260
Oil Pressure Regulating Screw	3/4 - 16	125-135
Lube Oil Filter Mounting	1/2 - 13	45-50
Spark Plugs	14 MM	25-30

FOREWORD

Allis-Chalmers Lift Trucks are designed, operator-engineered and manufactured to rigid specifications so that your company can achieve the most production for its investment. Correct operation and regular preventive maintenance, coupled with authorized Allis-Chalmers service and parts will ensure long operational life and continued top performance of your lift truck. This Operator's Manual is your guide to proper operation and service intervals By using this manual, veteran operators can gain additional information on techniques, while operators with little or no experience can learn proper operation in less time and with less chance of an accident.

SAFETY

After the operator has thoroughly read and understands this manual, with a few hours of practice he should be able to effectively operate a lift truck. The GOOD operator not only understands and follows the procedures written in this manual but is one who is SAFETY conscious. Several safety tips and procedures are Incorporated throughout this manual. Though these tips and procedures are Illustrated through a cartoon media, they are not to be taken lightly. The cartoons have their Intent and purpose for the manual. That is, to help make a GOOD operator.

If you have any questions regarding the operation, specifications, maintenance or service of your lift truck, contact your local Allis-Chalmers dealer.

INDEX

TOPIC 1. GENERAL DESCRIPTION

Allis-Chalmers Lift Trucks are designed to function in a variety of heavy-duty industrial applications. Power requirements are met by a gasoline, 4- or 6- cylinder, 4-stroke cycle, naturally aspirated engine. Engine cooling is accomplished by a belt-driven centrifugal pump that forces coolant through the head, block and fin-type radiator. The engines are pressure lubricated to the rocker arms, main bearings, and connecting rods by a gear type oil pump driven by the camshaft. The oil is cleaned by a replaceable oil filter. An oil filler cap is located on a filler tube assembly on the side of the cylinder block or on the valve cover. Oil level is easily checked by a conveniently located dipstick.

The power shift transmission consists of three major components - a constant-mesh transmission, a hydraulically actuated clutch pack, and a torque converter. A single-lever shift control on the right side of the steering column controls the direction of travel through a control valve mounted on the transmission housing.

The drive unit incorporates a double-reduction gear train using the latest advancements in gear design. All parts of the unit are bearing mounted for the greatest possible efficiency and quietness. The first reduction is through a heavy-duty spiral bevel ring gear and pinion drive gear. Final reduction is obtained through a pinion (jackshaft) and internal tooth gear (bull gear). This method greatly reduces torque stress on the axle shaft.

The truck is equipped with hydraulic brakes designed for long life and minimum maintenance. They have a large braking area and give smooth braking and positive control under all operating conditions. Brakes are located in each drive wheel. The parking brake is mounted on the differential case, and the brake drum is mounted on the differential drive pinion flange. The parking brake handle is located within easy reach of the operator's left hand.

A power steering control unit located at the lower end of the steering column diverts hydraulic oil, under pressure, to the appropriate power steering port. Hydraulic oil lines connect the steering unit to the power steering cylinder to give the lift truck a full power steering system. The power steering system provides maximum control of the lift truck with minimum steering effort.

The lift assembly utilizes special rolled steel channel sections, and/or "I" beams, and cross braces, all welded to form a rigid permanent structure. Due to construction features of the inner mast and carriage rollers, sliding friction is virtually eliminated. Two independent lift chains are used for safety; each has sufficient strength to safely handle a full load. A special seat at the bottom of the mast permits self-alignment of the lift cylinder within the mast channels, thus reducing off center stresses.

The heavy-duty welded steel fork carriage provides the ultimate in strength and visibility. The forks are identical and interchangeable. Notches spaced along the upper edge of the carriage act in conjunction with latches on the forks to position and secure them to the carriage.

Hydraulic pressure, used to actuate the cylinders or accessory equipment, is supplied by a positive-displacement gear pump coupled

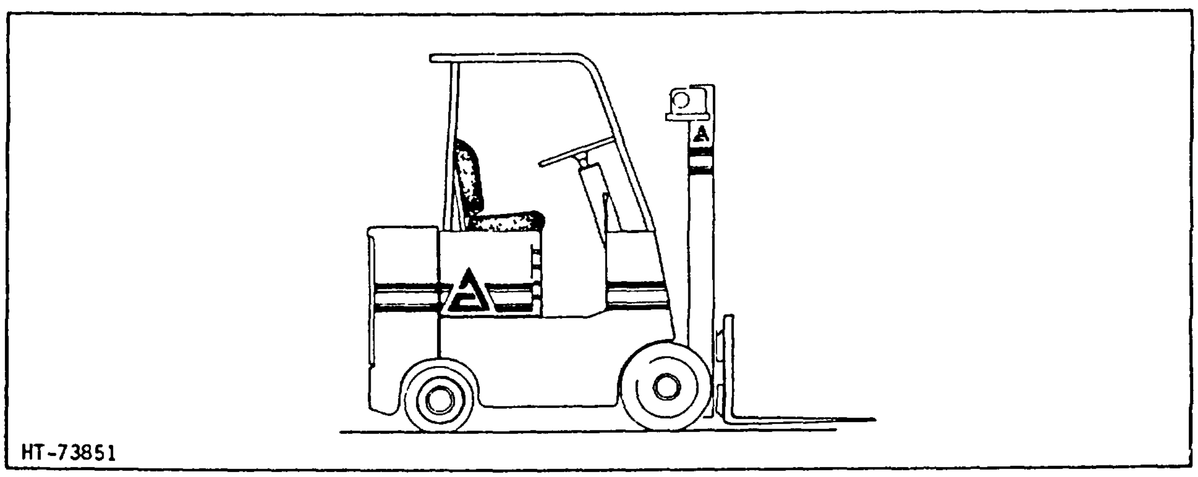


Figure 1-1. Lift Truck - Typical

directly to the engine crankshaft. A control valve with handles conveniently located to the right of the operator actuates the lift and tilt cylinders or attachments. The hydraulic oil reservoir has more than ample capacity for normal displacement needs.

Current advancements in stress analysis and design have made possible a lift truck frame that is lighter and less bulky, yet stronger than the conventional box-type frame. Counterweights, cowls, and fenders are easily removed, thereby reducing downtime for parts removal, service, and overhaul.

The instrument panel, located directly in front of the driver, has a complete set of electrical gauges including a gas gauge, oil pressure gauge, engine coolant temperature gauge, ammeter, and a direct-reading engine hourmeter. The ignition starting switch and choke control are also located on the panel.

All models have a 12 volt electrical system consisting of one 12 volt battery. A heavy duty alternator, voltage regulator, starting motor, solenoid switch, and horn are the other major components of the electrical system. The electrical gauges and horn are protected by fuses located on the right underside of the instrument panel.

The light switch is located on the right side of the instrument panel. Pull out on the light switch to turn on lights. Push in on light switch to turn off lights.

TOPIC 2. PREPARING NEW TRUCK FOR SERVICE

Your Allis-Chalmers lift truck is generally shipped with the fuel system drained, the cooling system filled with antifreeze, the crankcase filled to correct oil level, and the truck completely lubricated. Because shipping procedures may vary, it is imperative that the following checks be performed before placing the truck in service.

A. INSPECT UPON DELIVERY

For your protection, make a thorough inspection of the vehicle immediately upon delivery. In case of damage or any shortage, notify transit agent at once and have delivering carrier make a notation on the freight bill of lading.

B. ENGINE OIL

Check oil level in crankcase. Withdraw dipstick and wipe clean; reinsert all the way and then remove it for a true reading.

CAUTION: Do not check oil level while engine is running.

NOTE: All units are shipped with a preservative-type oil in the engine crankcase. This oil should be drained immediately and replaced with the proper oil. Refer to LUBRICATION SPECIFICATIONS for correct oil to use.

C. COOLING SYSTEM

Make certain the cooling system is filled with clean fresh water, or permanent type antifreeze.

All units are shipped from the factory with the cooling system protected to -30°F, or lower, with permanent antifreeze.

D. FUEL TANK

Check fuel gauge on instrument -panel and make sure the tank is full. If it is not, fill the tank with the proper fuel. Use regular grade gasoline that has a minimum octane rating of 89. The fuel tank filler is equipped with a protecto-seal cap to guard against fire hazards, theft, and tampering.

E. LUBRICATION

Be sure truck has been thoroughly lubricated. Check all lubrication points as shown in the LUBRICATION AND SERVICE GUIDE.

F. BATTERY

A 12-volt battery is located in a swing-out tray below the operator's seat inside the right side panel. Keep cells filled to the bottom of the filler holes with clean distilled water.

G. POWER SHIFT TRANSMISSION

Remove floor plate and with the parking brake set and transmission in NEUTRAL, start and run engine for a few minutes until transmission fluid operating temperature is obtained. Stop engine and immediately check transmission fluid level with the dipstick.

H. DIFFERENTIAL

With vehicle on a level surface, remove plug from front of axle housing. Oil should be level with lower edge of plug hole.

I. HYDRAULIC SYSTEM

With the truck on a level surface, lift cylinder vertical, and with lift plunger retracted, turn off the engine and check oil level in the hydraulic reservoir. Oil should be to the level shown on the dipstick. The dipstick is located at the top of the reservoir, inside the right hand panel.

J. BRAKE MASTER CYLINDER

The brake master cylinder is located under the floor plate on the right side of the truck. It should be filled to 3/8" from bottom of filler neck.

K. AIR CLEANER

The air cleaner, which is mounted inside the engine compartment, is a dry element type cleaner with replaceable cartridge. Check tightness of all connections.

TOPIC 3. OPERATING CONTROLS

All operators should learn the locations and functions of the various instruments and controls before attempting to operate the vehicle. See figure 3-1 for location of the controls described in this Topic.

A. STEERING WHEEL

The steering wheel is operated in the conventional manner, that is, when the wheel is turned right the truck will turn to the right; when the wheel is turned left, the truck will turn to the left. The steer wheels are located at the rear of the truck. These cause the rear of the truck to swing out when a turn is made. With a little practice, this type steering is easily mastered.

B. FORWARD/REVERSE LEVER - POWER SHIFT

The power shift lever is located on the steering column and beneath the steering wheel. There are three positions - forward, neutral, and reverse (Fig 4-1). The lever actuates a hydraulic valve mounted on top of the transmission; this directs the flow of oil to actuate forward or reverse clutches.

NOTE: On Power Shift models a safety switch incorporated in the shifting mechanism prevents engine startup with transmission in gear.

C. LIFT AND TILT CONTROLS

The lift, tilt, and accessory controls are located to the right of the operator (Fig 3-1).

D. PARKING BRAKE LEVER

The parking brake lever (Fig 3-1) is cam-action, over-center type, located on the instrument panel at the left side of the operator's compartment. It actuates an enclosed, dual-shoe mechanical unit attached to the brake drum flange. The hand grip on the handle permits adjustment to compensate for brake lining wear.

E. INCHING CONTROL - "POWER SHIFT"

The inching pedal is located at the lower left of the steering gear mounting support. A change in pedal stroke varies oil pressure in the clutch so truck can be "inched" along slowly while the engine is operated at high speed for fast lifts. The farther the pedal is depressed, the slower the truck travels. In fully depressed position, the clutch is completely disengaged and the service brakes are applied.

F. BRAKE PEDAL

The brake pedal, located to the right of the steering column, operates the brake master Figure 3-1. Controls and Instruments

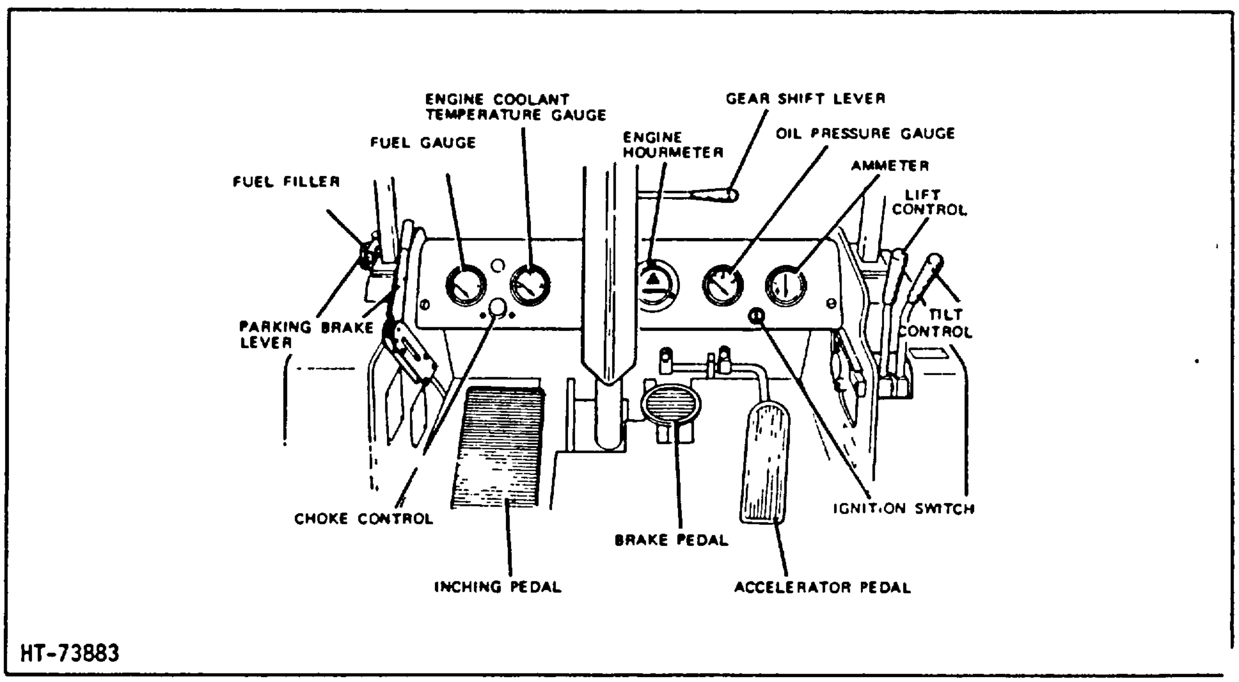


Figure 3-1. Controls and Instruments

cylinder which, in turn, actuates the wheel cylinder and brake shoes.

CAUTION: Always place the shift lever in neutral and set the parking brake before leaving the operator's seat.

G. ACCELERATOR PEDAL

The accelerator pedal, located to the right of the brake pedal, controls engine speed through linkage to the throttle lever on the carburetor.

H. INSTRUMENT PANEL

The instrument panel holds various gauges at a glareless, easy-to-read angle (Figure 3-1). The panel contains:

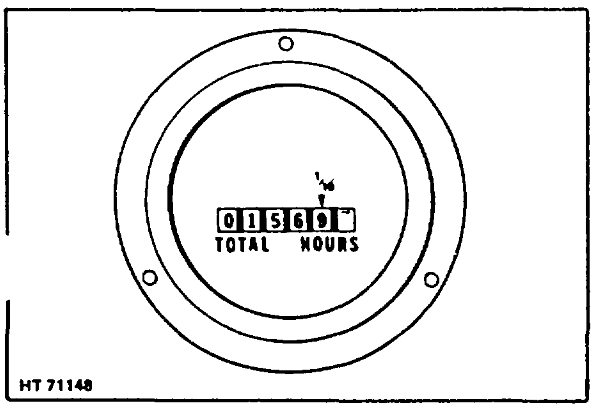


Figure 3-2. Hourmeter

1. Oil Pressure Gauge

The oil pressure gauge indicates the pressure of oil circulating through the engine. A cold engine will normally have a higher oil pressure than an engine that is warm.

CAUTION: Always check the oil pressure gauge immediately after the engine starts.

If the gauge does not register, or if it registers slightly (less than 5 psi at Idle speed), stop the engine immediately and check the lubrication system to determine cause of lack of pressure.

2. Ammeter

The ammeter is connected into the main battery circuit and indicates whether current is flowing into or out of the battery. A needle deflection to the CHARGE side indicates that the battery is being charged by the alternator, and a deflection to the DISCHARGE side indicates that the battery is discharging. Normally, the rate will be high for a short time after starting the engine, then the indicator will return to a point slightly above zero after a few minutes operation. However, if battery is in a rundown condition, charge rate may be high for some time. If ammeter indicates DISCHARGE when engine is operated above idle speed, alternator is not producing current, or there may be a short in the wiring system. Investigate and repair at once.

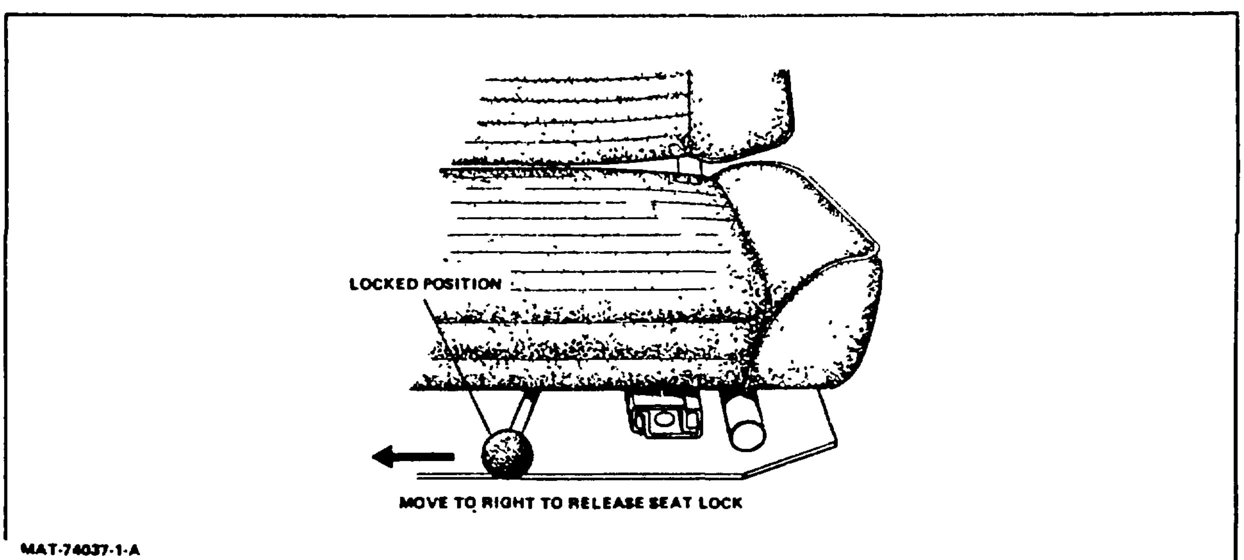


Figure 3-3. Operator's Seat Adjustment

3. Engine Coolant Temperature Gauge

Depending upon engine coolant temperature, the pointer of the gauge indicates one of three colored areas on the dial: a white, or engine warm-up area; a green, or safe operating area; or a red danger area. Optimum operating temperature is indicated when the pointer is over a mark in the center of the green area.

The engine is not designed for continuous operation at high temperatures. If normal work loads on a level surface tend to produce near-boiling temperatures, check the cooling system - thermostat, radiator pressure cap, temperature sender, coolant, radiator air passages, core, etc. - to determine the cause and correct as necessary.

4. Fuel Gauge

The panel mounted electric fuel gauge indicates the level of fuel in the fuel tank.

5. Hourmeter

The hourmeter (Fig 3-2) registers accumulated engine running time to 9,999.9 hours and then repeats itself. The figure on the right registers tenths of an hour.

6. Ignition Switch

The standard ignition switch, located on the left side of the instrument panel, is a three-position switch. It is used to turn current on or off, control flow of current to instrument panel gauges, and allow current to flow to the starter motor solenoid. Turn the key all the way to the right to crank the engine and release it as soon as the engine starts.

7. Choke Control

The choke control, located on the left side of the instrument panel, controls the gasoline carburetor choke plate. Pull choke knob all the way out when starting a cold engine. Gradually push choke knob in as engine warms.

8. Transmission Temperature Gauge

The transmission temperature gauge, located on right side of instrument panel, indicates temperature of transmission oil. The dial indicates from 100° to 250°F. If gauge reaches 210°F, stop truck and correct overheating condition.

I. OPERATOR'S SEAT ADJUSTMENT

The operator's seat is adjustable forward and backward for maximum comfort. The adjusting lever is located below the front edge of the seat (Fig 3-3). Move lever to the right to release seat lock, then move seat forward or backward to desired position by shifting weight. Release the lever to lock the seat in position.

TOPIC 4. OPERATION OF LIFT TRUCK

The following instructions are based on past experience and should be helpful in becoming fully acquainted with your "Allis Chalmers" lift truck. See Figure 3-1 for location of instruments and controls.

A. STARTING THE ENGINE

1. Put shifting lever in neutral position. On power-shift models, the forward-reverse lever must be in neutral position.
2. Insert ignition switch key and turn clockwise to ON position.
3. Do not depress accelerator pedal until engine starts.
4. Pull the choke knob all the way out when starting a cold engine.
5. Turn the ignition key all the way clockwise to the START position to actuate the starter motor. Release key as soon as engine starts. Key will automatically return to ON position.

CAUTION: Do not operate starter motor for more than 30-seconds at a time. If engine does not start, allow starter motor to cool for approximately two minutes before again attempting to start engine.

6. After starting, gradually push in choke control knob as engine warms up. It is not necessary to use choke during normal operation or when starting a warm engine.

NOTE: Excessive use of the choke dilutes crankcase oil causing wear-of piston rings and cylinder walls. It is recommended that engine oil be changed more frequently in cold weather because of this condition.

B. SHIFTING OPERATION "POWER SHIFT"

With engine idling, release parking brake. Place directional lever in either Forward or Reverse position (see Figure 4-1) and accelerate truck as required. To change direction, always come to a complete stop and simply move the directional control lever to either Forward or Reverse.

NOTE: Trucks equipped with power shift transmission have a return to neutral feature that will automatically shift the truck into neutral when the operator leaves the seat. To re-engage the transmission, the operator must return to operator's seat and manually return the shift lever to the desired position.

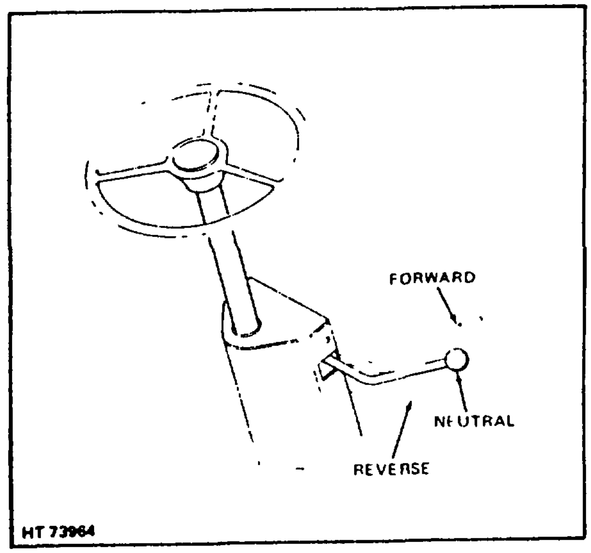


Figure 4-1. Power Shift Positions

C. LIFTING AND LOWERING OPERATIONS

Lifting and lowering action is controlled by the lever closest to the operator. (See Figure 3-1). Pull the lever back to lift and push it forward to lower. When the lever is released it will automatically return to the intermediate (NEUTRAL) position.

Rate of lift is controlled by speed of the engine and position of the lever. Slight acceleration of the engine and gradual movement of the lift lever from neutral to lift position will produce a slow lifting action. Accelerating the engine and pulling the lever back as far as possible increases the speed of lift. When the forks are raised to desired height, release lever smoothly to neutral position - forks and/or load will hold at this point.

Lowering speed is controlled by weight of the load and position of the control lever. Push lever forward slowly for smooth operation.

To Increase speed of lowering, push the lever forward as far as possible. Release lever slowly to neutral position as load reaches desired level. Maximum lowering speed is held within safe limits by a flow regulator in the oil port at the base of the lift cylinder.

CAUTION: Do not release lift control lever suddenly when lowering load because this causes severe mechanical shock.

D. TILTING OPERATIONS

The tilt Control lever is mounted to the right of the lift lever (Fig 3-1). Rate of tilt is controlled by speed of the engine and position of the lever. Slight acceleration of the engine and gradual movement of the tilt lever front neutral to tilt position will produce a slow tilting action. Accelerating the engine and pulling the lever back or pushing it forward as far as possible increases the speed of tilt. When the mast is tilted to desired position, release lever smoothly to neutral position and mast will hold at this point.

CAUTION: Use care when tilting mast forward to prevent the load from toppling.

E. SIDE SHIFTER OPERATION (Not Applicable)

The side shifter control lever is mounted to the right of the tilt lever (Fig 4-2). Push the lever forward to move the carriage to the left. Pull lever back to shift carriage to the right.

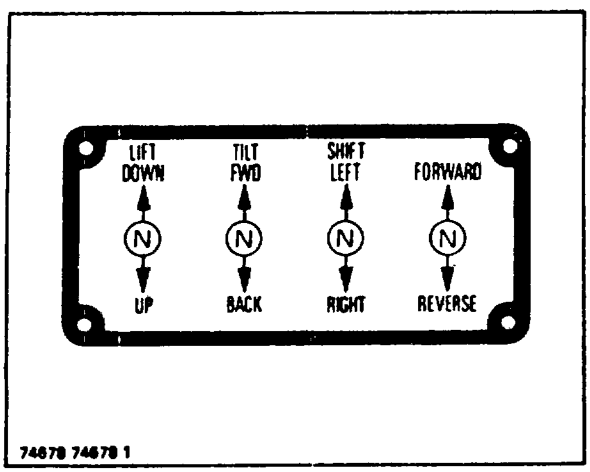


Figure 4-2. Raise, Lower, Tilt and Side Shift Positions

F. FORK ADJUSTMENT

For maximum balance, always position the forks in proportion to the width of the load. A fork lock in the top of each fork holds it in position in notches along the top bar of the carriage. To change fork location, pull up on lock and move fork right or left; allow lock to seat in notch nearest the location chosen (Fig 4-3).

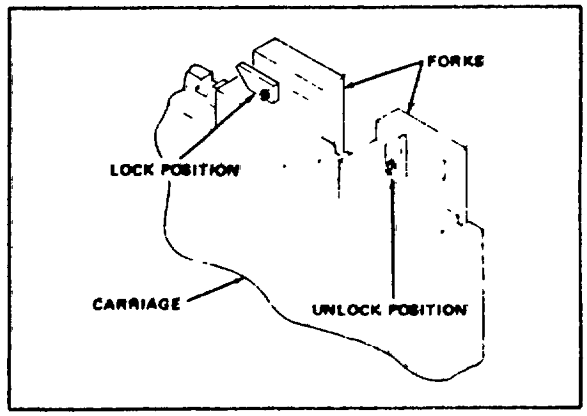


Figure 4-3. Fork Adjustment

Forks can be easily removed from the carriage by releasing the locks and aligning each fork (one at a time) with the wide slot on the bottom of the carriage. Remove fork by lifting it up and off the carriage.

G. LOAD HANDLING PROCEDURES

Lift truck stability is based on principles of the counter-balance and fulcrum (Fig 4-4). The drive axle of the lift truck is the balancing point (fulcrum). The load is carried at the front of the lift truck and is counterbalanced by the counterweight on the rear of the truck.

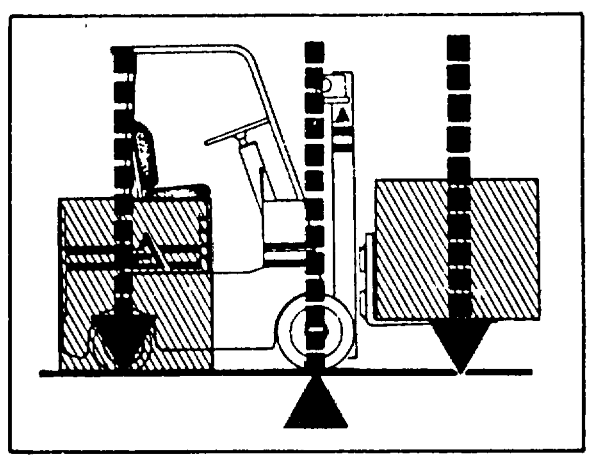


Figure 4-4. Counterbalance Principle

Stability of the truck is achieved by placing the load close to the fulcrum (near the face of the forks). Each lift truck is rated for specific load capacity at a given load center, usually at 24-inches. When various attachments or special masts are added, the load capacity and load center either increases or decreases, depending on the size and weight of the special mast or attachment. The load capacity of the lift truck should never be exceeded. Overloading the lift truck will: (1) be a hazard to the safety of others; (2) endanger other material; (3) damage the truck.

The following procedures are suggested to aid in operating your Allis-Chalmers lift truck. These are basic procedures that can be adapted to most load handling operations.

1. Lifting a Palletized Load

   a. Position the lift truck squarely in front of the load (Fig 4-5).
   b. Raise forks to the proper level, half way between the upper and lower members of the pallet. Watch for low-hanging pipes or electrical lines.
   c. With the mast in a vertical position and the forks parallel to the floor, slowly insert the forks into the pallet until the load rests against the fork faces. Unless the mast is vertical, the forks may hang up when they are inserted.
   d. Lift the load Just enough to clear the stack (or floor) beneath the load being removed. Then tilt the mast back enough to safely travel with the load.

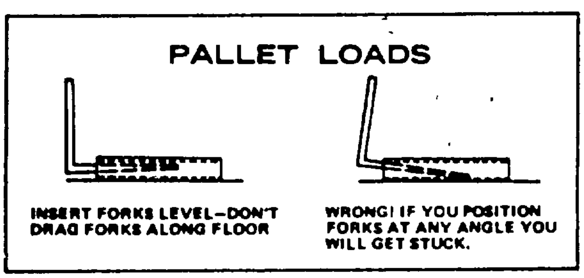


Figure 4-5. Palletized Load Handling

   e. Back the truck slowly away from the stock pile and when clear of all obstacles, lower the load. The load should always be carried as low as possible for maximum stability and vision. Maximum back tilt tends to cradle the load and prevent it from sliding off the forks when stopping.

CAUTION: If the load is so bulky that vision is obstructed, drive in reverse. Extra care must be taken when driving in reverse because the operator does not have a constant view of the load.

2. Traveling

   a. With heavy loads on the forks, steering is easier because the weight on the steer wheels is shifted forward.
   b. Obey all speed limit signs. If no speed limits are posted, travel at the safest speed that conditions allow.
   c. Always watch in the direction of intended travel.
   d. When ascending an incline, travel with load leading (Fig 4-6).
   e. Travel with the load trailing when descending an incline (Fig 4-7).

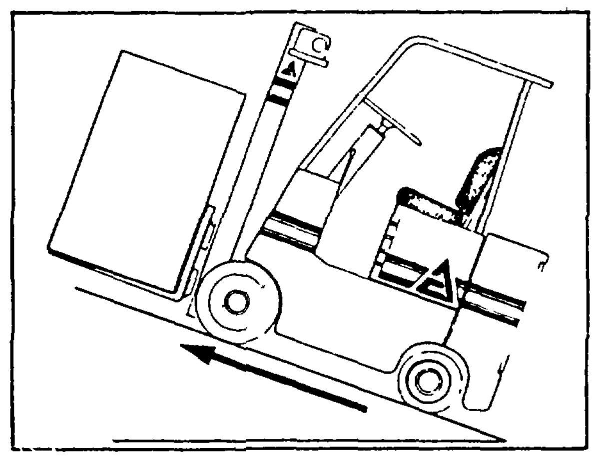


Figure 4-6. Ascending an Incline

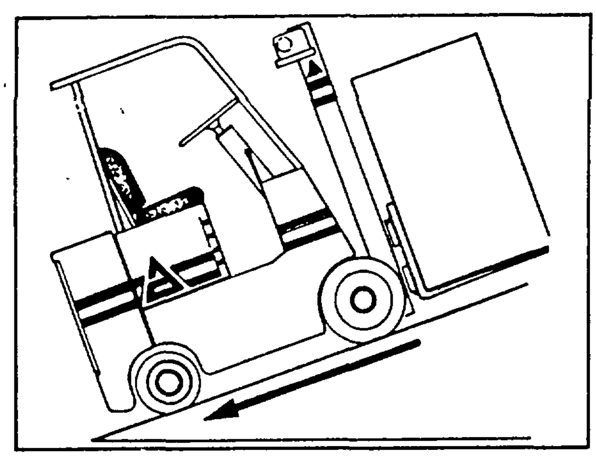


Figure 4-7. Descending an Incline

f. With an unloaded lift truck, ascend ramps with the counterweight leading. Descend the ramp with the counterweight trailing (Fig 4-8).

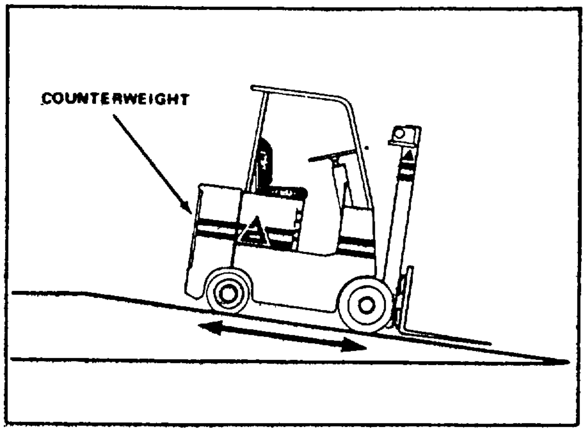


Figure 4-8. Unloaded Traveling Procedure

g. When ascending or descending a grade raise forks high enough to avoid hitting the ramp.
h. Cross all railroad tracks slowly and at a slight angle.
i. To prevent load spillage, apply brakes gradually and firmly.
j. When turning a corner, begin turn when front wheels are at a right-angle to the intended path of travel and allow for rear end swing.
k. Check the condition and capacities of all floors, dockboards, semitrailer beds, etc.
l. To maneuver in narrow aisles, raise forks to clear the stock pile and gain additional maneuvering area. Extra care must be taken with the forks raised. Watch for low-hanging object such as water pipes, electrical lines, etc. (Fig 4-9).
m. When operating with elevated loads, keep mast in full back tilt position except when actually lifting or depositing loads. Back tilt also shortens effective truck length.
n. Take full advantage of operating space in narrow aisles. Stay as far away from the stock piles as possible but allow for rearend swing (Fig 4-10).
o. Enter box cars at a slight angle and begin turning as soon as possible (Fig 4-11).

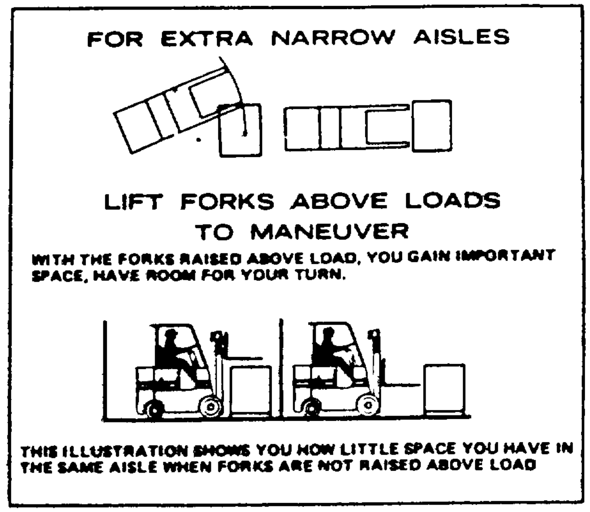


Figure 4-9. Narrow Aisle Maneuver

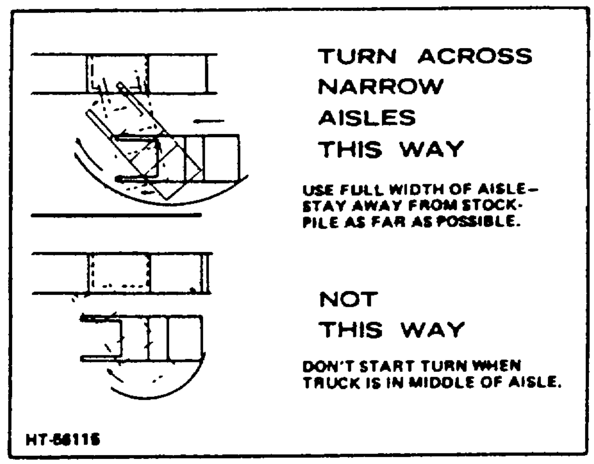


Figure 4-10. Aisle Turning Procedure

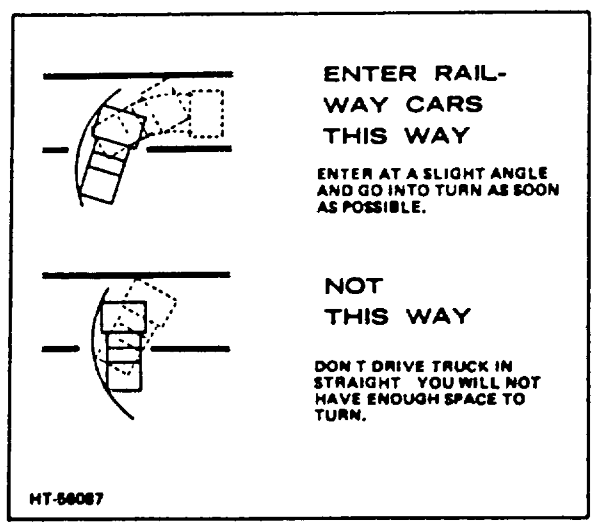


Figure 4-11. Entering Railway Cars

3. Positioning, Stacking, and Unloading

   a. Drive the loaded lift truck to the stacking area.
   b. If possible, position the truck squarely in front of the stock pile.
   c. Check all low-hanging obstructions. Raise the load with the mast tilted slightly back (Fig 4-12).

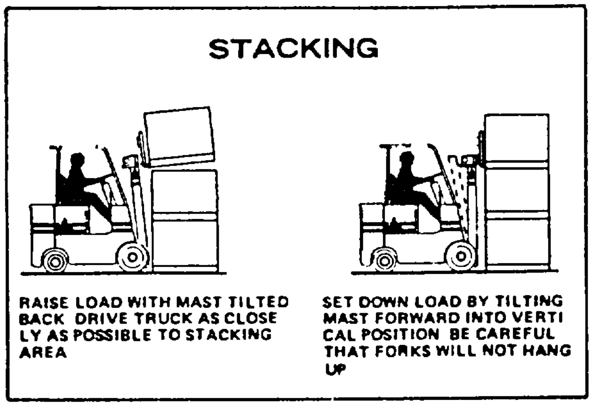


Figure 4-12. Stacking and Positioning

   d. With the load elevated, move the truck slowly forward and position the load squarely over the stock pile.
   e. Stack loads squarely and evenly to make use of all available space. Stock piles should always be stable to avoid injury to personnel and damage to equipment or stock.
   f. Tilt the mast forward to vertical position and lower the load slowly into position.
   g. Back lift truck slowly away from load to withdraw the forks.
   h. With the forks clear of the stock pile, lower them to within 2-inches of ground level before proceeding.

4. Unpalletized Loads

Special attachments are often used to handle unpalletized loads. If these attachments are not available and the load must be stacked or moved, proceed as follows:

   a. Tilt the forks forward so their tips contact the floor (Fig 4-13).
   b. As carefully as possible, insert forks under the load until the load is contacted by the vertical fork faces.

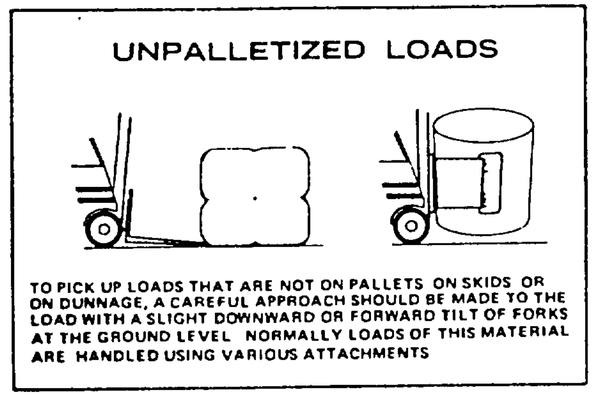


Figure 4-13. Unpalletized Load Handling

   c. Tilt the load slightly back.
   d. To stack unpalletized loads, position the truck squarely in front of the stock pile. Raise forks to proper level with the mast tilted back.
   e. Position load squarely over the stock pile, then lower the forks slowly until they rest on the stock.
   f. Tilt the load slightly forward and begin to back the truck. Proceed carefully to prevent damage to the load.
   g. Withdraw the forks from the stack and lower them to within 2-inches of the floor.

H. STOPPING THE TRUCK

To bring the truck to a safe, smooth stop, apply gradual pressure on foot brake pedal. When parking, pull back hand brake lever, place shift lever in neutral, and lower forks to floor.

Allow the engine to idle for a few minutes before turning off ignition switch; this allows it to cool gradually. Too rapid cooling of an extremely hot engine may warp valves or even crack the manifold. After idling for a short while, turn ignition key to OFF position. Key should always be removed from the ignition switch to prevent unauthorized use of the truck.

I. DAILY CHECK LIST

Refer to the following Paragraph J for detailed explanation of each inspection.

NO.	INSPECTIONS	DAILY
1.	Steer Axle Stops	X
2.	Overhead Guard	X

NO.	INSPECTIONS	DAILY
3.	Battery	X
4.	Engine Oil Level	X
5.	Fuel Tank	X
6.	Radiator Coolant Level	X
7.	Tires	X
8.	Hourmeter	X
9.	Accelerator Pedal (Operational Check)	X
10.	Brakes (Operational Check)	X
11.	Steering (Operational Check)	X
12.	Lifting and Lowering Speed (Operational Check)	X
13.	Forward and Backward Tilt (Operational Check)	X
14.	Unusual Noise (Operational Check)	X
15.	Fire Extinguisher	X

J. DAILY CHECK LIST EXPLANATION

The following explanations correspond to the inspections in the Daily Check List. It is necessary to perform these inspections daily. Should any discrepancy be found, it should be reported to the supervisor or the responsible maintenance personnel.

1. Steer Axle Stops - Check the steer axle stops at the beginning of each work shift. These stops are welded to the truck frame in such position that one is directly above each of the steer axle yokes (Fig 4-14).

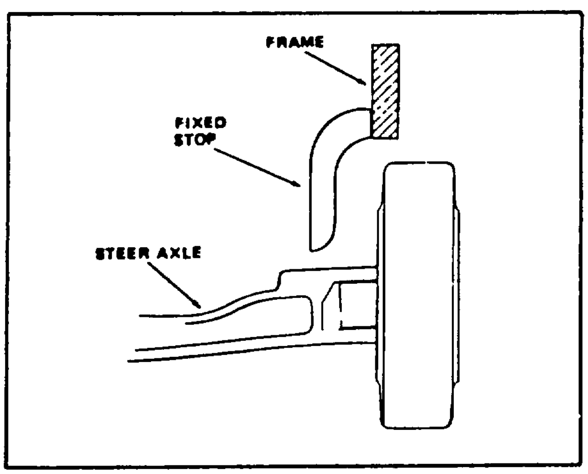


Figure 4-14. Steer Axle Stop

Turn the steer wheels to full right and to full left positions. Visually check positions of both axle stops; make certain they are not missing, bent, or otherwise damaged.

2. Overhead Guard - Inspect welds and hardware attaching overhead guard to the truck proper. Make sure all attaching hardware is in place and all welds and structural members are secure.

3. Battery - Check condition of battery as described in Topic 5 - BATTERY. Also, make sure that the battery cables are not damaged or loose and that the connector lugs are clean and securely attached.

4. Engine Oil Level - Check level with dipstick. If necessary, add oil to raise level to FULL mark. Refer to Topic 6 in this manual titled LUBRICANT SPECIFICATIONS for proper oil recommendation.

5. Fuel Tank - Fill fuel tank at end of each workday; this practice will prevent the condensation of moisture.

6. Radiator Coolant Level - Maintain coolant level approximately 1-inch below bottom of radiator filler tube. Add clean fresh water or antifreeze as required.

7. Tires - Check pressure of pneumatic tires. If necessary, fill to pressure recommended in the Maintenance Manual. Check tires for excessive wear and damage. Unevenly worn or badly damaged tires will vibrate excessively and cause hard steering. Remove steel chips and other foreign materials from tire treads to prevent further damage.

8. Hourmeter - Turn key switch ON and make sure hourmeter is energized.

9. Accelerator Pedal - The truck should accelerate smoothly from slow to fast speed.

10. Brakes - The brake pedal should have 1/2-inch free play when it is depressed. The truck should stop with normal brake pressure. When pedal is fully depressed, some reserve distance should remain. Check during operation.

11. Steering - The truck should steer smoothly and freely. Check during operation.

12. Lifting and Lowering - The mast and forks, or attachment combination, should raise and lower, accelerate and decelerate smoothly. Check during operation.

13. Forward and Backward Tilt - Operation of forward and backward tilt should be immediate and smooth. Check during operation.

14. Unusual Noise - During operation, note unusual mechanical noise and report it to the supervisor or to another responsible person.

15. Fire Extinguisher - If lift truck is equipped with a fire extinguisher, examine cylinder for bad dents. Make sure it has not been used and left empty by checking gauge, if so equipped, or seal wire to determine whether or not it has been broken during usage.

TOPIC 5. BATTERY

When liquid level of battery is low, add distilled water to raise level of each cell to bottom of filler holes. Be sure filler plugs are tight and vents are open (Fig 5-1).

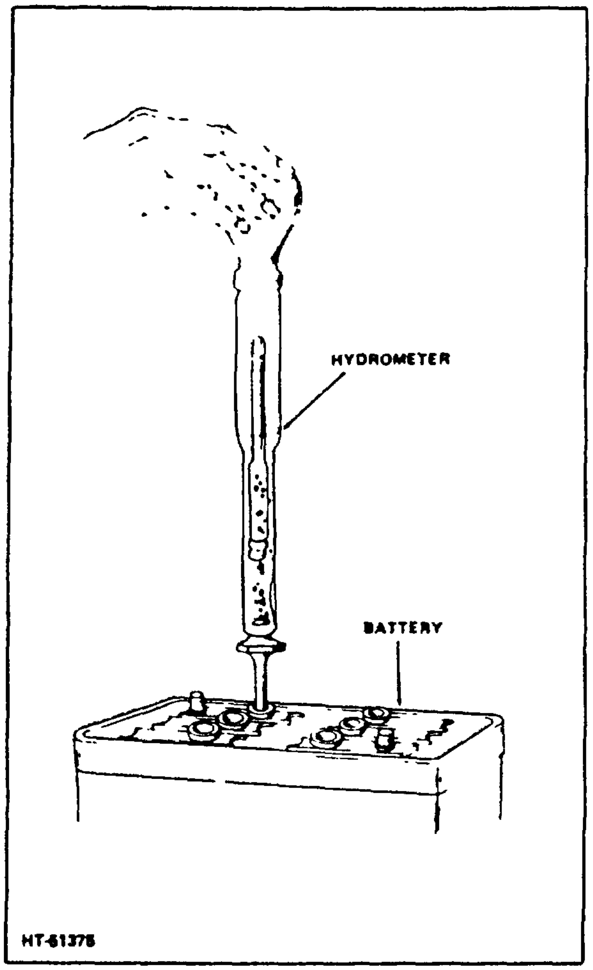


Figure 5-1. Checking Specific Gravity

CAUTION: Never fill battery immediately after operation in below freezing weather because water will not mix acid and may freeze. Always fill batteries before putting engine into service.

Periodically, check external condition of battery and connecting cables. Keep batteries clean and well secured. If the battery is dirty, clean it with soda solution and a brush. Filler plugs should be tight to prevent the soda solution from entering cells. After the foaming stops, flush surface with clean water and apply a thin coat of petroleum jelly to the posts and cable terminals.

WARNING: It is normal for the battery to generate hydrogen gas which is explosive when mixed with air. Never expose the battery to an open flame or to an electric spark. Do not remove or install battery cables while vent plugs are removed. Battery fluid is a sulfuric acid solution - avoid getting it on skin, clothing, painted surfaces, etc. Should any of the solution come in contact with your clothing or skin, flush the area immediately with cold water. If the solution gets on your face or in your eyes, flush the area with cold water and get medical help immediately.

Maintain battery in a fully charged condition (specific gravity above 1.250 with electrolyte at 80°F). Determine charge condition by checking specific gravity; use a hydrometer with electrolyte temperature corrected to 80°F.

Except in cases of accidental loss or change of electrolyte, the battery will not require a complete change of solution during its entire lifetime.

TOPIC 6. LUBRICANT SPECIFICATIONS

A. ENGINE LUBRICATING OIL

Lubricating oils used in Allis-Chalmers engines must:

1. Maintain pistons, rings, and other moving parts in a carbon-free, varnish-free, clean condition.
2. Maintain enough body to satisfactorily lubricate the moving parts at maximum oil temperatures.
3. Prevent bearing corrosion. Counteract corrosive products of combustion or contaminants in the fuel.
4. Promote general cleanliness within the engine.

The American Petroleum Institute has several service classifications for oils used in gasoline and LP gas engines; they are SA, SB, SD, and SE.

SERVICE SA: Service typical of engine used under light and favorable operating conditions, the engines having no special lubrication requirements and having no design characteristics sensitive to deposit formation.

SERVICE SB: Service typical of engines used under moderate to severe operating conditions, but presenting problems of deposit corrosion control when lubricating oil temperatures are high.

SERVICE SD: Service typical of engines used under unfavorable or severe types of operating conditions and where there are special lubrication requirements for deposit, wear, or bearing corrosion control, due to operating conditions, or engine design, or fuel characteristics.

SERVICE SE: Oils designed for this service provide more protection against oil oxidation, high temperature engine deposits, rust, and corrosion in gasoline engines than oils which are satisfactory for classification SD.

Generally, SERVICE SB will apply to the gasoline engine.

Use oils of the following viscosities:

Ambient Temperature	Viscosity
Below 32°F	SAE 20 W
32°F to 90°F	SAE 30
Above 90°F	SAE 40

Our recommendation of 100 hours for filter and oil change periods is based on the use of high quality oils and 85% average engine loads with the engine in good adjustment and operating with the coolant and lubricating oil at normal operating temperature. Variations from the considered normal operating conditions must be compensated for by more frequent oil change and filter change periods.

Our recommended oil change periods are based on what experience has shown to be conservative and safe hours of operation between oil changes. Actual testing of the lubricating oil in a particular engine application at each 5 to 10 hours operation after 100 hours operation to determine the condition of the oil may allow extending the oil change periods. This testing service is provided by most major oil companies. It is recommended to take advantage of this service.

B. HYDRAULIC SYSTEM OIL

Use a hydraulic oil that conforms to Allis-Chalmers specification MA 170.103 or SAE 10 SE engine oil (or MIL-L-2104B) in the hydraulic system.

The hydraulic oil must be fortified with special rust and oxidation inhibitors, plus antiwear ingredients, and treated to minimize foaming. The hydraulic oil must conform to the following in Allis-Chalmers specification MA 170.103:

Viscosity at 100 F SUS..........................150 - 170 secs
Viscosity Index ....90 min
Flash Point ....370°F min
Neutralization No.
(mgs KOH/g oil) 0.60
Aniline Point ....180°-220°F
Oxidation Stability (hrs. to
neut. No. 1.0 max) 1500
Rust Test ....Pass
Copper Strip Corrosion
(3 Hours at 212°F) ....Pass 2B
Pour Point ....-20°F max

The SAE grade 10 SL engine oil is available at all major oil companies and most local service stations. The oil meets the requirements of the American Petroleum institute and contains rust and oxidation inhibitors, anti-wear ingredients, and an anti-foaming agent.

Hydraulic system oil storage containers must be kept free of contaminants, such as dirt, water, and metal chips. Contaminated hydraulic oil is the major cause of hydraulic system failures. It is therefore advised that any oil that is added or replaced be final filtered through a ten micron filter (or finer) before entering the hydraulic system. It is recommended that each storage container be clearly marked - FOR USE IN HYDRAULIC SYSTEM ONLY.

C. POWER SHIFT TRANSMISSION OIL

Use ATF (Automat1c Transmission Fluid) Type "A", Suffix "A"; which can be obtained from major oil companies.

D. DIFFERENTIAL LUBRICANT

Lubricate with SAE 90 EP (extreme pressure gear oil which is non-corrosive and resists oxidation and foaming. It should have a low pour point to ensure quick lubrication at either high or low temperatures.

E. BULL GEAR AND JACKSHAFT PINION

Lubricate with high quality. Grade 2 lithium base grease (characterized by the word "Moly") that contains a maximum of 5% micronized molybdenum disulfide. Lubricant should be waterproof and heat resistant.

F. WHEEL BEARINGS AND JACKSHAFT BEARINGS

Use grease of the type specified in preceding paragraph E. Apply grease with an applicator that is designed to force it into the bearing rollers. Do not paint, dip, or swab It on by hand.

G. PRESSURE GUN FITTINGS

Lubricate with a high quality chassis lubricant. N. L. G. I. Grade 2 heavy duty sodium base grease available from any reputable oil company.

H. OIL CAN POINTS

Lubricate all points with SAE #10 or #20 engine oil.

I. BRAKE MASTER CYLINDER

Use only premium quality, heavy duty brake fluid with an extreme heat-cold range that conforms to SAE specification J1703d.

J. MASTS

Lubricate all sliding and roller contact surfaces of mast uprights with a high quality grease specified in preceding Paragraph E or G.

TOPIC 7. LUBRICATION AND SERVICE

The following paragraphs provide the operator/ maintenance man with a comprehensive list of service operations that should be performed periodically. Close adherence to the list by qualified personnel will go far toward preventing major trouble and subsequent downtime of equipment. The operator is normally responsible for performing the 8-hour Daily Checks only; it is the responsibility of the maintenance man to perform the 50 to 1000 hour Service Checks. For detailed service information on these checks, the maintenance man may refer to applicable topics in the maintenance manual.

> **NOTE: The time intervals given in this guide are based on normal operating conditions. When operating under abnormal or severe conditions, these services should be performed as often as required to maintain the vehicle in good operating condition.**

A. 8-HOUR SERVICE

Refer to Daily Check List and Explanations in Topic 4.,

B. 50-HOUR SERVICE

Perform 8 hour service in addition to the following:

Pressure Gun Fittings - Lubricate. Mast and Carriage Lubricate sliding and roller contact surfaces.
Oil Can Points - Lubricate.
Lift and Tilt Cylinders - Inspect for leaks.
Air Cleaner - Check and service element.
Battery - Check electrolyte level and charge condition.
Wiring and Connections - Check insulation and make certain connections are tight.
Clean Truck - Use industrial type vacuum cleaner or light air pressure (40 psi max).
Adjust valve clearance after-first 50 hours of operation.

C. 100-HOUR SERVICE

Perform 8 and 50 hour service in addition to the following:

Lift, Chains - Clean and inspect for bent or cracked links. Inspect for adjustment and lubricate.
Differential level - Check Oil.
Drive Axle Housing Breather - Check and clean.
Hydraulic Oil Reservoir - Check hydraulic oil level.
Engine Breather Cap - Remove and clean.
Engine Oil Filter - Replace.
Engine Oil - Drain and refill.
Fan Belt - Check condition and tension.
Fuel Strainer - Clean.
Power Shift Transmission - Check fluid level.
Radiator - Make certain radiator air passages are free of obstructions.

D. 200-HOUR SERVICE

Perform 8, 50, and 100 hour service in addition to the following:

Hydraulic Oil Filter - Replace.
Transmission Oil Filter - Replace.
Hydraulic Oil Reservoir Breather - Replace.

E. 500-HOUR SERVICE

Perform 8, 50, 1000, and 200 hour service in addition to the following:

Electrical System - Check tightness of terminals, wires, cables and electrical components.
Distributor - Replace points.
Spark Plugs - Replace.
Control Valve - Check linkage.
Fork Carriage - Check for side play and check chain adjustment if carriage is not level.
Lift Chains - Remove, clean and inspect for wear and broken or cracked links. Install, adjust, and lubricate.
Brake Master Cylinder - Check fluid level.
Wheel Cylinders and Brake Shoes - Inspect.
Hoses, Tubes, and Fittings - Inspect and replace if necessary. Correct any leaks that are evident.
Steer Wheel Bearings - Clean and lubricate.
Crankcase Vent Valve (if so equipped) - Remove and clean.
Universal Joint - Check and adjust if necessary.
Parking Brake - Check and adjust if necessary.

F. 1000-HOUR SERVICE

Perform 8, 50, 100, 200, and 500 hour service in addition to the following:
Cooling System - Drain, flush, and refill.
Differential - Drain oil and refill.
Power Shift Transmission - Drain fluid and refill.
Hydraulic Oil Reservoir - Drain hydraulic oil, flush, and refill.

TOPIC 8. HYDRAULIC FILTER ELEMENT INDICATOR

The hydraulic filter element is located to the right of the control valve handles. The indicator (Figure 8-1) assures longer element life, better filtration, and guards against element collapse. The indicator provides day-in, day-out condition of the element assuring 100% filtration at all times.

The following are the warning signals and their meanings:

A. GREEN BAND "ALL CLEAR"
When the white indicating line is in line with any portion of the GREEN band no changing of the element is required.

B. YELLOW BAND "CAUTION"
When the white indicating line is in line with any portion of the YELLOW band the element is becoming contaminated but still provides Full Flow Filtration. Change element at earliest convenience.

C RED BAND "STOP"
When the white indicating line reaches any portion of the RED band change element at once.

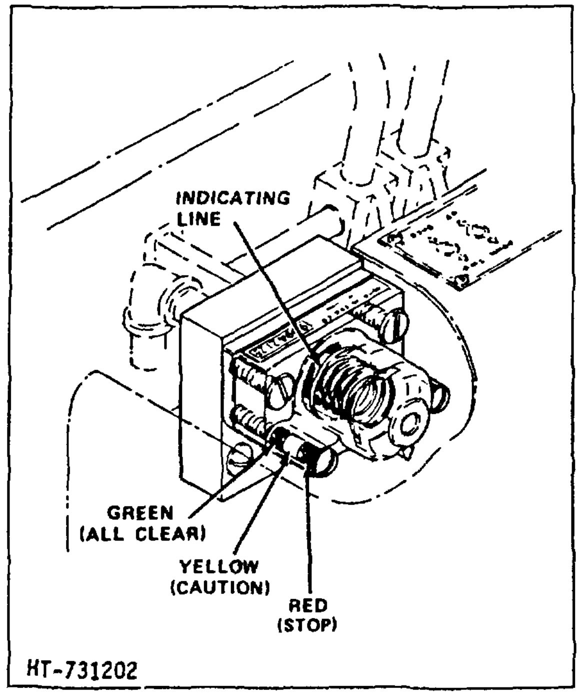


Figure 8-1. Element Indicator

MAINTENANCE INSTRUCTIONS

MAINTENANCE INDEX

TOPIC 1. DESCRIPTION AND SPECIFICATIONS

A. DESCRIPTION

The engine (Figure 1) is a four-stroke-cycle and L-type head design, with the valves arranged in the engine block. The main body consists of a single unit cylinder block and crankcase with integrally cast cylinders.

The aluminum pistons have four rings: The top two for compression, the third for scraping and the three-piece bottom ring for oil control. The full floating piston pins are retained by snap rings.

The front drive gear is keyed and pressed in place, and is sealed to the crankcase by a die cast filler block. The rear shaft extension is sealed to the crankcase by a die cast oil guard and a filler block.

The camshaft rotates in bearings located in the three main crankcase bulkheads. Camshaft drive is provided by the crankshaft timing gear. A spiral located on the camshaft drives the oil pump shaft and Its coupled distributor drive shaft. The fuel pump is actuated by an eccentric cam located towards the rear of the shaft.

The main and connecting rod bearings are of precision construction.

The entire length of the heat treated, steel forged connecting rods is rifle drilled for pressure lubrication of the piston pins.

The cylinder head is constructed of special alloy iron with carefully engineered water passages to ensure optimum cooling.

The intake manifold has individual porting (Figure 2) whereby each cylinder is fed with the fuel-air mixture individually and not influenced by other cylinders of the engine.

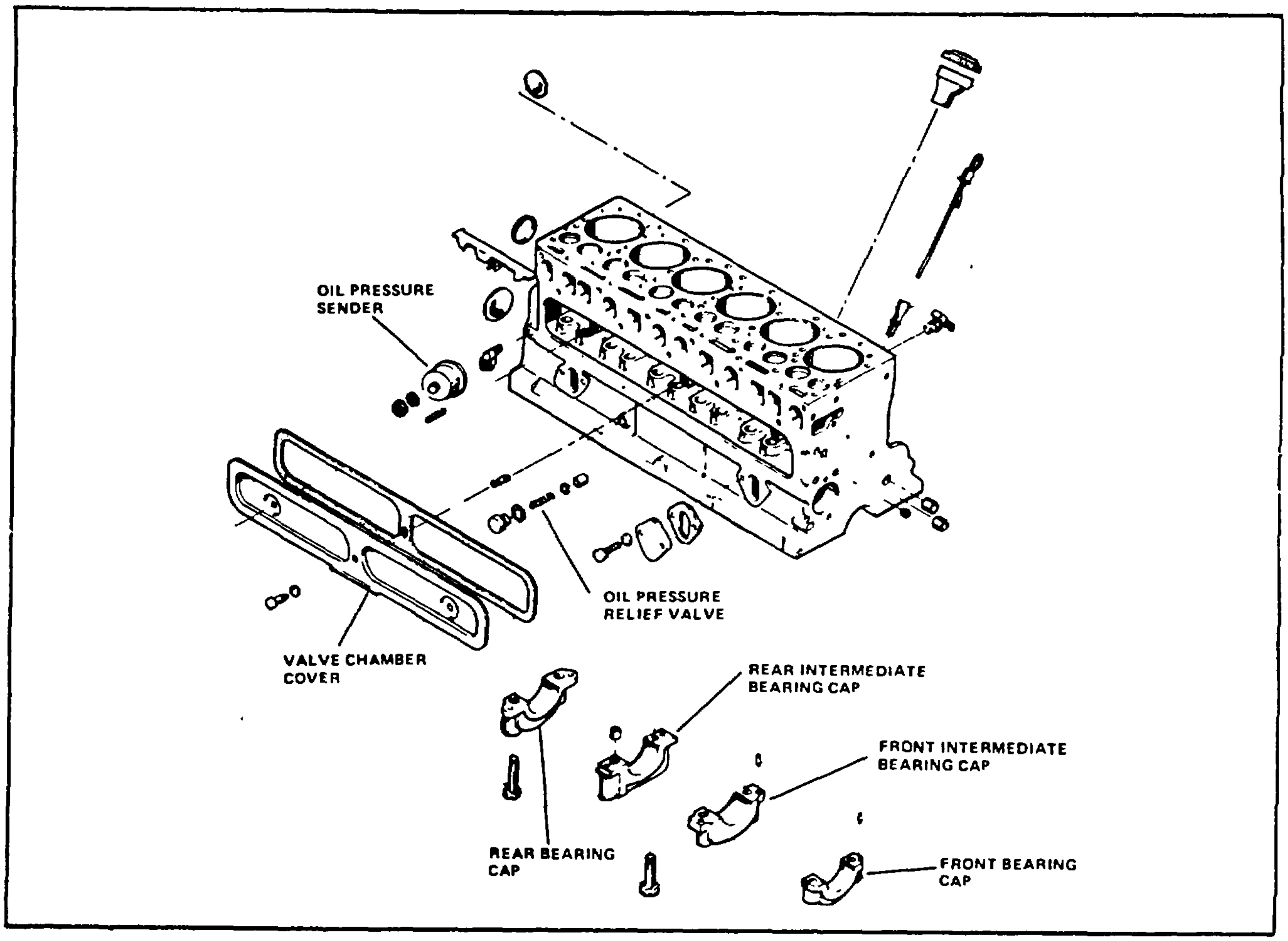


Figure 1. Cylinder Block Disassembled

This is accomplished by casting the cylinder block with individual intake valve passages for each cylinder and connecting these passages to an Intake manifold which also has Individualized passages for each cylinder. This equal distribution results in maximum power, smooth operation, easy starting and longer engine life.

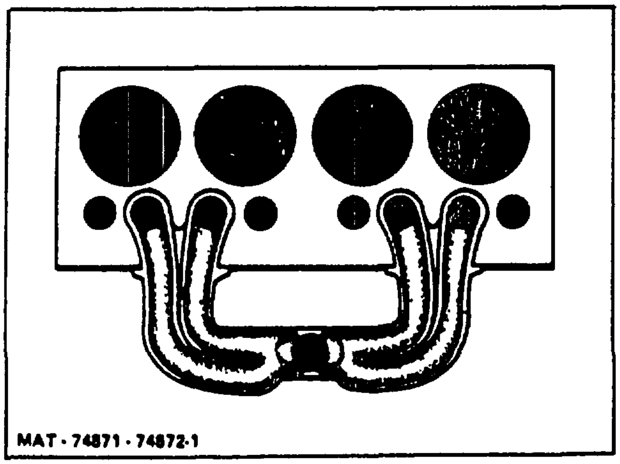


Figure 2. Intake Manifold Individual Porting

B. GENERAL SPECIFICATIONS

1. Size and Piston Displacement

   Number of cylinders 6
   Bore...3.4375"
   Stroke...4.375"
   Displacement (cu. in.) 244
   Compression Ratio 7.2:1

2. Type

   Four stroke cycle - naturally aspirated.

3. Crankshaft Rotation

   Clockwise facing fan end of engine.

4. Suspension

   Three point on rubber bushings.

5. Ignition

   Battery and distributor.

6. Firing Order

   1-5-3-6-24 Number 1 cylinder at fan end of engine.

7. Spark Plugs

   Standard metric 18 MM thread.

8. Lubrication

   Forced feed by oil pump driven directly off camshaft, to all main, connecting rod and camshaft bearings as well as tappets and timing gears.

9. Cooling

   Coolant circulated by centrifugal pump driven by "V" belt from crankshaft pulley.

   Full pressure flow through engine at all times.

   Engine capacity - 5 qts.

   Engine and Radiator capacity - 15 qts.

10. Oil Pressure

    Maximum - 30-40 p.s.i.

    Minimum (Idling) - 7 p.s.i.

11. Oil Sump Capacity

    Four quarts - add one-half quart extra when oil filter is replaced. Throw-away cartridge type filter.

12. Connecting Rods

    Drilled for piston pin lubrication. Bronze bushing at piston pin end.

13. Camshaft

    Supported by 3 replaceable bearings. Driven by helical gear from the crank-shaft.

14. Pistons

    Aluminum with four piston rings - 2 compression rings, 1 scraper ring and 1 oil control ring.

15. Valves

    Located in cylinder block. Operated by valve tappets directly from camshaft.

    Intake Valve Clearance - .012

    Exhaust Valve Clearance - .020

16. Crankshaft

    Supported by 3 main replaceable bearings.

17. Fan Drive

    Belt and "V" pulley on crankshaft.

18. Gear Train

    Helical gears (3) - crank gear, cam gear and governor gear.

19. Governor

    Centrifugal actuated, surge compensated, weight type driven by drive plate and pin from the gear train. The range of governor action is indicated by the differential between RPM under no load and RPM under-load.

C. ENGINE TUNE-UP SPECIFICATIONS

Timing .... O-Deg. T.D.C. (STATIC) @ 300 RPM (DYNAMIC)

Valve Lash

- Intake 9 Operating Temperature .... .012"
- Exhaust g Operating Temperature .... .020"

Point Gap .... .020"

Dwell 36-42

Firing Order 15-36-2-4

Plug Gap .... .025"

Low Idle .... 400-600 PPM

High Idle .... 2400 + 50 RPM

Compression ....10 p.s.i. max. variance Q 150 RPM (Engine Cranking Speed)

Oil Pressure, 1800 .... 7 p.s.i. 450-500 RPM - Min.
30-40 p.s.i. @ 2400 RPM - Max.

Oil Capacity................................. Oil Change, w/o filter - 5 qts.
Oil Change, w/filter- 5-1/2 qts.

TOPIC 2. VALVE ADJUSTMENT

A. DESCRIPTION

The valve tappets (Figure 3) are removable. These large, barrel shaped, pressure lubricated tappets are so designed that by removing the adjusting screw, the main body can be lifted out and replaced from above through the valve chamber. This eliminates the costly service operation of dropping the oil pan and pulling the camshaft. Locking of the adjustment is both simple and effective.

Accurate valve tappet settings materially prolong engine life and aid performance. In addition to impairing performance, excessive clearances are detrimental to cams and tappets as well as to the rest of the valve mechanism. When clearances are too low, the possibility of burned valves increases.

B. ADJUSTMENT

Check and adjust intake and exhaust tappets to following clearances at running temperature:

Intake - .012"
Exhaust - .020"

To adjust valve tappets proceed as follows:

1. Disconnect the high tension coil wire to prevent accidentally starting the engine.
2. Remove the valve tappet cover from the left side of the crankcase.
3. Remove the spark plug from number one cylinder.
4. Place thumb over the spark plug opening and slowly crank the engine until an outward pressure can be felt. Pressure indicates number one piston is moving toward Top Dead Center of the compression stroke. Continue cranking until the timing mark on the flywheel is in center of the flywheel housing timing hole. Both valves are then closed on the compression stroke of number one cylinder.

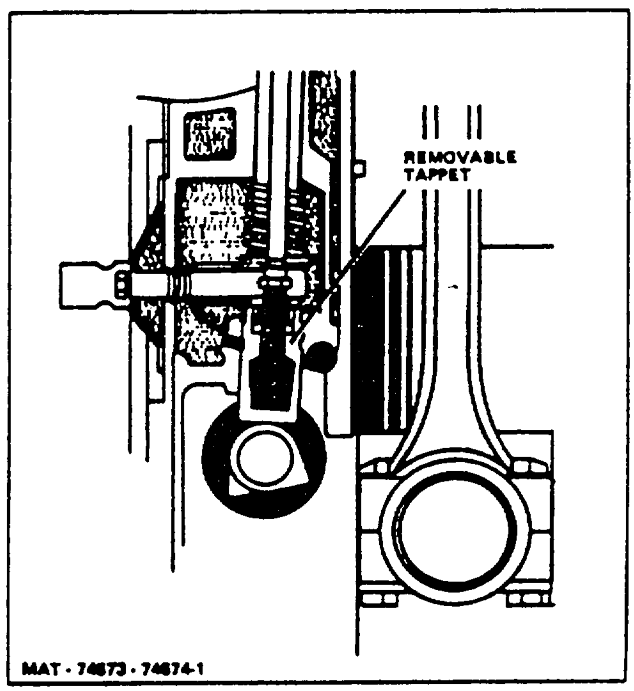


Figure 3. Removable Valve Tappet

5. Use two thin wrenches when adjusting valve clearance. Use the lower wrench to hold the tappet and the upper wrench to raise or lower the tappet adjusting screw. When- the valve lash is properly adjusted, the appropriate feeler gauge should pass between the tappet and its corresponding valve stem with a slight drag (Figures 4 and 5).

6. Crank the engine one-half revolution at a time and check the clearance of each valve; adjust if necessary. Do this on each set of cylinder valves in succession according to the firing order of the engine, which is 1-3-4-2.

7. Replace the valve tappet cover. Replace gasket and check to see that the valve cover makes an oil-tight seal with the crankcase.

8. Replace the spark plug, spark plug wire and coil wire.

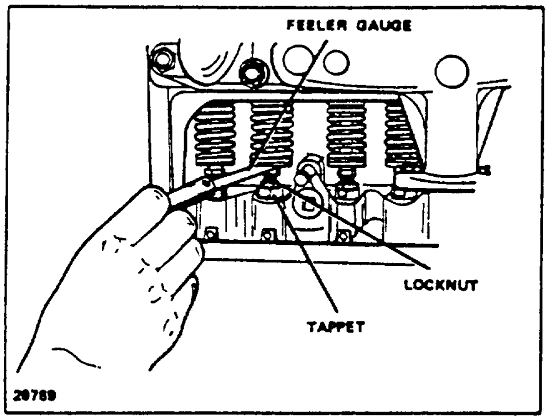


Figure 4. Checking Valve Tappet Clearance

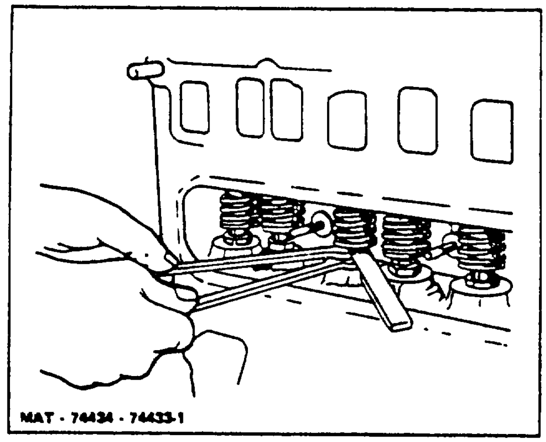


Figure 5. Adjusting Valve Tappet Clearance

TOPIC 3. OIL FILTER

A. DESCRIPTION

The engine oil is filtered through a "Spin On" by-pass type, throw-away, oil filter cartridge. This filtering is necessary to minimize the possibility of oil contaminations, such as metal chips, carbon, dirt, etc., that may have inadvertently entered the oil supply, causing excessive wear to the engine parts.

The oil filter cartridge should be replaced at every oil change.

B. REMOVAL

1. Remove and discard filter cartridge and clean out all oil residue in filter base mount (Figure 6).

C. INSTALLATION

1. Install replacement filter cartridge. Spread light coat of oil between the cartridge and the mounting, and hand tighten ONLY.

2. Start engine and check for leaks around base mounting.]

3. Stop engine and check oil level.

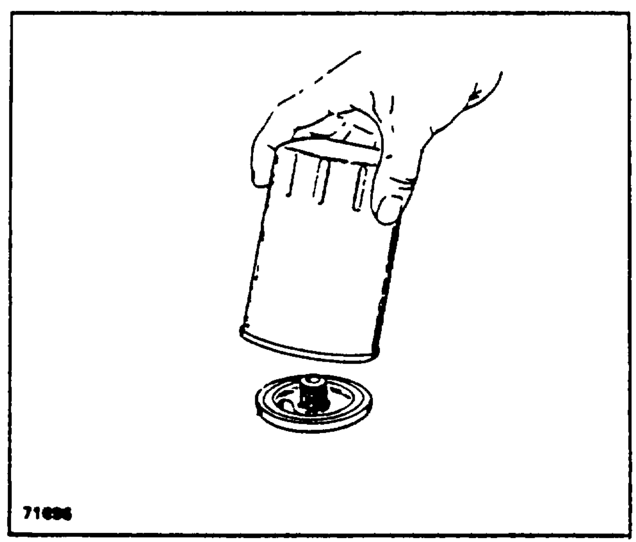


Figure 6. Oil Filter Removal

TOPIC 4. OIL PRESSURE RELIEF VALVE

A. DESCRIPTION

Pressure relief is located externally on the right hand side, near the oil pan flange at the center. Pressure is controlled by a plunger and spring (Figure 7) the latter specifically for a certain range. The only adjustment variation is either to change springs or assemble or remove washers from behind the present spring. Up to four washers are permissible. Decrease the oil pressure by removing washers from behind the compression spring.

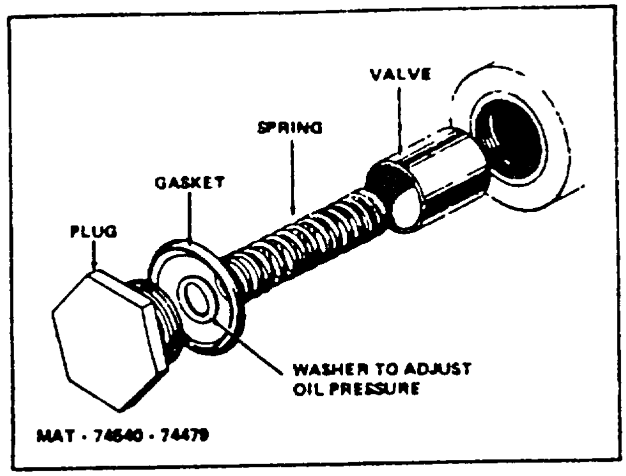


Figure 7. Oil Pressure Relief Valve Components

TOPIC 5. ENGINE TUNE-UP

Engine tune-up is an orderly process of restoring the engine to satisfactory performance. In addition, preventive maintenance and corrective operations should be accomplished so that engine serviceability will be unimpared. The following outlines simple adjustments, inspections and tests, and should be performed in the order given.

A. BATTERY SERVICEABILITY

Be sure that battery tray is clean and level and that battery hold-down clamps are snug. Ensure battery posts and cables are clean and free of corrosion. Apply a light coat of grease to terminals.

Make certain that battery cables are not reversed. Connect negative to ground, positive to starter solenoid.

Check electrolyte level regularly, and add clean water if necessary, but do not overfill. Keep battery clean and wash with baking soda solution if corrosion is evident. Do not allow soda solution to enter cells. Inspect cables, clamps and hold-down bracket regularly. Replace if necessary.

B. INSPECT AND ADJUST SPARK PLUGS

Blow dirt from spark wells, then remove plugs. Clean spark plugs. Inspect for cracked or broken insulators, broken electrodes or excessive carbon deposits. Replace any faulty plugs. Adjust gap to specifications. Test cylinder compression before reinstalling plugs.

C. COMPRESSION

Warm up engine to operating temperature. Blow dirt out of pockets around spark plugs. Remove all plugs and insert compression gauce in first spark plug hole and hold it firmly. Crank engine until the highest gauge reading is obtained. (Approximately four compression strokes.)

Check-all cylinders in this manner. If readings are low in two adjacent cylinders, a blown head gasket is indicated. If readings are low and vary widely (more than 10 PSI), pressure is being lost either at the pistons, rings or valves. To determine where pressure loss is occurring, insert about one tablespoon of SAE 30 engine oil through the spark plug hole. Take a new reading. If this reading is higher than the initial reading, the piston rings are faulty. If reading is the same as the initial reading, the valves may be leaking or the cylinder head gasket is damaged.

D. CYLINDER LEAK TEST

Perform cylinder leak test by removing one spark plug at a time, (ensure high tension coil wire is disconnected) and insert leak tester in spark plug well; build up pressure as recommended. Record reading and record any appreciable pressure fall-off. If pressure loss is indicated, check cylinder head for hissing noise, (head gasket), carburetor, (intake valve), exhaust pipe and manifold, (exhaust valve), and oil fill tube, (piston rings). Check all cylinders in like manner and repair as required.

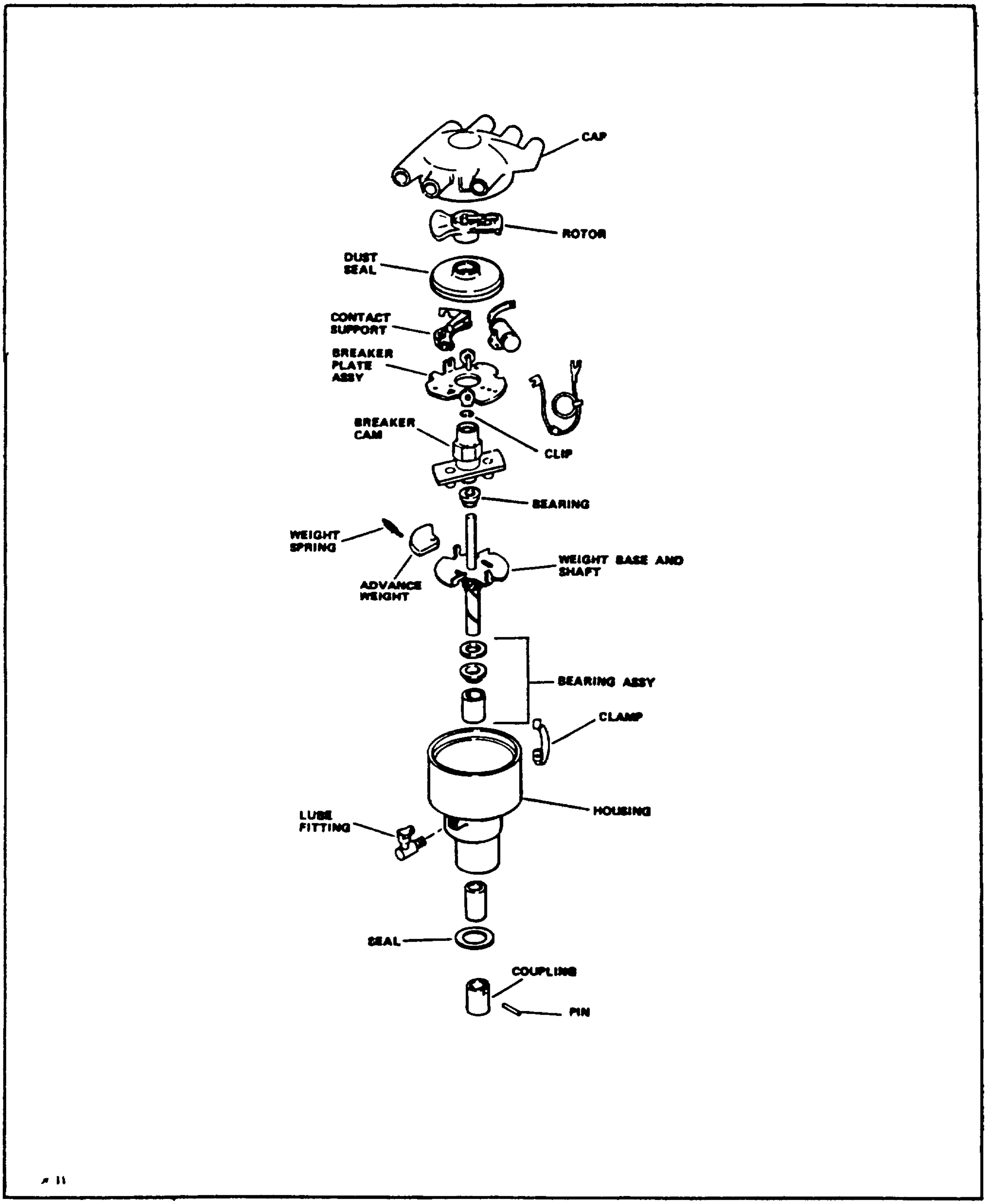


Figure 5-2. Distributor Assembly (Type II) Exploded View

E. IGNITION TIMING

The ignition system consists of the battery, ignition coil, distributor, condenser, spark plugs, alternator and high and low tension wiring.

The system produces and delivers high voltage surges of up to 20,000 volts to the correct plug, at the correct intervals in exact time with the engines' sequential mechanism.
To maintain efficient, economical engine operation, the electrical and mechanical sequencing must be exactly matched or timed.

The distributor warrants particular attention in relation to this sequencing and the following procedure is recommended as a comprehensive alignment:

1. At regular intervals, remove the distributor cap and dust seal and inspect contact points, rotor and cap for evidence of wear, arcing, cracks or corrosion. Repair or replace as required.

2. Badly pitted or burned points must be replaced.

> **NOTE: If points are burned or pitted, replace the condenser, too.**

3. Install contact set and be certain that points are in perfect alignment (Figure 10).
4. Remove timing cover on flywheel housing and remove the spark plug from number one cylinder.
5. Place thumb over spark plug opening and rotate the engine crankshaft by hand until an outward pressure against thumb is felt. Continue turning crank-shaft until D.C. mark (Figure 9), is aligned with the reference mark at center of the timing window.
6. Loosen clamp bolt at base of distributor and slowly rotate distributor housing until the breaker lever rubbing block is on the high spot on the cam.
7. Bring the points to their maximum open position (Figure 10), and loosen the contact assembly locking screw. Lock distributor clamp bolt.
8. Insert a .020" feeler gauge between contact points, insert a screwdriver into the adjusting slot and turn clockwise or counterclockwise to obtain the specified contact point gap of .020".
9. When properly adjusted, a slight drag will be felt as the feeler gauge is slid between-the points.

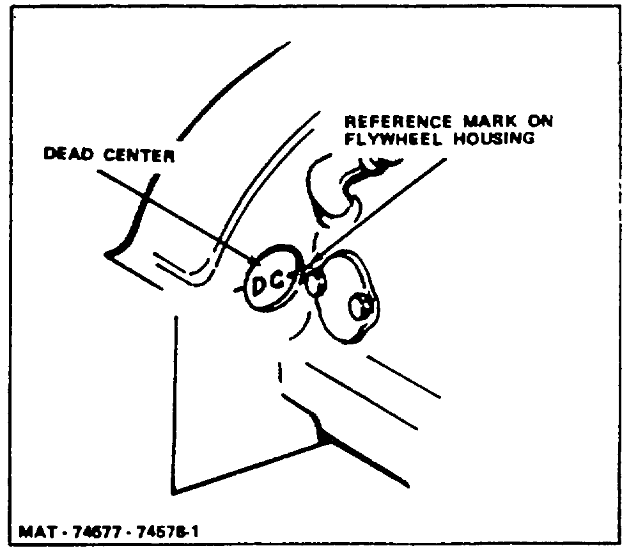


Figure 9. Flywheel Timing Marks

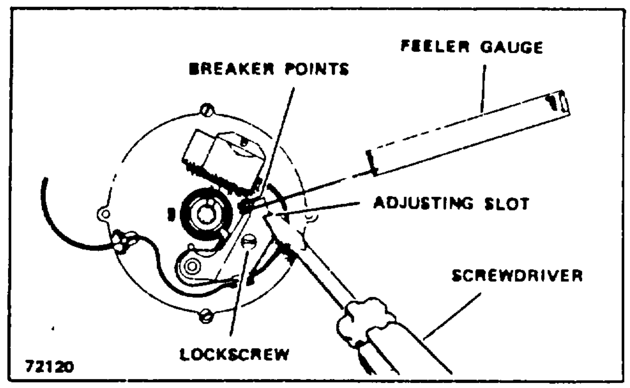


Figure 10. Adjusting Contact Gap

10. Tighten locking screw and recheck point gap for accuracy.
11. Replace dust seal, rotor and distributor cap.

> **NOTE: Following data is required for proper distributor to engine timing.**

F. DISTRIBUTOR CHARACTERISTICS

Rotation .......................C.W. (Viewing Rotor)
Point Opening .... 020"
Cam Angle Range ....36° - 42°
Start Advance (T.D.C.) ....500 RPM
Maximum (22.00) .... 2400 RPM
Contact Point Spring Pressure ..17 - 21 oz.

(Refer to following engine timing procedures.)

G. STATIC IGNITION TIMING

The exact timing of the, spark- depends: on the actual breakage, or opening, or the electrical contact across the points. Should there be any question as to the accuracy of point setting relative to the engine timing mark, the use of the static timing method is recommended.

1. Make up a simple light circuit consisting of an automotive light bulb with soldered-on leads or a socket with lead wires attached. Remove distributor cap, rotor and dust seal.
2. Clip one lead to the positive or ungrounded side of the battery and attach the other lead to the primary wire connector on the side of the distributor.
3. Remove timing window cover on flywheel housing and manually turn crankshaft until D.C. mark aligns exactly with reference mark on flywheel housing (Figure 9).
4. The light will go out if the distributor is correctly aligned at D.C mark.
5. If light stays on, loosen, distributor clamp and turn distributor housing, until spot on cam opens contact points to their maximum position. Light will go, out.
6. Lock distributor clamp and verify point gap of .020" using feeler gauge (Figure 10).
7. Remove bulb tester leads. Replace dust. seal, rotor and distributor cap.
8. Replace flywheel timing window cover.
9. Perform the Dynamic Timing Procedure to assure proper engine running performance.

H. DYNAMIC IGNITION TIMING,

Ensure distributor point gap is properly set at .022". (Refer to Ignition Timing above.)

1. Loosen clamp at the distributor (Figure 11).
2 Remove flywheel inspection cover and turn crankshaft manually to align flywheel D.C. (Dead-Center) mark with reference mark on flywheel housing (Figure 9).
3. Connect timing light as follows: Red lead to battery positive post, black lead to battery negative post, and blue lead to number one spark plug (Figure 12). If necessary, refer to Individual Timing Light Instructions.
4. Install a tachometer and connect the hot lead to the positive ignition coil led and connect other lead of tachometer to ground
5. Start engine, and using the carburetor idle adjusting screw, lower the idle speed to a point where no distributor advance arm. (Approximately 300-350 r.p.m. as indicated on tachometer.

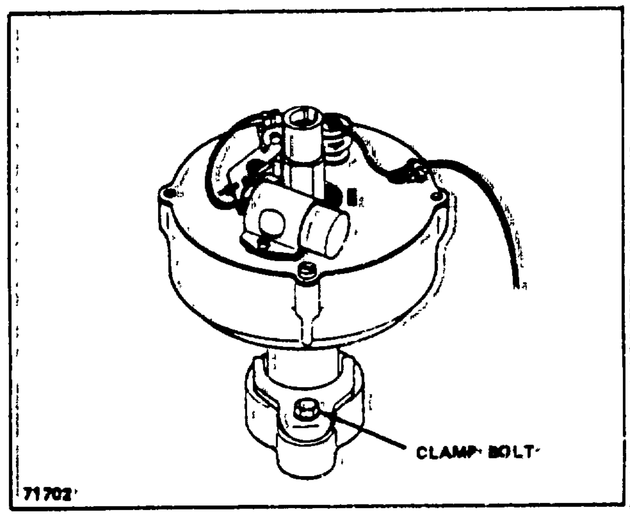


Figure 11. Distributor Timing, Adjustment

6. Direct timing light at flywheel timing hole and turn distributor housing, as required, until timing light strobe, shows perfect alignment of D.C. mark with flywheel housing reference mark.
7. Lock distributor in this position.
8. Accelerate engine rapidly a few times and observe movement of D.C. mark after engine retards to 300-350 r.p.m. range.
9. If the spark advance is, functioning properly,, the D.C. mark will move counterclockwise during acceleration and drop back to D.C. alignment at engine idle. Reset engine idle speed.
10. Shut engine off. Remove tachometer and timing light. Replace flywheel inspection cover.

I. GENERAL INSPECTION

1. Clean fuel filter. Remove and clean filter bowl. Clean screen in filter head. (Refer to Fuel System.)

2. Clean Air Cleaner. Clean air cleaner element. (Refer to Air Cleaner, Fuel System.)

3. Adjust valve clearances. Inspect and adjust valve clearances. (Refer to Valve Clearance Adjustment.)

4. Adjust Carburetor. With all above operations completed, start engine and operate until hot. Adjust carburetor. (Refer to Fuel System.)

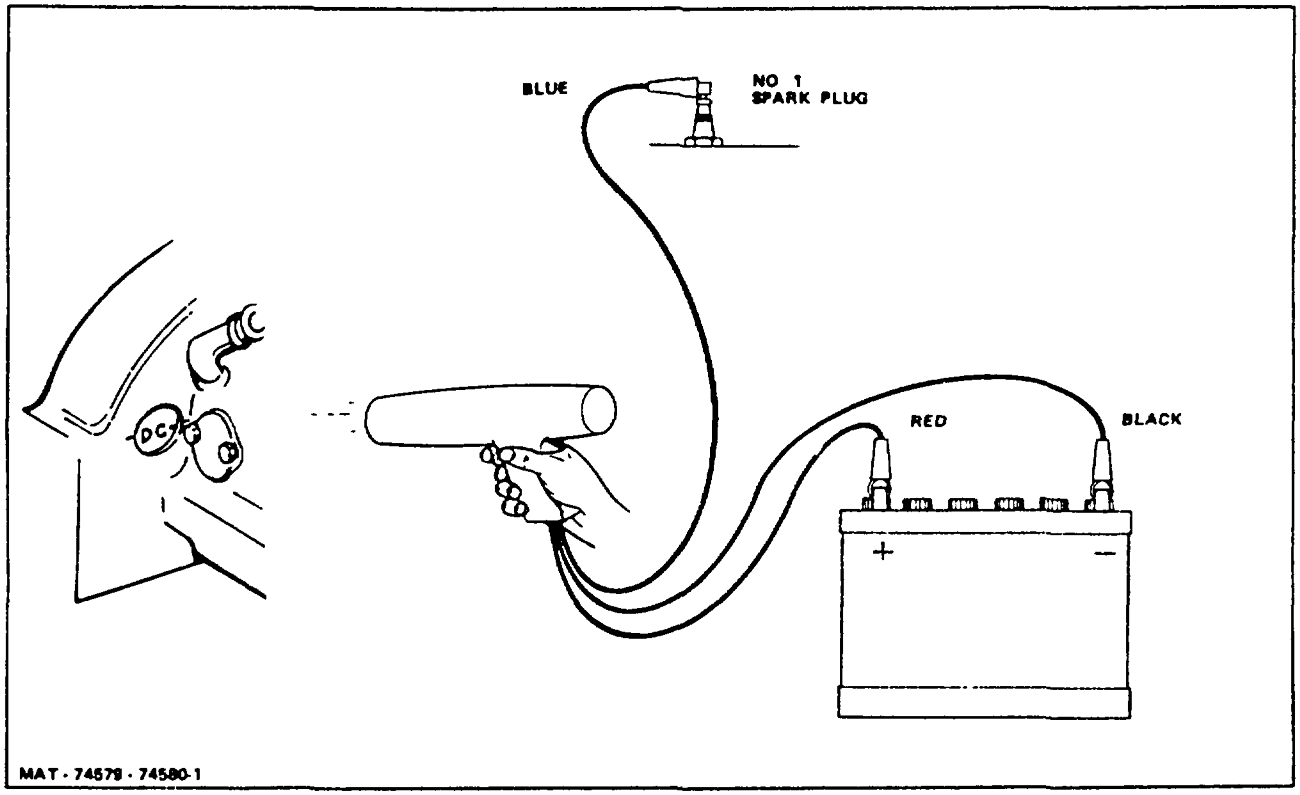


Figure 12. Timing Light Connections

TOPIC 6. TROUBLESHOOTING

It as been proven that over 90% of the troubles that occur in engine operation are avoided when those persons responsible for maintenance adhere to an adequate program of lubrication, inspection and maintenance on a regularly scheduled basis. The time and expense involved in such programs is only a fraction of that incurred when poor maintenance practice results in a major malfunction or breakdown.

In most cases, when trouble is detected and remedied immediately, a more expensive, time consuming repair will be avoided. Following are some of the normal complaints encountered in routine operation and the probable causes. For detailed inspection, maintenance and repair procedures, refer to the specific topical section, repair manual, relating to the malfunctioning component.

A. ENGINE WILL NOT START

If the starting motor will not crank engine then check for:

1. Weak or dead battery.
2. Poor ground connection.
3. Faulty starting switch or relay.
4. Defective starting motor.
5. Internal engine seizure, turn engine manually to determine cause.

When the engine cranks but does not start disconnect one spark plug wire, turn ignition on with starter cranking engine and free end of wire 1/8" from cylinder head, note spark.

1. No spark.
   a. If ammeter shows no discharge, it indicates an open primary circuit due to:
      (1) Points not closing.
      (2) Open primary wires.
      (3) Defective ignition switch.
      (4) Faulty coil.
   b. A normal ammeter reading (2.5 amps) indicates that primary circuit is OK, trouble may be in secondary circuit due to:
      (1) Broken or grounded high tension wire, from coil to distributor.
      (2) Wet high tension wires.
      (3) Faulty distributor cap or rotor.
      (4) Broken secondary winding of coil.
   c. An excessive ammeter reading (over 5 amps) indicates a "short" in the primary winding which may be due to:
      (1) Shorted or grounded primary winding.
      (2) Distributor or points not opening.
      (3) Grounded breaker point arm.
      (4) Defective condenser.
2. Weak spark may be caused by:
   a. Loose ignition wiring connections.
   b. Burned or pitted distributor points.
   c. Wet spark plug wires.
   d. Defective condenser.
   e. Cracked distributor cap.
   f. Weak ignition coil.
3. Good spark at each plug indicates that ignition system is OK and trouble is in fuel system, which may be due to:
   a. No gas in carburetor due to:
      (1) No gas in tank.
      (2) Clogged filter or lines.
      (3) Faulty fuel pump.
      (4) Leaky fuel line from tank.
      (5) Plugged vent in fuel tank cap.
   b. Gas in carburetor flooded due to:
      (1) Too much choking and the plugs are wet.
      (2) Wrong float level.
      (3) Choke not operating correctly.
      (4) Water in Gas.

B. POOR ENGINE PERFORMANCE

Engine runs with continuous mis-firing due to:

1. Uneven compression.
2. Wet or deteriorated high tension wires.
3. Cracked distributor cap.
4. Faulty spark plugs, if spark plug porcelain is white when removed, use Colder plug, if light brown OK, if Black or oily use Hotter plug.

Engine runs unevenly.

1. At idling speed, which may be due to:
    a. Too wide spark plug gaps.
    b. Poor carburetor idle adjustment.
    c. Wrong float level.
    d. Carburetor or intake manifold air leaks.
    e. Leaky cylinder -head gasket.
2. At high speed, which may be due to:
    a. Wide breaker points.
    b. Weak distributor breaker arm spring.
    c. Weak valve springs.
    d. Spark plug of wrong type or incorrect gap.

Engine runs improperly.

1. Back-firing into manifold indicates Too Rich a fuel mixture; into carburetor indicates Too Lean a mixture, may be due to:
    a. Late Ignition Timing.
    b. Clogged Air Cleaner.
    c. Fuel line restriction.
    d. Clogged carburetor jets.
    e. Sticking Valves.
    f. Weak or broken valve springs.
2. Excessive ping (detonation) results in damaged pistons and bearings and is caused by pre-ignition or using inferior grade of gas.
3. Engine idles too fast indicates improper throttle adjustment or weak throttle return springs.
4. Engine dies when idling which indicates incorrect speed or mixture adjustment; clogged idling circuit in carburetor or wrong choke adjustment, or air leaks in intake manifold.
5. Engine "stumbles" on acceleration which may be due to defective accelerator pump or air in fuel lines.
6. Defective spark plugs. Lack of power which may be due to:

1. Poor compression.
2. Wrong timing.
3. Throttle control not opening fully.
4. Air leak in fuel system.
5. Restriction in air cleaner, should have vacuum less than 10" water.
6. Exhaust line obstructed, should have back pressure of not more than 20" water.
7. Poor fuel.
8. Piston rings sticking or worn.

C. ENGINE OVERHEATING

Engine overheats indicates one of the following:

1. Lack of water in radiator.
2. Fan belts slipping.
3. Thermostat sticking or inoperative.
4. Radiator clogged or leaky.
5. Late ignition timing.
6. Back pressure in exhaust line.
7. Defective water pump.
8. Overloading of engine.

D. OIL PRESSURE OR CONSUMPTION PROBLEMS

Low oil pressure will indicate:

1. Low oil level.
2. Oil pressure gauge or line faulty.
3. Oil too light, diluted.
4. Suction screen plugged.

5. Dirt in relief valve or broken spring.
6. Worn bearings.
7. Worn or damaged oil pump gears.
8. Worn can bushings.

Oil pressure should not exceed recommended pressures except when engine is starting up cold. Abnormally high oil pressure is not desirable because it increases oil consumption, possible causes of high oil pressures are:

1. Engine oil too heavy.
2. Stuck relief valve.
3. Obstruction in distributing line.
4. Faulty oil pressure gauge.

High oil consumption indicates:

1. Oil leaks.
2. Too high oil level.
3. Incorrect grade of oil used.
4. Clogged crankcase breather.
5. Oil pressure too high, stuck relief valve.
6. Piston rings not run-in, due to too smooth cylinder bore finish or glazed condition.
7. Worn, broken or stuck piston rings and clogged oil control rings.
8. Worn pistons and sleeves.
9. Worn bearings.
10. Worn valve guides.

(Manifold may be removed for visual Inspection.)

E. ENGINE MECHANICAL NOISES

Engine knocks and other noises.

1. Operating knocks which may be due to:
   a. Pre-ignition the most common cause of which is the wrong type plugs which are too hot.
   b. If carbon is noticeable when engine is accelerated while hot, clean head and pistons.
   c. Early timing causes knocks similar to carbon, but may tend to kick back when starting.
   d. Detonation knock caused by poor gas.
   e. Overloads at lower operating speeds.

2. Mechanical knocks result from wear, abuse or improper adjustments, which may be due to:

   a Crankshaft and main bearings.
      (1) Worn or burned-out main bearings, a heavy, dull knock when accelerating under load. Locate by shorting out plugs on both sides of the bad bearing.

      (2) Crankshaft end-play, excessive end-play is indicated by an intermittent knock which will come and go when the load is released and engaged.

   b. Worn or burned out connecting rod bearings. The worst condition, a light pound or metallic knock, is noted at idling and to about 2/3 maximum speed. Bad bearings can be determined by shorting out plugs.
   c. Pistons and wrist pins.

      (1) Loose wrist pins, noise doubles when the correct plug is shorted out, most noticeable at idling speed.

      (2) Piston loose in cylinder "piston slap" is noted by metallic knocking at low speed under load; but disappears at high speed also most noticeable when starting cold. Test by shorting out plugs.
   d. Broken piston ring or pin indicated by a sharp clicking noise that won't short out.
   e. Valves.

      (1) Burned valves and seats cause engine misses, especially at low speeds, or acceleration under load.

      (2) Weak or broken valve springs, missing at low or high speeds when under load.

(3) Sticking valves cause loss of power and popping sound when bad.

(4) Tappet noise, excessive clearance causes noise when cold which diminishes at normal operating temperature.

f. Cawshaft, noise due to loose bearings or end play, usually occurs at half engine speed.

g. Timing gear noise, loose or worn gears rattle or knock, tight gears hum.

3. Vibration originating at engine, the most common sources of vibration originating in or on the engine, as distinguished from causes created outside the engine are as follows:

a. Misfiring.
b. Misalignment of engine.
c. Bent or off-center coupling.
d. Engine loose on bed and type of mountings.
e. Out of balance condition of flywheel and clutch assembly.

TOPIC 1. FUEL SYSTEM

A. DESCRIPTION

The following components make up the fuel system: The fuel tank, fuel pump, strainer and filter, the carburetor, accelerator linkage and, the governor assembly.

The fuel tank is, the fuel reservoir and, via the fuel lines, fuel pump, strainer and filter, supplies the carburetor with raw fuel to be vaporized and mixed with fresh air for controlled combustion.

The fuel system is designed to function virtually trouble free, but does require adequate preventive maintenance to ensure its continued operation.

TOPIC 2. AIR CLEANER

A. DESCRIPTION

The air cleaner is-mounted on the side of the engine and is connected to the carburetor air intake by tubing and hose. It prevents dust, chaff, or other foreign matter, the chief causes of engine, wear, from entering the manifold and engine.

The air enters the cleaner and passes through a replaceable type, dry filter element. The element is constructed of pleated paper and bound at the edges with plastic. This construction -filters and removes the fine dust particles from the air stream intake. The clean and purified air is then drawn through the center tube of the element and into the carburetor and intake manifold. For continued efficient engine operation, the air cleaner must be properly serviced.

B. INSPECTION

Inspect the filter element at intervals frequent enough to ensure having a clean element. It may become necessary to inspect the element more often in an atmosphere heavily laden with dust, chaff and lint.

C. SERVICE

When servicing the cleaner, reduce engine down time to a minimum by replacing a dirty filter element with a new element or one that has been cleaned. Service the dirty element later, using procedures detailed in Subparagraph 2 (Optional Service Methods).

CAUTION

Never remove the air cleaner while engine is running, and do not run engine unless air cleaner is in place.

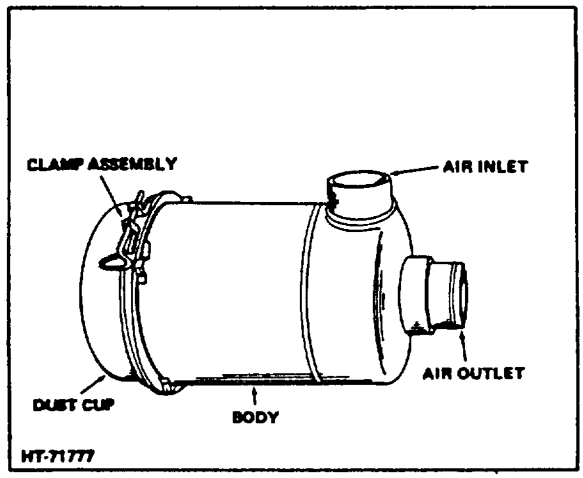


Figure 3-1. Air Cleaner

1. Air Cleaner Service

   Clean baffle and dust cup as follows:

   a. Loosen clamp assembly (Fig 3-2) and remove dust cup.

   b. Loosen wing nut and remove baffle from dust cup.

   c. Empty dirt from cup. Clean cup and baffle.

   d. Remove foreign material from around filter element.

   e. Assemble baffle to dust cup. Tighten wing nut.

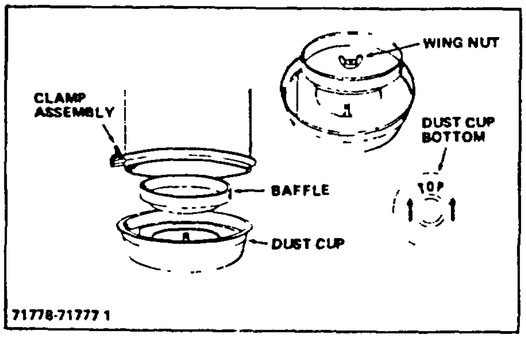


Figure 3-2. Baffle and Dust Cup Details

⚠ CAUTION
Bottom of dust cup is marked with arrows and the word TOP. Air cleaner is mounted in horizontal position. Be sure dust cup arrows point up (Fig 3-2). DO NOT USE OIL IN DUST CUP.

f. Position dust cup on air cleaner body. Tighten clamp securely.

Replace filter element as follows:

a. Remove wing screw and gasket washer. Remove filter element.

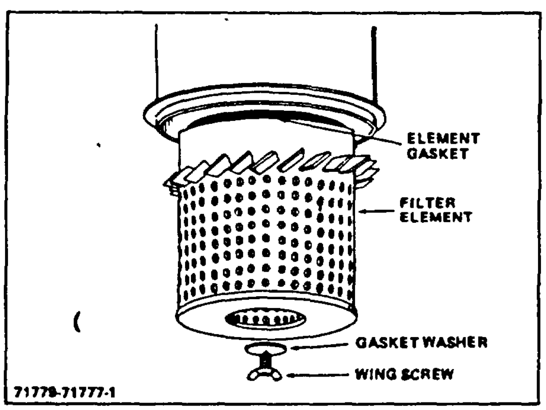


Figure 3-3. Removing Filter Element

b. Inspect element gasket for damage.

c. Install a new or clean element. Inspect cup gasket (if applicable) and replace if it' is damaged.

⚠ CAUTION
Air cleaner is mounted in horizontal position. Be sure dust cup arrows point up. (See Fig 3-2) DO NOT USE OIL IN DUST CUP. Always refer to manufacturer's instructions on air cleaner.

d. Install dust cup on air cleaner body. Make certain it seals 360 degrees around the body. Tighten clamp securely.

2. Optional Service Methods

⚠ CAUTION
Pre-cleaning fins on filter element are not removable.

⚠ CAUTION
Air pressure at nozzle must not exceed 100 psi. Maintain reasonable distance between nozzle and filter element.

The filter element can be either dry cleaned or washed as detailed below.

a. To dry clean filter element, direct a jet of dry clean air up and down pleats on clean air side of element.

b. If filter element is oily and soot laden, wash it in a solution of warm

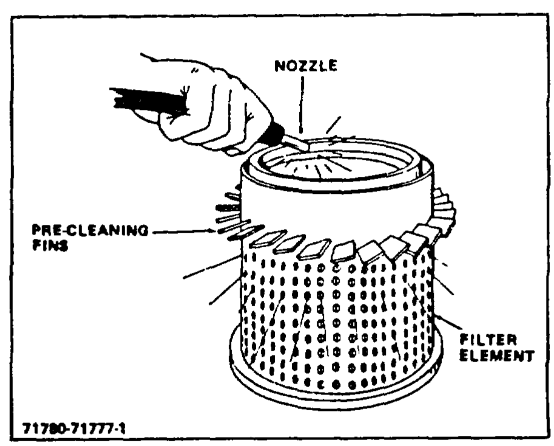


Figure 3-4. Dry Cleaning Filter Element

water and household detergent. The warmer (100°F) the solution, the better it will clean. Soak element for 15 minutes, then remove it and rinse thoroughly with clean, running water (maximum pressure 10 psi). Air dry thoroughly before reusing. (A fan or air draft may be used for drying, but do not heat element to hasten drying.)

c. Inspect for damage by placing a bright light inside element (Fig 3-5). Thin spots, pin holes or the slightest rupture will render the element unfit for further use.

NOTE: Replace filter element after 6 cleanings.

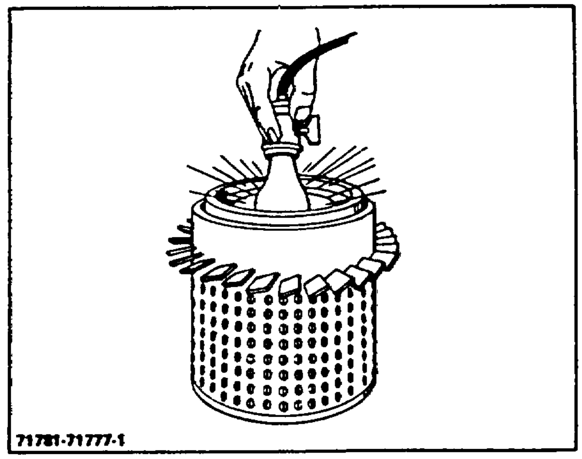


Figure 3-5. Inspecting Filter Element

TOPIC 3. FUEL TANK

A. DESCRIPTION

The fuel tank is of steel construction-with welded seams. It includes a fuel level sender unit and a filler cap with filter screen.

The fuel tank requires little, if any service other than periodic cleansing of the fuel filter screen.

B. CLEANING AND INSPECTION

1. Remove filler cap assembly and check filter screen for fouling. Clean if required, and dry with compressed air.

2. Replace filler cap assembly.

3. Loosen drain plug.

4. Inspect for water contamination.

5. If contaminated, drain until water is emptied, then close valve.

6. Connect outlet fuel line and fill tank to recommended capacity with proper octane fuel.

7. Check tank and fuel lines for leaks. Repair if necessary.

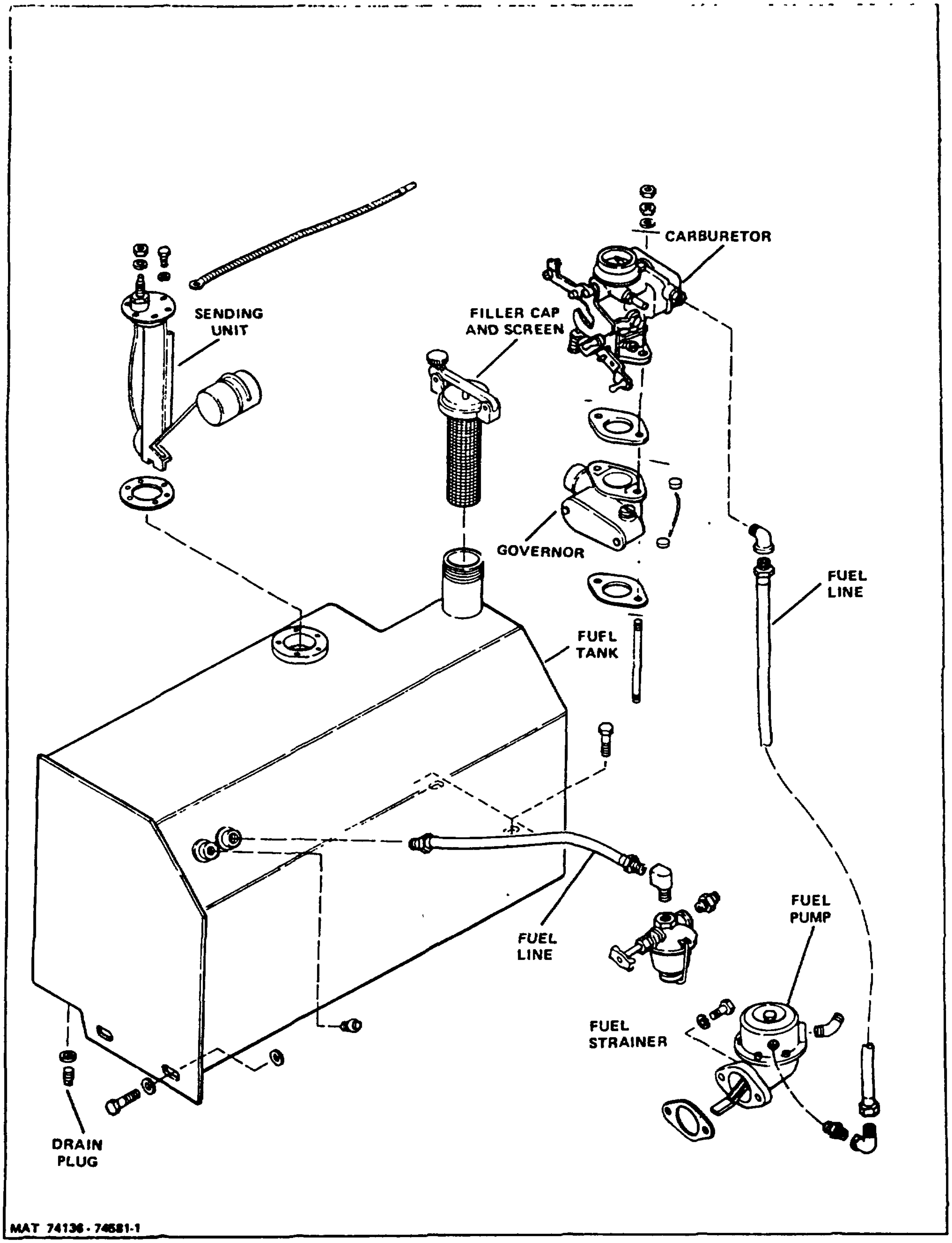


Figure 2. Fuel System

TOPIC 4. FUEL PUMP AND FUEL FILTER

A DESCRIPTION

The fuel pump is a mechanical diaphragm type pump with a strainer and sediment bowl. The pump is mounted on the left side of the engine and is operated by an eccentric cam on the engine camshaft.

Fuel from the tank enters the strainer-sediment bowl on the suction stroke of the pump and is forced to the carburetor on the pressure stroke. Action is controlled by two valves in the cover assembly.

B. REMOVAL AND INSPECTION

1. Disconnect fuel pump inlet and outlet lines.
2. Remove capscrews and lockwashers from fuel pump mounting flange and remove pump.
3. Clean pump with solvent and dry with compressed air.
4. Remove bowl and bowl gasket.
5. Remove strainer screen from top cover and discard.
6. Install new strainer screen after ensuring that it shows no damage or obstruction. New screen must fit snugly around inner and outer edges.
7. Install new bowl gasket, swing bail assembly into position over bowl, and tighten nut securely.
8. Test operation of pump valve by attaching pressure gauge to outlet and operating rocker arm. Pressure should be between 2-3/4 p.s.i. to 3 p.s.i. Pressure should not fall off rapidly.
9. Install fuel pump as removed, ensuring new mounting gasket is used.
10. Install and secure capscrews and lockwashers.
11. Connect inlet and outlet fuel lines. Do not over tighten connections.

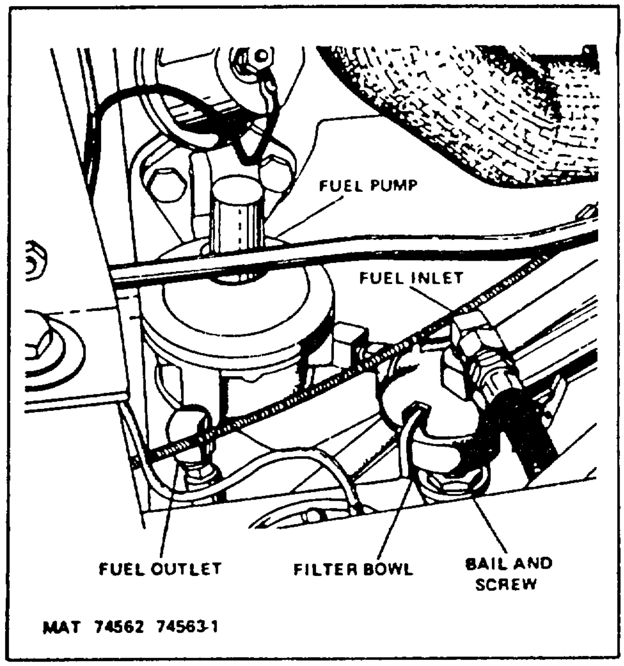


Figure 3. Pump Mounting

TOPIC 5. CARBURETOR

A. DESCRIPTION

The carburetor used in this fuel system is a single venturi, updraft type with fixed jets covering all speeds except idle. It has an airbleed well method of compensation, an idle fuel adjusting screw and an idle throttle stop screw. The air intake of the carburetor is provided with a choke valve control. The flow of fuel through the main jet system is controlled by the size of the jet. The idle adjusting screw controls the fuel mixture for the idle system.

B. CHOKE VALVE ADJUSTMENT

To aid in starting a cold engine, a choke valve is provided in the air inlet of the carburetor. By closing this valve, a rich mixture of fuel is drawn into the carburetor for quick starting.

It is only necessary to make certain the choke control fully opens the valve by the time the engine has reached normal operating temperature and choke control button is pushed all the way in. Adjustment is made at the swivel connection on the choke shaft lever.

C. CARBURETOR ADJUSTMENTS

NOTE: Before any work is performed on carburetor, make sure the trouble is not due to poor compression, or in the ignition system due to incorrect timing, fouled spark plugs, burned ignition points, etc.

Refer to REPAIR MANUAL for CARBURETOR REPAIR.

The correct mixture of fuel and air is controlled by a fixed main jet and an adjustable idle fuel jet. The idle throttle stop screw controls the throttle position to ensure correct engine idle speed.

Adjustments are properly set when the unit is shipped from the factory and if they have to be disturbed the carburetor must be readjusted.

NOTE: Before making any carburetor adjustments, allow the engine to warm up to normal operating temperature. Make carburetor adjustments as follows:

1. Throttle stop-screw adjustment: The throttle idling stop-screw should be turned in against the stop to hold the throttle open slightly. Then, after the idle fuel adjustment is made, adjust the stop-screw to obtain an idle speed of between 500 and 550 r.p.m.

2. Idle fuel adjustment: Turn idle adjustment screw in to obtain a lean mixture or turn out to obtain a rich mixture. During adjustment, engine speed may increase or decrease. Adjust idle screw until the engine runs smoothly and steadily. It may be necessary to reset throttle stop-screw to obtain correct idle speed.

TOPIC 6. ACCELERATOR LINKAGE AND GOVERNOR ASSEMBLY

A. DESCRIPTION

The accelerator linkage provides manual, foot pedal control of the engine speed by either increasing or decreasing the fuel, flow to the carburetor. Maximum engine speed, r.p.m., is controlled by the governor assembly, which is pre-adjusted at the factory.

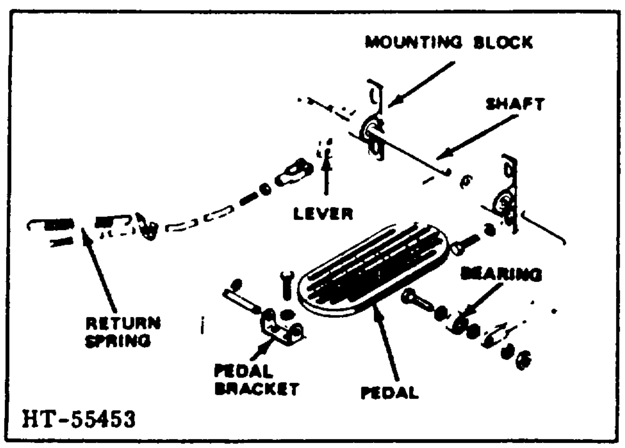


Figure 4. Accelerator and Linkage

B. GOVERNOR ASSEMBLY

The velocity type governor is mounted between the carburetor and the manifold. It consists of a main body, containing a throttle shaft, a throttle valve and a main governor spring.

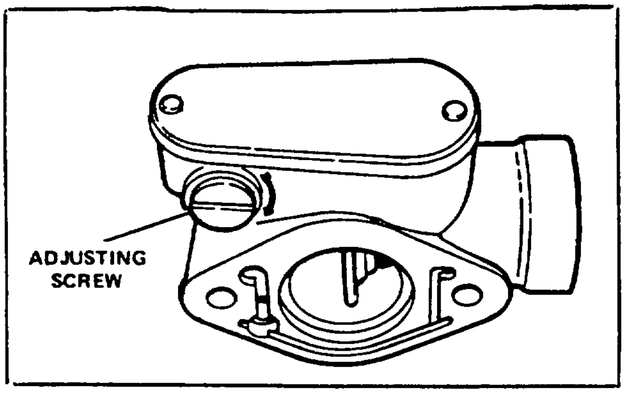


Figure 5. Velocity Governor

C. GOVERNOR ADJUSTMENT

To obtain the desired engine speed, turn adjusting screw in or out to increase or decrease pull on the governor spring.

A. DESCRIPTION

The electrical system includes the battery, alternator with integral voltage regulator, spark plugs, starter motor solenoid and starter motor, associated wiring and accessories. The electrical gauges and the horn are protected by fuses conveniently located underneath the instrument panel.

The instrument panel and engine, chassis and accessory wiring groups are all neatly bundled in a common wiring harness to protect wiring from moisture, grease and possible damage due to inadvertent contact with frame or linkage.

A typical electrical wiring diagram is illustrated in Figure 1.

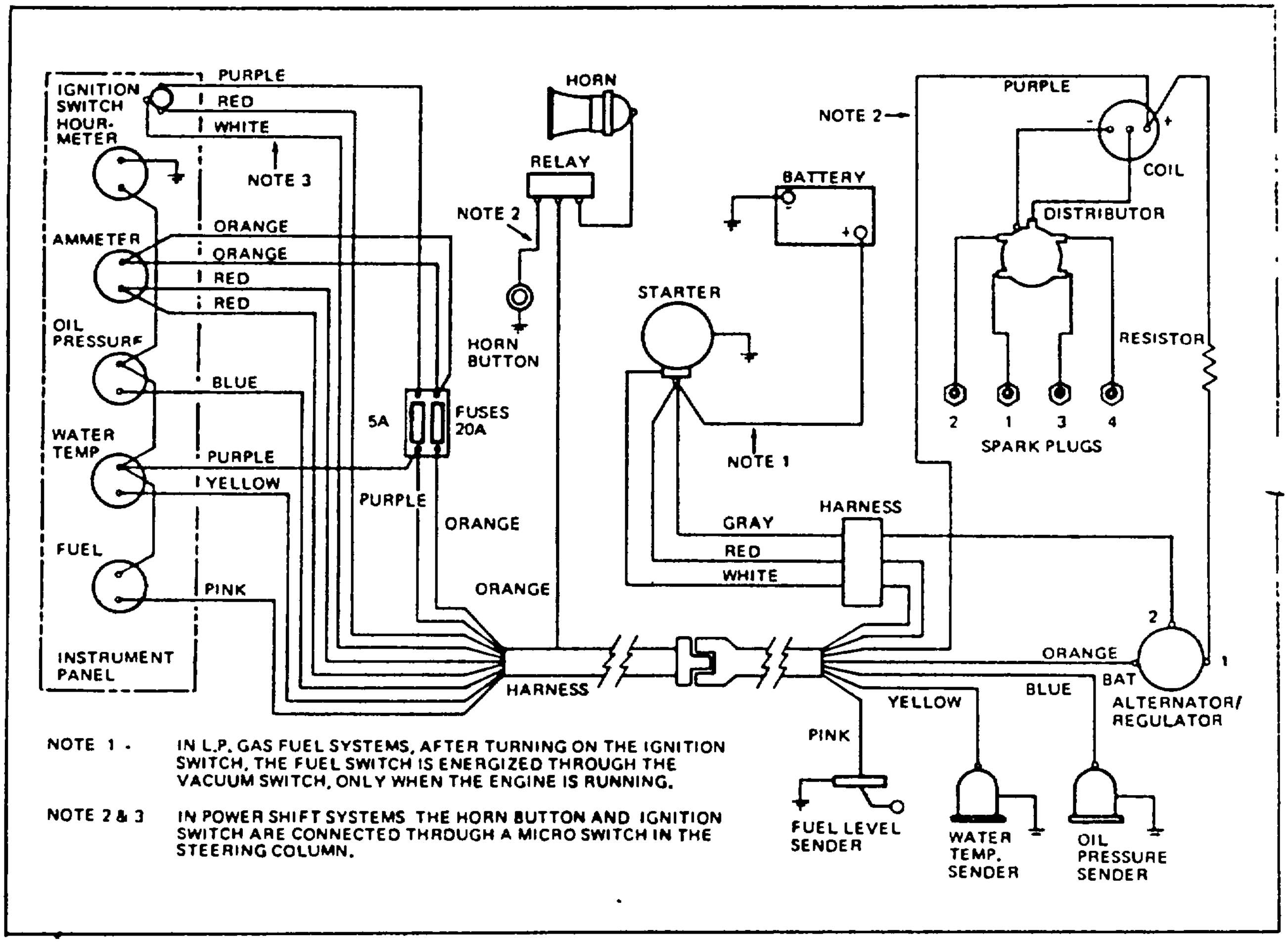


Figure 1. Electrical Wiring Diagram

A. DESCRIPTION

The storage battery mounted on a swing-out steel tray located beneath the operator's seat, is used to store current for the electrical system. The steel tray is held securely in place by a neoprene covered hold-down clamp. Electrical energy drained from the battery, through the operation of various units in the system, is restored by the regulated alternator. Refer to Figure 1, wiring diagram, for proper battery installation.

B. SERVICE

Use of water with a high mineral content reduces battery efficiency due to the mineral build-up on the cells as the water evaporates. Be sure the filler plugs are replaced tightly and that plug vent holes are not clogged.

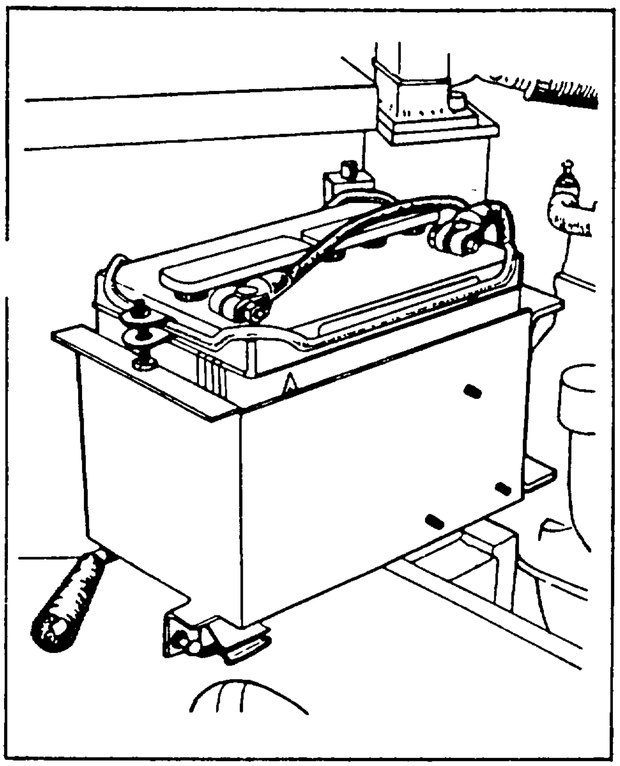


Figure 2. Location of Battery

When connecting a booster battery, be sure to connect the negative battery terminals together and the positive battery terminals together.

When connecting a charger to the battery, be sure to connect the charger positive lead to the battery positive lead, and the charger negative lead to the battery negative lead.

C. REMOVAL

1. Lift operator's seat.
2. Gain access to the battery by swinging out the side panel.
3. Disconnect the positive and negative battery cables from their respective posts.
4. Remove the wing nuts from the holddown clamp.
5. Tilt battery towards rear of truck and lift out of battery tray. Take care not to spill any of the electrolyte during handling.

D. INSTALLATION

1. Maintain replacement battery in an up-right position, tilting only as required for fit, during installation.
2. Be certain battery replacement position is the same as when removed.
3. Make certain battery posts and cable terminals are clean and that the terminals are connected to proper posts securely.
4. Expand cable terminals for ease of installation, and do not hammer onto posts, as this practice could loosen posts and ruin battery.
5. Be sure the ground polarity of the battery and ground polarity of alternator are the same.
6. Ensure that electrolyte in each cell is at proper level.
7. Replace hold-down clamp.
8. Swing side panel back to normal operation position.

NOTE: Refer to REPAIR MANUAL for detailed battery information.

TOPIC 3. ALTERNATOR AND REGULATOR

A. DESCRIPTION

Although the alternator and its built-in regulator are designed and constructed to give trouble-free service for long periods of time, following a regular inspection procedure will allow maximum life to be obtained from the units.

The inspection frequency will be determined by the type of operating conditions: High speed operation, high temperatures, and heavy duty conditions all increase wear on the alternator slip rings and bearings. The terminals should be inspected at regular intervals for corrosion or loose connections.

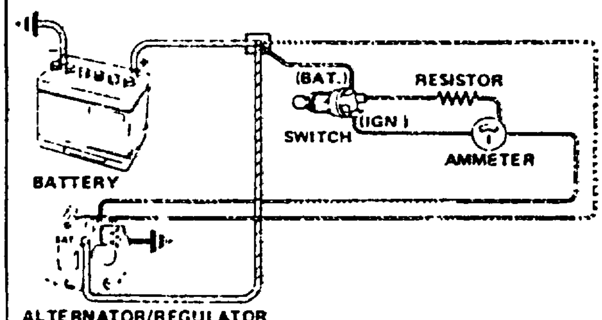


Figure 3. Typical Wiring Diagram

B. ADJUSTMENT

Be sure to check the mounting bolts for tightness and the belt for alignment, corrosion, tension and wear. Belt tension should be adjusted to allow approximately 3/8" inward deflection of the belt between the alternator pulley and the fan pulley with a force of about 10 pounds. (See Figure 4.)

When tightening belt tension, always apply pressure against the stator laminations, never against the end frames.

A noisy alternator can be caused by worn or dirty bearings, loose mounting bolts, a loose drive pulley, a defective diode or a defective stator.

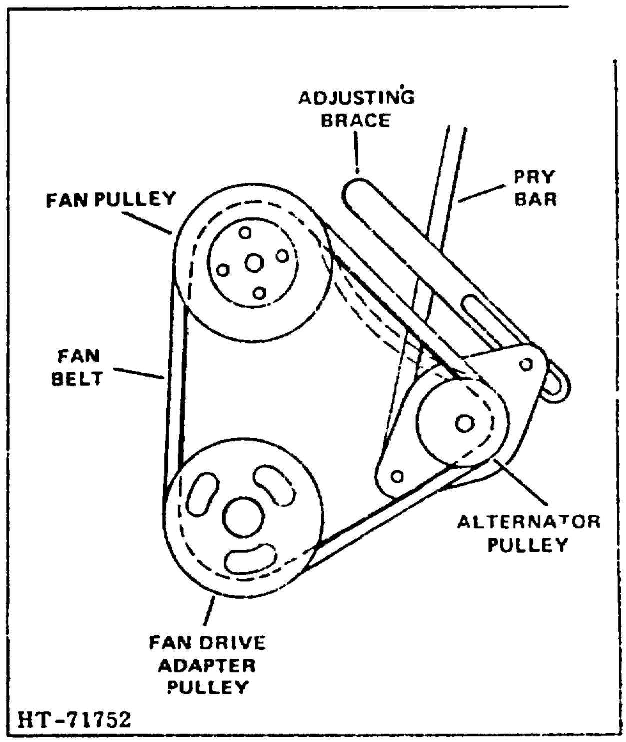


Figure 4. Fan Belt Tension

NOTE: For proper disassembly, inspection, repair and reassembly procedures, refer to REPAIR MANUAL.

C. REMOVAL

1. Disconnect the battery from the electrical circuit prior to alternator removal/installation.

2. Disconnect the "BAT" (battery) terminal and "#1" and "#2" post connectors at the alternator.

3. Loosen adjusting brace and mounting bolt, then push alternator towards engine until fan belt is disengaged from alternator pulley.

4. Carefully remove the alternator from the engine as the pivot mounting bolt and adjusting brace capscrew are removed.

NOTE: Refer to REPAIR MANUAL for DISASSEMBLY, INSPECTION, REPAIR AND REASSEMBLY.

D. PRECAUTIONARY PROCEDURE

The alternator is designed for use on only one popularity system; therefore, the following precautions must be observed when working on the charging circuit. Failure to heed these precautions will result in serious damage to the electrical equipment.

1. When installing alternator be absolutely sure the ground polarity of the alternator and the ground polarity of the battery are the same.

2. When connecting a booster battery, be sure to connect the negative battery terminals together and the positive battery terminals together.

3. When connecting a charger to the battery, be sure to connect the charger positive lead to the battery positive lead, the charger negative lead to the battery negative lead.

4. Be absolutely sure all connections in the circuit are secure, as the alternator must never be operated with an open circuit.

5. Never ground or short across any of the alternator terminals.

6. Do not attempt to polarize the alternator.

E. INSTALLATION

1. Carefully position the alternator mounting flange on mounting bracket and install pivot bolt and adjusting brace capscrew.

2. Hold alternator close enough to engine to engage fan belt on alternator pulley, then, using pry-bar as shown in Figure 4, tighten pivot bolt and adjusting brace capscrew for 3/8" belt deflection with about 10 pounds of applied force.

3. Connect previously removed wiring as labeled.

CAUTION: Be certain that connections are properly made and secured.

F. DISASSEMBLY, REPAIR, REASSEMBLY
Refer to REPAIR MANUAL for proper procedures.

TOPIC 4. STARTER MOTOR

A. DESCRIPTION

The starter motor is designed to operate under overload conditions and to produce high torque. Because of its limited physical size it can only do this for short periods of time, since in order to produce such power a high electrical current must be used. High current creates considerable heat and if the starting operation is continued for any length of time, the accumulated heat will cause serious damage.

CAUTION: Starter must never be used for more than 30 seconds at any one time. Allow starter motor to cool for 2 minutes before using again. Never use starter to move truck.

The drive mechanism incorporates a locking feature which prevents demeshing of the drive pinion from the flywheel ring gear, until a predetermined flywheel speed is reached. The automatic meshing of the drive pinion with the flywheel ring gear is accomplished in the usual manner. If the engine fails to continue running, due to weak or irregular firing, premature demeshing of the pinion from the ring gear is prevented by the locking feature.

The starter motor is a completely enclosed unit and requires very little maintenance. However, to ensure satisfactory operation, periodic inspections should be made to make sure mounting and wiring connections are tight and in good condition.

B. INSPECTION

1. Verify that starter motor electrical connections to battery are clean and tight.

NOTE: Loose or dirty connections anywhere in the electrical circuit will cause high resistance and reduced cranking efficiency.

2. When all mounting and wiring connections are kept in good condition, and the starter motor responds instantly and cranks engine when the ignition switch is closed, the starter motor may be considered to be in satisfactory working condition.

NOTE: The starter motor is equipped with graphite and oil impregnated bushings which should be lubricated only when motor is disassembled.

C. REMOVAL

1. Lift operator's seat and swing open side panel. '
2. Disconnect battery cable leads at battery to guard against possible electric shock during removal.
3. Disconnect and label all electrical connections at starter motor.
4. Remove mounting bolts which secure starter motor to flywheel housing.
5. Carefully pull starter motor assembly out of flywheel housing until drive end clears flywheel housing, then tilt commutator end up to remove unit from truck.

NOTE: For DISASSEMBLY, INSPECTION, REPAIR and REASSEMBLY, refer to REPAIR MANUAL.

D. INSTALLATION

1. Insert drive end of starter motor in flywheel housing. If drive mechanism is fully extended, then mesh pinion gear with flywheel ring gear.
2. Install mounting bolts and tighten securely.
3. Connect all electrical leads to starter motor.
4. Connect battery positive lead to positive post and negative lead to negative post.
5. Close side panel and lower operator's seat.

TOPIC 5. ELECTRICAL WIRING

A. DESCRIPTION

For the most part, the electrical wiring that Interconnects all the electrically operated components of the truck is grouped in a harness assembly which is properly taped and securely clamped to the truck frame. Wherever necessary, wires are protected by loom and rubber grommets to prevent chafing where direct contact is made with the frame or the engine.

Individual wires in the wiring harness are color-coded for ease of identification, since; in the covered harness, only the extreme ends of the individual wires are visible. This color coding facilitates ease of identification during installation, trouble-shooting and repair.

The following chart, Figure 5, outlines wiring identity by color, gauge and connections.

Color	Gauge	Description
Red	10	Starter to Ignition Switch
White	16	Starter to Ignition Switch
Gray	10	Starter to Alternator (2)
Purple	16	Coil (+) to 5A Fuse
Purple	16	Coil (+) to Gauge (+) Terminals
Orange	10	Alternator (BATT) to 20A Fuse
Orange	16	Alternator to Horn Relay
Blue	16	Oil Gauge to Sender
Yellow	16	Water Temp. Gauge to Sender
Pink	16	Fuel Gauge to Sender
Black		Horn Button to Horn Relay
Black		Coil to Distributor Terminal
Black		Relay to Horn
Black		Battery to Starter
Orange (2)	10	Ammeter to 20A Fuse
Red (2)	10	Ammeter to Starter

Figure 5. Wire Identity Chart

B. SERVICE (REMOVAL/INSTALLATION)

It is recognized that replacement of one or re individual wires may be necessary and that complete harness replacement may be impractical. Emergency repair can be made by installing a new wire between two points, and disconnecting the old or defective wire at each end.

CAUTION: Because of the potential danger of electrical shock, it is wise to disconnect the battery cables curing electrical repair work.

Select the desired length, color and gauge wire for replacement. Run the new wire along the wire harness and attach it in several places with electrical tape. Attach new terminal tips to the replacement wire and after covering terminal wire connection with tape or neoprene tubing, attach both ends of wire to respective component tie point.

NOTE: Always keep connections clean and tight to ensure low resistance conductivity.

Check for defective circuits is easily accomplished. Disconnect wires at both ends of suspected circuit. With a test lamp, touch test probes to each end of circuit and if test lamp fails to light, circuit will have to be repaired or replaced.

TOPIC 6. HORN AND HORN RELAY

A. DESCRIPTION

The horn is a magnetically sensitive, vibrating unit, and is actuated by a horn relay which, in turn, is energized by the horn button located in the center of the steering wheel. The horn and horn relay are located on the right hand cowl support.

The horn is relay operated to provide shorter, more direct electrical connections between the battery and the horn. This supplies a higher working voltage at the horn with a resultant improved performance and avoids the necessity of pulling the full current load through the horn button.

When the horn button is depressed, current flows through the relay coil, with a resulting magnetic field Induced in the relay coil and core, which attracts the relay armature. The armature is pulled downward against a spring tension and closes the battery to horn circuit contact points.

B. SERVICE

Before checking horn and horn relay, make certain battery is connected and that it is producing the rated voltage output. If the battery circuit is operating properly, proceed as follows:

1. If horn produces a weak signal, connect a voltmeter from ground (truck chassis) to horn terminal, press horn button and note voltage reading on voltmeter. If voltage is between 0 and 10.7 volts, check for an open circuit, defective horn relay, poor wiring or a shorted horn coil.

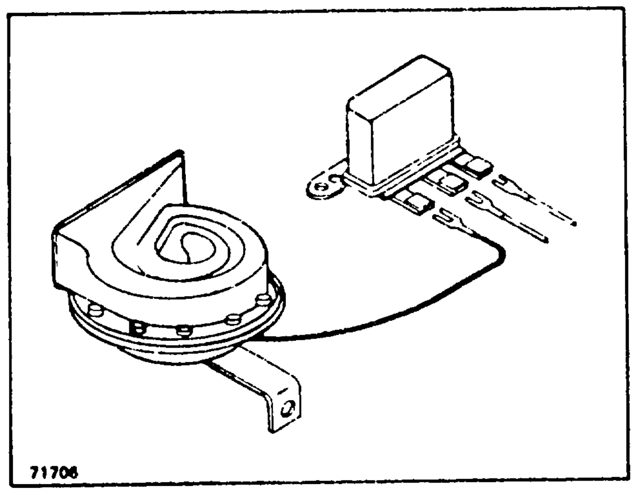


Figure 6. Horn and Horn Relay

2. If horn signal is weak and voltage at horn terminal is normal, check volume adjusting screw in horn cover. Screw turns IN or OUT to increase or decrease volume.
3. If horn relay requires adjustment, cover can be removed and relay points correctly gapped. (Refer to HORN RELAY ADJUSTMENT in REPAIR MANUAL for proper procedure.) Air gap setting at coil is 0.020" with points closed, and 0.018" with points opened. The correct closing voltage is 8.3 to 10.2 volts.

TOPIC 7. IGNITION COIL

A. DESCRIPTION

The purpose of the high voltage ignition coil is to deliver high voltage surges to the spark plugs, via the distributor. The ignition coil accomplishes this by stepping up a primary input voltage of 12 V.D.C. to a surge of about 20,000 V.D.C. through normal transformer action.

The coil consists of a primary and a secondary winding. (See Figure 7.) The primary winding contains about 200 turns of heavy wire, and the secondary winding contains about 20,000 turns of very fine wire. To concentrate the magnetic field, these windings surround a soft iron core composition and are enclosed by a soft iron shell. The entire assembly is built into a one piece steel coil case which is oil filled and hermetically sealed by the cap and gaskets. This construction prevents moisture from entering the coil and also permits faster dissipation of the generated heat.

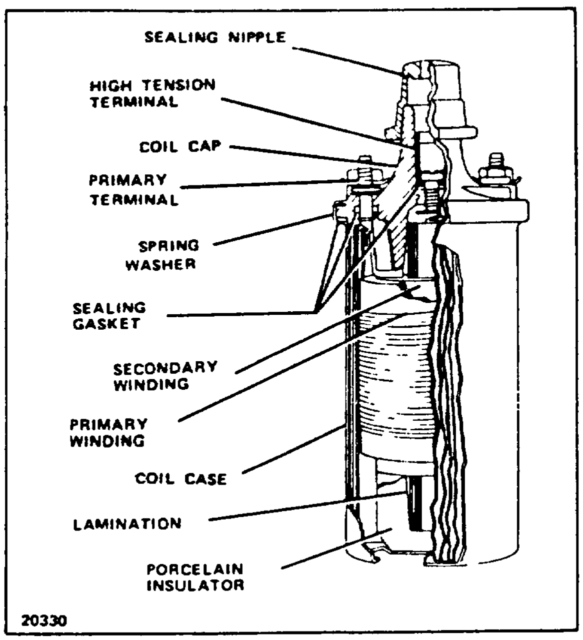


Figure 7. Ignition Coil

The coil has two primary terminals marked "+" and "-" on the exterior cap. (The proper polarity is noted on the ignition wiring diagram.) The coil is generally mounted as near as possible to the distributor in order to keep the interconnecting high tension lead as short as possible. (This reduces the possibility of a high voltage arc between the wire and any chassis (ground) points it might otherwise contact.)

All the ignition cabling in the high tension circuit (coil to distributor to spark plugs) is neoprene covered and is resistant to oil, grease, battery acid. This type of insulation also helps to prevent current losses.

B. SERVICE

The ignition coil requires no particular service other than an occasional operational performance check. Also check electrical contact points for cleanliness and tightness of connection. The coil can only be tested on a reliable coil testing machine; however, if the engine is quick starting and smooth running it can be assumed that the ignition coil is performing satisfactorily.

C. REMOVAL

1. Disconnect and label primary lead, resistor lead and condenser lead attached to cap of ignition coil.
2. Pull high tension (secondary) wire out of center of cap.
3. Loosen securing clamp and remove ignition coil.
4. Clean exterior of coil assembly with an acceptable cleaning solvent. Check that primary connectors are free of dirt and grime and provide a good electrical connection.
5. Remove sealing nipple and check for cracks. Replace, if damaged.
6. Inspect high tension terminal for foreign deposits and clean, if necessary.
7. Inspect entire case for cracks or oil seepage. Replace, if damaged.
8. Place ignition coil on ignition coil tester and check for proper voltage output and voltage breakdown. Take action as indicated by test results.

D. INSTALLATION

1. Insert ignition coil in retaining clamp and secure clamp.
2. Insert high tension lead in center of ignition coil cap. Press down firmly and feel definite snap as it seats properly. Ensure that sealing nipple is pressed firmly against coil cap shoulder.

3. Reconnect condenser lead to post from which removed and reconnect primary and resistor lead to primary post from which removed.

NOTE: Ensure that proper "+" or "-" polarity is strictly observed.

4. Ensure that all electrical connections have been properly made, i.e., coil to distributor to spark plugs, etc.

NOTE: The ignition coil center tower rubber "Boot" should always be replaced when a new coil is installed. Carbonized tracks in the rubber "Boot" form when a coil failure is due to a "burned tower", and if the rubber boot is not replaced, early failure of the new coil can be expected.

TOPIC 8. DISTRIBUTOR

A. DESCRIPTION

The distributor delivers the high voltage surge, induced in the ignition coil secondary, to the spark plugs at the proper time for sequential cylinder firing. The distributor is mounted on the cylinder head, and is driven off the camshaft at one-half of the engine crankshaft speed.

The distributor consists of a cast housing into which a shaft and weight base are fitted in a bronze bushing. Centrifugal advance weights are pivoted on studs in the weight ,se and are free to move against the calibrated weight springs which connect them to the breaker cam assembly.

During the time the contact points remain closed, current flows from the battery, through the ignition coil primary windings, the contact points and back to the battery through a ground return. Energy in the form of magnetism is stored in the ignition coil. As the distributor breaker cam continues to rotate, the next cam lobe is brought around to where it strikes the breaker lever rubbing block and opens the contact points.

The open contact points break the electrical circuit and although current tends to continue to flow through the coil because of self-induction, it is shunted through a capacitor to prevent arcing across the open points. The stored magnetic energy in the coil collapses producing a very high voltage in both windings. The energy in the coil begins to drain through the secondary high tension lead, into the center of the distributor cap, through the rotor and then jumps to the electrode opposite which the rotor has been positioned, out through another high tension lead and finally fires the proper spark plug.

The spark is sustained through several degrees crankshaft rotation. At the same time, the shunted energy in the condenser discharges back through the primary circuit, but not until the spark is completed at the plug, and the whole firing cycle starts again.

B. REMOVAL

1. Remove the high tension wiring from the spark plugs and the high tension wire from coil to distributor at the coil. Remove the primary lead that runs from side of distributor to coil primary connection.

2. Remove capscrew, lockwasher, and distributor clamp arm and lift distributor assembly from cylinder head opening.

3. Unlock distributor cap retaining screws and remove cover assembly.

C. INSPECTION

The distributor cap should be removed at regular intervals to examine the contact points, rotor and the cap.

NOTE: Dust cover under distributor cap must be removed before points can be checked.

1. Check all high tension wiring for defective insulation and poor connections at distributor cap and spark plug connectors.

2. Wipe distributor cap and check cap and rotor for cracks or carbon tracks indicating leakage of high voltage current across surface.

3. Check centrifugal advance mechanism by turning breaker cam in direction of rotation and then releasing it. Advance springs should return cam to its original position without sticking.

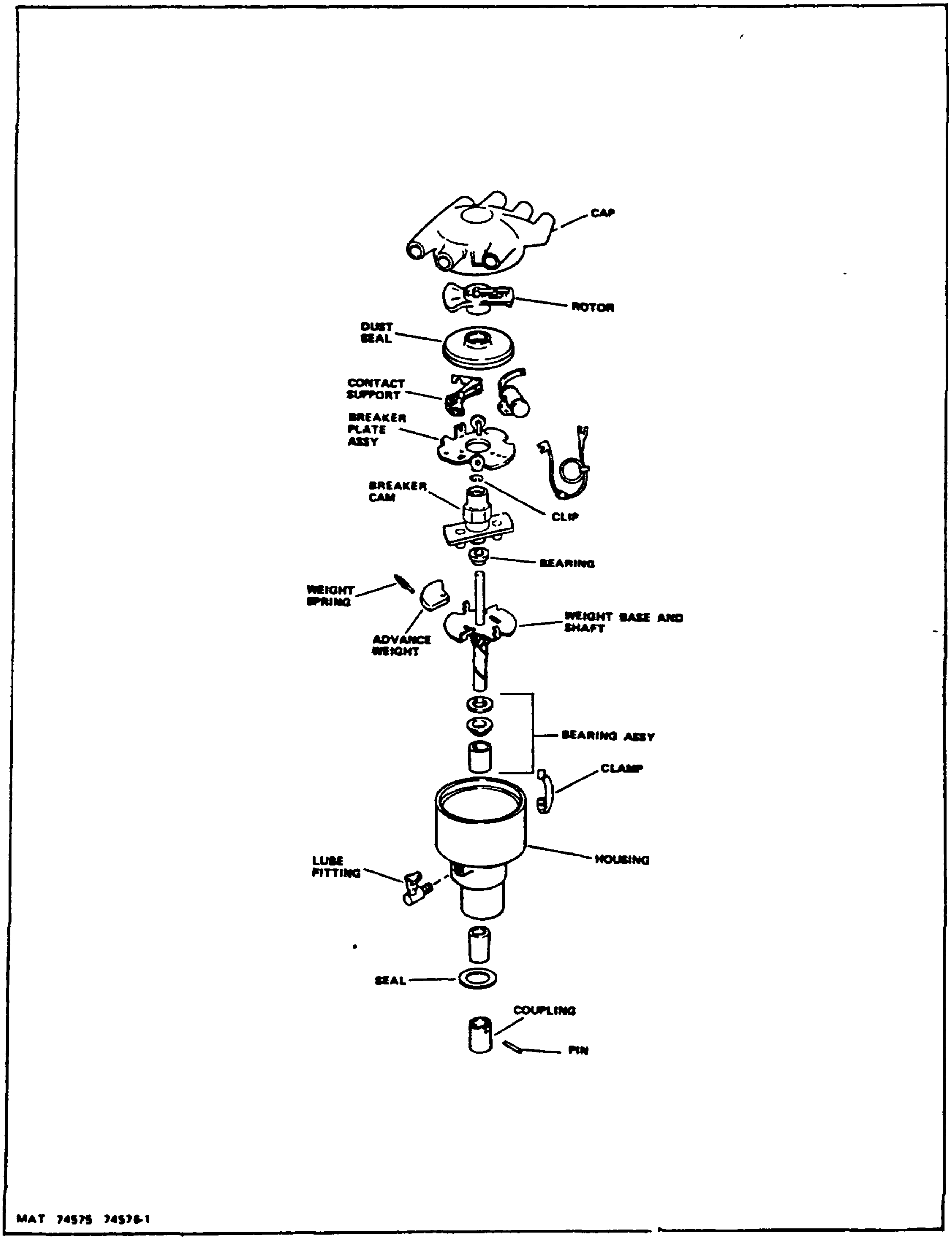


Figure 8. Distributor Assembly, Exploded View

4. Remove dust cover and inspect contact points. If points are badly burned or pitted, they must be replaced and adjusted.

NOTE: Refer to ENGINE MAINTENANCE MANUAL, TIMING Section for proper procedures.

5. Replace contact points, dust cover and distributor cap.

D. INSTALLATION

1. Remove distributor cap insert distributor assembly into opening in cylinder head.
2. Using rotor, turn distributor shaft until offset tongue of distributor coupling enters groove in top of oil pump drive gear.
3. Install distributor clamp arm, washer and capscrew and tighten securely. Replace distributor cap and secure.
4. Install high tension wiring to spark plugs, and connect high tension wire from distributor cap to ignition coil. Replace primary lead from distributor to coil, at coil primary connection.

NOTE: Refer to REPAIR MANUAL for DISASSEMBLY, REPAIR AND REASSEMBLY and refer to ENGINE MAINTENANCE MANUAL for proper TIMING procedure.

TOPIC 9. INSTRUMENTS

A. DESCRIPTION

The truck instrumentation consists of the following components: an oil pressure gauge, a coolant temperature gauge, fuel gauge, ammeter and engine hourmeter. All the instruments are mounted on the instrument panel and are display oriented for ease of use. Also mounted on the instrument panel are the ignition switch, the electrical fuses and the manual choke control.

1. Ammeter:

Connected directly into the battery circuit, this gauge indicated the status of the battery and the direction of current flow. Pointer deflection to the "charge" side of dial face indicates that the battery is being charged by the alternator and pointer deflection to the "discharge" side of dial face indicates that the battery is discharging. Normally, the "charge" rate will be high for a short time after starting engine, with pointer returning to slightly above zero after a few moments of operation. However, if battery is run down, the "charge" rate may remain high for some time. If the ammeter indicates a "discharge" condition when engine is operated above idle speed, then the alternator is not producing current, or there is a short in the circuit.

2. Oil Pressure, Coolant Temperature and Fuel Gauges:

The oil pressure, coolant temperature and fuel level gauge all operate similarly in that one side of each gauge is tied to the ignition coil, through the ignition switch, while the other side is connected to the respective sensing sender unit.

The oil pressure sending unit mounts on the engine oil gallery, the coolant temperature sending unit is located in the cylinder head coolant outlet passage, and the fuel level sending unit is installed in the fuel tank assembly. The rheostat sensor In the sending unit allows more electrical current to flow through the respective gauge deflection coil as the oil pressure increases, the engine coolant becomes warm, or as the fuel tank is being filled.

These gauges provide quick response, direct read-out dial indications of engine system conditions during engine operation. If any of the units become inoperative, check the wiring circuit, or determine whether the gauge or the sending unit is defective by replacing with one which is known to be good.

CAUTION: Do not attempt to repair gauges or sending units, but always replace defective item whenever necessary.

3. Engine Hour Meter:

The engine hour meter is a direct reading type. The unit records up to 9999.9 hours and then automatically returns to 0000.0. The four figures are read directly to record hours, while the figure on the right records 10ths. of an hour.

The engine hour meter starts recording when the ignition switch is turned on. Meter will stop recording when the ignition switch is turned off.

If the hour meter does not operate or runs erratically, check wiring for poor terminal connections, a loose joining connection, bare or frayed wires. Repair or replace as is required.

Since the hour meter is a completely sealed unit, it will have to be replaced if tests indicate the meter is defective.

4. Ignition Switch:

The ignition switch closes the electrical circuit between the ignition coil primary winding and the battery. Accordingly, it has one battery terminal lead, and one terminal lead to the ignition coil primary post and the instrument gauges.

Since the ignition switch operates the starter solenoid when turned to the extreme right, a third terminal is used to run a lead to the starter solenoid.

When the ignition switch is in the "OFF" position, current is turned off between the ignition switch, the ignition coil and the instrument gauges. With the switch turned to the "ON" position, current can flow between the battery, the ignition coil and the gauges.

Turning the switch to the "START" position, (which has a spring-loaded return), causes current to flow to the starter solenoid switch to actuate the starter motor. As soon as the engine starts and the ignition key is released it will automatically return to the "ON" position. The engine will continue to run in this position until the ignition switch is turned to the "OFF" position.

The current type ignition switch has a built in interlock. Whenever the switch is in "ON" position, it must be returned to "OFF" position before it can be turned to "START" position.

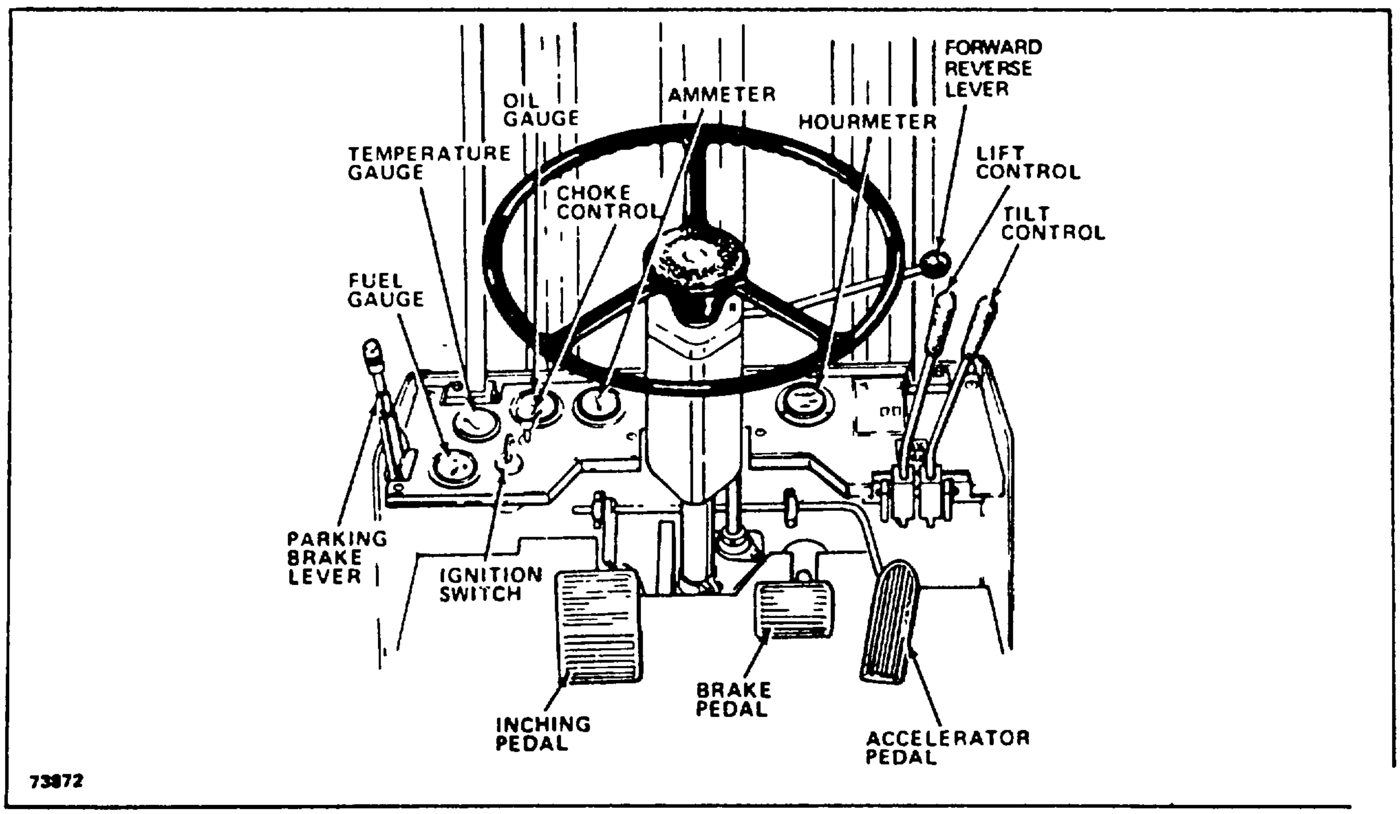


Figure 9. Instrument Panel (Typical)

The various ignition switch circuits can be checked by removing wires from their respective terminals and holding test lamp probes to each terminal. If lamp fails to light, wire is defective and should be repaired or replaced.

WARNING: This could be dangerous work. Electrically it is always wisest to disconnect the battery when any troubleshooting or maintenance is performed on the electrical system.

5. Fuses:

Fuse protection is wired into the horn and instrument gauge circuits to prevent burning up of this unit in-case an electrical short circuit developes. The gauges are protected by a 5 ampere fuse and the horn and horn relay circuit is protected by a 20 ampere fuse. Both fuses are located in clip retainers on a fuse block on the right underside of the instrument panel. If either the gauges or the horn fail to operate, then the fusing should be checked first. If a fuse is blown, it should be replaced with a fuse of identical rating.

6. Instrument Panel:

The instrument panel can be removed from truck and reinstalled by following the typical procedure as outlined below.

NOTE: For safety purposes, the battery should be disconnected to prevent the possibility of electrical shock.

a. Removal

(1) Remove hardware, choke cable, and harness clamps, then lift up: panel cannot be completely removed from truck.

(2) The removal of any damaged or defective component is apparent. Most components are retained by locknuts and washers. Removal of any damaged or defective components can be accomplished by removing the retaining hardware. When installing, always make certain unit is securely mounted and that all connections are tight.

NOTE: Due to styling and model changes, subtle differences may exist in the instrument panel mounting hardware. Removal and installation procedures will generally follow these instructions and any variations will be obvious.

b. Installation

(1) Ensure that all attaching components are properly mounted, secure and that associated wiring is properly connected.

(2) Ensure that side panel anchor supports and lock pins are all properly aligned and that instrument panel is securely retained.

(3) Connect fuel gauge sender lead at connector behind left side of instrument panel.

(4) Reconnect battery cables and make sure posts and cable terminals are secure and corrosion free. Make certain that positive battery cable is attached to positive post and that negative cable goes to the negative post.

c. Torque Chart - (Instrument Panel Component Mounting)

To avoid damage to the electrical and mechanical gauges, senders, etc., caused by improper tightening during installation, the following list of recommended installation torque values is offered:

1/8" - 27 Pipe Thread	10	lb	ft
1/4" - 18 Pipe Thread	15	lb	ft
3/8" - 18 Pipe Thread	20	lb	ft
1/2" - 14 Pipe Thread	25	lb	ft
7/16" - 26 Straight Thread	25	lb	ft
7/16" - 24 Flared Tube	150	lb	in.
5/16" - 24 Female	100	lb	in.

Electric Gauge Dash Units:

Mounting Clamps	14	lb	in.
Terminal Nuts	14	lb	in.

TOPIC 1. COOLING SYSTEM

A. DESCRIPTION

The cooling system consists of the following component parts: the radiator, water pump and thermostat, the cooling fan and fan belt, the water passages in the cylinder block and head, and the necessary hoses and lines to complete the system.

The purpose of the cooling system is to carry off the excess heat from the engine, and to hold the engine at an efficient operating temperature. This is performed in the following manner: The centrifugal water pump, which is driven by a "V" belt from the crankshaft pulley, pulls the coolant from the bottom of the radiator and circulates it through the water passages in the engine block and cylinder head. The coolant then passes from the cylinder head of the engine through the thermostat and the upper radiator hose to the upper part of the radiator. The coolant then passes from the top to the bottom of the radiator and is cooled by the air flow pushed through the radiator core by the cooling fan.

If the temperature of the coolant is less than 180°F, the thermostat remains closed and the coolant is bypassed back to the pump and is recirculated through the engine without passing through the radiator. When the coolant temperature exceeds 180°F, then the thermostat begins to open and permits the coolant to fluid into the radiator where it is cooled by the belt-driven cooling fan. At approximately 200°F, the thermostat will be completely open and the coolant will flow at the maximum rate through the radiator until the average temperature has been reduced and the thermostat closes.

B. GENERAL MAINTENANCE

Proper cooling system maintenance requires the observance of the following procedures:

1. Coolant: Keep sufficient cooling liquid in the system, but do not overfill. A basic coolant is fresh, clean, soft water to which is added a 2% solution of rust preventive soluble oil. At temperatures below 320°F, the cooling system should be protected from freezing by adding a sufficient quantity of a permanent type (glycol base) anti-freeze solution.

2. Cleaning: Drain, flush and refill the system whenever an inspection reveals an accumulation of rust or scale deposits. Always clean the cooling system seasonally, as well as before and after using anti-freeze solution

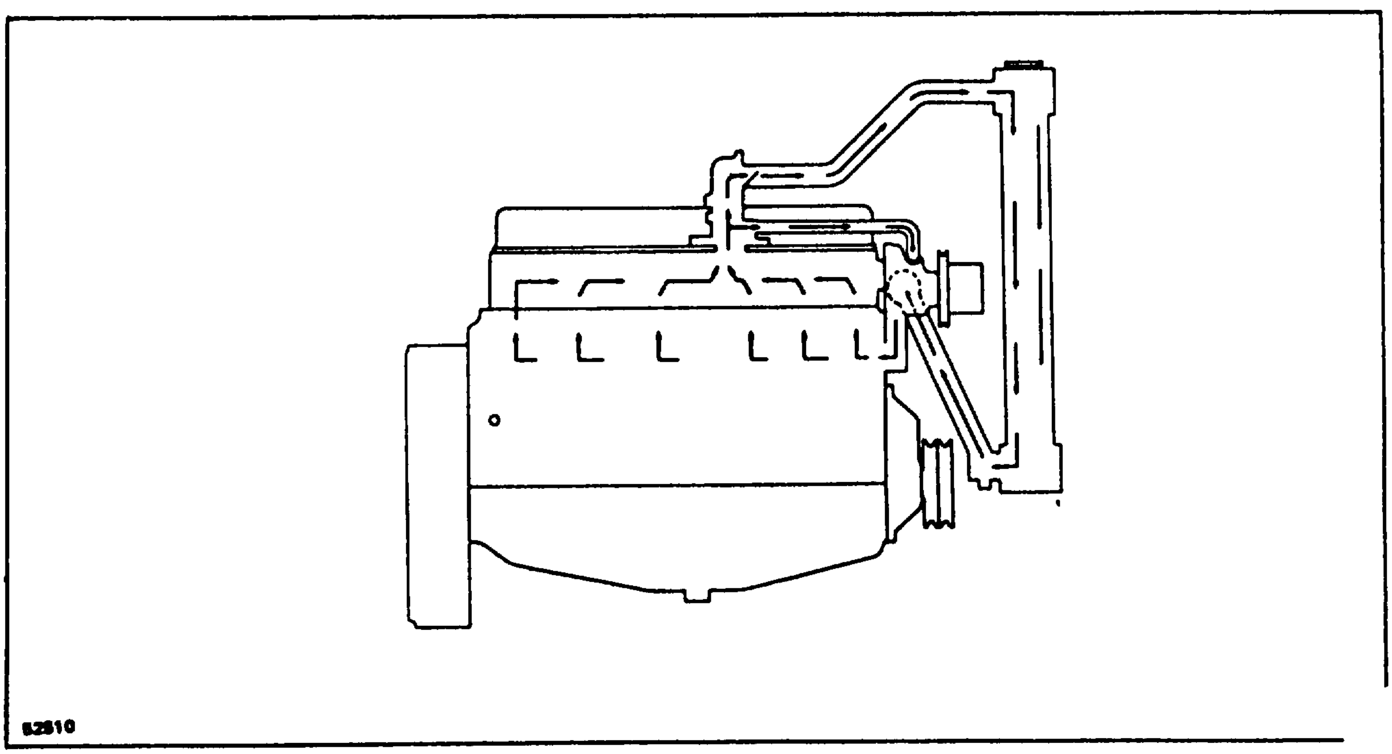


Figure 1. Coolant Flow Diagram (Typical)

3. Overheating: If the engine overheats from lack of coolant, do not add fresh coolant immediately. Wait until the boiling has ceased and the engine has cooled down. Then add coolant slowly, with the engine running. If a cold coolant is poured into the system when the engine is hot, the sudden temperature change may damage the radiator, cylinder block or cylinder head.

4. Protection: Keep cylinder head capscrews, water pump capscrews, hose clamps and all fitting connections tight. All leaks must be corrected as soon as they are evident. Inspect hoses carefully and replace if they are deteriorated.

5. Fan Belt: It is very important to occasionally inspect the fan belt, making certain that no oil or grease is accumulating on it and that the fan belt tension is kept in correct adjustment. Replace a badly worn, burned, oil or grease soaked belt. Be sure correct type of belt is used.

6. Thermostat: Maintaining the correct engine temperature depends mainly on the proper function of the thermostat. If the engine temperature remains consistently below normal, the thermostat should be removed and inspected. If corroded or stuck, a new thermostat must be installed.

C. SERVICE

1. Summer: In warm weather keep the cooling system filled with clean, soft water or rain water. If soft water is not available and hard water is used, the hard water should first be treated with a water softener. Eight ounces of a reliable commercial rust inhibitor (soluble oil) should be added to the coolant during warm weather operation.

2. Winter: In winter weather use a non-evaporating ethylene glycol base antifreeze solution in the cooling system to protect against damage from freezing.

   After the cooling system has been thoroughly cleaned and inspected, determine the quantity of anti-freeze required for the lowest anticipated temperature by referring to the protection chart furnished by the manufacturer. Add this quantity to the radiator. Then fill complete cooling system; but do not overfill. Run the engine to thoroughly mix the water and the anti-freeze, and to allow the coolant to reach operating temperature. Finally, test the coolant with an ethylene glycol hydrometer to make sure it will withstand the prevailing or anticipated temperature.

CAUTION: Never mix anti-freeze compounds or inhibitors with any cleaning neutralizing, or flushing compounds.

TOPIC 2. RADIATOR

A. DESCRIPTION

The radiator (Figure 2) is of the fin and tube type and is vertically supported by angle bracing to the truck frame. The front of the radiator is protected from structural damage by a heavy grille mounted in the counterweight. An overflow tube is connected to the filler neck and leads to the bottom of the radiator.

B. REMOVAL

When it becomes necessary to remove the radiator for service, the following procedure is recommended:

1. Remove the side panels and raise the operator's seat.

2. Remove the radiator cap, open the drain cocks located underneath the ignition coil (Figure 3) and in radiator outlet elbow to drain the cooling system.

CAUTION: When removing the filler cap, rotate the cap counterclockwise very slowly; if hissing of vapor is encountered, tighten cap immediately and wait for system to cool sufficiently to allow removal of cap.

CAUTION: Never pour cold-water or cold anti-freeze into the radiator of an OVERHEATED ENGINE. Allow the engine to cool and avoid the danger of cracking the cylinder head or block. Keep engine running while adding water.

3. Loosen the retaining hose clamps and remove the inlet and outlet hoses from the top and bottom of the radiator.

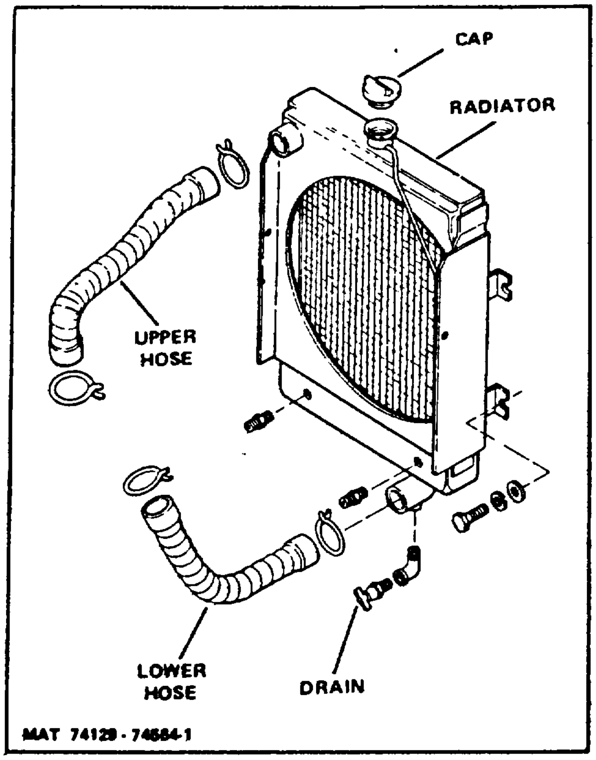


Figure 2. Radiator Assembly

NOTE: On models equipped with a powershift transmission, an oil cooler is an integral part of the bottom of the radiator to prevent overheating of the transmission. The oil cooler lines must be removed prior to removing the radiator.

4. Remove securing capscrews and the radiator grille from the back of the frame. Also remove rear section of exhaust pipe and muffler (ACP only).

5. Remove the capscrews which hold the radiator in position on the mounting bars located on the frame inside the counterweight.

NOTE: A quantity of spacers may have been used between the radiator and the mounting bars. These spacers must be replaced exactly as removed.

6. Slide the bottom of the radiator out of position. After the filler neck of the radiator has cleared the inside top of the counterweight, the radiator can easily be removed.

NOTE: Refer to REPAIR MANUAL for proper RADIATOR INSPECTION, TESTING and REPAIR.

C. INSTALLATION

1. Slide radiator up into mounting position within the counterweight, ensuring against any damage to filler neck or cooling fins.

2. If spacers were present between radiator mounting flange and frame, be sure to replace in their original locations. Use spacers as necessary to prevent fan from hitting radiator.

3. With radiator properly aligned and spacers installed, if any, tighten all mounting capscrews through radiator mount to frame support bars.

4. Install the radiator grille and tighten securely. Also install muffler and tail pipe section (ACP only).

NOTE: On units equipped with a powershift transmission, the oil cooler lines will have to be reinstalled.

5. Install upper and lower radiator hoses and secure retaining clamps. If hoses are cracked or cut, they must be replaced.

6. After radiator is installed, measure distance between the leading edge of the fan blades and the radiator core. This dimension should be at least 7/8". Also ensure that the cooling fan is properly centered within the radiator shroud.

7. Close the cooling system drain cock located below the ignition coil and at bottom of radiator (Figures 2 and 3). Fill system to recommended capacity with coolant; replace pressure cap and check for any leaks.

NOTE: Allow engine to reach normal operating temperature. The thermostat will then open and the coolant will flow into the engine. Coolant level must then be "topped-up.

8. Replace the side panels, and lower operator's seat.

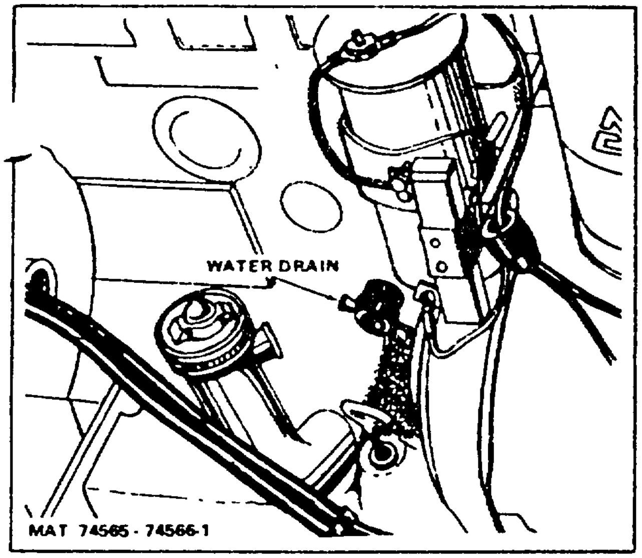


Figure 3. Water Drain

D. RADIATOR PRESSURE CAP

A seven-pound pressure cap (Figure 4) is installed on the radiator filler neck. As long as there is pressure in the cooling system, the temperature can be considerably higher (over 220°F) than the boiling temperature of the solution in the radiator without causing the solution to boil. Removal of the radiator cap while the engine is hot and the pressure is high will cause the solution to boil instantaneously and possibly with explosive force, spewing the coolant over the engine and the person removing the cap. There is also the possibility of causing serious burns.

Pressure caps should be checked at least once a year and care should always be taken in filling radiators that no damage is done to the pressure cap seat in the radiator filler neck.

CAUTION: When removing the filler cap, rotate cap counterclockwise very slowly; if hissing of vapor is encountered, tighten cap immediately and wait for system to cool sufficiently to allow removal of cap.

After pressure in the system has been relieved, turn cap counterclockwise and remove.

Turn cap clockwise when installing. Cap must form a tight seal to prevent any leakage.

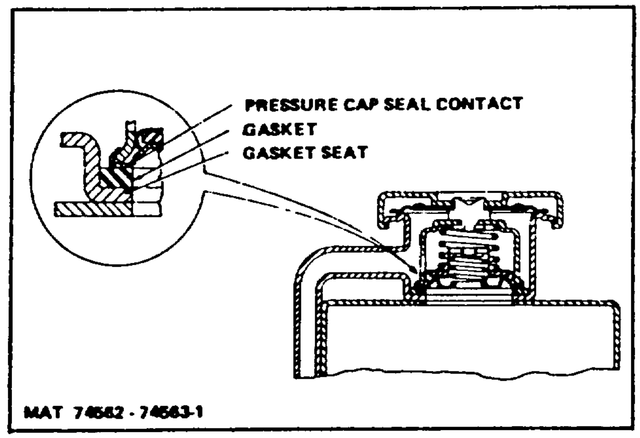


Figure 4. Pressure Cap, Sectional View

TOPIC 3. WATER PUMP

A. DESCRIPTION

Liquid coolant is circulated through the engine and the radiator by a centrifugal water pump. The pump is enclosed in a sealed, cast metal housing and is flange mounted to the front of the cylinder block. The pump impeller is pressed on one end of the pump steel shaft and the fan mounting hub is pressed on the other end. The shaft is supported at the drive end by a sealed, double row ball bearing, and is prevented from moving endwise by a shoulder in the pump housing and a snap ring on the outside.

The construction of the water pump is conductive to long life with minimum attention if an coolant is used in the system. Water containing scale forming elements is especially harmful to the pump parts due to corrosion.

The water pump requires no attention other than bearing replacement when bearings show excessive looseness, or if a water leak develops, which shows a damaged or badly worn seal that needs replacement.

B. COOLING SYSTEM PROTECTOR PELLET

All Continental engines are shipped with a cooling system protector pellet in the water outlet header. The pellet should be allowed to dissolve in the cooling system.

This pellet will dissolve in the cooling water with proven results as a rust inhibitor and water conditioner. It can be used with all types of anti-freeze.

C. REMOVAL

When It becomes necessary to remove the water pump for service or replacement, the following removal procedure is recommended (Figure 5):

1. Open water drain (Figure 3).
2. Disconnect by-pass hose and pump inlet hose.
3. Remove fan by taking out four capscrews.
4. Loosen generator so that fan belt can be slacked off enough to slide over pulley.
5. Remove nuts and lockwashers holding the pump body to the front of the block and remove the pump assembly.

NOTE: Refer to REPAIR MANUAL for WATER PUMP DISASSEMBLY INSPECTION, REPAIR and REASSEMBLY.

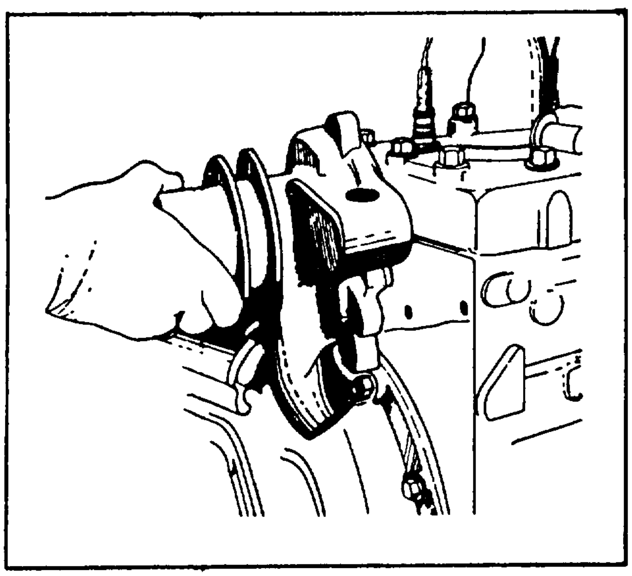


Figure 5. Removing Water Pump

D. INSTALLATION

1. Clean the gasket mounting surfaces on water pump flange and on cylinder block and install new gasket. Use approved sealing compound as required.
2. Mount and secure the water pump with mounting capscrews.
3. Replace the coolant bypass tube and tighten the clamps.

CAUTION: Do not overtighten clamps as this could cause bypass tube to fracture or split.

4. Replace the coolant inlet line at the water pump, and secure with clamp.
5. Install the fan pulley, the fan blade and the mounting capscrews. Tighten capscrews securely.
6. Properly align fan belt at crankshaft pulley, fan pulley and alternator pulley.
7. Force the alternator away from the engine with a long-handled screwdriver or pry bar, until the fan belt has approximately 1/2" to 3/4" deflection at a point halfway between the fan pulley and the alternator pulley, with about 10 lbs. applied force. (Refer Fan Belt Adjustment.) After proper adjustment, secure alternator capscrews.
8. Close water drain.
9. Fill the cooling system to the recommended capacity with proper coolant and replace radiator pressure cap.
10. Operate the engine until the normal operating temperature has been reached, then check the cooling system for any evidence of leaks. Correct if necessary, and top-up coolant level.
11. Replace the engine side panels and lower the operator's seat.

TOPIC 4. THERMOSTAT

A. DESCRIPTION

The thermostat is installed in the cooling system to regulate the temperature of the coolant, and is located in the cylinder head end of the upper radiator hose. Normally, when the coolant temperature is 180°F or less, the thermostat is closed, preventing the coolant from flowing through the radiator. When the coolant temperature rises above 180°F, the thermostat begins to open, allowing the coolant to flow through the radiator where the temperature is reduced through the cooling effect of the fan. The thermostat should be fully open at 202°F; in this manner, it acts as a temperature controlled valve that regulates the coolant temperature within its characteristic limits.

The thermostat seldom needs replacement in service, however, it should be checked when the cooling system is cleaned. While removing the thermostat, check the hose; if it shows signs of deterioration when flexed, replace the hose. Also check the hose connected to the bottom of the radiator, and if it shows signs of deterioration, replace it.

CAUTION: DO NOT RUN ENGINES WITHOUT A THERMOSTAT!

B. REMOVAL

1. Replace the thermostat if it sticks in an open or closed position. If the engine overheats or does not reach and maintain normal operating temperature, the thermostat should be removed, tested for proper operation, and replaced if found defective.

2. Remove the engine side panels and raise the operator's seat.

3. Partially drain the cooling system, then remove the clamps from the top radiator hose and the coolant by-pass hose or L.P.G. converter tube. Pull these hoses off the water outlet elbow.

4. Remove two nuts and lockwashers, and lift the outlet elbow off the cylinder head. Remove adapter ring and thermostat from elbow.

5. Suspend and completely immerse the thermostat in a container of clean water (Figure 6). Heat the water and stir with an accurate thermometer to check the water temperature.

6. As the water temperature reaches 180°F, observe the thermostat. If the valve does not start to open at temperatures of 180°-200°F. or if it opens well before the 180° point is reached the thermostat should be replaced.

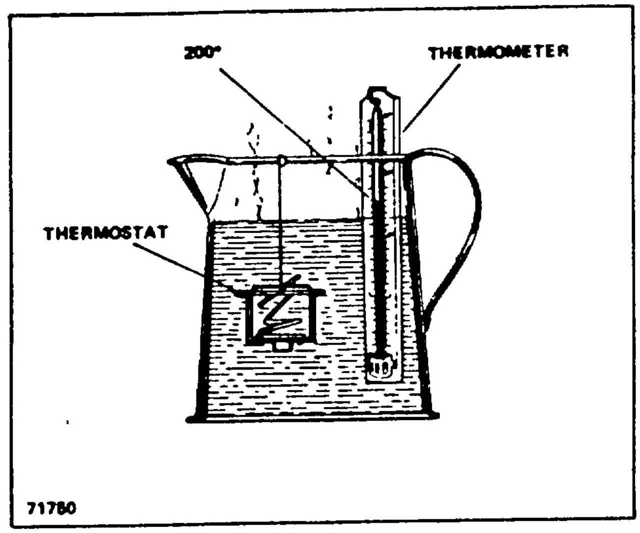


Figure 6. Testing Thermostat

C. INSTALLATION

1. Clean all surfaces of the bypass line, and the thermostat.

2. Inspect upper and lower radiator hoses for any signs of deterioration. Replace if damaged.

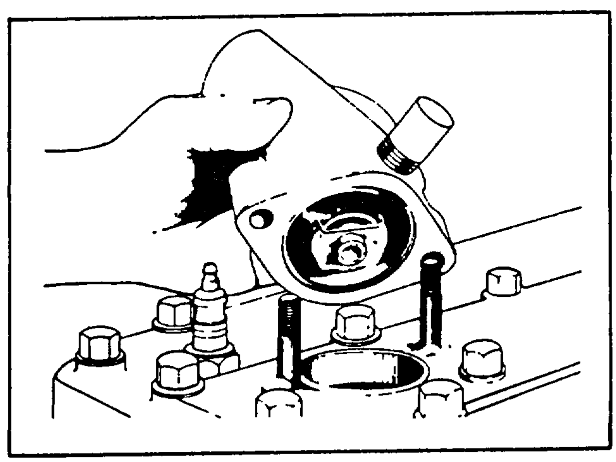


Figure 7. Replacing Thermostat

3. Use non-hardening gasket sealer and thoroughly cover all rubber hose connections.

4. Properly position thermostat in water outlet elbow and install adapter ring.

5. Assemble new gasket to cylinder head, position water outlet elbow on studs, and secure with two nuts and lockwashers (Figure 7).

6. Install outlet hose and by-pass hose or L.P.G. converter tube on outlet elbow and secure clamps.

CAUTION: Thermostat must be installed exactly as it was removed so that the direction and heat of the coolant will open it.

NOTE: When filling the cooling system, care should be taken to keep the coolant clean to prevent any clogging of the cooling system or damage of the water pump. Use only permanent antifreeze in connection with the 180°F. thermostats.

TOPIC 5. FAN AND FAN BELT

A. DESCRIPTION

The cooling fan (Figure 8) pushes air through the engine radiator and helps to cool the engine water as it circulates from the top to the bottom of the radiator core.

B. SERVICE

1. Fan blades seldom require service; however, bent blades will affect the balance of the fan and this is detrimental to the water pump bearing. A fan which is bent will not cool as efficiently as it was originally designed to perform. In the event of damage, the fan should be removed and the blades restored to their original contour or replaced by a new fan assembly.

2. Periodic replacement of the fan belt is a good safeguard against a damaged radiator and unnecessary shutdowns.

NOTE: Attempting to force the fan belt over the pulley while it is under tension is almost certain to cause damage to the pulley or bearings.

C. REMOVAL

Fan Blade:

1. Remove the radiator.

2. Loosen the alternator adjusting bracket capscrew and the alternator mounting capscrews and relieve the fan belt tension.

3. Remove the capscrews and lockwashers which mount the fan on the fan pulley.

4. Repair or replace the cooling fan as required.

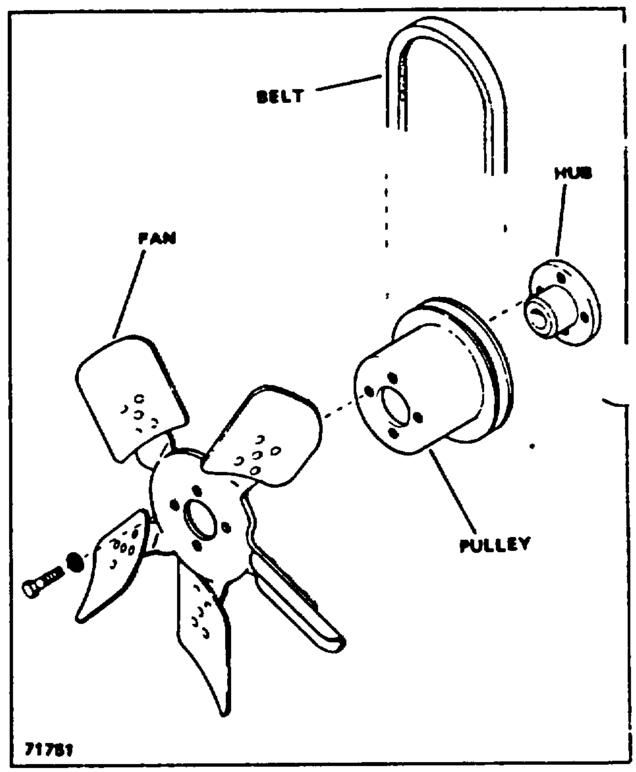


Figure 8. Fan Blade, Belt and Pulley (Typical)

Fan Belt:

1. Loosen the alternator adjusting bracket capscrew and alternator mounting capscrews and relieve the fan belt tension.

2. Remove the radiator grille.

3. Slide the fan belt from alternator pulley and crankshaft pulley. Remove fan belt from the fan pulley by sliding it off over fan assembly. Be careful not to damage radiator when sliding the belt past the fan blades.

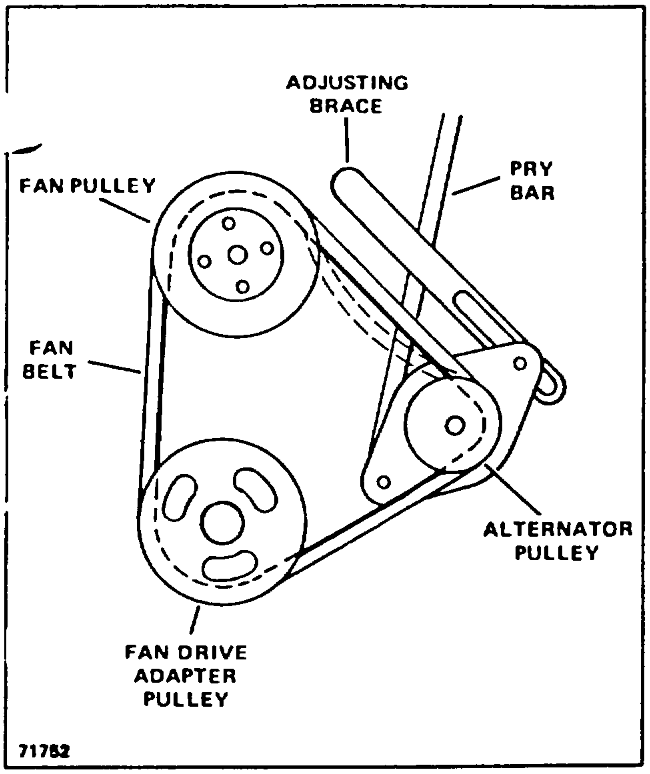


Figure 9. Fan Belt Adjustment

D. INSTALLATION

Fan Blade:

1. Replace the fan blade and lockwashers and tighten with mounting capscrews.

2. Install fan belt and ensure that it is properly installed across all pulleys, including fan pulley prior to final tightening of fan blade capscrews.

3. Force the alternator away from the engine with a long-handled screwdriver or pry bar, until the fan belt has approximately 1/2" to 3/4" deflection at a point half way between the fan pulley and the alternator pulley with about 10 lbs. applied force (Figure 9).

4. Tighten the alternator mounting capscrews and the alternator adjusting bracket capscrew.

5. Replace radiator. (Refer to RADIATOR INSTALLATION Section.)

Fan Belt:

1. Place replacement fan belt over fan blade and onto fan pulley; then pull belt around crankshaft pulley and over alternator pulley.

2. Force the alternator away from the engine with a long-handled screwdriver or pry bar, until the fan belt has approximately 1/2" to 3/4" deflection at a point half way between the fan pulley and the alternator pulley with about 10 lbs. applied force (Figure 9).

3. Tighten the alternator mounting capscrews and the alternator adjusting bracket capscrew.

4. Replace the radiator grille.

TRANSMISSION- POWER SHIFT (ONE- SPEED)

TOPIC 1. TRANSMISSION

A. DESCRIPTION

The "Power-Shift" transmission consists of three major components: The torque converter, a hydraulically actuated clutch pack and a single speed, constant mesh transmission. A single lever type shift control is mounted on the steering column to control the direction of travel through a control valve mounted on the transmission housing.

Power from the engine is delivered to the torque converter which, in turn, drives a pump and clutch pack. Housed In the clutch drum are two double faced clutch plates which, when activated, move the truck forward or reverse through splined hubs, transmitting power to the gear train.

If the reverse clutch is activated, power is delivered to the transmission through a hollow shaft which connects the reverse gear and reverse clutch. If the forward clutch is actuated, power is delivered to the transmission through a solid shaft, which rotates inside the hollow reverse shaft, connecting the forward gear and forward clutch.

TORQUE CONVERTER:

The torque converter is composed of three members: The impeller or driving member, the turbine or driven member, and the stator or reaction member. The impeller forms the outer shell of the converter, and the turbine and stator operate within the impeller but turn free of the Impeller.

The complete unit is mounted on the engine flywheel and always turns at engine speed. (Refer to Figure 1.) The torque converter is filled with oil and when the impeller is rotated by the engine, the oil In the impeller vanes also rotates, and, being subjected to centrifugal force, causes the oil to flow outward. At the beginning, the turbine is stationary, and there is no centrifugal force on the oil in it. Therefore, the oil in the impeller, due to its centrifugal force, enters the turbine near its outer

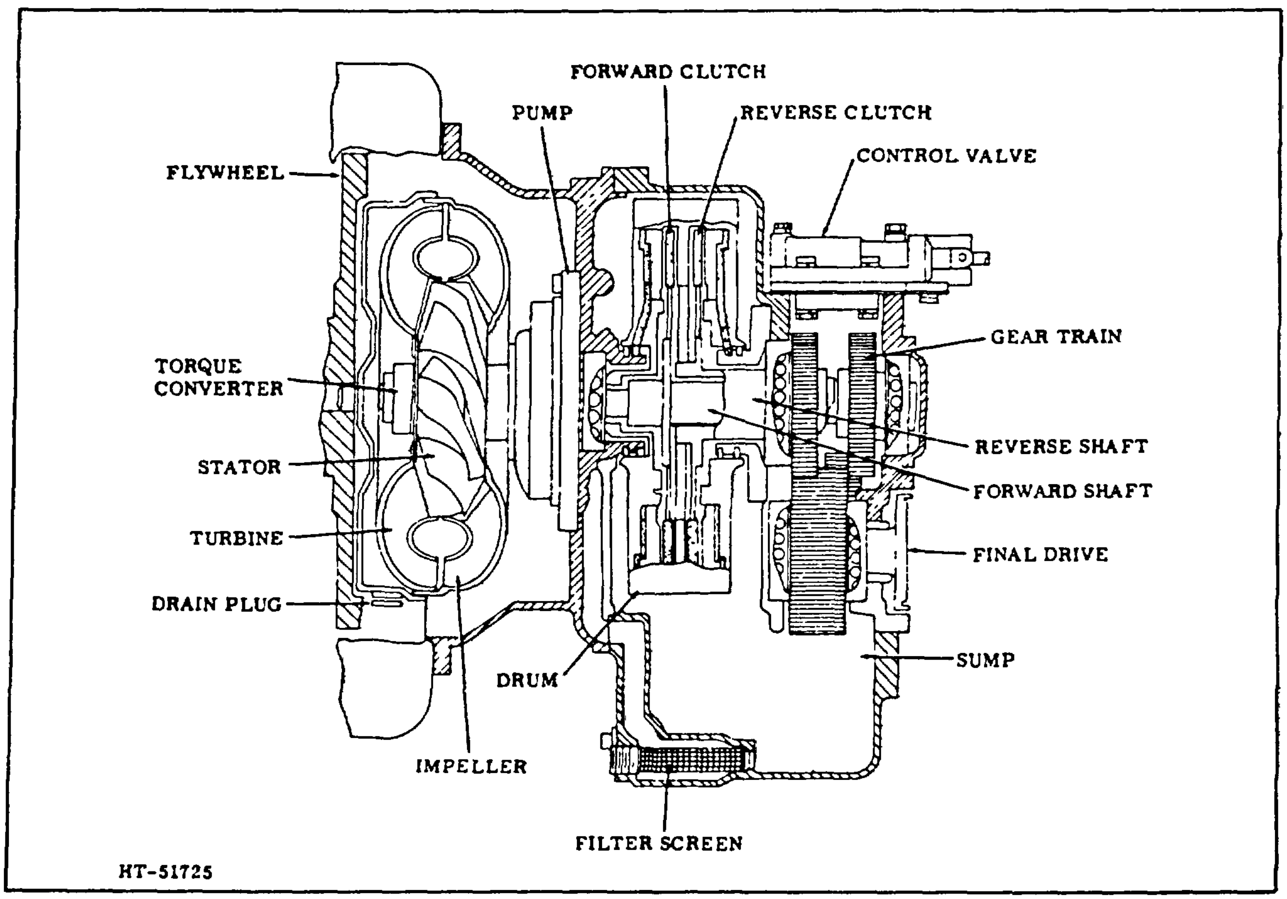


Figure 1. Power Shift Torque Converter Drive

circumference and forces oil from the turbine back into the impeller near its inner circumference. A circulation of oil is set up, which continues as long as there is a difference between the speeds of the Impeller and the turbine.

In normal Lift Truck operation the turbine generally turns at a slower speed than the impeller and since both are the same dimension, the centrifugal force on the oil in the impeller is always greater than that of the oil in the turbine. It is this difference plus the pressurized oil from the pump which causes the oil to circulate in and through the converter.

From the above it can be seen that the oil in the converter has a dual motion. It travels with the impeller and the turbine around the outer circumference of the converter and it also flows around the inner circumference or central core of the converter. As a result of these motions the oil carries a certain amount of kinetic energy. The velocity of the oil in the converter increases as the oil passes from the impeller to the turbine and decreases as it passes from the turbine back to the impeller.

Since the velocity increases in the impeller, its kinetic energy increases and this gain in kinetic energy can come only from the impeller. That is to say, when increasing the velocity of oil in its vanes, the impeller encounters a resistance, and it takes power (from the engine) to keep the impeller running against this resistance. In the turbine the oil is slowed down and presses forward against the vanes, and when the turbine is moving under this force, power to drive the truck is produced. Thus, all the oil passing through the Impeller picks up energy and gives it to the turbine. Up to this point operation Is the same as a fluid coupling and there is no torque multiplication.

To transmit velocity to the oil at the inner circumference of the converter, a third member, the stator, is added to the fluid coupling, between the impeller and the turbine. It is here that the fluid coupling becomes a torque converter. With the impeller rotating and the turbine stalled, the oil is driven through the curved blades of the turbine. The curved blades redirect the oil in the opposite direction from which it was received. As the oil leaves the turbine blades, it strikes the stator blades causing a reaction which produces torque multiplication.

The stator directs the oil back to the impeller where-any remaining kinetic energy combines with the kinetic energy of the impeller oil, producing additional torque multiplication. When the output torque becomes high enough, the turbine starts to turn and the truck will move. As the turbine speeds up and its speed approaches the impeller speed, there is no longer any reaction on the stator and It starts to turn with the turbine. At this point the unit becomes a fluid coupling since there is no longer any torque multiplication.

POWER SHIFT HYDRAULIC SYSTEM'

The transmission hydraulic system consists of the torque converter, a converter driven pump, the control valve and the clutch pack.

Control Valve: The control valve is mounted or, the transmission housing and forms, the top closure of the gear case. Machined porting plates are attached to the bottom of the valve to eliminate external piping. Passages in the plates align with passages drilled or cast into the transmission housing.

Clutch Pack: The clutch pack consists of a drum, a forward and a reverse clutch, and pistons and cylinders. The clutches are engaged by oil pressure applied behind the clutch pistons, which causes engagement within the drum.

Oil Pump: The gear type oil pump provides hydraulic pressure for the converter and the clutch pack. It is directly driven from the input side of the converter. Since the converter is mounted on the engine flywheel, the pump Is in operation whenever the engine is running. This means that there is hydraulic pressure even with the engine idling.

With the converter pump operating, the oil is taken from the sump and pumped under pressure to the converter and to the pressure regulator of the control valve.

Oil pressure in the converter is reduced from pump pressure by a metering orifice in the passage between the pump and the converter.

Oil from the converter flows back to the sump through the turbine shaft, to the oil cooler and into the clutch pack for cooling the clutches. Ahead of the cooler is a spring loaded bypass valve which relieves excessive pressures which may develop in the cooler circuit. If oil is restricted in the circuit, the valve ball will unseat between 50-70 p.s. i.

NOTE: Bypass valve is only used on six cylinder engines, with the four-cylinder FP-40/50 excepted.

To assure a constant flow of oil for cooling, with controlled pressure, especially at engine idle speed or slightly below, (500 r.p.m.), the pressure regulating valve is set for 18 to 30 p.s. i., with the oil temperature at 120 to 140 degrees F.

At the same time oil is being pumped to the converter and cooling circuit, it is also being delivered under full pump pressure to the pressure regulator valve in the control valve. The regulator controls the oil pressure delivered by the pump. The spring is calibrated to provide between 80 to 105 p.s. i., so that oil under controlled pressure is ready for delivery to the clutch pack. The regulator also controls the amount of oil being delivered for clutch cooling. Also, a portion of the cooling oil is diverted for lubricating the front bearing of the forward drive shaft. Pressure is reduced by forcing the oil through a metering orifice.

From the regulator valve, oil passes to the inching valve. This valve is a variable regulator which

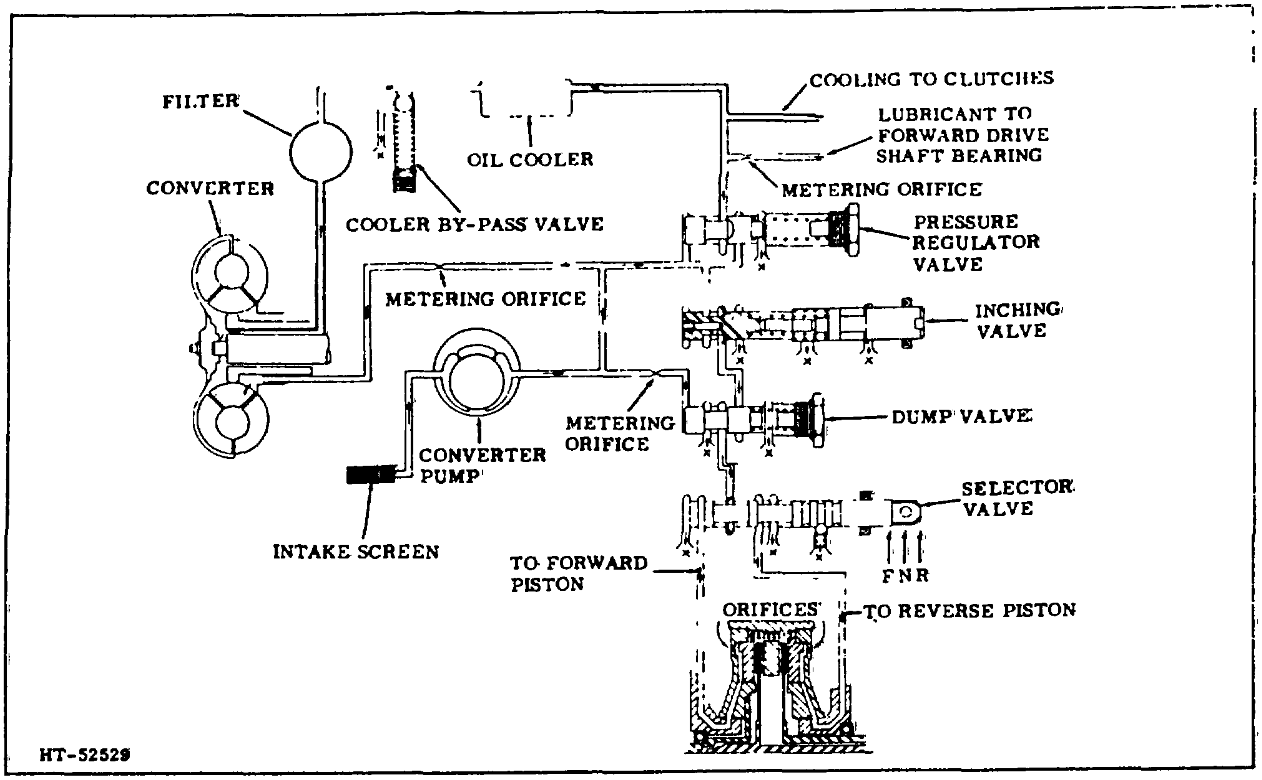


Figure 2. Power Shift - Hydraulic Schematic

permits the operator to vary pressure on the clutch plate from 100 p.s.i. maximum to 0 p.s.i. minimum. When an "Inching" operation is performed, actuating the inching pedal relieves spring pressure on the inching valve spool.

This action allows oil pressure in back of the spool to move it far enough to restrict the flow of oil to' the selector valve, thus controlling pressure on the clutches. This allows a "feathering" effect during "inching" operations.

The forward and reverse clutch supply or dump valve is placed in the circuit to control the flow of oil to the selector valve. The valve spool is pressurized by the converter pump through a metering orifice in a branch circuit from the main supply line. Pump pressure at this orifice is reduced to 3 p.s.i., maximum with the engine at full governed speed.

Oil flowing through the dump valve, enters the selector valve. With the selector valve plunger in the neutral position, oil is blocked at this point and the truck will not move. As soon as the directional lever is moved to either forward or reverse, the selector valve plunger opens the ports to either the forward or reverse clutch pistons. Movement of piston, due to the oil pressure in the circuit, causes the clutch to engage the rotating clutch drum, thereby moving the truck. The orifices in the clutch drum cylinders are for the purpose of accelerating the release of pressure whenever the operating pressure to the clutches is blocked, off or lowered.

An oil cooler is installed in the "Power Shift" hydraulic system to control the temperature of the oil. The cooler unit is located in the bottom of the radiator.

B. SERVICE

At the truck lubrication period, remove the floor 'plate and on the right side of the transmission, check the oil level of the transmission sump by use of the dipstick. Engine must be running for this check. Add automatic transmission fluid, if necessary, to bring the oil level up to the FULL mark on the dipstick. When so noted (every 1000 hours of operation), the transmission sump should be drained and refilled with new oil.

No specific time intervals are given, but the shift control adjustment should be checked on occasion. (Refer to SHIFT CONTROL ADJUSTMENT, REPAIR MANUAL.) The transmission operating pressures, should be checked whenever the unit is not operating efficiently or after any internal parts have been replaced. Make certain the oil cooler lines are tight.

At periodic inspections, make sure All mounting capscrews are tight. Make certain no oil is leaking past the output shaft and that the universal joints are tight.

C. REMOVAL

When it becomes necessary to remove the transmission and/or converter for repair, the following procedure is recommended:

1. Remove the floor plates, seat deck assembly, battery case and battery, and one corner post.
2. Drain oil from transmission by removing drain plug at rear of sump.
3. Disconnect the cooler lines at the bottom and at the right side of the sump.
4. Remove all control linkage.
5. Disconnect the universal joints at the transmission.
6. Remove the capscrews and lockwashers which mount the converter to the flywheel. Use a suitable tool to rotate the flywheel.
7. Attach a lifting chain and chain hoist to the transmission assembly and carefully remove from truck.

CAUTION: Ensure that all attachments to transmission assembly that could hinder removal, have been disconnected.

8. After transmission assembly has been removed from truck, place on a suitable work area for service. (Refer to REPAIR MANUAL for DISASSEMBLY, INSPECTION, REPAIR and REASSEMBLY.)
9. To remove the pump and converter, proceed as follows:

   a. Mark the pump housing to ensure proper installation and remove capscrews securing pump and collector ring to housing. (See Figure 3.)

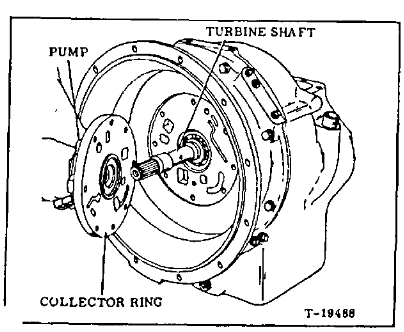


Figure 3. Pump Removal

NOTE: It may be necessary to tap the pump assembly with a rawhide hammer to free it from gasket.

NOTE: Refer to REPAIR MANUAL for DISC DRUM and CONVERTER HOUSING REMOVAL, and for CONVERTER AND DISC DRUM DISASSEMBLY, INSPECTION, REPAIR AND DISASSEMBLY.

D. INSTALLATION

Refer to CONVERTER ALIGNMENT AND INSTALLATION procedure in REPAIR MANUAL then proceed as follows:

1. Attach lift chain and chain hoist to transmission assembly and maneuver transmission into position for installation.

CAUTION: Ensure that transmission mounting area is free and clear of any obstacles, such as linkage or hoses, to prevent unnecessary damage.

2. Position the converter in the pump at the back of the transmission, making sure that the converter hub tangs properly engage pump driven gear.
3. Reinstall the transmission on the flywheel bell housing, connect the universal joints and note the following.

   a. Ensure that converter has been properly secured to flywheel housing with mounting capscrews.

   b. After the converter has been securely Installed, rotate until the filler hole appears and add one quart of oil.

   c. After installation is completed drain plug replaced, cooling lines reconnected and linkage replaced, add proper type and quantity of transmission fluid to transmission.

NOTE: Oil should be changed every 1000 operating hours. Use transmission fluid as recommended in the lubrication and service guide. (Good quality type 'A' or suffix 'A'.)

4. Replace battery case and battery; ensure that battery connections are properly made. (Refer to ELECTRICAL SYSTEM.)
5. Replace and secure the deck assembly and the floor plates.

UNIVERSAL JOINT AND COUPLING

TOPIC 1. UNIVERSAL JOINT

A. DESCRIPTION

The universal joint and drive shaft assembly are of a heavy duty industrial type consisting of a drive shaft (3), two cross-bearing assemblies (2-4) at either end of the drive shaft, and the transmission flange output, the brake drum and the differential flange.

The purpose of the universal joint assembly is to transfer the transmission driving power output to the drive wheels of the truck. Very little service is required of this assembly, other than periodic packing of the cross assembly bearings. Also, periodically check the torque of the drive shaft mounting capscrews.

B. REMOVAL (Figure 1)

1. Raise and securely block the lift truck to gain access to the universal joint assembly.
2. At the transmission end of the assembly, remove the capscrews that attach the cross assembly (2) to the output flange (1).
3. At the differential end of the assembly, remove the capscrews that attach the cross assembly (4) to the universal joint flange (6).
4. Remove the entire universal joint assembly from the lift truck.

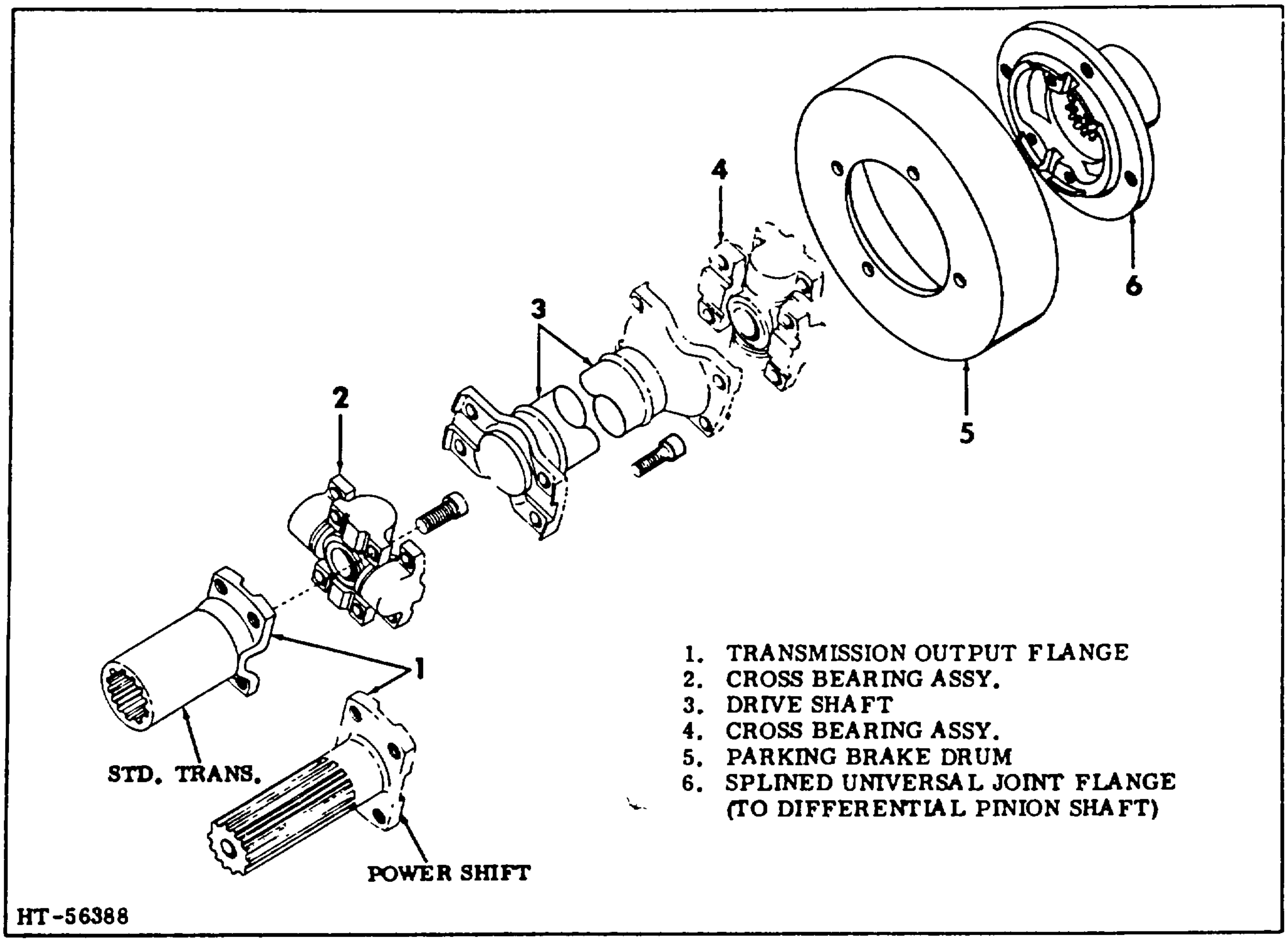


Figure 1. Universal Joint Assembly

NOTE: In order to make the assembly drop from position, It may be necessary to rotate the assembly by turning the drive wheels by hand.

5. Remove the output flange (1) from the transmission output shaft.

6. Remove the securing capscrews which attach the brake drum (5) to the universal joint flange (6).

7. Make sure the parking brake lever is in the released position.

8. Remove the brake drum.

9. Remove the cotter pin and castellated nut securing the universal joint flange (6) to the differential pinion shaft.

10. Remove the universal joint flange from the pinion shaft.

C. INSTALLATION

1. On the workbench, install the universal joint flange (6) inside the parking brake drum (5). Insert capscrews and torque to 25 - 30 ft. lbs.

2. Install 18 gauge (0.0475") lockwire in the brake drum capscrews.

3. Place the flange and brake drum assembly on the splined differential pinion shaft. Tighten the castellated pinion nut.

CAUTION: If interference is encountered when tightening the pinion nut against the universal joint flange, remove the flange and drum assembly and check for interference between the brake shoes and the flange/brake drum. When necessary, correct this condition by removing small amounts of interfering metal.

4. Insert cotter pin through the castellated nut slots and through hole in the end of the differential pinion shaft. If the slots and hole do not line up, tighten the nut until the pin can be properly inserted.

CAUTION. Tighten, do not loosen, the pinion nut. This nut must be tight to prevent noise in the differential.

5. Position the pinion shaft end of the universal assembly so holes in the cross assembly (4) align with holes in the flange (6). Insert capscrews and tighten to 25 30 ft. lbs. of torque, dry threads, (or 20 ft. lbs. lubricated threads).

6. Position the output flange (1) on the transmission output flange.

7. Position the transmission shaft end of the universal assembly so threaded holes of the output flange (1) align with the holes in the cross assembly (2). Insert capscrews and tighten to 25 - 30 ft. lbs, dry threads, (or 20 ft. lbs. lubricated threads).

8. Remove the blocks supporting the lift truck and lower truck to the floor.

TOPIC 1. DRIVE AXLE

A. GENERAL

The A-C planetary drive axle assembly (Fig 1-1 or 1-2) consists of the axle housing, differential carrier assembly, the axle shafts, planetary gear carriers and ring hubs. The service brakes are located within each of the two drive wheel hubs. The parking brake is located on the differential carrier assembly.

The first stage of gear reduction occurs at the differential carrier input pinion and the spiral bevel ring gear. The final reduction occurs at the drive ends of the axle shafts, which mesh with the planetary ring gears within the drive wheel hubs.

The purpose of the drive axle unit is to accept and transmit the driving torque from the drive shaft coupling to the drive wheels of the lift truck, thus moving the truck in a forward or reverse direction, and is accomplished as follows:

The input differential carrier pinion is driven by the transmission output drive shaft and, in turn, is connected to and drives the differential ring gear. The spider gear cluster, within the differential case, meshes with the floating axle shaft pinion gears, thereby transferring the driving torque to the axle shafts. Final reduction is accomplished through the planetary carrier which is driven by the opposite ends of the axle shafts; the planetary gears (Fig 1-3) are driven by the floating axle shaft drive gears. Because the outer periphery of the planetary gears meshes with the stationary ring gear, any rotation of the axle shaft will turn the planetary gears, which will turn within the stationary planetary ring, thereby rotating the drive wheels.

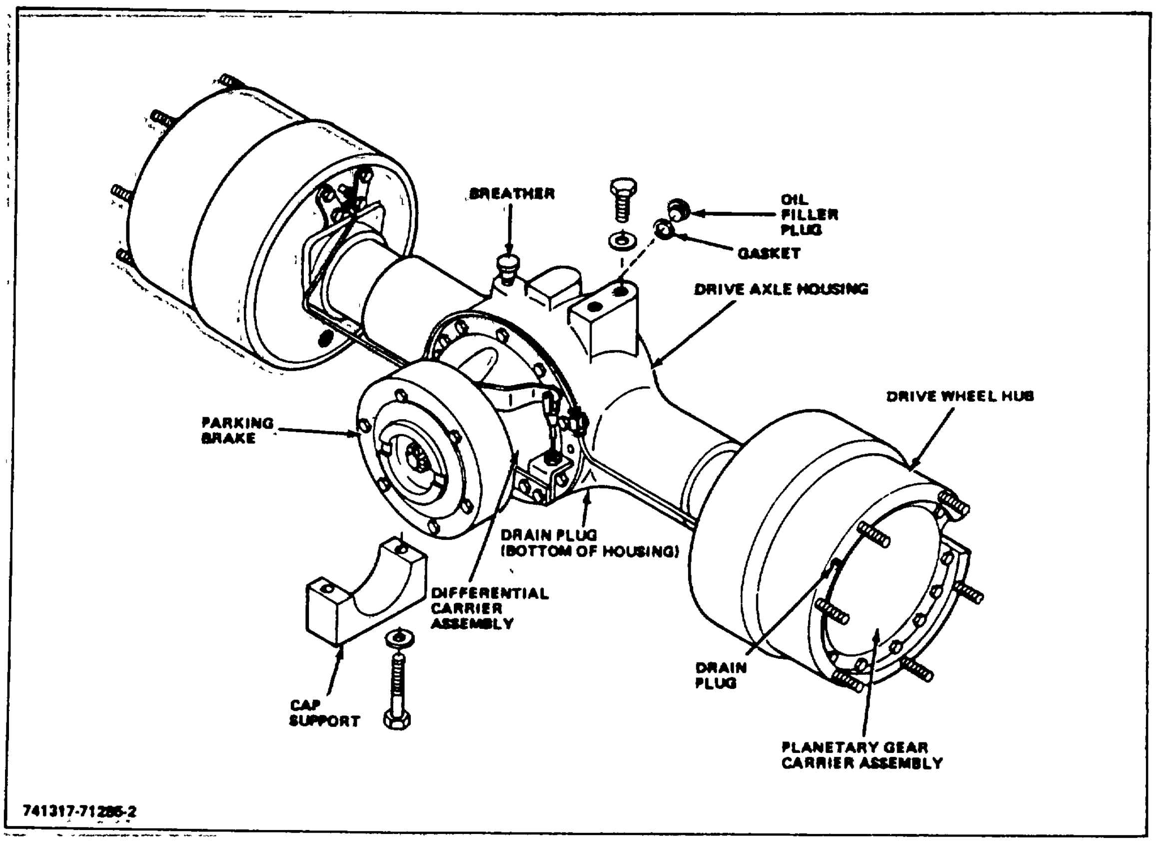


Figure 1-1. A-C Planetary Drive Axle Unit

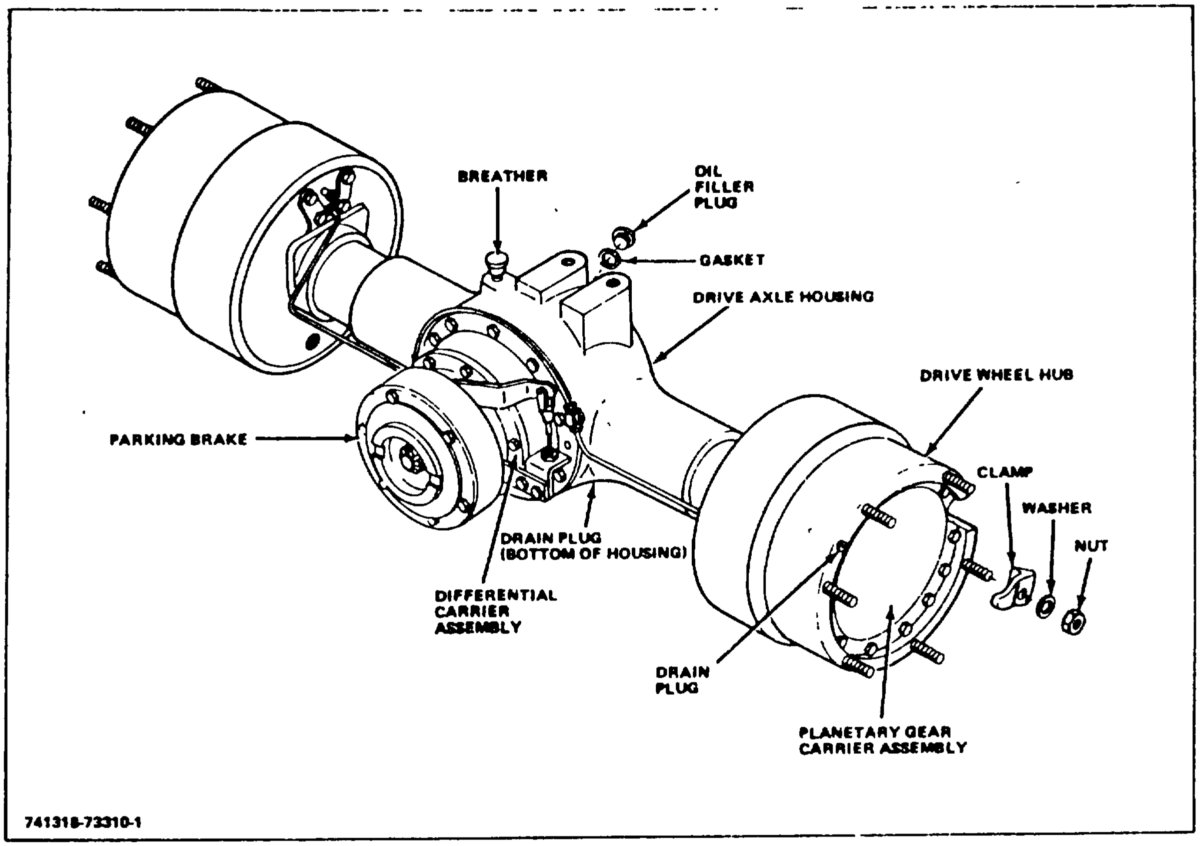


Figure 1-2. A-C Planetary Drive Axle Unit (ACP 100-120-140)

The planetary carrier, planetary ring gear and the drive end of the axle shaft are enclosed within the sealed end of the drive wheel hub, which also serves as a self-contained, lubricating oil reservoir.

B. 100 HOUR CHECKS

After each 100 hours of operation, check the oil level in the drive axle housing. Remove the oil filler plug (Fig 1-1 or 1-2) from the front of the drive axle housing. With the lift truck in a level position, the oil level should be up to the bottom of the opening. If necessary, add specified lubricant through the level opening but do not overfill. Then install oil filler plug securely.

NOTE: Previous drive axle units are equipped with a 1/2" pipe thread oil filler plug and drain plug.

Current drive axle units are equipped with an oil filler plug and a drain plug which have a .750"-16 straight thread. Gaskets are used with the straight thread plugs.

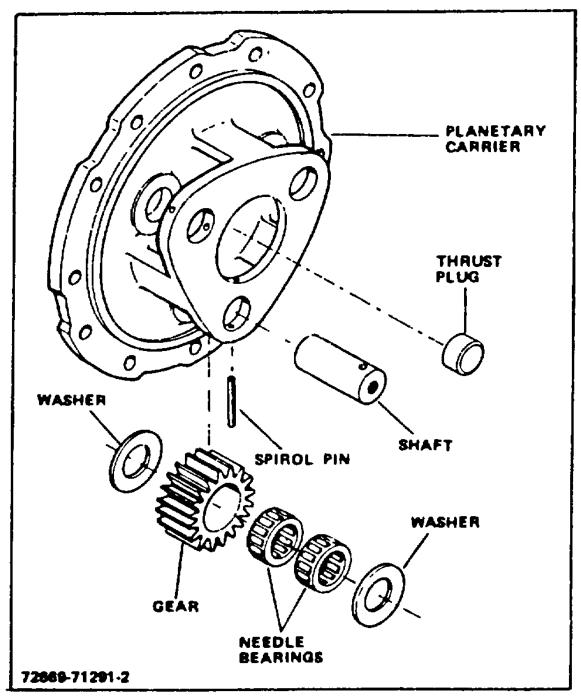


Figure 1-3. Planetary Gear Carrier Assembly

After each 100 hours of operation, check differential breather to make certain it is clean and open. Remove breather (Fig 1-1 or 1-2) from the top of the drive axle housing. Wash it in a suitable cleaning solvent and dry it with clean compressed air to make certain it is not clogged. Install breather and tighten securely.

C. 1000 HOUR SERVICE

After each operating interval of 1000 hours, change the oil in the drive axle housing. Ambient temperature conditions will indicate what grade of gear lube is to be used. Change gear lube as follows:

1. Rotate each drive wheel so drain plugs in drive wheel hubs are at the lowest position. Remove oil filler plug from front of drive axle housing. Remove drain plugs (Fig 1-1 or 1-2) from drive wheel hubs and drain plug from bottom of drive axle housing; allow oil to drain.
2. After oil has drained, install drain plug (with gasket) in bottom of drive axle housing.
3. Rotate each drive wheel until the oil level arrow, located on the planetary carrier, is horizontal to the floor.
4. Fill drive axle housing, at filler plug opening, with specified gear oil until oil begins to run out of oil level holes in drive wheel hubs. Refer to the following for approximate capacities:

   ACP 60 .... 22 pints

5. Install drain plugs in drive wheel hubs and install oil filler plug (with gasket) securely.

TOPIC 2. SERVICE BRAKES

A. GENERAL

The service brakes are of the "Duo-Servo" design principle. This design makes use of the momentum of the truck to assist the braking system in bringing the truck to a stop. (Refer to Figure 2-1.) In the "Duo-Servo" brake system, there is only one anchor pin and it is located near the hydraulic wheel cylinder.

An adjusting screw assembly and tension spring connects the bottom ends of the two brake shoes.

When hydraulic pressure is applied to the wheel cylinder, the cylinder pistons move the brake shoes out into contact with the brake drum. The friction force between the drum and the linings rotates the shoes counterclockwise (in left-handed brake assembly, as illustrated in Figure 2-1. Torque will be clockwise in right-handed brake assembly.), and this movement causes the primary (front-facing) shoe to move away from the wheel cylinder, and causes the secondary shoe to move back against the cylinder. The friction force between the drum and the primary shoe is transmitted through the adjusting screw assembly and pivot nut assembly to the secondary shoe. This servo action increases the pressure between the secondary shoe and the drum. When the hydraulic pressure is removed from the wheel cylinder, the shoe return springs pull the shoes away from the drum rubbing surface and the piston insert, at the primary shoe, moves back against the wheel cylinder.

If the brakes are applied during reverse drum rotation, the shoes rotate clockwise with the drum (counterclockwise for right-handed brake assembly). In this case the secondary shoe moves away from the wheel cylinder and the primary shoe anchors against the cylinder; here, the secondary shoe applies the primary shoe against the drum. Therefore, the action of the brake system is identical in either direction, forward or reverse, hence, DuoServo.

The automatic adjuster operates when the brake applications are made during reverse drum rotation. As noted previously, during reverse drum rotation, the secondary shoe moves away from the wheel cylinder with brake application. The toggle lever likewise moves away from the wheel cylinder to which the upper adjuster link is attached. This causes the upper adjuster link to rotate the toggle lever counterclockwise around the pivot pin on the web of the secondary shoe. The toggle lever movement causes the lower adjuster link to rotate the adjuster lever clockwise around

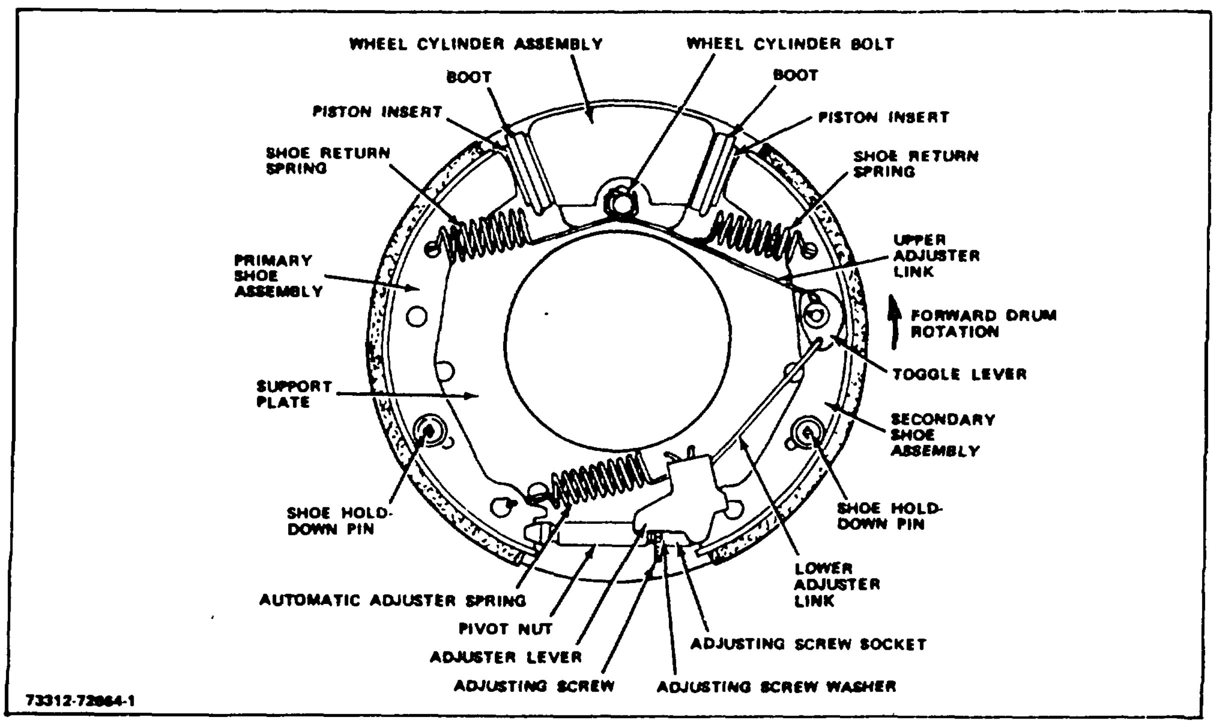


Figure 2-1. Brake Assembly - Left Side

its pivot point on the web of the secondary shoe. When the brakes are released, the automatic adjuster spring rotates the adjuster lever back to its original position.

If the shoe lining has worn sufficiently to allow the lever to engage another tooth on the adjusting screw assembly starwheel, the adjuster spring rotates the adjusting screw when the brakes are released.

Automatic adjustment, therefore, is accomplished at the end of a reverse brake application if the shoe lining is sufficient to allow the lever to move to a new tooth position on the adjuster starwheel.

B. WHEEL CYLINDER AND BRAKE SHOE INSPECTION

After each 500 hours of operation, inspect wheel cylinders for leaks and check brake shoes to determine the amount lining remaining on the shoes. When the lining has worn down to less that 1/8" thickness, the shoe and lining assemblies should be replaced.

CAUTION: Do not operate the lift truck after lining has worn down to under 1/16" thickness.

1. Drive Wheel Removal

   a. Raise front end of unit and place adequate service jacks and/or blocks under drive axle housing.

   b. Rotate each drive wheel so drain plugs in drive wheel hubs are at the lowest position. Remove oil filler plug from front of drive axle housing. Remove drain plugs from drive wheel hubs and drain plug from bottom of drive axle housing; allow oil to drain.

   c. After oil has drained, install drain plug in bottom of drive axle housing.

   d. Remove the twelve (12) planetary carrier mounting bolts and carefully pull the planetary carrier straight out of wheel hub to remove.

NOTE: When carrier is difficult to remove, insert two (2) of mounting bolts just removed, into the threaded bolt holes on carrier housing perimeter and turn bolts inward to assist in prying carrier housing off.

   e. Pull floating axle shaft straight out of axle housing and place to the side, out of the work area.

   f. Using extreme care because of the total assembly weight involved (tires and wheel hub unit), loosen and remove the large axle nut and washer while supporting wheel assembly.

WARNING: Be certain that the axle housing is properly blocked prior to wheel unit removal.

   g. Using a steady, strong pull, remove the entire wheel hub and tire assembly. The ring gear, the outer and inner wheel bearings, and the shaft seal will all pull off as part of the assembly.

NOTE: One suggestion to aid in removal is to place a large greased sheet of heavy paper under the tire unit to be removed, and when ready, slide tire assembly off across the slick paper surface.

2. Cleaning and Inspection

   Brush dirt and lining dust from the drum and the brake support plate.

   When the shoe guide area of the support place is rusty, use steel wool or fine emery cloth to clean this surface.

   Inspect the wheel cylinder ends of the shoes for bent webs. Replace shoes if webs are distorted. Check all springs for fatigue cracks. Inspect the automatic adjuster lever, the toggle lever, and the upper and lower links for excessive wear. Check adjusting screw for sheared threads or broken teeth on the starwheel. Replace any defective components.

3. Wheel Cylinder Inspection

   When inspection of the wheel cylinder reveals a hydraulic fluid leak around the dust boots, pull back the boots and check for brake fluid behind the pistons. When there is evidence of fluid leakage, the wheel cylinder should be replaced.

4. Drive Wheel Installation

   a. Before installing the drive wheel assembly, apply a light film of grease to the following:

      (1) On support plate where shoe rim rests (6 places).

(2) On end of each shoe web where web contacts cylinder piston insert.

(3) On shoe web surface at point where web contacts the hold down cup.

(4) On adjusting screw threads and at socket end of adjusting screw assembly.

(5) On the toggle lever pivot pin where pin contacts toggle lever.

NOTE: To check for proper operation of automatic adjuster, carefully insert a screwdriver between end of shoe and wheel cylinder on brake backing plate; raise and lower the secondary shoe where its web contacts cylinder piston insert to simulate adjustment.

b. Center the brake shoes using the outside diameter of the support plate as a guide. Adjust the shoe ring diameter (measured across shoes at horizontal centerline) to approximately .030" less than the brake drum inside diameter. Adjust shoes by turning the adjusting screw IN or OUT of the pivot nut as required.

c. Install the shaft seal (Fig 2-2) on the axle wear sleeve with the exposed, protruding lip on I.D. of seal facing toward differential housing.

NOTE: The seal is pre-coated with bore tight sealer. Seal is the enclosed type to prevent spring from popping out during installation or operation.

d. Carefully inspect the inner roller bearing assembly for evidence of scratches, flats, or excessive wear. Replace if necessary. Install roller bearing on axle shaft and ensure that narrow end of taper faces out, toward planetary carrier end of axle shaft.

e. Carefully inspect the inner and outer wheel hub bearing cups. If there is any evidence of excessive wear or flat spots, then replace bearing cups. Position the wheel hub and tire assembly next to the axle shaft mounting location, and be sure that truck is blocked to proper height for hub unit installation.

f. Using a steady and straight pushing motion, install hub and tire assembly on axle shaft.

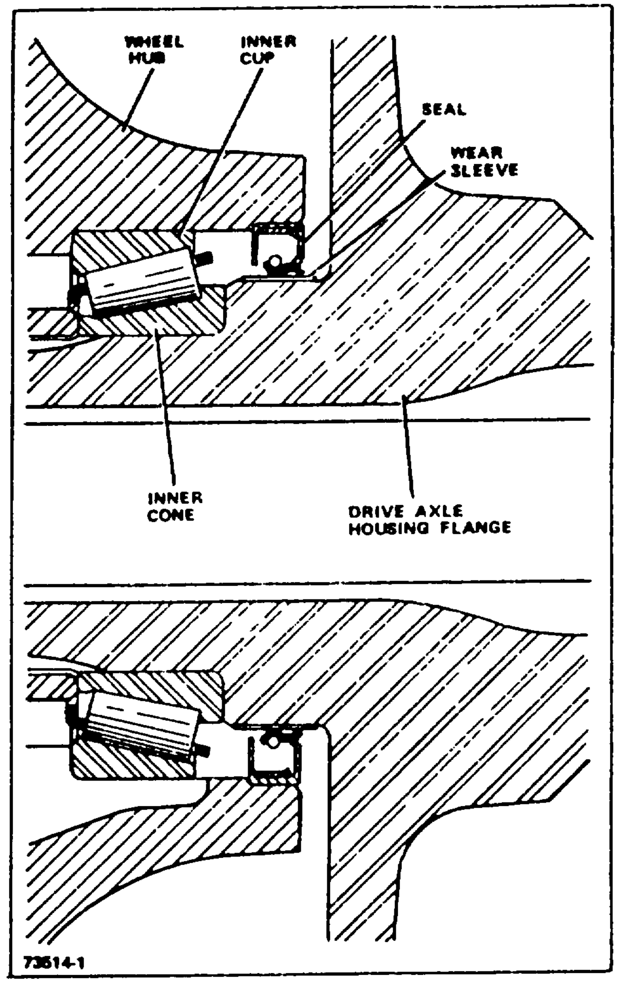


Figure 2-2. Oil Seal Installation

CAUTION: Take care to ensure that wheel hub is properly seated on the shaft seal and inner roller bearing.

g. Inspect the outer roller bearing assembly for evidence of excessive wear or flats. Replace if necessary. Install outer roller bearing assembly on the planetary ring gear housing, with roller bearing narrow taper facing inward toward the differential housing.

h. Install the planetary ring gear assembly within wheel hub, ensuring that the outer roller bearing on ring gear seats properly in bearing cup. Install large retaining washer and nut, and torque nut to 300-325 lb-ft. Use special socket with chamfer (part No. 4908103-7) to tighten nut.

While tightening nut with torque

wrench, simultaneously rotate wheel six times in each direction. Wheel should turn freely. Check end play with a dial indicator.

Range for end play is .000" to .0075". If ZERO end play is obtained, wheel should turn freely and without any drag (.001" to .002" preload on bearing will not harm bearing).

i. Install the axle shaft in axle housing and be certain that spline end of shaft is fully inserted in differential side gear.

j. Install planetary carrier assembly along with axle shaft thrust plug and lubricated O-ring into the wheel hub, and install the carrier mounting bolts. Tighten mounting bolts to 56 lb-ft torque.

k. Rotate each drive wheel until the oil level arrow, located on the planetary carrier, is horizontal to the floor. Install drain plug in bottom of drive axle housing.

l. Fill drive axle housing, at filler plug opening, with specified gear oil until oil runs out of oil level holes in drive wheel hubs. Refer to the following for approximate capacities:

ACC100 C...................................16 pints
ACC 100-120...............................16 pints
ACP 60-70-80 ....22 pints
ACP 100-120-140........................37 pints

m. Install drain plugs in drive wheel hubs and install oil filler plug securely.

n. Carefully lower the truck and remove service jacks and/or blocks.

C. SERVICE BRAKE ADJUSTMENT

If brake pedal travel is excessive, this is due to brake shoes not being properly adjusted (brake shoe lining should be .020" from drum). A series of reverse stops will automatically adjust the brakes. If brakes are grossly underadjusted, they can be adjusted by turning the adjusting screw starwheel.

1. Use a spoon type adjusting tool (access through lower slot on backside of brake backing plate) and turn adjusting screw starwheel to obtain .020" clearance between each brake shoe and drum (total clearance of .040").

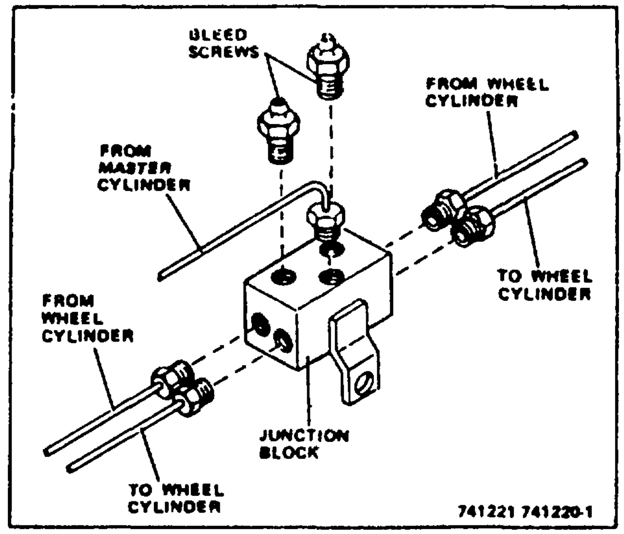


Figure 2-3. Central Bleeding System

NOTE: Check clearance by inserting .020" feeler gauge between brake shoe and drum at rear of support plate, along wheel hub diameter.

D. BRAKE SYSTEM BLEEDING

Whenever the wheel cylinders are replaced, the hydraulic brake system must be bled to remove any air that may have entered the brake lines.

1. Fill master cylinder with clean specified brake fluid.

CAUTION: Due to importance of fluid used in brake system, use only premium quality, heavy duty brake fluid with an extreme heat-cold range that conforms to SAE specification J1703d.

2. Bleed the wheel cylinder furthest from the master cylinder first (right side of lift truck).

NOTE: Normally, the bleed screw is located at the back of each drive axle flange. However, some Models of lift trucks are equipped with a central bleeding system. This system utilizes a junction block located near the top of the drive axle housing. The junction block is equipped with two bleed screws, one for each wheel cylinder. For lift trucks equipped with a central bleeding system, see Figure 2-3.

3. Have an assistant apply the brake pedal

to apply pressure to the brake fluid and open the bleed screw to allow the air to escape from the wheel cylinder. Close the bleed screw while foot pressure is still on the brake pedal. After the bleed screw is closed, allow the pedal to return to its released position.

4. Repeat step 3 as many times as required until the brake fluid is free of air bubbles and then tighten the bleed screw before allowing the pedal to return to its released position.

5. Bleed the other wheel cylinder in the same manner as outlined in preceding steps 3 and 4.

CAUTION: Be sure to keep fluid level in master cylinder high enough to prevent reentry of air into the system.

6. Fill master cylinder with specified brake fluid to within 3/8" from bottom of filler opening.

NOTE: Fluid salvaged during bleeding operation is aerated and not suitable for reuse.

TOPIC 3. PLANETARY CARRIER ASSEMBLY

A. GENERAL

The planetary gear assembly, contained within each drive wheel hub, is made up of three symmetrically spaced gears (see Figure 1-3 in preceding Topic 1). These gears ride on roller bearing assemblies which are mounted on individual support shafts and are retained within the planetary carrier housing by spirol pins.

The planetary gears are concentrically driven by the floating axle shaft drive gear. Because the outer periphery of the planetary gear meshes with the ring gear, any rotation of the axle shaft will turn the planetary gears, which will turn within the stationary planetary ring, thereby rotating the drive wheels.

As an assembly, the planetary carrier is bolted on the end of the drive unit, directly to the drive wheel hub. On its inner flange, the planetary carrier housing supports a large rubber O-ring, to act as a sealant for the lubricating oil retained within the carrier housing. The planetary carrier also serves as a retainer for the floating axle shaft by limiting its axial plane of travel. An oil drain plug is located on the hub bolt periphery for ease of access when filling or draining the planetary carrier lubricating oil.

B. REMOVAL

1. Rotate drive wheels so drain plugs in drive wheel hubs are at the lowest position. Remove oil filler plug from front of drive axle housing. Remove drain plugs from drive wheel hubs and drain plug from bottom of drive axle housing; allow oil to drain.

2. After oil has drained, Install drain plug in bottom of drive axle housing.

3. Remove the twelve planetary carrier mounting bolts and carefully pull the planetary carrier straight out of the wheel hub to remove.

NOTE: When carrier is difficult to remove, insert two of mounting bolts just removed, into the threaded bolt holes on carrier housing perimeter and turn bolts inward to assist in prying carrier housing off.

4. Carefully remove the large O-ring from the inner side of the carrier assembly and place off to side where it won't be damaged. (0-ring can be reused if there are not signs of wear or damage such as tearing.)

5. Carefully inspect the planetary gears for any evidence of excessive wear or damage such as, broken teeth, chipped teeth or worn bearings.

6. The gears should turn smoothly and quietly in carrier; look for any binding or rough spots. Repair as required.

C. INSTALLATION

Inspect carrier O-ring seal for wear or damage, replace if necessary. Install O-ring on carrier housing shoulder using a light film of petroleum jelly or grease.

1. Install planetary carrier assembly along with axle shaft thrust plug and lubricated O-ring into the wheel hub, and install the carrier mounting bolts. Tighten mounting bolts to 56 lb-ft torque.

2. Rotate each drive wheel until the oil level arrow, located on the planetary carrier, is horizontal to the floor.

3. Fill drive axle housing, at filler plug opening, with specified gear oil until oil runs out of oil level holes in drive wheel hubs. Refer to the following for approximate capacities:

   ACC100 C..................................16 pints
   ACC 100-120..............................16 pints
   ACP 60-70-80 ....22 pints
   ACP 100-120-140........................37 pints

4. Install drain plugs in drive wheel hubs and install oil filler plug securely.

TOPIC 4. DRIVE WHEEL PNEUMATIC TIRES

A. GENERAL

The drive wheel pneumatic tire assembly consists of a rim, tire, tube, flap, disc, and a retaining ring. For good performance and long tire life, the correct tire pressure must be maintained. Air pressure should be checked every day with an accurate tire gauge.

Recommended tire pressure for Models ACP 100-120-140 with 8.25 x 15 12 ply tires is 100 psi.

Recommended tire pressure for Models ACP 100-120-140 trucks with specified heavy duty rims and 7.50 x 15 14 ply tires is 130 psi.

Recommended tire pressure for Models ACP 6070-80 trucks with specified standard rims is 100 psi.

B. INSPECTION

Always make certain that valve stem caps are in place and are turned tightly by hand. Check pneumatic tires for evidence of cuts, tears, or excessively worn treads. Repair or replace as required. Whenever the tire assemblies are installed to the wheel hubs, tighten the clamp securing nuts to a torque of 100 lb-ft.

CAUTION: A safety tire rack, cage, or equivalent protection should be provided and used when inflating, mounting, or dismounting tires installed on rims equipped with locking rings or similar devices.

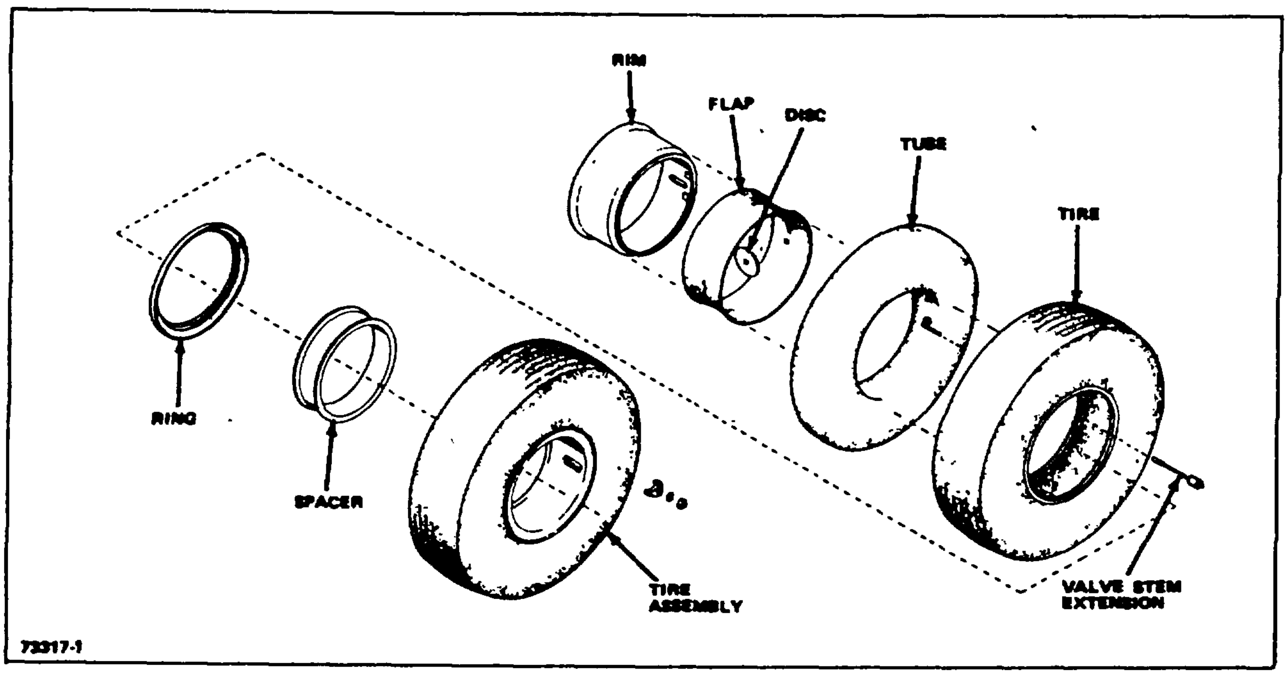


Figure 4-1. Dual Tire Assemblies

TOPIC 2. MASTER CYLINDER

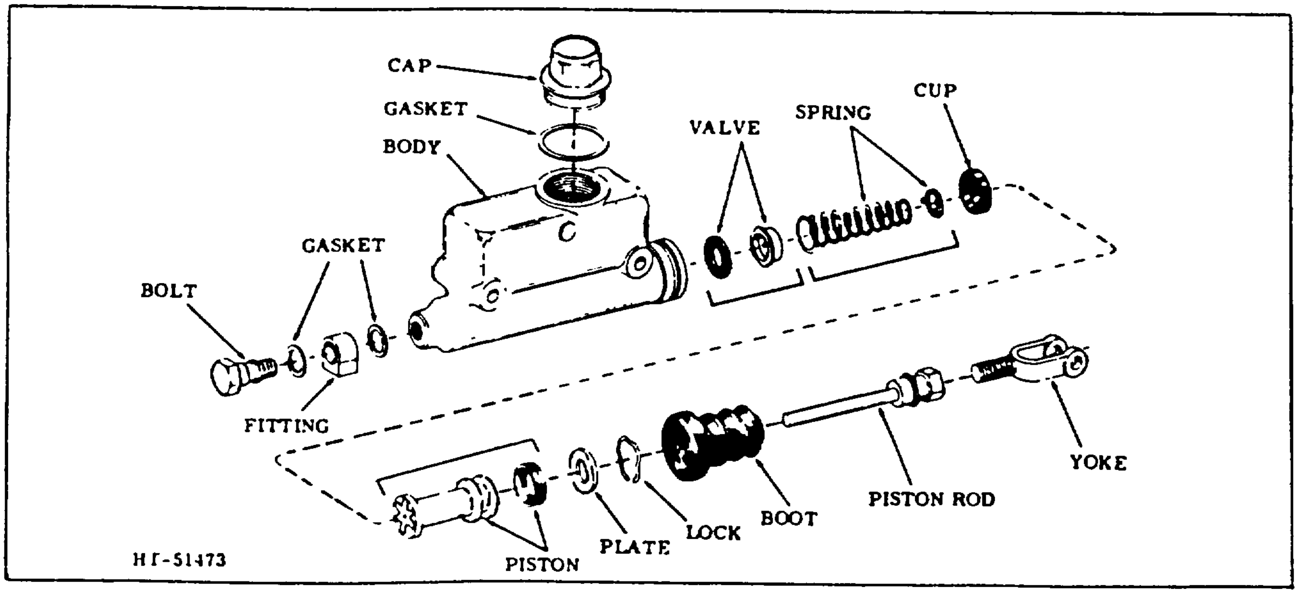


Figure 3. Master Cylinder Assembly

A. DESCRIPTION

The master cylinder and hydraulic fluid reservoir are combined in one casting and are joined by intake and by-pass ports located In the cylinder wall. (See Figure 3.) Internal parts are removed or Installed at the push rod end of the cylinder. The stop plate holding the internal parts is retained by a lockwire clipped into the cylinder bore. The cylinder piston is operated through a push rod connected to the brake pedal. The push rod and cylinder opening is enclosed with a rubber boot.

It is impractical to thoroughly clean the cylinder and fluid reservoir on the truck. For this reason the following instructions should be observed:

B. REMOVAL

1. Remove floor and toe plate.
2. Disconnect brake hydraulic line attached to master cylinder.
3. Remove clevis pin holding the pushrod to the brake pedal assembly.
4. Remove capscrews that mount the master cylinder to the inside of the truck frame and remove.

C. INSTALLATION

1. Replace master cylinder assembly in Its relative mounting location and install securing capscrews.
2. Attach brake pedal pushrod to cylinder and secure with clevis pin previously removed.
3. Connect brake hydraulic line to cylinder
4. Refer to LUBRICATION CHART and fill cylinder with proper high grade hydraulic brake fluid. SAE specification R-71 is recommended.
5. Bleed brake system as outlined under appropriate heading, REPAIR MANUAL.
6. Replace floor and toe plate.

MEMO

MEMO

TOPIC 4. PARKING BRAKE

A. DESCRIPTION

A dual shoe mechanical brake, mounted at the drive shaft, can be used as either a parking brake or as an emergency brake. The brake shoes are actuated through a cable by an adjustable, over-center type lever, mounted on the left hand cowl panel. (See Figure 5.)

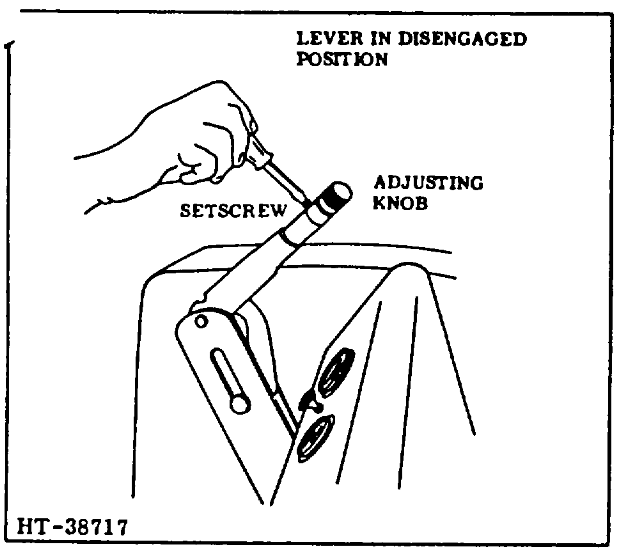


Figure 5. Hand Brake Adjustment

The brake mechanism requires no lubrication except at time of assembly. The brake actuating mechanism, such as the hand lever and linkage, should be lubricated periodically.

B. ADJUSTMENT

To compensate for brake lining wear, the tension on the hand brake can be increased by adjusting the knob on top of the hand brake lever. (See Figure 5.) The following procedure is recommended for proper adjustment of hand brake lever:

1. Set the hand brake lever In the fully released position.

2. Remove the setscrew that locks the adjusting knob in position.

3. Turn the adjusting knob in a clockwise direction one or two turns, then verify adjustment by engaging the brake. Lever should pull harder to engage brake if properly adjusted.

4. Repeat Step 3 if additional tension is required. When satisfactorily adjusted, turn setscrew in to lock the adjusting knob.

NOTE: Refer to REPAIR MANUAL if brake shoe adjustment is required.

TOPIC 1. STEERING

A. DESCRIPTION

Vehicles with power steering have a steering wheel and column, a hydraulically operated steer gear at the base of the column, a hydraulic pump, filter, reservoir, and a power steer cylinder that actuates the drag link. The drag link moves the tie rods which, in turn, transfer movement to the steer wheels at the back of the truck.

The steer wheels turn the truck in the same direction as the steering wheel is turned, but they do this by swinging the back of the truck away from the turn.

The steering wheel and column are similar to standard steer systems, but the gear has ports for the movement of hydraulic fluid. When the steering wheel is turned to the right, fluid flows out of one port in the gear to the forward power steer cylinder port. The fluid forces the piston in the cylinder out, thereby pushing backward on the drag link. The drag link pushes on the pivot arm. The pivot arm turns, moving the tie rods with it. The other ends of the tie rods connect to the spindles on which the steer wheels are mounted. Therefore, the wheels turn.

When the steering wheel is turned to the left, the hydraulic fluid flows out of the other port in the steer gear. This fluid is forced into the back of the power steer cylinder. This forces the piston forward; the piston takes the drag link forward with it. The drag link pulls forward on the pivot arm, and the pivot arm pulls the tie rods and thus steers the wheels into position for a left turn.

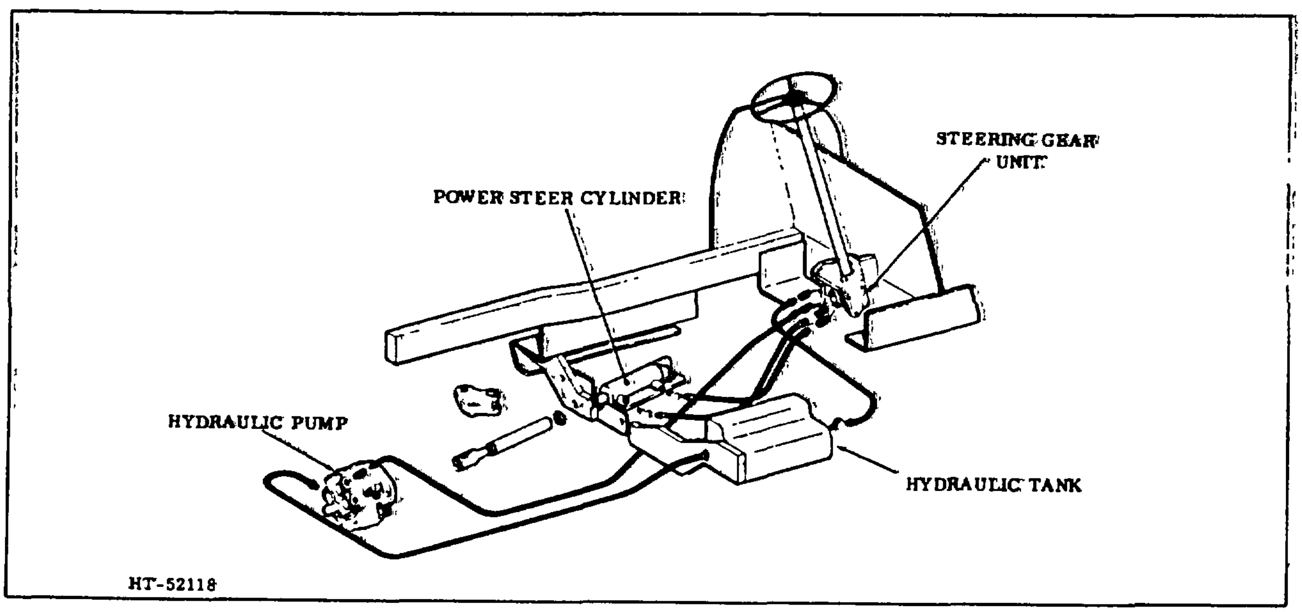


Figure 1. Power Steering Components

TOPIC 2. STEER AXLE

A. DESCRIPTION

The steer axle assembly (Figure 2), is attached to the truck frame by two axle mounting housings. (See Figure 3.)

It will be necessary to raise the rear of the truck to remove the steer axle assembly, and the following procedure is recommended.

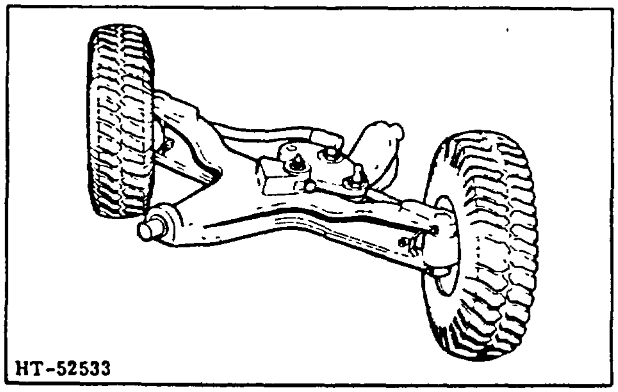


Figure 2. Steer Axle Assembly

B. REMOVAL

1. Raise rear end of truck with chain hoist to a height which makes all parts accessible, and block truck in this position.
2. Remove steer wheels.
3. Place a suitable jack under steer axle and raise slightly to remove stress from axle mounting housings and to support axle during removal.
4. Remove drag link from pivot arm. Refer to DRAG LINK Section.
5. Remove capscrews and locknuts securing axle mounting housings to truck frame.
6. Lower jack and pull steer axle assembly from under the truck.

NOTE: Refer to REPAIR MANUAL for DISASSEMBLY, INSPECTION, REPAIR and REASSEMBLY procedures.

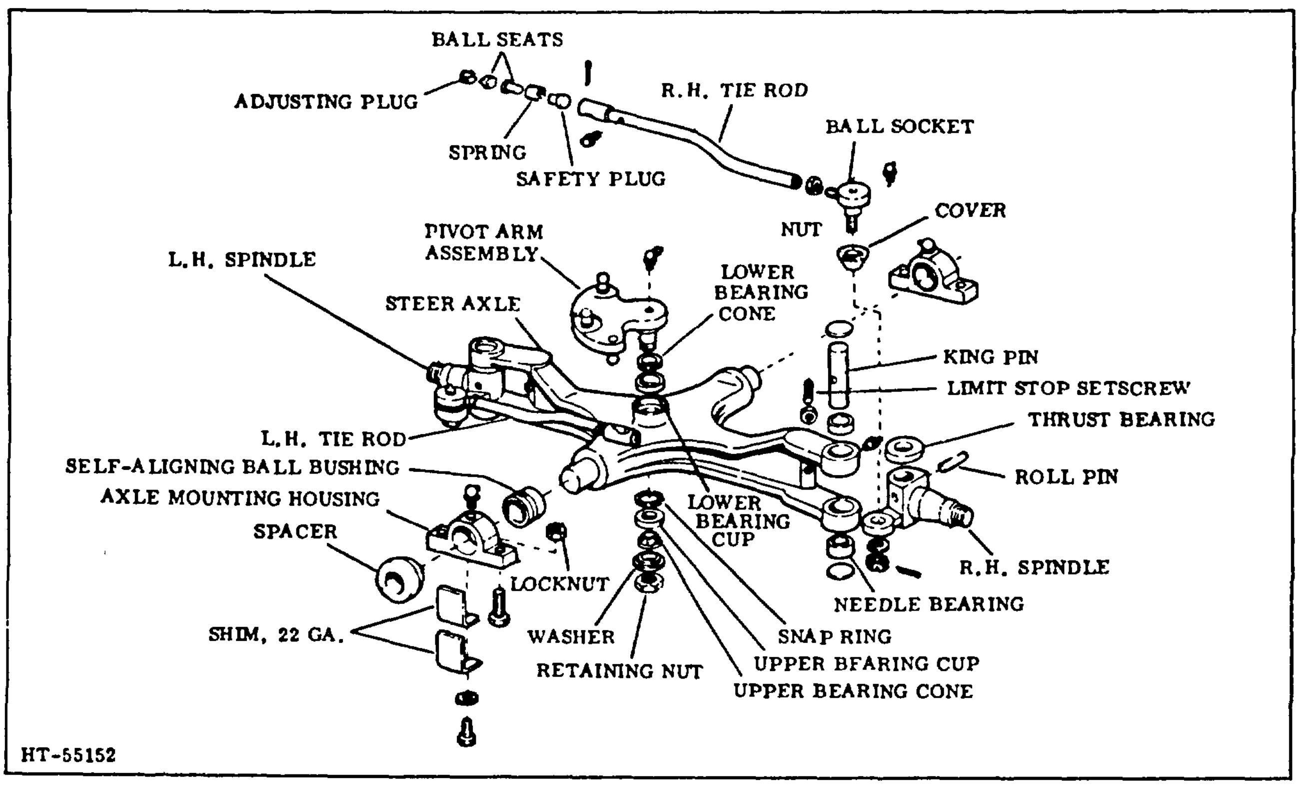


Figure 3. Steer Axle and Connections

C. INSTALLATION

1. Install self-aligning ball bushings into axle mounting housings. Screw lubrication fittings into axle mounting housings.

2. Slide axle mounting housings and spacers on each end of steer axle.

3. Install tie rods and tighten adjusting plugs. Pull adjusting plugs up tight, then loosen so there is no end play and secure in position with cotter pins.

4. Attach ball sockets in tie rods and lock in place with check nuts. Install ball sockets in spindles and secure with nuts making sure to lock nuts with cotter pins.

5. With steer axle assembly on jack, raise axle assembly into position and secure axle mounting housings to truck frame with capscrews and locknuts.

6. Install equal amount of shims between frame and spacers on each end of steer axle to eliminate all end play. Secure shims to axle mounting housings with capscrews. Torque housing mounting capscrews to 125 - 135 ft. lbs.

7. Install drag link to pivot arm. (Refer to DRAG LINK Section.)

8. Install steer wheels. (Refer to WHEEL and TIRE ASSEMBLY Section.)

D. STEERING SYSTEM ADJUSTMENT

If the steering system should require adjustment, follow the procedure outlined below:

1. Raise the rear end of the truck so that the steer wheels clear the floor. Block in position.

2. Disconnect the drag link from the pivot arm.

3. Turn the steer wheels full right and full left. Measure the distance between the wheel and the axle at both wheels. Clearance should be at least 1/2". While holding this distance, adjust the spindle stops to allow approximately .030" clearance between the stop and the spindle.

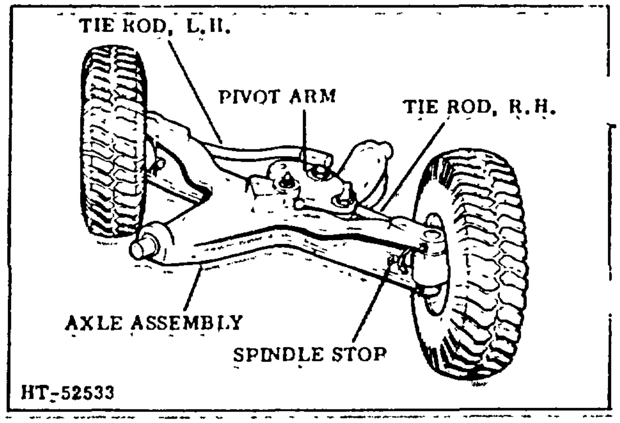


Figure 4. Stop Adjustment

4. Set the steer wheels straight ahead, parallel with the side of the truck frame. It may be necessary to adjust the tie rods to obtain this position, as zero degrees toe-in must be maintained at all times.

5. Position the plunger rod half way out of the power steering cylinder. Loosen the locknut that secures the drag link socket to the plunger rod. Turn the drag link IN or OUT while holding the power steering plunger rod with a wrench on the flats near the end of the rod. The drag link socket must be centered over the steer axle pivot arm ball stud while the steer wheels are in a straight ahead position, parallel with the frame.

6. Connect drag link to pivot arm ball stud. Tighten adjusting plug in end of drag link and install cotter pin. Then tighten locknut to secure drag link socket to plunger rod.

7. Remove the blocks and lower the rear of the lift truck so the steer wheels rest on the floor.

8. Start the engine and check the steering system. With all adjustments correctly made, the wheel spindles should contact the stop screws on the axle to prevent the piston from bottoming in the steering cylinder.

TOPIC 3. STEERING WHEEL AND COLUMN

DESCRIPTION

Although the steering wheel and column are similar to standard steering systems, the power steering system incorporates a hydraulically operated steer control unit instead of the usual steer gear box. (Figure 5.)

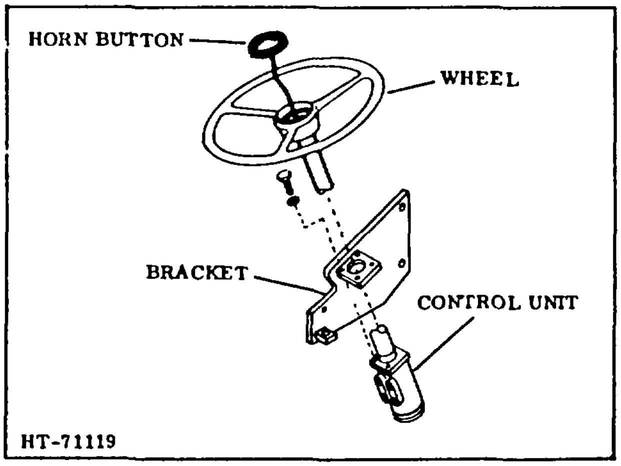


Figure 5. Power Steer Assembly

Then the steering wheel is turned in either direction, hydraulic fluid is channeled through the appropriate control unit ports, thus pushing or pulling the drag link, which controls direction of wheels.

B. STEERING COLUMN ADJUSTMENT

Proper alignment of the steering column is very important. The column must not be sprung in any direction from its free position. To determine whether or not misalignment exists, release the upper column support and note whether column moves to a different position--its free position. If it does move, then it has been out of line and should be clamped in proper position, or position corrected at mounting bracket on truck. If column has been bent permanently because of severe misalignment, then replacement of the tube, shaft, or entire unit may be necessary.

C. REMOVAL

The following procedure is recommended for proper steer control unit removal:

1. Disconnect battery terminals.

2. Remove the floor and toe plates.

3. Disconnect the hydraulic lines from the steer control unit. Tag hydraulic lines for identification.

NOTE: All hydraulic lines should be plugged immediately after they are disconnected to prevent dirt from entering the system.

4. Disconnect the horn wires from column.

5. Remove the capscrews that hold the steer unit to the stationary bracket.

6. Lift the steer gear up and out of the vehicle and place in a clean working area.

NOTE: Refer to REPAIR MANUAL for DISASSEMBLY, INSPECTION, REPAIR and REASSEMBLY.

D. INSTALLATION

1. Place the steer gear control unit in its relative mounting location at end of steering column and insert and tighten securing capscrews.

2. Reconnect the horn wires.

3. Unplug and connect the hydraulic lines to steer unit as they were removed.

4. Ensure that reassembly is complete, then replace the floor and toe plates.

5. Reconnect the battery terminals.

If the steering system requires adjustment, refer to Paragraph D in preceding Topic 2.

TOPIC 4. DRAG LINK

Refer to POWER STEER CYLINDER TOPIC for REMOVAL and INSTALLATION.

TOPIC 5. TIE ROD

Refer to STEER AXLE REMOVAL to gain access to the TIE RODS, and refer to STEER AXLE DISASSEMBLY, REPAIR MANUAL, for TIE ROD REMOVAL, DISASSEMBLY, REPAIR and REASSEMBLY.

TOPIC 6. POWER STEER CYLINDER

A. DESCRIPTION

The power steer cylinder is controlled by the hydraulic steer gear unit and subsequently controls the direction of turn of the steer wheels through the drag link coupled to its output shaft.

The following procedure is recommended to remove the power steer cylinder:

B. REMOVAL

1. Raise back of vehicle with a chain hoist until cylinder connections are easily accessible. Block front wheels and place blocks under frame.

2. Place a drain pan under cylinder ports and remove hoses leading to power steer cylinder. Plug cylinder ports and cap hoses to prevent dirt from entering hydraulic system.

3. Remove drag link from pivot arm.

4. Remove cylinder from its connection at truck frame. (Figure 6.)

5. Unscrew drag link (Figure 7) from cylinder.

NOTE: Refer to REPAIR MANUAL for REPAIR procedures.

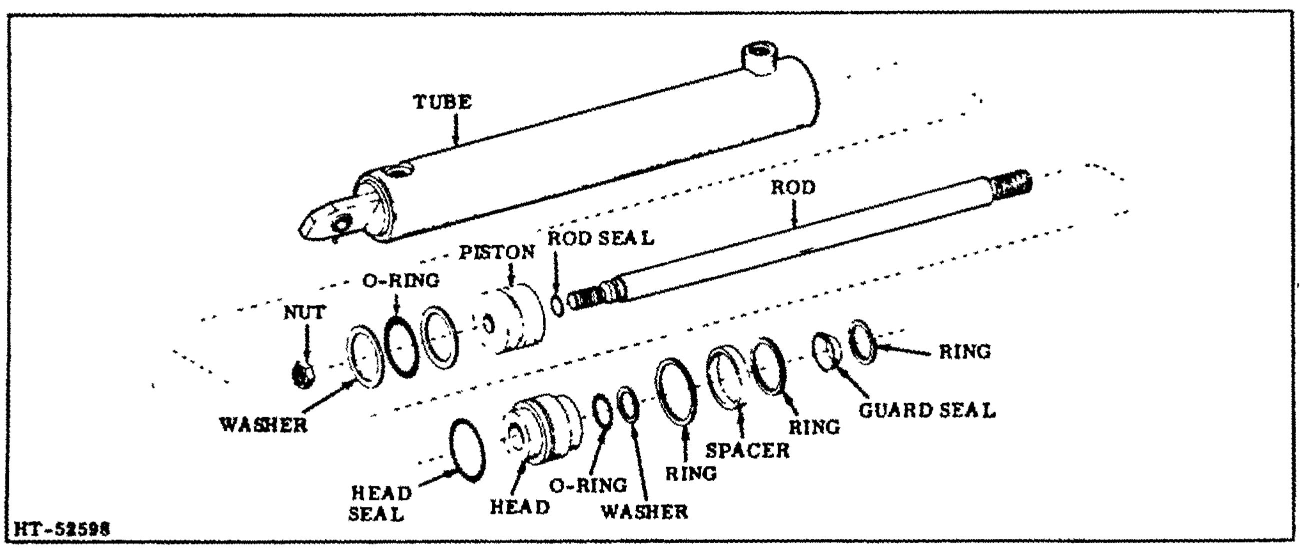


Figure 6. Power Steering Components

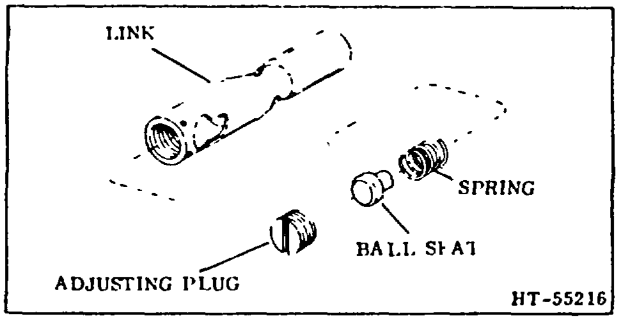


Figure 7. Drag Link Components

C. INSTALLATION

1. Attach drag link to pivot arm and to cylinder. Attach cylinder to frame.

2. Connect hydraulic lines to cylinder.

3. Loosen suction hose at hydraulic pump to make certain hose is not air-bound. With suction hose loosened, air will leak out.

CAUTION: Make certain hydraulic oil is up to the "FULL" mark on dipstick.

4. Tighten hose and lower truck to floor.

TOPIC 7. WHEELS AND TIRES

The steer wheels are located at the rear of the lift truck, at the counterweight end. To remove either or both steer wheels, it is recommended that the drive wheels be properly blocked and that a properly attached hoist chain and jacks or blocks be used to raise rear of truck for steer wheel tire removal.

A. REMOVAL

1. Ensure drive wheels are securely blocked and set parking brake to prevent truck from rolling.

2. Remove the nuts and lockwashers attaching the rims to the bolts in the wheel hub. (See Figure 8.)

3. Pull the tire and rim assembly from the hub.

NOTE: Refer to REPAIR MANUAL for DISASSEMBLY, REPAIR and REASSEMBLY.

B. INSTALLATION (PNEUMATIC TYPE)

1. Install tire and rim assembly on hub.

2. Secure tire and rim assembly with nuts and lockwashers.

3. Remove blocks, lower truck and release handbrake.

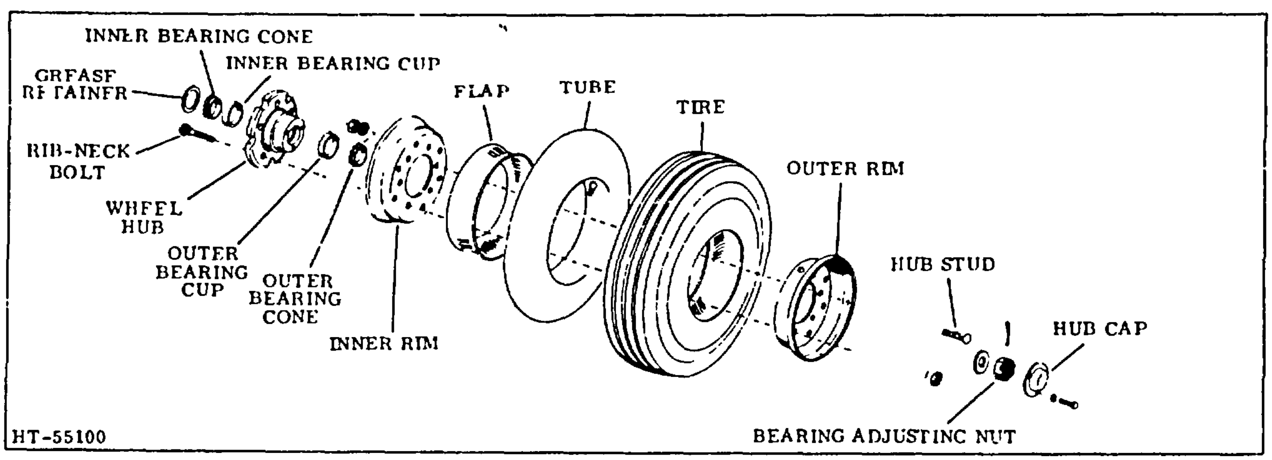


Figure 8. Steer Wheel Assembly (Pneumatic Tire Type)

C. SERVICE - TIRE AND TUBE REPAIR

If a tire is excessively worn or badly damaged, replace it as follows:

CAUTION: Ensure tube has been completely deflated prior to separating rims.

1. Completely deflate the tube assembly.

2. To remove the steer wheel tire, tube and flap, remove the six (6) bolts, nuts and lockwashers (inside the inner rim) and separate the inner and outer rims. (See Figure 6.)

CAUTION: A safety tire rack, cage, or equivalent protection should be provided and used when inflating, mounting, or dismounting tires installed on split rims, or rims equipped with locking rings or similar devices.

3. Replace or repair the defective tire, tube or flap and reassemble in reverse order of removal by placing tube in tire, then inserting flap; place inner and outer rims in tire and secure nuts, bolts and lockwashers.

TOPIC 1. HYDRAULIC SYSTEM

A. DESCRIPTION

The hydraulic system operates the lifting and tilting functions of the mast assembly through the use of hydraulic pressure. The hydraulic system consists of an oil reservoir, a hydraulic pump directly driven from the engine, power steer unit and cylinder (if so equipped), a control valve, lift and tilt cylinders, and the necessary hydraulic lines, fittings and hose connections. (Refer to Figure 1.)

On certain applications where attachments are installed on the fork carriage, the control valve may have two, three or four plungers. A forward or backward movement of the control valve levers operates the hydraulic attachment.

An oil filter is installed in the hydraulic pump return line for the purpose of removing contaminants which may have entered the system.

The pump is the heart of the hydraulic system. In operation, it circulates hydraulic oil from the reservoir to maintain a constant supply of fluid, through the control valve, the hydraulic filter, and back to the reservoir.

At all times the engine is running, the pump is in operation, and oil is flowing through the open center of the control valve. When a handle is actuated, this flow is diverted to a hydraulic cylinder and oil pressure builds up to overcome the load on that cylinder.

When the control handle is positioned in the opposite direction, the hydraulic oil is released from the cylinder and the cylinder piston will retract, returning the oil through the control valve and the oil filter to the reservoir.

The hydraulic system incorporates an "anti-cavitation" circuit which prevents the tilt cylinders from drawing a vacuum on the head end of the cylinders, when tilting a load forward with the engine at idle speed. This circuit makes use of tee connected hydraulic lines attached to the tilt cylinders and an in-line check valve, which draws make up oil from the power steer circuit.

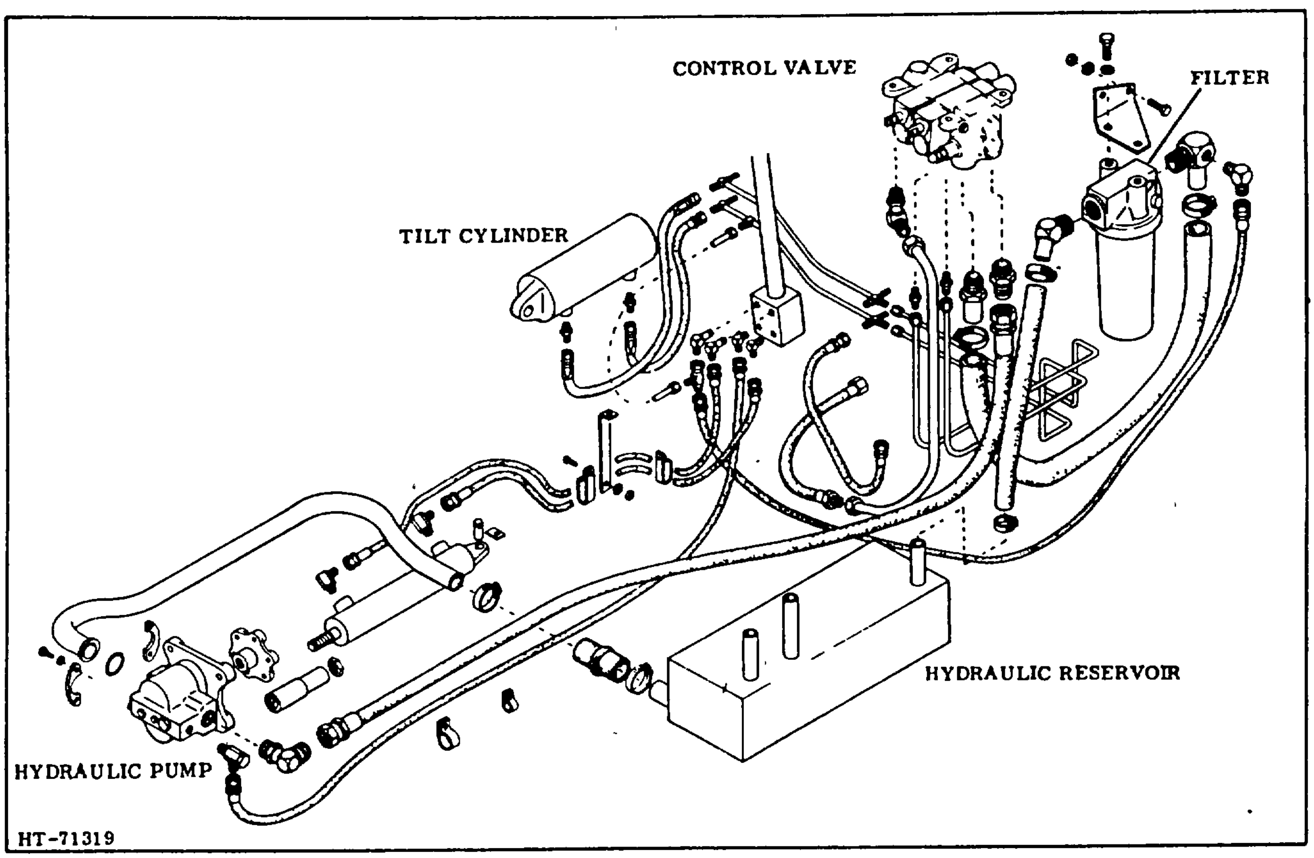


Figure 1. Hydraulic System (Typical)

When the hydraulic system is activated, the check valve allows hydraulic oil in the "anti-cavitation" circuit lines to fill the void (cavitation) behind the oil cylinder pistons.

B. GENERAL MAINTENANCE

1. Keep all fittings and connections tight to eliminate oil leaks.

CAUTION: Do not excessively tighten brass fittings as it is not necessary to do so to prevent them from leaking.

2. If pipe or pipe fittings are removed, use a sealing compound on the threads when replacing. Be sure all parts are thoroughly cleaned before installation.

3. When installing a hose assembly be sure it is not twisted when the connections are tightened. Always use two wrenches on the swivel end. One to hold the hose and the other to tighten the connection.

4. Keep hose clamps tight to prevent hose chafing.

5. The lift cylinder and tilt cylinder packing should be replaced as soon as leakage becomes evident.

6. Clean the oil reservoir at 1,000 hour intervals.

7. Keep the breather clean.

8. Check the pump mounting and coupling for tightness at 1,000 hour intervals.

NOTE: Keep the hydraulic system clean. A dirty hydraulic system is the major cause of hydraulic pump and control valve wear or failure.

TOPIC 2. RESERVOIR

A. DESCRIPTION

The purpose of the hydraulic tank is to hold sufficient oil for the entire hydraulic system. It is here that most of the foreign material, such as dirt or water, can enter the oil. Its construction is such that it must be kept filled to Full mark on dipstick, or to the oil level plug, to insure adequate fluid to fully extend all the cylinders.

The suction line inlet is located near the bottom to prevent air from being drawn into the pump, causing pump noise and erratic operation of the system. The return line is also located near the bottom; this helps to prevent foaming of the oil.

When oil is drawn from the reservoir and into the hydraulic system, air is drawn into the reservoir. Likewise, when oil is returned to the reservoir from the hydraulic system, air is expelled. The breather, therefore, is designed to allow air to flow unrestricted in both directions to keep the reservoir ventilated.

The present breather is a "spin-on" can type with a pleated paper element and is rated at 10 microns. It Is the "throw away" type and cleaning is not recommended.

A drain plug is provided on the bottom of the tank to drain out all the oil when necessary.

CAUTION: Always use a high grade mineral (anti-wear) hydraulic oil of recommended viscosity. NEVER USE BRAKE FLUID. Make sure containers and surrounding parts are clean when filling tank, to prevent dirt from contaminating the oil. Any hydraulic oil used should contain a rust preventive, oxidation inhibitor, and should not foam.

B. RESERVOIR SERVICE

The hydraulic oil reservoir should be drained at periodic intervals of 1,000 hours. Draining is important primarily because of condensation and contamination. Heating of the oil during service and cooling of the oil when the truck Is not in use is conducive to condensation which is injurious to the hydraulic system. Contaminants such as dirt, dust, rust, scale and products of oil deterioration are also detrimental to the hydraulic system.

Remove the drain plug from the bottom of the reservoir. After all oil has been drained, the reservoir can be cleaned and flushed with any acceptable cleaning compound.

Dry all the parts with compressed air. Check the tightness of all connections at the reservoir. When filling, make certain container, funnel, etc., are clean.

C. HYDRAULIC HOSES

Flexible hose is used throughout the hydraulic circuit - mainly to absorb vibration and shock, for ease of installation, and to provide flexibility for component motion.

NOTE: All pressure hoses are selected to conform to SAE specifications, 100 R1, 100 R2, 100 R5, 100 R7 or equivalent.

The inside diameter of the hydraulic hose is determined by the amount of oil flow required. Pressure requirements determine the wall construction of the hose.

Unless apparent damage is Incurred, hydraulic oil lines need practically no service. Check occasionally for leaks at couplings, for any evidence of coupling/hose separation, and chafing of hose outer cover.

Take following precautions when installing lines:

1. Hose should be correct length and not stretched between fittings.
2. Hoses should not be twisted or distorted.
3. Hoses should not have sharp or excessive bends which could restrict flow of oil.
4. Hoses should not be exposed to excessive heat.

D. HYDRAULIC OIL FILTER

There are occasions, especially when operating conditions are particularly dusty, when it is possible for contaminants to enter the hydraulic oil system. These contaminants, such as dirt, rust, dust, scale and products of oil deterioration are detrimental to the hydraulic system.

To prevent contaminants or other foreign material from reaching the hydraulic pump, a hydraulic oil filter is installed in the return line between the control valve and the reservoir. This filter is rated at 10 microns, and contains a bypass valve to divert the hydraulic oil flow around the element if it becomes clogged. As a result of this fine filtration, the life of the hydraulic system will be Increased.

The filter element is a paper type and cannot be washed, and so it must be replaced. It is recommended that the element be replaced at the first 25 and 100 hours of service, then at each 200 hour interval thereafter.

E. HYDRAULIC OIL FILTER SERVICE

Refer to Figure 2, and proceed as follows to replace hydraulic filter:

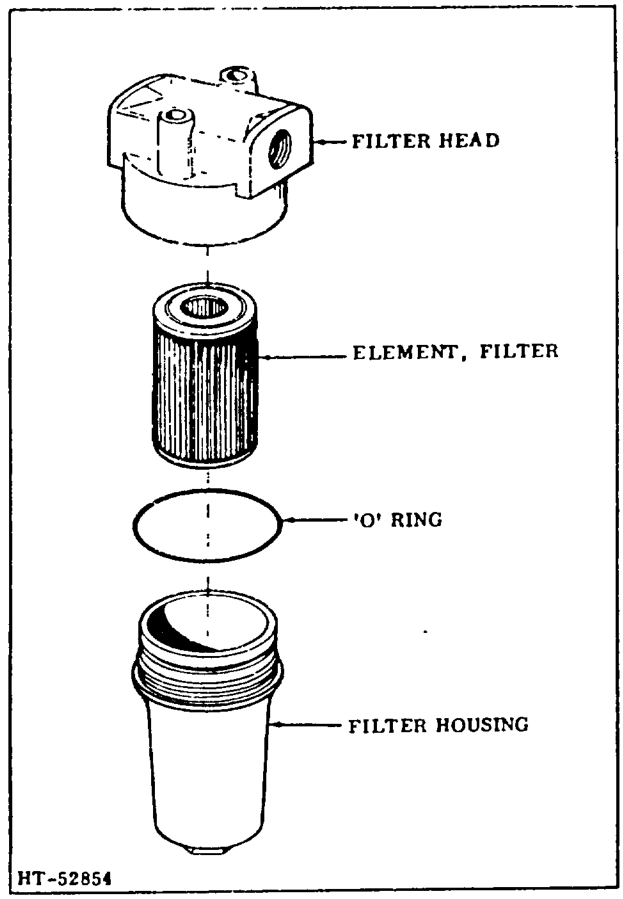


Figure 2. Filter Components

1. Gain access to hydraulic filter unit for service (actual location of filter housing varies depending on lift truck model, but unit is easily identified by its over-large size as compared to the engine lubrication filter, for example).
2. Most filter housings have a large hex-head (approximately 1-1/2”) cast nut at the base of the housing; using appropriate wrench, loosen and remove filter housing and element.

NOTE: "O" ring will come out with housing as it is seated in the upper lip groove of housing.

3. Remove "O" ring from housing and inspect for wear or cuts. The "O" ring should be replaced in keeping with good maintenance practice.
4. Discard old filter element. Thoroughly clean filter head and housing shell and inspect for any defects. Replace damaged parts.

F. INSTALLATION

1. Place a light coat of clean hydraulic oil on replacement housing "O" ring and carefully install "O" ring in groove on housing; do not over stretch or tear "O" ring.

2. Insert replacement 10 micron filter element in housing and install housing, with filter element into filter head. Hand tighten making certain that element center hole aligns properly within filter head.

3. Use same wrench to tighten filter housing as was used during removal. Tighten until a snug fit is ensured.

CAUTION: Do not use undo force when tightening housing; remember, someone will have to remove it again at next routine service period.

4. Check all hydraulic hose connections and hoses for security of installation; tighten, repair or replace as is necessary.

5. Check hydraulic oil reservoir level dipstick. Fill reservoir to Full mark on dipstick.

6. Operate the hydraulic system and check the filter for oil or air leaks. Correct any abnormal conditions found.

TOPIC 3. HYDRAULIC PUMP

A. DESCRIPTION

The hydraulic pump Is a gear type unit, driven directly through a flexible coupling from the engine crankshaft. With this type of installation, the pump Is always driven at engine speed.

The hydraulic pump consists of a housing, a combination end plate and mounting flange, gears, seals, bushings and capscrews. The housing also contains bores for the priority flow control valve, and the priority flow relief valve.

The relief valve pressure setting can be adjusted by turning the setscrew, located in the end of relief assembly, in or out. Turning the setscrew IN increases the spring pressure on the cone to increase the relief pressure setting, while turning the setscrew OUT will decrease the relief pressure.

When the hydraulic pump must be removed for replacement or repair, the following procedure is recommended:

B. REMOVAL

1. Remove radiator grille and components necessary to gain access to hydraulic pump.

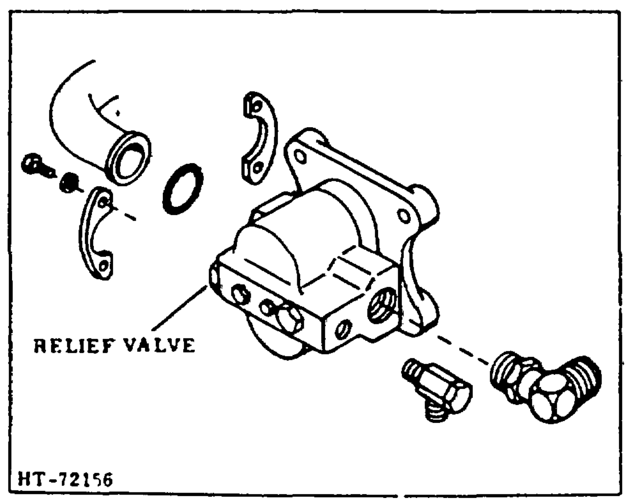


Figure 4. Hydraulic Pump Assembly

NOTE. On truck applications where the hydraulic oil reservoir is below the supply line connection at the pump, it will not be necessary to drain the reservoir. Check reservoir to see if oil level is above or below the pump. If it is above the pump, oil will flow out of the supply (suction) line, when it is removed from the pump.

2. Disconnect hoses from fittings on hydraulic pump, and cap hoses to prevent contamination.

3. Remove capscrews and lockwashers attaching pump bracket to the engine and remove pump assembly.

4. Place the hydraulic pump assembly min a suitable work area for service.

NOTE: Refer to REPAIR MANUAIL for proper DISASSEMBLY, INSPECTION, REPAIR and REASSEMBLY Procedures.

C. INSTALLATION

NOTE. If the splines of the original coupling are worn, replace coupling.

1. Install the pump and the mounting bracket onto the front of the engine. Reconnect the hydraulic lines to the hydraulic pump.

2. Check the hydraulic oil reservoir to be sure the oil level is correct. Run pump for one minute at no load, idle speed, to allow the system to fill. Check for any pressure or air leaks in the system at this time. After one minute of running, shut engine off and recheck oil level in reservoir. If low, fill to proper level as indicated by Full mark on oil level dipstick.

NOTE: If severe foaming is observed, It indicates a suction leak or improper oil, and must be corrected.

3. Set the main hydraulic relief pressure (adjustable valve located in control valve assembly) to 1950 ± 50 p.s.i.

4. Install a pressure gauge (2000 p.s.i.) in the pressure side of the steering circuit. With the hydraulic pump operating at full speed, turn the steel wheels to their limit. The opening pressure should be set at 1100 p.s.i. by adjusting the pump relief valve setscrew IN or OUT.

5. Always start the hydraulic pump under no load conditions to prolong pump life. Refer to SPECIFICATIONS of LUBRICANTS for proper oil to use.

6. Install the radiator grille and components which were removed to gain access to the pump.

TOPIC 4. CONTROL VALVE

A. DESCRIPTION

The function of the control valve is to direct the flow of the hydraulic oil, under pressure, to the appropriate cylinders. The control valve requires very little attention with the exception of keeping the hydraulic lines and hose connections tight.

There are, normally, two operating plungers in the valve. One is a single acting plunger which operates the lift cylinder. The other is a double acting plunger to operate the tilt cylinders.

A check valve is located within the single acting lift section, and one or more check valves are mounted in the double acting tilt section. The check valves are located in a manner to check back flow through the cylinder ports during the time period of pressure build-up.

When the control lever is in "neutral" position, the oil is being circulated through the open center of the valve and back to the reservoir; but is not entering any of the cylinder ports. As the control lever is moved to its operating position, the cylinder ports begin to open and the open center passage begins closing. At the extreme limit of control lever travel, the cylinder ports are open and the open center passage is closed. The applied oil pressure then opens the check valve and allows the oil to flow to and/or from the lift or tilt cylinders.

An adjustable relief valve is incorporated in the control valve. It is used to relieve extreme pressures when maximum tilt or lift position, or overloads are reached, to prevent damage to parts of the hydraulic system.

B. REMOVAL

The following procedure is recommended for proper control valve removal:

1. Make sure lift is collapsed and that mast is tilted all the way forward.

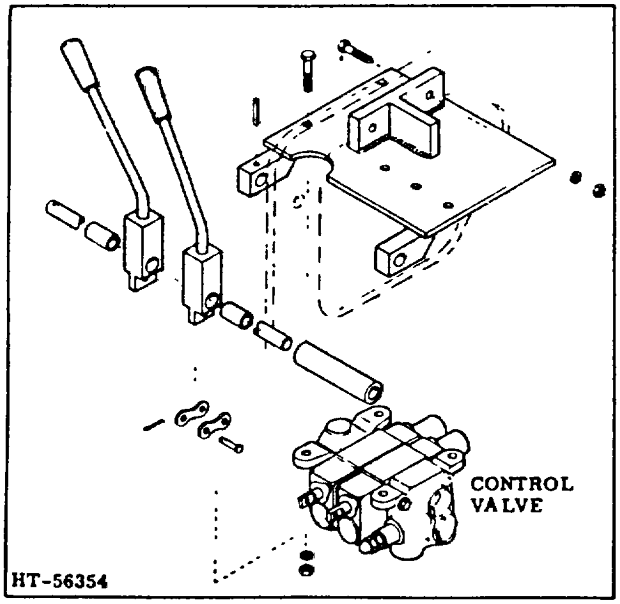


Figure 5. Control Valve (Typical)

2. Disconnect control lever linkage if necessary to gain access for control valve removal. On some new model trucks, the handles, linkage, and mounting bracket can all be removed along with the control valve.

3. Disconnect and cap all hydraulic lines.

NOTE: Properly tag all lines so that they will be reconnected to their proper ports.

4. Remove the mounting capscrews and control valve.

5. Clean outside of valve with a solvent and dry with compressed air.

6. Remove all fittings and place control valve in a suitable work area.

NOTE: Refer to REPAIR MANUAL for DISASSEMBLY, INSPECTION, REPAIR and REASSEMBLY.

C. INSTALLATION

1. Ensure that all fittings have been replaced and properly tightened.

2. Place control valve assembly in its relative mounting location and insert the attaching capscrews.

3. Uncap and connect the hydraulic lines as marked.

4. Reconnect the lever linkages if disconnected.

5. After complete reassembly has been assured, run the hydraulic system (i.e., operate the lift control, tilt control and any auxiliary functions associated with the hydraulics) for about 5 minutes to eliminate any air present in system. The internal construction of the hydraulic reservoir will "bleed-off" any trapped air in the hydraulic oil as it flows through the reservoir. Recheck the hydraulic oil level (reservoir) after operating the hydraulic system and refill, if necessary.

TOPIC 5. LIFT CYLINDER

Refer to MASTS, CARRIAGES and FORKS Section for LIFT CYLINDER DESCRIPTION.

TOPIC 6. TILT CYLINDER

A. DESCRIPTION

The action of the tilt cylinder is a straight line motion. Any misalignment between the cylinder and the piston will cause binding, rapid wear of packing and packing gland, rapid wear of piston rod and packing, and will tend to break the weld on the cylinder case. The welded section is designed to hold hydraulic pressure and should not be called upon to sustain any bending action due to misalignment. (See Figure 6.)

B. TILT CYLINDER SERVICE

At the truck lubrication period, the tilt cylinder mountings should be checked. Make certain the yoke bolt is tight so that the plunger will not rotate in the cylinder. Check the stroke of both plungers to make sure they are even. Uneven stroke can cause serious damage to the cylinders, frame and mast structure. Check for any oil leakage at the packing gland and at hose connections.

If excessive leakage is evident, inspect cylinder as follows:

1. Tilt mast forward and inspect piston rod for scratches or a scored condition.

2. Remove scratches or scores using a fine emery cloth, and polish with crocus cloth (if this can be accomplished without destroying the chrome plating).

   Do not polish lengthwise but use rotary motion.

3. If piston rod will not clean up to a smooth finish, without destroying the chrome finish, it is recommended that the rod be replaced.

   If the gland nut seal or wiper ring has to be replaced, follow the procedure outlined in TILT CYLINDER REPAIR MANUAL.

If mast tilts too slowly or creeps under load, It is an indication that oil is leaking past the piston seal. This can easily be checked by:

1 Tilt mast forward to extreme limit.

2. Disconnect hoses at front or yoke end of cylinders.

3. Hold tilt control handle in forward position. Accelerate engine to develop pressure and check for oil flow through disconnected opening. If oil flows out of opening of either cylinder, remove and replace piston seal.

   If oil does not flow out of either opening it indicates the control valve Is at fault. Repair as outlined in CONTROL VALVE.

C. TILT CYLINDER REMOVAL

The tilt cylinders are mounted under the toe plate and floor plate. To remove tilt cylinders the following procedure is recommended:

1. Set hand brake. Operate tilt cylinder lever and put mast in forward position. Turn ignition switch to OFF position. Secure mast In position with a chain hoist.

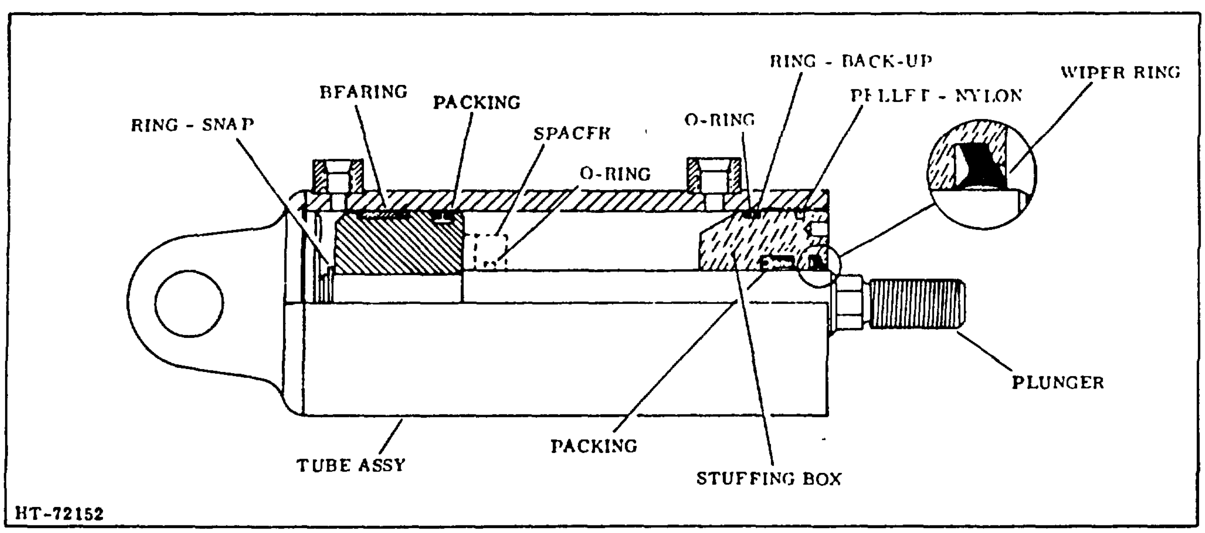


Figure 6. Tilt Cylinder - Sectional View (Typical)

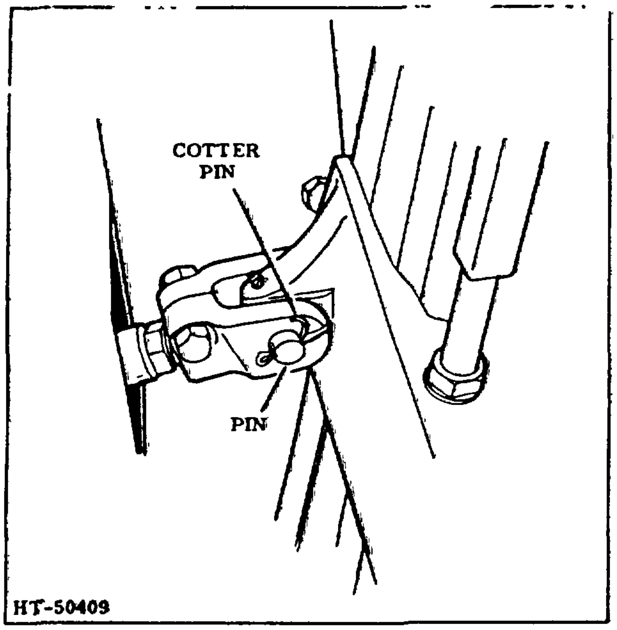


Figure 7. Tilt Cylinder Yoke

2. Remove cotter pin and yoke pin (Figure 7).

CAUTION: Protect tilt cylinder rod from truck frame and handling mishaps.

3. Remove toe plate and floor plate.

4. Disconnect hydraulic lines at tilt cylinder.

5. Remove capscrew and pin retainer (Figure 8).

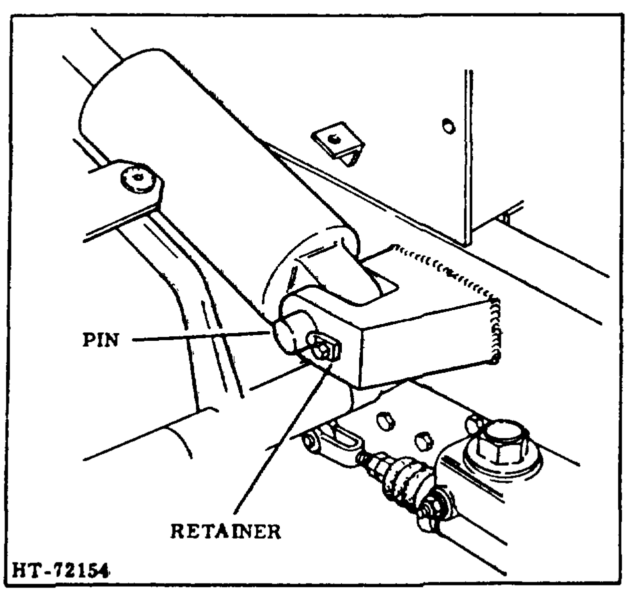


Figure 8. Tilt Cylinder Anchor Pin

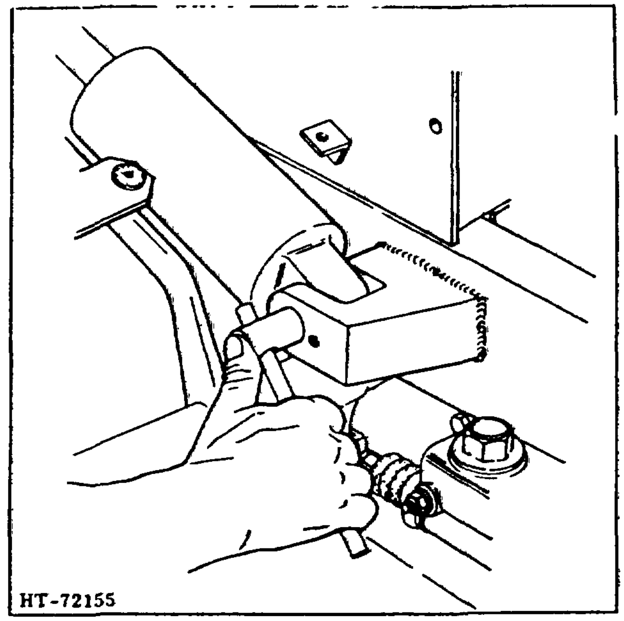


Figure 9. Tilt Cylinder Pin Removal

6. Insert drift pin in hole provided for it in tilt cylinder mounting pin, and remove pin. The tilt cylinder may then be lifted from location.

NOTE: Refer to REPAIR MANUAL for DISASSEMBLY, REPAIR and REASSEMBLY.

D. TILT CYLINDER INSTALLATION

1. Place the tilt cylinder in the mounting bracket lining up holes and insert mounting pin.

2. Install pin retainer and capscrew.

CAUTION: Make sure pin retainer is positioned properly so that capscrew can be easily installed.

3. Install hydraulic lines, making sure connections are tight. Check for leakage before installing toe and floor plate.

4. Install yoke pin at back of mast. Install cotter pin.

5. Check tilt cylinders to make sure they bottom simultaneously.

E. FORWARD AND BACKWARD TILT ADJUSTMENT

Normal degree of tilt is 5° forward and 10° backward.

NOTE: In some cases, tilt is restricted to less than 5 and 10 degrees due to stability requirements and/or interferences caused by some optional equipment.

Use a protractor to obtain the proper degree of tilt. Proceed as follows:

1. Set the protractor for correct degree of backward tilt. Tilt mast to end of backward stroke and place protractor on back of mast.

NOTE: Be sure truck is standing level when checking tilt.

2. Bubble in level of protractor should center if degree of backward tilt is correct (Figure 10).

NOTE: Check both right and left side of mast assembly and at same time make sure both cylinders have come to end of stroke.

3. If adjustment is necessary, tilt mast to forward position and loosen capscrew on tilt cylinder yoke. Place wrench on adjusting hex on tilt cylinder piston and, turn in or out of yoke to obtain proper adjustment.

4. After each adjustment, check degree of tilt. When proper degree of tilt is obtained tighten capscrews at yoke.

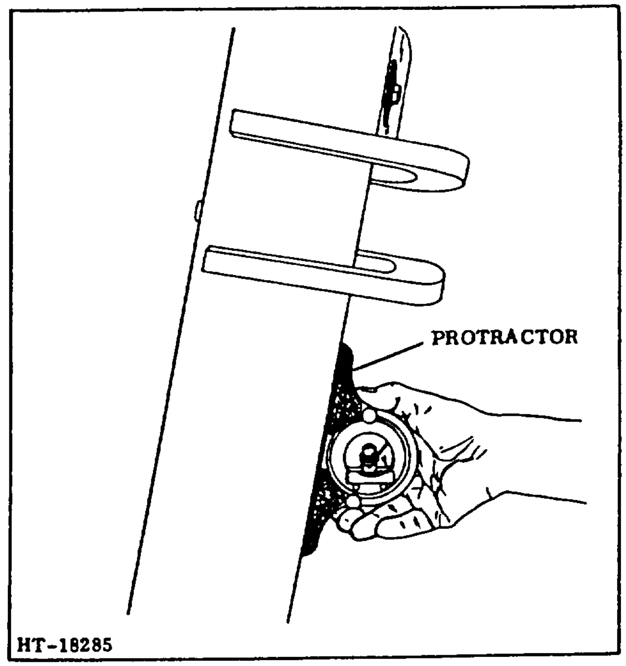


Figure 10. Checking Degrees of Mast Tilt

5. Forward tilt is automatically properly adjusted when backward tilt is set.

CAUTION: Minimum thread engagement between yoke and cylinder rod should not be less than 3/4".

TOPIC 1. COUNTERWEIGHT AND FRAME

A. DESCRIPTION

The lift truck frame design reflects the latest advancement In stress analysis engineering. This produces a lighter, stronger and less bulky unit. The major components of the frame consist of the base welded frame assembly, the counterweight, rear grille, engine hood and side panels, seat support assembly and seat, the floor and toe plate, and the overhead guard assembly. All of the above component parts are easily removed to facilitate quick repairs and easy accessibility during the maintenance routine.

The overhead guard is a standard equipment safety feature which, through the use of welded tabular steel construction, provides maximum operator visibility coupled with operator safety. The overhead guard assembly complies with all safety specifications and standards set forth by the American National Standards Institute.

TOPIC 2. COUNTERWEIGHT

A. DESCRIPTION

Excepting the variable weight difference and subtle exterior design contours, there are two basic types of counterweight; one, the current prevalent style which incorporates three attaching bolts (Figure 1), and the newer style counterweight which incorporates only one attaching bolt (Figure 2).

Certain care must be exercised during the removal and installation of the counterweights to prevent equipment damage or bodily injury. The following removal

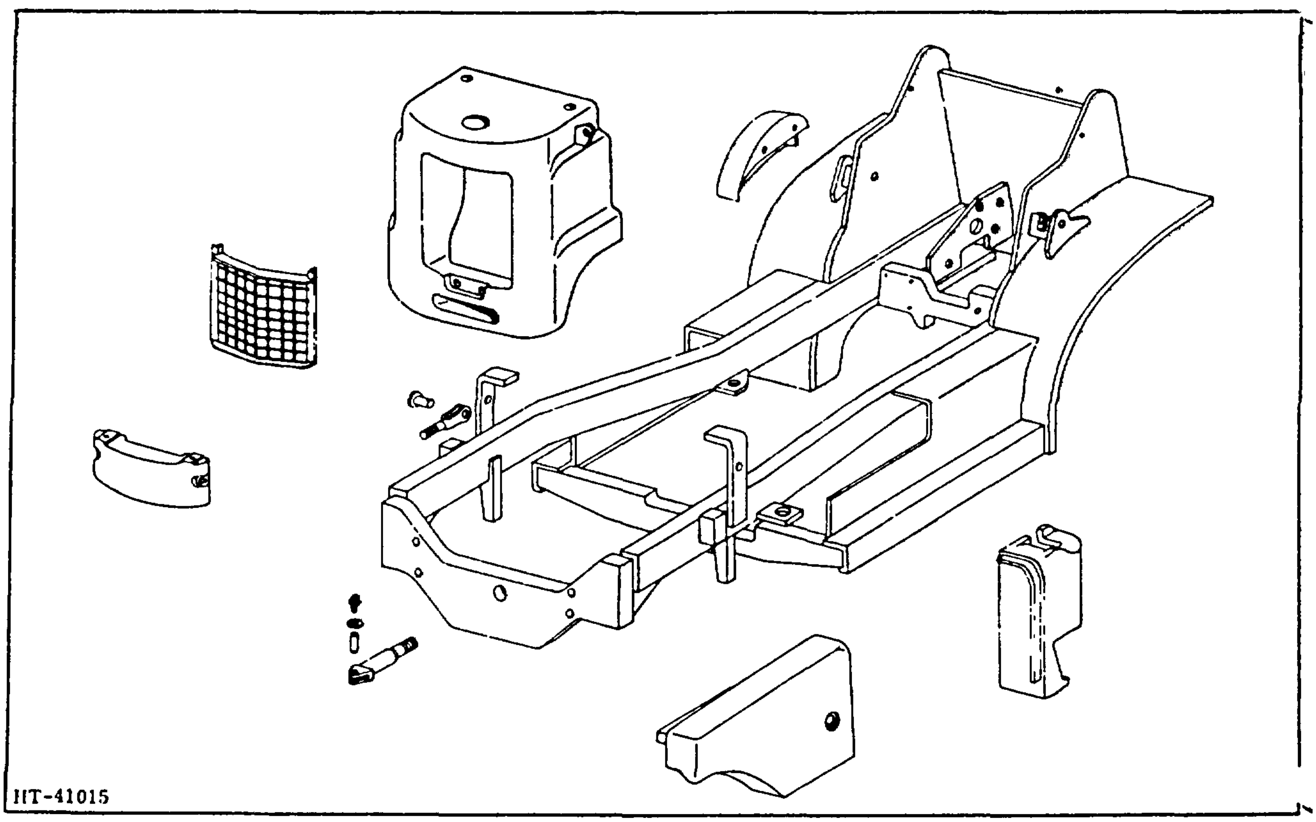


Figure 1. Counterweight and Frame (Typical) (Pneumatic Lift Truck)

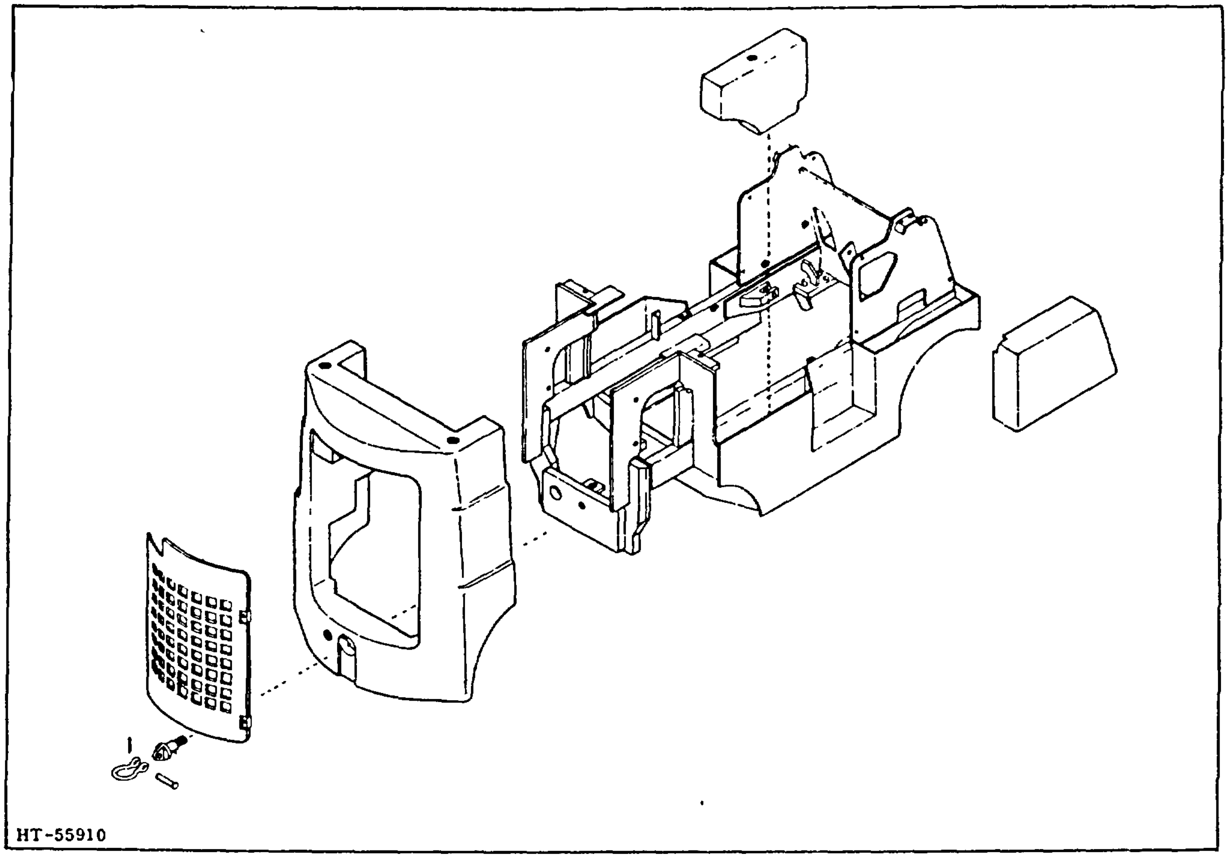


Figure 2. Counterweight and Frame (Typical) (Cushion Lift Truck)

procedure is recommended as a service outline:

B. REMOVAL

1. Ensure that lift truck is properly located under hoist chain for removal, and that truck is adequately blocked to prevent rolling.

2. Attach hoist chains to counterweight (eyelets, where applicable) and take up slack In chain.

WARNING: Be certain that hoist chain and lift are adequately rated for estimated counterweight mass density. Do not attempt to lift counterweight with a hoist rated below estimated counterweight mass.

3. Remove the grille assembly mounting capscrews and lockwashers while supporting grille.

4. Remove grille and rear panel, if installed.

5. Using the hoisting chain to relieve the pressure, remove mounting bolts (bolt), nuts (nut), and washers. (Refer to Figures 1 and 2.)

6. Ensure that counterweight Is free of attachment to truck frame, then very carefully lift counterweight up slightly and then out away from frame.

CAUTION: Be certain that counterweight clears hydraulic pump during removal/installation. Failure to use care will result in unnecessary destruction of equipment.

7. Ensure that counterweight is properly balanced and blocked, if necessary, prior to disengaging hoist chains.

C. INSPECTION

Carefully inspect counterweight for fractures, particularly at mounting points, such as tow bolt hole, and at right angle stress points.

It is common practice to replace, rather than attempt to repair a badly fractured counterweight. But when the truck is operated within reasonable stress limits and not abused, such damage is highly unlikely.

D. INSTALLATION

1. Ensure that rear of lift truck (counterweight mounting area) Is clear of any obstructions prior to installation.

WARNING: Be certain that hoist chain and lift are adequately rated for estimated counterweight mass density. Do not attempt to remove or install a counterweight with a hoist rated below estimated counterweight mass.

2. Securely attach hoisting chains to counterweight (eyelets, where applicable), then lift and maneuver counterweight into its relative mounting position on the lift truck frame.

CAUTION: Be certain that counterweight clears hydraulic pump during removal/installation. Failure to use care will result in unnecessary destruction of equipment.

3. Carefully rower counterweight into mounting surfaces and keep enough tension in hoist to allow insertion and tightening of securing bolts (bolt), lockwashers and nuts (nut).

4. Replace grille and rear panel, if applicable, and insert and tighten capscrews and lockwashers.

5. Ensure counterweight is properly secured and that hydraulic pump is intact.

6. Slowly play out hoist chain until there is enough slack to, disengage chain hooks. Remove hoist chains.

TOPIC 3. BODY COMPONENTS

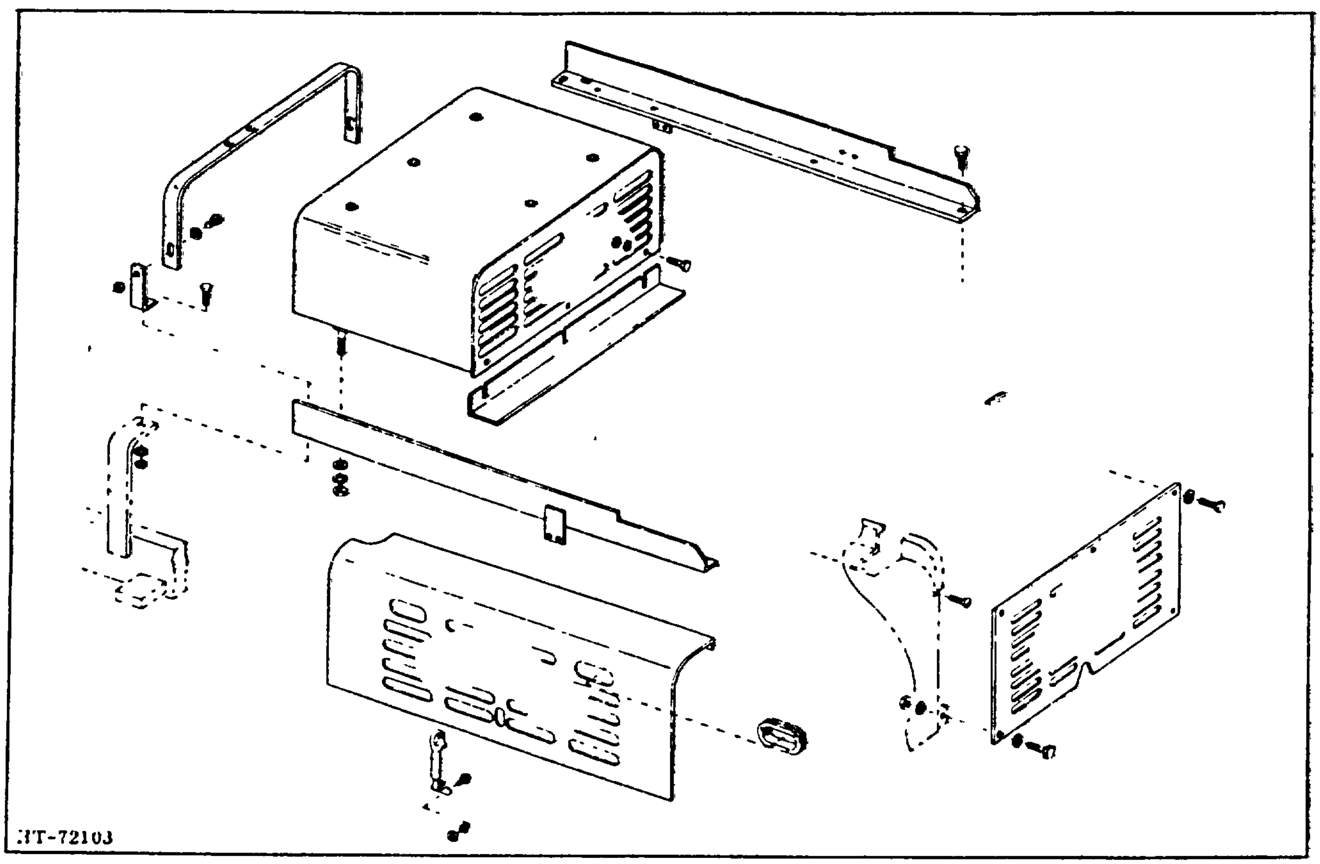


Figure 3. Engine Hood, Side Panels and Grille (Typical) (Pneumatic Lift Truck)

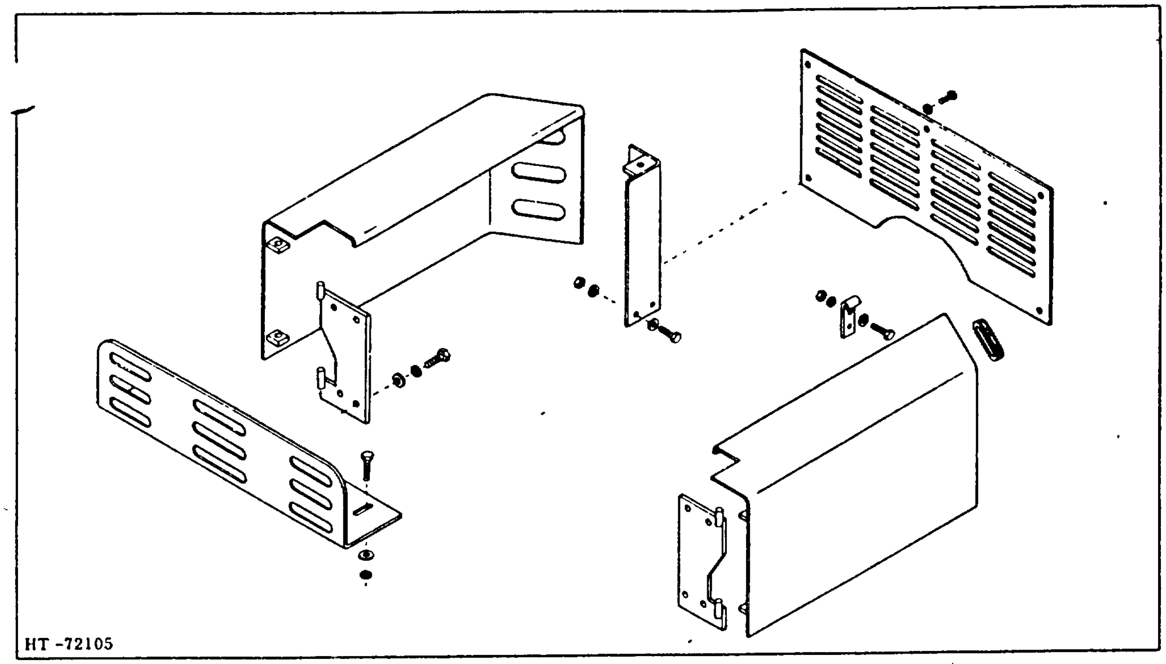


Figure 4. Side Panels and Grille (Typical)
(Cushion Lift Truck)

A. HOOD AND SIDE PANELS

Figures 3 and 4 represent a non-specific, general representation of the engine hood, side panels and front engine grille typical to all lift truck models.

1. The side panels are normally secured with a spring type latch, the disengagement of which allows side panel removal for service to engine.

2. The hood, cross assemblies, seat support assembly, and front grille are all attached with capscrews, lockwashers and nuts. To disassemble, simply study the inter-relationship of the parts of interest and remove the capscrews, lockwashers, nuts and parts required for access to component requiring service.

3. Reverse disassembly procedure, as required, to reassemble.

B. FLOOR AND TOE PLATE

Refer to Figures 5 and 6 to locate the floor and toe plates. As a rule the floor and toe plates will require no maintenance whatever, but are removed during normal maintenance routine to service items such as transmission, steering column, intake master cylinder, etc.

1. To remove floor and/or toe plate, simply remove capscrews and lockwashers and lift plate away from truck.

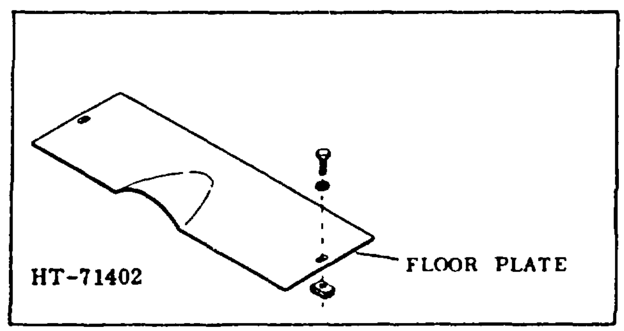


Figure 5. Floor Plate

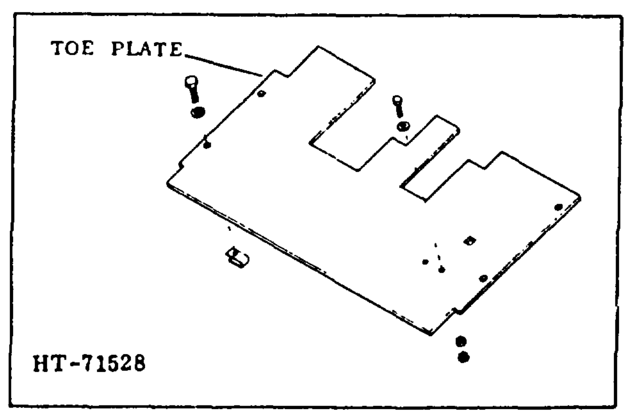


Figure 6. Toe Plate

2. To install either or both plates, place in correct position, align holes and replace capscrews and lockwashers.

C. SEAT ASSEMBLY

The operator's seat has .two vinyl covered, foam rubber .cushions; one serves as a backrest and the other as the seat cushion. These cushions are contoured for maximum comfort and reduced sliding.

The seat assembly (Figure 7) has a forward/backward adjustment ,to allow for optimum pedal reach as desired by operator.

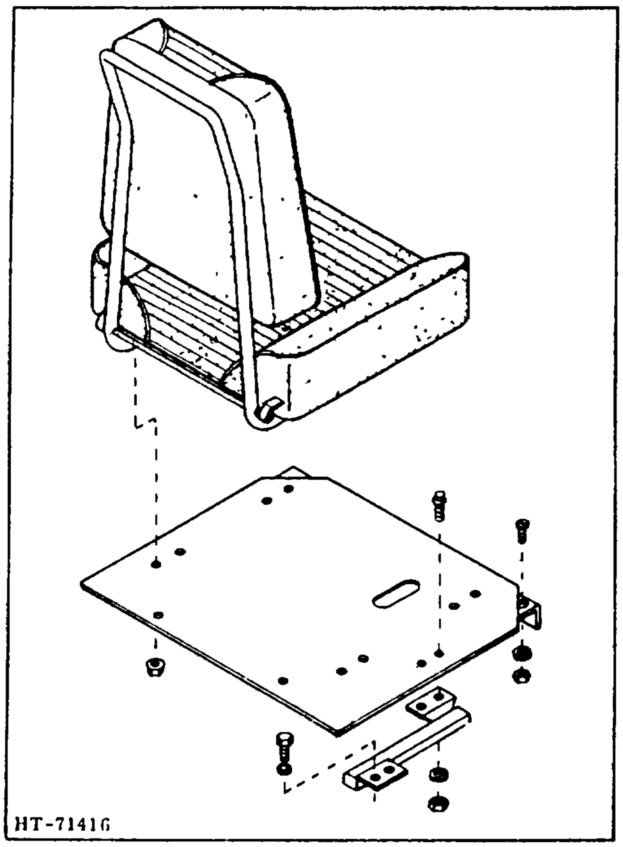


Figure 7. Seat Assembly

1. Should it become necessary to remove the operator's seat, simply remove the seat base assembly mounting capscrews and lift from truck.

2. To replace the operator's seat, place assembly in relative mounting position, align all holes and insert and secure capscrews and lockwashers.

D. OVERHEAD GUARD

The overhead guard assembly is a standard equipment installation on all lift trucks and is intended to provide maximum operator protection consistent with unimpaired vision for safe vehicle handling. The overhead guard assembly is simply taken off the truck, with the assist of a hoist chain, after the removal of the securing capscrews, lockwashers and nuts. (See Figure 8.)

To install the overhead guard assembly, use hoist chain to position guard over relative mounting location, then insert capscrews with lockwashers and nuts, and tighten evenly and securely.

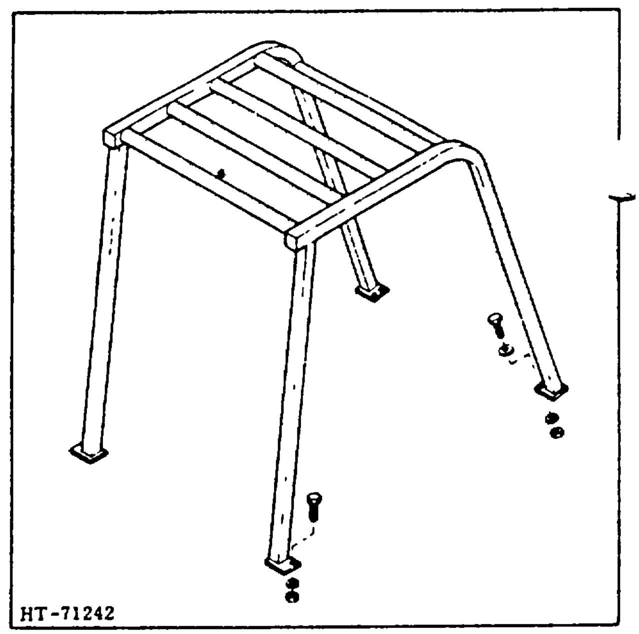


Figure 8. Overhead Guard Assembly

MASTS, CARRIAGES AND FORKS
TOPIC 1. GENERAL DESCRIPTION

The extra lift mast assembly is composed of the following items: Parallel welded, telescoping uprights (channels or beams), actuated by a hydraulically controlled lift cylinder, a carriage assembly and adjustable lift forks.

Several mast assembly configurations are available, depending on the ultimate application of the truck. These masts are of the welded type construction and offer the operator a wide visibility range. The masts use shimmed, canted roller bearings and/or wear plates and shims.

The canted roller type construction utilizes ball bearings to provide friction free operation within the telescoping upright sections. (Figure 1.)

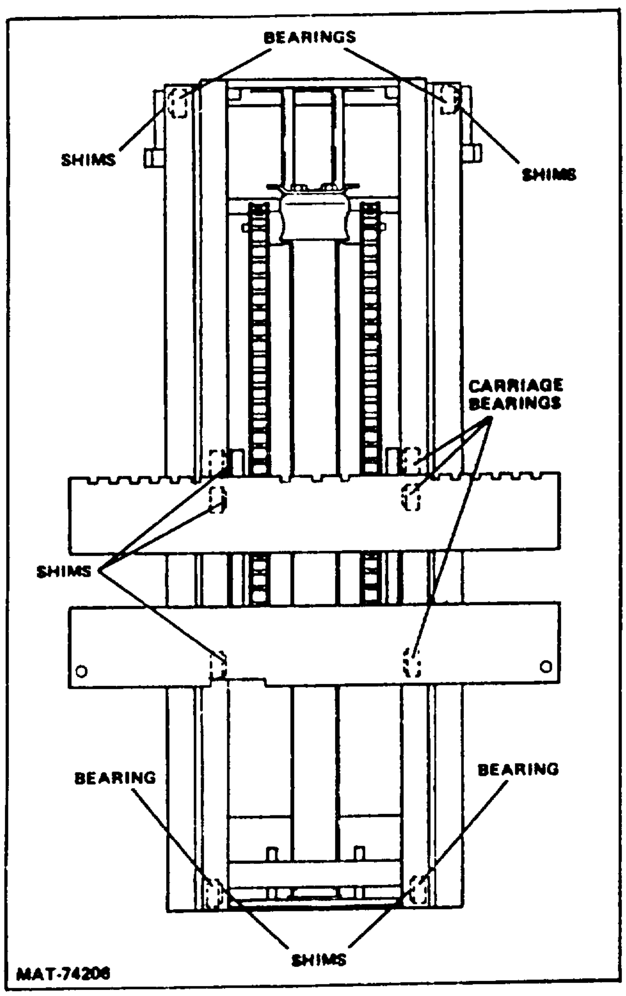


Figure 1. Canted Roller Type Carriage and Mast

The mast carriage is a heavy duty structure of welded steel built to provide ultimate strength and operator visibility with a minimum of overhang from the center of the drive wheels to the face of the forks.

TOPIC 2. MAST ASSEMBLY

A. DESCRIPTION

The conversion of the hydraulic system fluid energy into mechanical energy necessary in lift truck operation is accomplished by the mast assembly. The extra-lift mast is constructed of two structural uprights. It is available for all model lift trucks. All extra-lift masts utilize two (2) chains for safety and to minimize the effect of off-center loading. The chain anchors are individually adjustable to ensure equal tension and a level fork carriage. The chains are centrally located so as to offset any bending action on the lift cylinder plunger. Should it become necessary to re-center the mast uprights for smooth and even operation, the following alignment procedures are provided (adjustment method varies with the model and load capacity of mast employed): Canted bearing type; wear plates and aligning shims; and roller bearings and aligning shims. Each of these methods of adjustment will be discussed in the applicable maintenance paragraph.

B. LUBRICATION

The mast roller bearings used on all extra lift masts are of the pre-lubricated type and do not require periodic lubrication.

After every 50 hours of operation, all inner and outer web surfaces of the mast uprights should be lubricated. To perform this requirement fully extend the mast; coat all inner and outer web surfaces with a moderate amount of high quality Grade 2 wheel bearing grease, or a Grade 2 lithium base grease, (characterized by the word "Moly"). Also lubricate all grease fittings.

C. REMOVAL

To perform the necessary adjustments on the canted bearing type mast, the mast must be disassembled to allow the placement of shims behind the roller bearings.

CAUTION: Fully retract or lower lift cylinders.

1. Remove carriage. (Refer to appropriate topic in CARRIAGE REPAIR MODULE).

2. With the mast fully Towered, attach a sling from an overhead hoist to the mast lift eyes to secure entire mast assembly during removal.

CAUTION: Be certain overhead hoist is rated to safely support mast assembly weight.

3. Disconnect tilt cylinders. from outer mast.

4. Disconnect hydraulic hoses from lift cylinder.

NOTE: Cap or plug hydraulic hoses and inlet and outlet ports on lift and tilt cylinders to prevent contamination by foreign particles.

5. (PIVOT PIN TYPE) Remove lockwires, capscrews, and lockwashers which retain pivot pins to mast assembly. Raise overhead hoist high enough to relieve pressure on the pins and remove them. Use hoist to lay mast on suitable supports.

NOTE: Adjustment of canted bearing type mast must be made before reassembly of mast. Refer to following Paragraph F, ADJUSTMENTS.

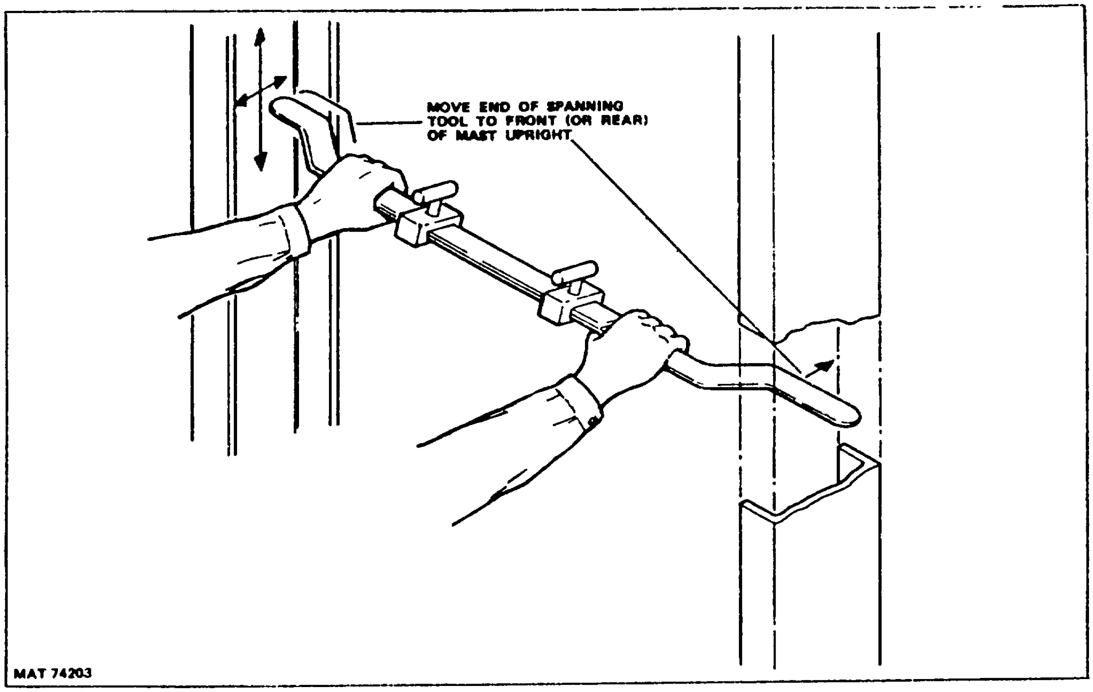


Figure 4. Spanning Outer Mast Uprights

D. DISASSEMBLY-INSPECTION

Refer to REPAIR MANUAL for proper DISASSEMBLY, INSPECTION, REPAIR and REASSEMBLY procedures.

E. INSTALLATION

1. Using a properly rated hoist, maneuver the mast assembly into its relative mounting position on front of lift truck.

2. (PIVOT PIN TYPE) Use a drift pin to align the mounting holes on the mast and lift truck frame. Insert pivot pins, and reinstall retaining capscrews and lockwashers, then tighten securely. Reinstall lockwires.

4. Connect and properly secure the tilt cylinders.

5. Reinstall hydraulic hoses.

6. Reinstall carriage (Refer to appropriate topic in CARRIAGE REPAIR MODULE).

7. Lubricate mast uprights (Refer to preceeding Paragraph B, LUBRICATION).

F. ADJUSTMENTS

1. Canted Bearing Type

   a. Outer Mast Assembly. Use an adjustable inside spanning tool (Figure 4) and check the rear inside of the outer mast upright to find narrowest distance between uprights. Lock tool in this position. Set an adjustable outside spanning tool to match inside spanning tool. Lock tool in this position. (Figure 5)

   b. Inner Mast Assembly. Install bearings on studs located at bottom of inner mast assembly. Use an outside spanning tool as set in Step a above and span bearings at maximum camber point where bearings contact the outer mast uprights. Shim

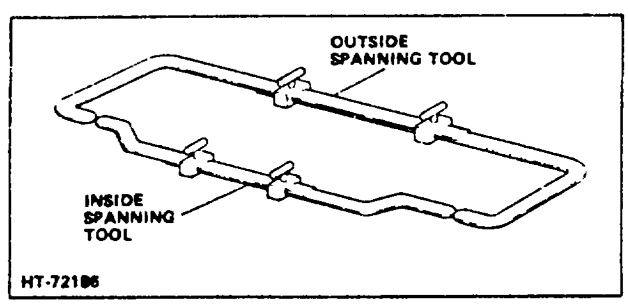


Figure 5. Setting Outside Spanning Tool

bearings, if required, to obtain maximum .015 inch clearance between bearings and outside spanning tool. Divide shims as equally as possible between bearings. Shims are available in 0.015 and 0.040 inch thicknesses.

NOTE: If odd shim is required, place odd shims on same side of all mast sections and carriage so mast will be in balance.

c. Outer Mast Assembly Top Bearing. Use outside spanning tool and find widest point in rear outside width of web of inner mast assembly. Install bearings on studs at top inside of outer mast. Use inside spanning tool to span bearings at maximum camber point where bearings contact inner mast uprights. Check clearance between outer and inner spanning tools. Measure clearance accurately and install shims to provide proper clearance. Install shims as equally as possible under both bearings to provide maximum .015 inch clearance.

TOPIC 3. LIFT CYLINDERS

A. DESCRIPTION

The hydraulic oil enters the lift cylinder at, or near, the base of the cylinder causing the plunger to extend.

A flow regulator, located at the oil inlet port of the lift cylinder, controls the outflow of hydraulic oil so that the load lowers at a controlled rate of speed from the raised position.

B. SERVICE

After each 50 hours of operation, inspect the mast lift cylinder, cylinder hoses, and fittings for evidence of leaks and repair as necessary.

C. REMOVAL

CAUTION: The lift cylinder must be in the fully lowered position during removal; always handle cylinder in the fully retracted position to avoid scratching or nicking the ram surface.

1. With lift cylinder fully collapsed and carriage resting on ground, disconnect the lift chains at the lift cylinder or chain anchors.
2. Disconnect high pressure hose.
3. Disconnect low pressure return hose (if applicable).

NOTE: Plug or cap all hoses, and inlet and outlet ports on lift cylinder to prevent contamination by foreign particles.

CAUTION: Be certain hoist is rated to safely support entire mast assembly weight.

4. Wrap chain securely around outer case of cylinder assembly, below lift chain anchor flanges, then attach a suitable hoist chain to the cylinder assembly and take up slack.
5. Remove the two(2) capscrews attaching the cylinder plunger to the mast roller support.
6. Remove retaining device (retaining nut, or retaining plate as applicable) at bottom of cylinder.
7. Lift the cylinder assembly gently, to clear both upper and lower ends of cylinder from mast assembly, and remove.

CAUTION: Be careful not to damage cylinder assembly when removing it from the mast assembly.

NOTE: Refer to REPAIR MANUAL for DISASSEMBLY, INSPECTION, REPAIR and REASSEMBLY.

D. INSTALLATION

1. Securely attach a hoist chain to the cylinder assembly and carefully maneuver cylinder into its relative mounting position within the mast assembly.
2. Install and tighten the capscrews which attach the lift cylinder plunger to the inner mast roller support. Install lift cylinder retaining device (nut, snap ring, or retaining plate as applicable) at bottom of cylinder.
3. Unwrap the lift chains previously bound around the cylinder to assist during removal.
4. Connect hydraulic lines previously removed from lift cylinder.
5. Reinstall lift chains.

NOTE: Refer to CHAIN ADJUSTMENT prior to operational use of lift truck.

E. LIFT CHAIN ADJUSTMENT

When it becomes apparent that the fork carriage is not level, that the lift chains are loose, or that that the forks are higher than .25" to 50" above the floor when the lift cylinder is fully lowered, then the lift chains require adjustment.

To adjust the chain length, refer to Figure 9 for a general view of chain anchor and use the following outline.

1. Position the mast assembly so it is vertical. Ensure that the inner mast section and lift cylinder are in the fully lowered position.
2. Loosen the chain anchor locknuts. (Figure 9)

3. Chain tension is adjusted by increasing or decreasing the chain lengths with the adjusting nuts. Alternately tighten or loosen the chain on one side and then on the opposite side, until the chains are snug, with no slack and carriage forks clear the floor within .25" to .50".
4. Make certain that the lift chain tension is equal on each chain and that the fork carriage is level.
5. After the adjustment is completed, tighten the locknuts securely and make certain anchors were not turned.

F. CHAIN LUBRICATION SERVICE

Approximately every 500 hours of operation, remove the lift chains from mast assembly and clean them in an oil solvent solution (50% SAE-30 nondetergent engine oil and 50% suitable cleaning solvent). Soak chains in oil-solvent solution for about four (4) hours and agitate them several times during the soaking period. Remove chains from oil-solvent and wipe off all of the cleaning solution. Inspect lift chains for wear and broken or cracked links. Replace entire chain if any links are broken or cracked. Install the chains; then use a 1" paint brush and lubricate both sides of chains with SAE-20 engine oil. Wipe off excess oil with a clean cloth. Adjust chains so fork carriage is level and all slack is removed from the lift chains.

G. LIFT CYLINDER BLEED SERVICE

It is general good practice to bleed the lift cylinders after cylinder repair or installation, or when erratic cylinder operation is noted. The following outline is recommended as a guide to properly vent any trapped air in hydraulic fluid.

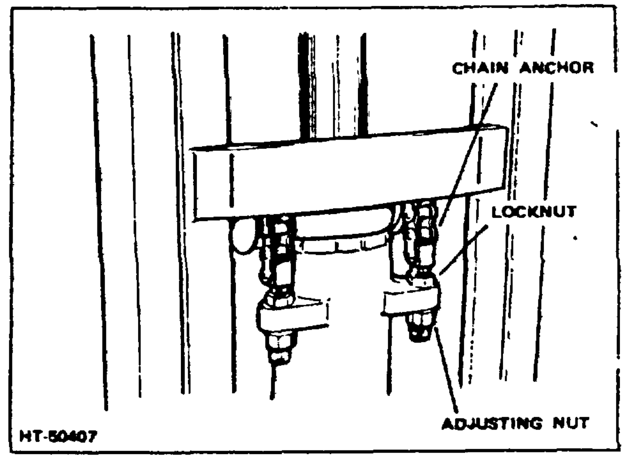


Figure 9. Chain Adjustment (On Cylinder)

1. Raise mast until forks are approximately 3 ft. off of ground.
2. Open cylinder bleed screws until a stream of PURE HYDRAULIC OIL comes out.

NOTE: Be sure the oil being emitted is free of any air bubbles that may be seen only under close inspection. Leave bleed screw open until a pure stream of hydraulic oil comes out.

3. Close bleed screw.
4. Check hydraulic oil level; fill if required, with specified oil.
5. Raise and lower mast to check for leaks if any, and repair as necessary.

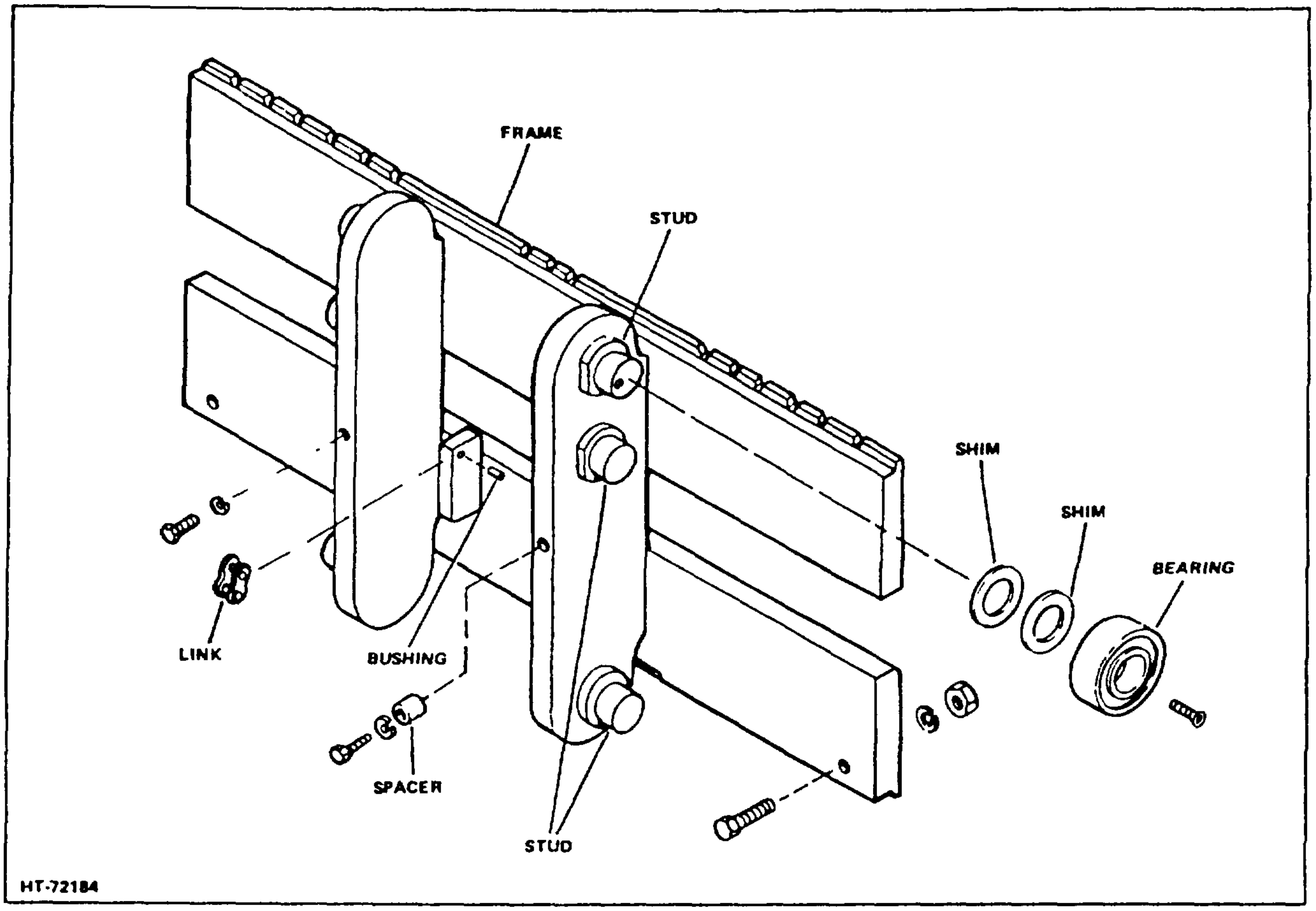


Figure 1. Hook Type Carriage Assembly (Typical)

A. DESCRIPTION

The carriage assembly is a heavy duty structure of welded steel, built to provide ultimate strength and visibility, with a minimum of overhang from the center of the drive wheels to the face of the forks. The carriage assemblies are of different types and include: adjustable canted roller bearings (Fig 1), side thrust plug type (Fig 2), shimmed wear plate type (Fig 4), eccentric roller type (Fig 5), and the side thrust roller type (Fig 6). An optional item used in conjunction with the carriage assembly is the backrest. This assembly is a welded metal frame which is attached to the carriage (in front of the uprights vertically), and serves to prevent loads from resting against the mast when the mast is tilted back. It also keeps loads from falling back onto the operator.

C. REMOVAL (EXTRA-LIFT AND HIGH FREE LIFT 3,500 - 14,000 lb and ALL TRI-MAX)

1. Place two pieces of wood, approximately 2" thick, underneath forks (or attachments), (one towards front of the forks and one underneath carriage frame.
2. Remove carriage stop capscrews (or stop, if applicable).
3. Remove lift chain anchor pins (or connecting link, if applicable), and disconnect chains from carriage.
4. Ensure that no attachments secure the carriage to the mast. Start engine and raise inner mast high enough to clear inner mast uprights.
5. Back lift truck out of the way and move carriage to desired location.

NOTE: If carriage is of the canted bearing design, it must be adjusted before installation. Refer to following PARAGRAPH F. ADJUSTMENT.

E. INSTALLATION (EXTRA-LIFT AND HIGH FREE LIFT 3,5000 - 14,000 lb AND ALL TRI-MAX)

1. Raise inner mast high enough to clear carriage assembly bearings.
2. Position lift truck so that inner mast uprights are directly centered over carriage bearings. Slowly lower inner mast making sure carriage bearings slide into inner mast uprights.
3. Reinstall carriage stop capscrews (or stop, if applicable).
4. Reinstall lift chain anchor pins (or connecting link, if applicable), and reinstall lift chains.

F. ADJUSTMENT-CANTED BEARING TYPE (Figure 1)

1. Use an inside spanning tool and check inside of web of inner mast assembly and determine narrowest point where bearings contact inner mast uprights.

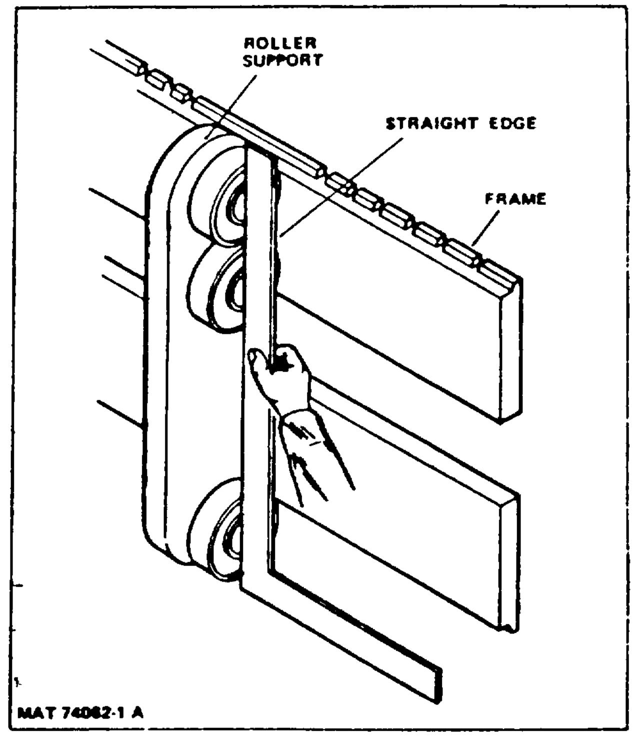


Figure 3. Checking Bearing Alignment

2. Set outside spanning tool to match inside spanning tool. Lock tool in position.
3. Install bearings on roller studs on carriage. Span bearings on carriage assembly at the maximum camber point with outside spanning tool. Span all sets of bearings. Shim bearings to produce maximum .015 inch clearance with spanning tool.
4. To check bearing alignment, place a straightedge against stud centerline to all bearings on both sides of carriage assembly. No visible gap should be seen between bearings and the straightedge (Fig 3).

TOPIC 4. FORKS

A. DESCRIPTION

Basically, there are two types of lift forks; the shaft style pivots on a horizontal support shaft, and the more commonly used hook style fork (Figure 5) which hooks into notches along the top edge of the fork carriage. The standard or hook type fork will be discussed here. Any differences will be noted in shaft type removal and installation.

The forks should always be adjusted on the carriage to obtain the optimum balance in proportion to the width of the anticipated loads.

A fork lock (Figure 6) is installed in the top of each of the hook type forks to hold it in position in one of the notches along the top bar of the carriage. To change the fork location, pull up on the lock and move fork to the left or right. Allow fork lock to seat In the notch nearest to location chosen.

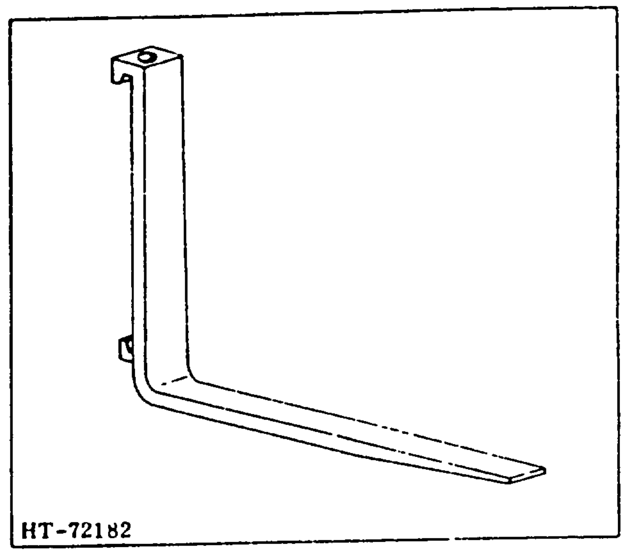


Figure 5. Hook Type Fork

The forks can be easily removed from the carriage by releasing the locks and aligning each fork with the wide removal slot (Figure 6) at the bottom of the fork carriage. (Refer to following REMOVAL procedures for detailed instructions.

CAUTION: Naturally, the weight of each fork depends upon its size. Therefore, exercise caution while fork is being removed from the carriage to avoid injury to personnel and to prevent damage to the equipment.

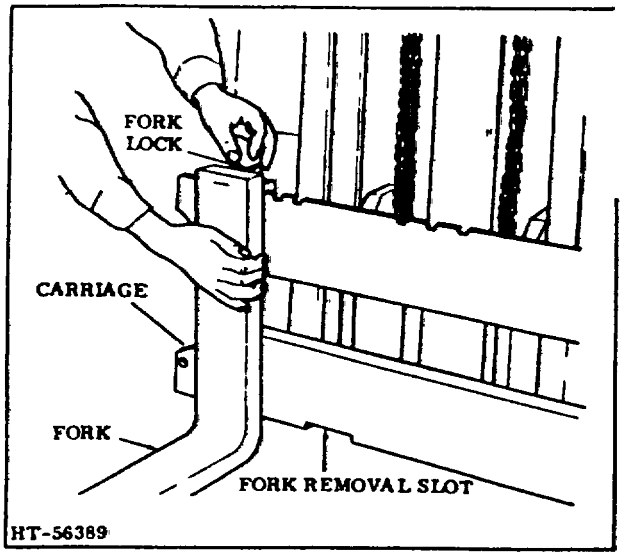


Figure 6. Fork Adjustment and Removal

B. REMOVAL

(Hook Type)

1. Lower fork carriage until base of fork just clears the floor.
2. Release the fork lock pin and slide fork to a position over the cut-out in the lower carriage bar (Figure 6).
3. Tilt the lower portion of the fork forward and up, releasing the lower hanger from the lower carriage bar.
4. Refer to cautionary note in Paragraph A above, and lift fork off upper carriage bar.

C. SERVICE

1. Inspect hook fork and locking mechanism for any evidence of wear or damage.
2. If locking mechanism is worn or damaged, remove and replace it as a unit.
3. If fork is defective, then replace with same type and capacity rated fork.

D. INSTALLATION

(Hook Type)

1. Carefully lift fork up onto upper carriage mounting slot, then slowly lower until back of fork rests against carriage face and bottom fork hook passes through lower carriage cut-out.
2. Release the fork lock pin and slide fork left or right until properly positioned for anticipated load clearance/balance requirements.

TROUBLESHOOTING

TOPIC 1. TROUBLESHOOTING CHARTS

A. GASOLINE FUEL SYSTEM

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Engine hard to start or will not start.	Air in line.	Locate cause of nit entry and repair or replace defective part.
	Water in the fuel.	Let stand. When the water has settled to the bottom, drain it from the carburetor, fuel pump sediment bowl, and fuel tank.
	Gasoline flow obstructed.	Check fuel lines, carburetor screen, fuel valves in fuel pump, and fuel pump sediment bowl. Locate and remove obstructions.
	Carburetor choke not set properly.	Adjust.
Engine stops suddenly.	No fuel.	Refill tank.
	Dirt in fuel.	Drain out. Refill with fresh fuel only after sediment bowl, carburetor, and gasoline tank have been cleaned.
	Dirt in filter.	Clean carburetor and air filters.
	Water in fuel.	See Engine Hard to Start.
	Plugged fuel line.	Disconnect fuel lines. Blow out or remove obstruction.
	Air leak in fuel line or at fuel pump.	If an line, tighten connections or replace faulty tubing. If at fuel pump, repair fuel pump.
	Faulty fuel pump.	Repair fuel pump.
Engine knocks.	Improper fuel.	Drain complete fuel system. Refill with proper fuel.
	Lubricating oil thin or dirty.	Drain oil pan, clean out filter housing, replace with new filter, and add new oil or correct viscosity for the prevailing temperature.
	Carburetor choke not set properly.	Adjust.
Loss of power	Low oil pressure, due to (a) external oil leaks, (b) thin oil, or (c) sticking of oil pressure relief valve.	(a) Repair leaks by tightening the connections or replacing the line, (b) drain and fill with fresh oil, (c) remove oil pressure relief valve and clean. Do not stretch spring.
	Air leak at fuel line or fuel pump.	Tighten connection, or if leak is in the fuel pump, tighten or repair pump.
	Air cleaner obstructions.	Clean air cleaner and tubing, tighten connections.

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Loss of power. (Continued)	Choke valve out of adjustment.	Adjust.
	Improper fuel.	Use only a good grade of gasoline.
	Improper governor adjustment.	Adjust link rod.
Engine runs irregularly (sputters).	Air leaks in carburetor gaskets.	Tighten or replace gaskets in carburetor.
	Partially closed tank shut-off.	Open.
	Water and sediment in carburetor.	Let water settle to bottom and drain. Drain out sediment, and clean screens. Check source of supply.
	Fuel lines partially blocked.	Check line; remove obstruction and any kinks in tubing.
	Fuel pump failure.	Repair or replace pump.
	Clogged air cleaner.	Clean.
	Loose jets in the carburetor.	Remove carburetor and tighten.
Smoky exhaust.	Carburetor float sticking. (Black smoke.)	Tap carburetor lightly with hammer handle. If this does not correct the situation, carburetor must be cleaned.
No gasoline at the carburetor.	Fuel pump faulty, clogged suction line.	Check the fuel lines between the tank and the fuel pump and the carburetor.
	Float stuck (dirty needle valve).	Tap the carburetor bowl gently. Or remove the carburetor, and clean the needle valve and float chamber.
	Fuel tank empty.	Refill.
	Air leak.	Check all connections and fuel lines between the carburetor, fuel pump, and tank.
Engine surges.	Surge screw out of adjustment (governor).	Adjust.
	Lean gasoline mixture. Water in the gas.	Adjust carburetor. Drain gas tank. Check source of supply.
Carburetor leaks gasoline with idling.	Float stuck (dirty needle valve).	Tap carburetor gently to dislodge the dirt in the fuel valve. If this does not correct the condition, remove, the carburetor and clean the valve.
	Float level incorrect.	Adjust.
	Drain plug not tight.	Tighten.

D. COOLING SYSTEM

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Loss of coolant.	Leaks at hose or hose connections.	Replace hose.
	Cracked engine block or head.	Replace damaged part.
	Defective head gasket.	Replace.
	Leaking radiator.	Repair or replace.
	Drain cocks loose or open.	Repair.
	Leaking water pump.	Repair or replace.
	Thermostat remains closed.	Replace thermostat.
Overheating.	Inoperative instrument panel gauge or sending unit.	Replace inoperative unit.
	Thermostat does not open.	Replace thermostat.
	Loose fan belt.	Adjust or replace belt.
	Surface of radiator core clogged.	Clean the core.
	Obstruction in cooling system.	Clean out cooling system.
	Damaged or worn out water pump.	Repair or replace.
	Leak in cooling system.	Repair.
Rapid wear or breakage of fan belt.	Incorrect adjustment.	Readjust.
	Incorrect belt.	Replace with correct type.
	Fan blades striking belt.	Repair or replace fan.
	Excessive alternator drag.	Check alternator bearings.
	Broken or rough pulleys.	Replace pulleys.

D. COOLING SYSTEM (CONT))

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Fan or water pump noisy.	Worn or damaged bearing or seal.	Replace worn or damaged parts.
	Loose fan-blades.	Repair or replace fan.
	Broken pump impeller.	Repair.
	Excessive pump shaft end play.	Repair.
	Loose fan hub.	Tighten.

F. HYDRAULIC SYSTEM

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Unable to lift or tilt load.	Load too heavy.	Check capacity on Serial No. Plate.
	Insufficient or no oil.	Check tank for proper oil level and, plugged suction line.
	Air leak at suction line.	Tighten connections.
	Damaged or worn pump.	Remove and repair.
	Relief valve binding open.	Remove and repair.
	Broken lift chains.	Repair.
	Obstruction in hydraulic lines.	Check flow of oil from pump through hydraulic system.
	Damaged lift cylinder.	Check for binding, or any reason for inoperative plunger.
	Control valve inoperative.	Inspect for internal leakage or damaged parts and repair.
Lift and tilt too slow.	Engine speed governed too low.	Inspect governor controls and adjustment.
	Internal leakage at pump.	Inspect for worn or- damaged parts.
	Excessive leakage at cylinder packing.	Repair or replace packing.
	Air leaks in system.	Tighten all connections.
	Misalignment.	Check masts, carriage or tilt linkage for cause of binding.
	Faulty relief valve.	Check for worn or damaged parts. Repair or replace. Check relief valve setting.
Load creeps tilting or lowering.	Internal leakage in cylinders.	Repair or replace packing.
	Oil leak at packing glands.	Repair or replace packing.

E. HYDRAULIC SYSTEM (CONT)

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Load creeps-tilting or lowering. (Continued)	Leak in control valve.	Check for worn or damaged plungers.
	Leaks in oil lines.	Tighten all connections or replace damaged lines.
Noisy hydraulic pump.	Insufficient or no oil.	Check tank for proper oil level or restricted suction line.
	Air leaks.	Tighten Intake connections.
	Air bubbles in intake oil.	Use hydraulic oil with antifoaming characteristics.
	Oil reservoir breather re-stricted.	Replace breather.
	Coupling misalignment.	Realign.
	Pump head loose.	Tighten.
	Worn or broken parts.	Replace.
Hydraulic oil overheating.	Pump too tight after overhaul.	Remove and repair.
	Restricted lines.	Check and repair.
	Relief valve set too high.	Valve should be set as recommended.
	Incorrect oil.	Drain, replace filter and use only recommended oil.
	Internal oil leakage.	Repair or replace pump.

F. DRIVE UNIT

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Failure to op-erate.	Broken jackshaft/axleshaft.	Replace jackshaft/axleshaft.
	Teeth broken out of jackshaft, bull gear, axleshaft, or planetary cluster.	Replace jackshaft, bull gear, axleshaft, or planetary.
	Broken teeth on ring gear or pinion.	Replace ring gear and pinion.
Axle noise on drive or coast.	Excessive wear at ring gear and pinion.	Adjust, if possible, or replace.
	Worn pinion gears or side gears in differential case.	Replace worn gears.
Continuous axle noise.	Excessive wear in gears.	Replace worn parts.
	Lack of lubrication.	Lubricate with specified lubricant.
	Uneven tire wear.	Replace tires.
	Worn or damaged bearing.	Replace bearings.

F. DRIVE UNIT (CONT)

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Excessive back-lash on unit.	Worn splines on jackshaft/axleshaft.	Replace jackshaft/axleshaft.
	Worn ring gear or pinion.	Replace gear and pinion.
	Loose or worn universal joints.	Tighten or replace.

G. HYDRAULIC BRAKE SYSTEM

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Pedal goes to toe board.	Normal lining wear.	Check, repair, or replace self-adjuster.
	Low fluid level in master cylinder.	Fill reservoir and bleed lines.
	External leak in brake system or leak past master cylinder piston cup.	Check system for leak and repair.
	Air trapped in hydraulic system.	Bleed system.
Both brakes drag.	Pedal lash not correctly adjusted.	Readjust to correct lash.
	Mineral oil in brake system.	Clean out system, replace cups in wheel cylinders and master cylinder. Refill master cylinder with specified brake fluid and bleed brake system.
	Breather port in master cylinder clogged.	Clean out breather port.
One wheel drags,	Weak or broken brake shoe return springs.	Replace broken or weak springs.
	Brake shoe or drum clearance too small.	Check, repair, or replace self-adjuster.
	Tight wheel bearing.	Readjust.
	Obstruction in brake line.	Remove obstruction or replace line.
	Swollen wheel cylinder piston cups or piston binding.	Replace defective or damaged parts.
Truck pulls to one side.	Grease or brake fluid on brake lining.	Replace with new lining.
	Loose wheel bearings.	Readjust.
	Different makes of brake lining.	Make sure same type of lining is used at each wheel.
	Brakes incorrectly set.	Readjust.
	Uneven tread wear.	Replace tires.

G. HYDRAULIC BRAKE SYSTEM (CONT)

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Truck pulls to one side. (Continued)	Lining charred or drum scored.	Replace lining or repair or replace drum.
	Adjusting cams loose.	Repair.
Brakes spongy.	Air trapped in brake system.	Bleed brake system.
	Brake adjustment not correct.	Check and/or replace self-adjuster.
	Shoe surface not square with drum.	Repair.
Excessive pedal pressure.	Brake adjustment not correct.	Check and/or replace self-adjuster.
	Incorrect brake lining.	Install specified lining.
	Oil or fluid soaked lining.	Replace lining.
	Lining making only partial contact.	Realign brake shoes.
Light pedal pressure-brakes too severe.	Brake adjustment not correct.	Check and/or replace self-adjuster.
	Small amount of grease or brake fluid on lining.	Correct cause and replace lining.
	Incorrect lining.	Install specified lining.
Brakes squeak.	Brake shoes twisted.	Repair.
	Particles of metal or dust embedded in lining.	Remove foreign material; sand lining to drum.
	Chamfer at end of lining too short.	Elongate chamfer.

H. POWER STEERING SYSTEM

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Hard steering.	Failure of pump.	Replace or recondition.
	Badly worn pump.	Recondition pump.
	Broken or weak relief valve spring.	Replace spring.
	Binding relief valve.	Free valve.
	Low pump pressure.	Replace worn or faulty parts.
	Line leakage.	Tighten connections.
	Low oil level.	Fill reservoir to correct level.
	Bent linkage.	Replace damaged parts.
	Improper wheel alignment.	Align wheels.

H. POWER STEERING SYSTEM (CONT)

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Hard steering. (Continued)	Lack of lubrication.	Lubricate.
	Leakage in steer cylinder.	Repair.
	Air in system.	Bleed the system.
	Faulty regulator valve.	Recondition valve.
	Faulty control valve.	Repair or replace.
Steering too sensitive.	Faulty flow control valve.	Recondition - free any binding parts.
Loose steering.	Wheels out of alignment.	Align- wheels.
	Loose linkage.	Tighten linkage or replace.
	Worn king pins.	Replace.
	Wheel bearings loose or worn.	Adjust bearings or replace.
	Air in system.	Bleed the system.
	Steering gear out of adjustment.	Adjust cam and worn shaft.
Low oil pres- sure.	Low oil level.	Fill reservoir to correct level.
	Worn pump.	Recondition or replace.
	Weak relief valve spring.	Replace spring.
	Relief valve stuck open.	Remove and free valve.
	Flow- control valve stuck open.	Free flow control valve.
	External leakage.	Tighten or replace fittings, hoses, or seals.
	Internal leakage.	Replace seals in valves or cylinders.

J. MAST HYDRAULIC SYSTEM

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Unable to lift or tilt load.	Relief valve binding open.	Remove and repair.
	Broken lift chains.	Repair or replace.
	Obstruction in hydraulic lines.	Check flow of oil from pump through hydraulic system.
	Damaged lift cylinder.	Check for binding or any reason for inoperative plunger.
	Load too heavy.	Check capacity on Serial No. Plate.
Lift and tilt too slow.	Engine speed governed too low.	Inspect governor controls and adjustment.
	Excessive leakage at	Repair or replace packing.
	cylinder packing.	
	Air leaks in system.	Tighten all connections.
	Misalignment.	Check masts, carriage or tilt linkage for cause of binding.
	Faulty relief valve.	Check for worn or damaged parts. Repair or replace. Check relief valve setting.
Load creeps-tilting or lowering.	Internal leakage in cylinders.	Repair or replace packing.
	Oil leak at packing	Repair or replace packing.
	glands.	
	Leaks in oil lines.	Tighten all connections or replace damaged lines.
Oil over-heating.	Relief valve set too high.	Valve should be set as recommended.

M. POWER SHIFT TRANSMISSION

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Transmission won't shift into gear/out of gear.	Improperly adjusted or disconnected linkage.	Adjust or reconnect shifting linkage.
	Transmission overheated.	Check fluid level; refill to proper level if low. Check for leaks. Check specified operating pressures.
	Defective pump.	Repair or replace as necessary.
	Defective control valve.	Repair or replace as necessary.
Transmission is sluggish/jerky.	Parking brake not released.	Release parking brake; check parking brake drum for any possible damage.
	Fluid level low.	Check fluid level; refill to recommended capacity if necessary.
	Faulty or worn components.	Check torque converter operation, pump, clutch-pack, control valve. Check the specified operating pressures. Repair or replace any defective parts.

M. POWER SHIFT TRANSMISSION (CONT))

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Transmission does not shift smoothly.	Linkage improperly adjusted.	Adjust shifting linkage.
	Fluid level low.	Check fluid level; refill to recommended level if necessary.
	Malfunctioning control valve.	Verify proper operation of control valve; repair, adjust or replace if necessary.
Inching pedal does not slow or stop truck.	Improperly adjusted.	Adjust inching pedal stop bolt.
Transmission won't shift into LOW or HIGH gear speed. (If so equipped.)	Improperly adjusted or disconnected linkage.	Adjust or reconnect shifting linkage.
	Fluid level low.	Check fluid level; refill to recommended capacity if necessary.
Transmission "jumps" out of gear	Improperly adjusted linkage.	Adjust linkage.
	Mechanical obstruction	Inspect linkage for any improper routing or possible obstruction forces linkage out of desired position, remove obstruction.

N. ELECTRICAL SYSTEM

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Ammeter reading "Zero" with ignition switch "On" engine being rotated.	Defective ignition switch.	Replace switch.
	Defective ammeter.	Replace.
	Broken or loose wiring at ignition switch.	Repair or replace wiring.
Ammeter does not show charge.	Defective regulator.	Adjust or replace regulator.
	Defective stator.	Repair or replace windings.
	Worn alternator brushes.	Replace brushes.
	Shorted alternator armature.	Repair or replace armature.
	Defective rectifying diodes in alternator.	Replace.
	Shorted alternator fields.	Repair or replace alternator.
	Slip rings dirty or worn.	Clean slip rings or repair or replace alternator.
	Defective wiring.	Check for loose, broken, or disconnected wires.

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Ammeter shows excessive charge.	Defective current control in regulator.	Repair or replace regulator.
	Battery run down.	Recharge or replace battery.
	Defective alternator.	Repair or replace.
	Defective ammeter.	Replace.
Ammeter shows discharge during engine. operation.	Inoperative alternator.	Repair or replace.
	Faulty regulator controls.	Replace regulator.
	Shorted circuits.	Check for faulty circuit and repair.
	Fan belt loose or broken.	Adjust or replace belt.
Excessive battery water usage.	Shorted battery cell.	Replace.
	High regulator setting.	Adjust.
Starting motor failure.	Broken connections.	Reconnect or replace wires.
	Faulty switches.	Check ignition switch or starter button.
	Battery dead or low charge.	Replace or recharge battery. Check for low regulator setting.
	Commutator dirty.	Clean.
	Worn brushes.	Replace.
	Broken drive.	Replace.
Ammeter shows heavy discharge with engine stopped.	Shorted circuits.	Trace wiring for shorts.
	Defective voltage	Inspect for closed contacts. Adjust or replace regulator.
	Defective ammeter.	Replace.
Ammeter shows rapid fluctuation.	Loose alternator drive belt.	Readjust.
	Shorted or loose connections.	Trace wiring for breaks or looseness.
	Dirty, loose, or worn alternator brushes.	Clean and tighten brushes. Replace if worn.
	Defective alternator.	Repair or replace.
	Voltage regulator out of adjustment.	Readjust.
Horn does not blow.	No current to horn.	Check for broken wire or dead battery.
	Faulty horn button.	Check for faulty ground or replace horn button.
	Defective horn.	Replace.
	Defective horn relay.	Replace.

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Horn blows continuously.	Grounded horn wire.	Eliminate ground. Check for frayed wire.
	Shorted horn.	Replace horn.
	Defective horn button.	Replace.
	Faulty relay.	Replace.

LUBRICANT AND FUEL SPECIFICATIONS

TOPIC 1. LUBRICANT SPECIFICATIONS

A. ENGINE LUBRICATING OIL

The basic requirements for lubricating oils used in Allis-Chalmers engines are:

1. Maintain pistons, rings, and other moving parts in a carbon free, varnish free, and clean condition.

2. Maintain enough body to satisfactorily lubricate the moving parts at maximum oil temperatures.

3. Prevent bearing corrosion. Counteract corrosive products of combustion or contaminants in the fuel.

4. Promote general cleanliness within the engine.

The American Petroleum Institute has several service classifications for oils used in gasoline and L. P. gas engines; they are SA, SB, SD, and SE. For diesel engines, the classifications are CA, CB, and CD.

SERVICE SA and CA: Service typical of engines used under light and favorable operating conditions, the engines having no special lubrication requirements and having no design characteristics sensitive to deposit formation.

SERVICE SB and CB: Service typical of engines used under moderate to severe operating conditions, but presenting problems of deposit corrosion control when lubricating oil temperatures are high.

SERVICE SD and CD: Service typical of engines used under unfavorable or severe types of operating conditions and where there are special lubrication requirements for deposit, wear, or bearing corrosion control, due to operating conditions, or engine design, or fuel characteristics.

SERVICE SE: Oils designed for this service provide more protection against oil oxidation, high temperature engine deposits, rust, and corrosion in gasoline engines than oils which are satisfactory for classification SD.

Generally, SERVICE SB will apply to the gasoline or L. P. gas engines, and SERVICE CB will apply to the diesel engines.

Use oils of the following viscosities:

Atmospheric Temperature	Viscosity
Below 32°F	SAE 20
32°F to 90°F	SAE 30
Above 90°F	SAE 40

Our recommendation of 100 hours for filter and oil change periods is based on the use of high quality oils and 85% average engine loads with the engine in good adjustment and operating with the coolant and lubricating oil at normal operating temperature. Variations from the considered normal operating conditions must be compensated for by the use of premium grade oils or more frequent oil change and filter change periods, or both.

Our recommended oil change periods are based on what experience has shown to be conservative and safe hours of operation between oil changes. Actual testing of the lubricating oil in any particular engine application at each 5 to 10 hours operation after 100 hours operation to determine the condition of the oil may allow extending the oil change periods. This testing service is provided by most major oil companies. It is recommended to take advantage of this service.

B. HYDRAULIC SYSTEM OIL

Use a hydraulic oil that conforms to Allis-Chalmers specification H-100 or SAE 10 SE engine oil (or MIL-L-2104B) in the hydraulic system.

The hydraulic oil must be fortified with special rust and oxidation inhibitors, plus anti-wear ingredients, and treated to minimize foaming. The hydraulic oil must conform to the following in Allis-Chalmers specification H-100:

Viscosity at 100°F SUS .... 150 - 170 secs
Viscosity Index .... 90 min
Flash Point .... 370°F min
Neutralization No.
(mgs KOH/g oil) 0.60
Aniline Point .... 180 - 220°F
Oxidation Stability (hrs.
to neut. No. 1.0 max)...................................... 1500
Rust Test .... Pass
Copper Strip Corrosion
(3 Hours at 212°F)..................................... Pass 2B
Pour Point .... -20°F max

The SAE grade 10 SE engine oil is available at all major oil companies and most local service stations. The oil meets the requirements of the American Petroleum Institute and contains rust and oxidation inhibitors, anti-wear ingredients, and an anti-foaming agent

If the hydraulic system oil is stored in large containers, the storage containers must be kept free of contaminants, such as dirt, water, and metal chips. Contaminated hydraulic oil is the major cause of hydraulic system failures. It is recommended that each storage container be clearly marked - FOR USE IN HYDRAULIC SYSTEM ONLY.

C. POWER SHIFT TRANSMISSION OIL

Use a good quality type "A" or suffix "A" automatic transmission fluid available from any major oil company.

D. DIFFERENTIAL, STANDARD SHIFT TRANSMISSION, PLANETARY GEAR, AND STEERING GEAR OIL

Lubricate these assemblies with SAE 90 EP (extreme pressure) gear oil which is non-corrosive and resists oxidation and foaming. It should have a low pour point to ensure quick lubrication at either high or low temperatures.

E. BULL GEAR AND JACKSHAFT PINION

Lubricate with high quality, Grade 2 lithium base grease (characterized by the word "Moly') that contains a maximum of 5% micronized molybdenum disulfide. Lubricant must be waterproof and heat resistant.

F. WHEEL BEARINGS AND JACKSHAFT BEARINGS

Lubricate with a high quality, Grade 2 lithium base grease (characterized by the word "Moly") that contains a maximum of 5% micronized molybdenum disulfide. Lubricant must be waterproof and heat resistant.

G. PRESSURE GUN FITTINGS AND UNIVERSAL. JOINT

Lubricate with a high quality chassis lubricant, N. L. G. I. Grade 2 heavy duty sodium base grease available from any reputable oil company.

H. OIL CAN POINTS

Lubricate all points with SAE 10 or 20 engine oil.

I. BRAKE MASTER CYLINDER

Use only premium quality, heavy duty brake fluid with an extreme heat-cold range that conforms to SAE specification J1703C.

J. MASTS

Lubricate all sliding surfaces of mast uprights with a high quality, Grade 2 lithium base grease (characterized by the word "Moly'") that contains a maximum of 5% micronized molybdenum disulfide. Lubricant must be waterproof and heat resistant.

K. OIL CLUTCH TRANSMISSION

Clutch Housing - Use a good quality type "A" or suffix "A" automatic transmission fluid.

Gear Housing - Use SAE 90 EP (extreme pressure) gear oil which is non-corrosive and resists oxidation and foaming.

TOPIC 2. FUEL RECOMMENDATIONS (GASOLINE AND L. P. GAS)

A. GENERAL

Depending upon the owner's selection, the carburetors offered for the engine are designed for either gasoline or liquid petroleum gas carburetion.

1. Gasoline

   For economy and performance on gasoline units, it is recommended that a good regular grade of gasoline with an octane rating of 89 or higher be used. The gasoline should meet the requirements of ASTM-D357-61 (motor method) and/or ASTM-D-908-61 (research method).

   Low-lead and no-lead gasolines, from a reputable oil manufacturer, are acceptable for a lift truck equipped with a low emission engine. However, the low emission engine will still be low in emissions, regardless of whether a leaded or unleaded gasoline is used.

2. Liquid Petroleum Gas

   Liquid petroleum fuel is a gas and is only in the liquid state when under pressure or extreme low temperature. When released from the tank, it vaporizes rapidly forming a gas that is heavier than air.

CAUTION: When storing unit in a closed building, be sure the fuel system contains no leaks. Leaks may be located by using liquid soap on valves, connections, etc. Keep all fire, sparks, static electricity, cigarette smoking, etc. out of building because serious explosions can occur.

A leak in L. P. Gas equipment is difficult to detect because the fuel vaporizes so readily that it does not leave a wet area around leak. However, rapid expansion and vaporization of the fuel causes refrigeration. Therefore, if frost is detected on fuel system components when unit is not in use, a leak is most likely present and should be repaired immediately.

CAUTION: Some states require a license to install, repair, and adjust liquid petroleum gas equipment. Check local regulations.

The fuel tank must not be filled above the 80% full level. The remainder of tank contains vapor given off by the fuel.

CAUTION: Never fill tank while engine is running. Never smoke while filling tank. Do not allow fuel or vapor to contact skin because the very low temperature may cause frostbite or freezing of affected areas.

B. FUEL STORAGE

The Importance of proper fuel storage cannot be too strongly stressed. Storage tanks, drums, or service tanks must be free of rust, scale, sediment, or any other foreign material that will contaminate the fuel.

C. HANDLING OF FUEL (GASOLINE)

The following rules cover handling of fuel before it reaches the carburetor.

1. Do not handle fuel in an open container.
2. Do not use waste or linty rags around fuel containers.
3. Clean all storage tanks at regular intervals.
4. If hand pumps are used to bring fuel from storage tanks, keep them covered with dustproof covers when not in use.
5. When drawing fuel from a drum, agitate drum as little as possible and leave from 2 to 3 inches of fuel in bottom of drum.
6. Keep fuel handling equipment, such as measures, funnels, containers, etc., clean at all times and covered when not in use.
7. Use funnel equipped with a 200-mesh wire screen.

TOPIC 3. LUBRICATION AND SERVICE GUIDE

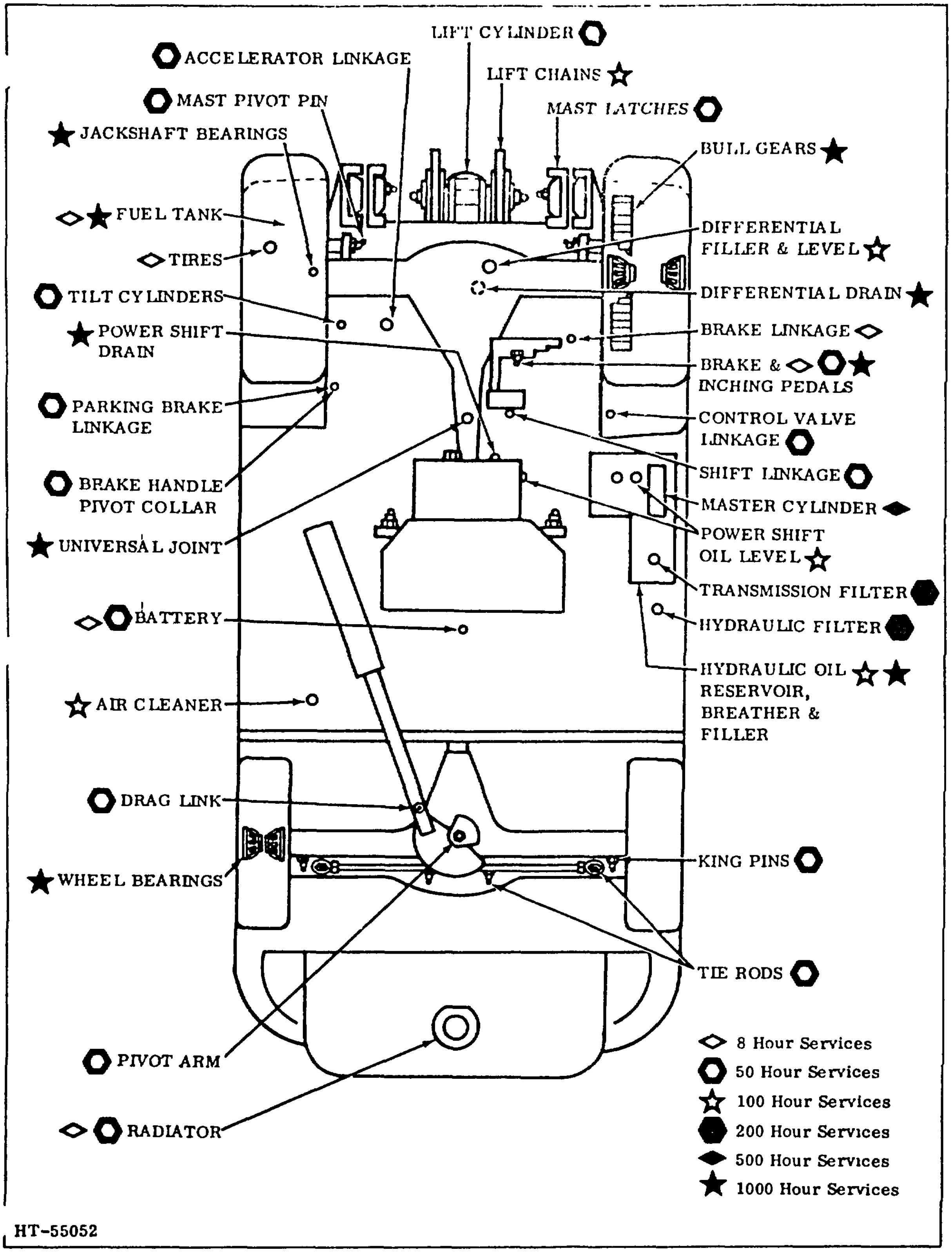


Figure 1. Lubrication and Service Guide

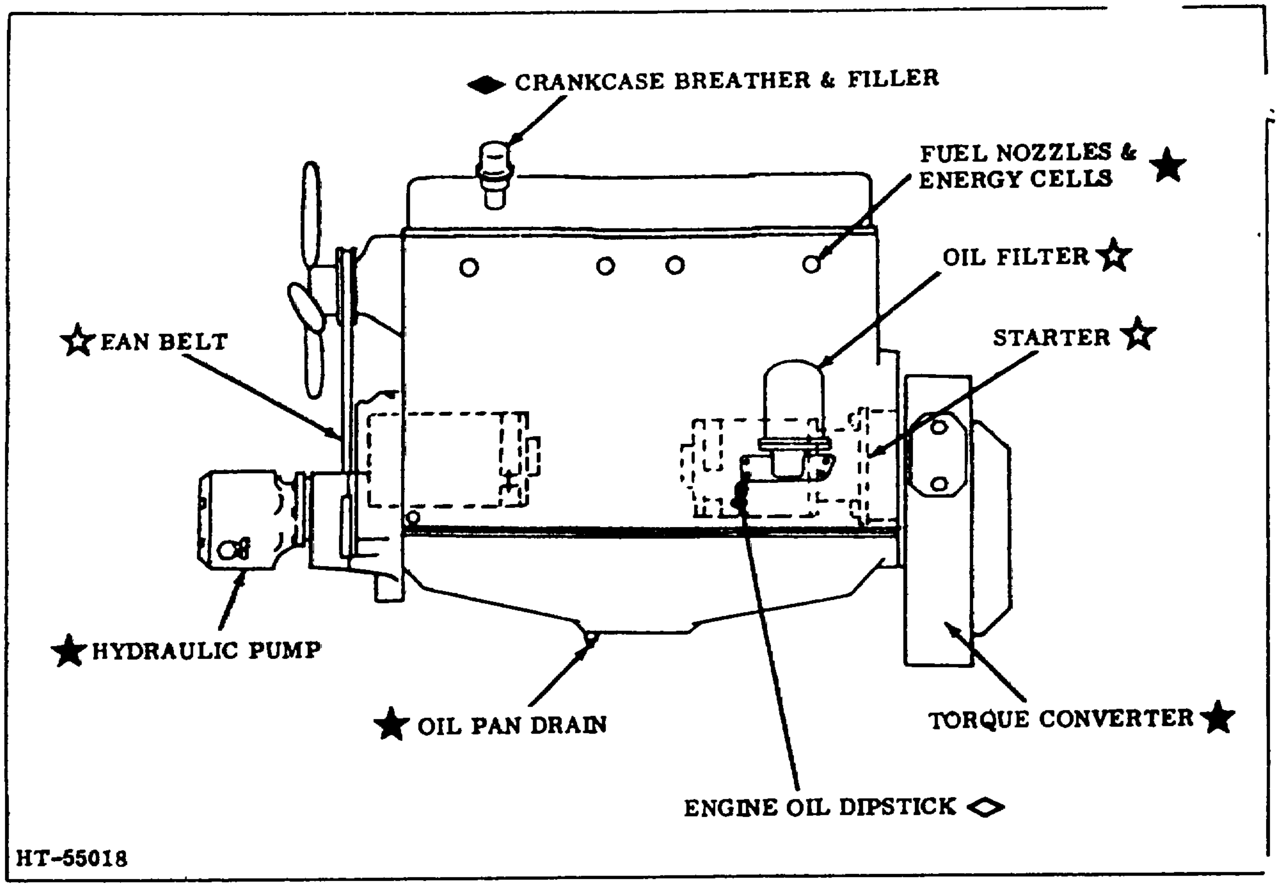


Figure 2. Lubrication and Service Guide

REPAIR INSTRUCTIONS

REPAIR INDEX

CONTINENTAL ENGINE

TOPIC 1. FITS AND TOLERANCES

DESCRIPTION

A. PISTONS

Piston Diameter	3.412-3.417
Cylinder Diameter	3.4395-3.4325
Wear Limits-Cylinder Bore	.008
Piston Pin Hole Diameter	.8597-.8595
Top Ring Groove Width	.081-.080
Maximum Wear Limit Width	.083
Second And Third Rings Groove Width	.0965-.0955
Maximum Wear Limit Width	.0985
Fourth Ring Groove Width	.2515-.2505
Maximum Wear Limit Width	.2535
Piston Fit-Feeler Gauge	.003
Lbs. Pull	5-1G

B. PISTON RINGS

Top Ring Width	.078-.077
Wear Limits-Minimum Width	.075
Second and Third Rings Width	.0930-.0925
Wear Limits-Minimum Width	.0905
Fourth Ring Width	.248-.244
Wear Limits-Minimum Width	.242
Top Ring Gap Clearance	.008-.018
Second and Third Rings Gap Clearance	.008-.018
Fourth Ring Gap Clearance	.010-.030
Top Ring Side Clearance	.002-.004
Second and Third Rings Side Clearance	.0025-.0040
Fourth Ping Gap Clearance	.0025-.0075

C. CONNECTING RODS

Bushing Hole Diameter	.914-.913
Bearing Hole Diameter	2.1870-2.1865
Bearing Thickness	.0616-.0613
Wear Limits-Minimum Thickness	.0608
Crank Pin Diameter	2.0621-2.0619
Wear Limits-Minimum Diameter	2.0609
Clearance Limits	.0006-.0022
Desired Clearance	.0015
Wear Limits-Maximum Clearance	.0032
Side Play	.010-.006
Desired Side Play	.006

D. PISTON PIN

Length	2.868-2 878
Diameter	.8593-.8591
Wear Limits-Minimum Diameter	.8588
Desire Fit	Light Push
Bushing Hole Diameter - Fin.	.8597-.8595
Wear Limits-Maximum Diameter	.8607
Pin Clearance in Bushing	.0006-.0002
Desired Pin Fit	.0004

E. MAIN BEARINGS

Bearing Bore in Block, Diameter	2.5622-2.5615
Bearing Thickness	.0925-.0928
Wear Limits-Minimum Thickness	.0920
Main Bearing Journal Diameter	2.3752-2.3744
Wear Limits-Minimum Diameter	2.3734
Clearance Limits	.0007-.0028
Desired Clearance	.0015
Crankshaft End Play	.002-.006
Center Flange Bearing	
Thickness	.0926-.09290
Wear Limits-Minimum Thickness	.0921
Clearance Limits	.0005-.0026
Desired Clearance	.0015

F. CAMSHAFT

Bearing Journal Diameter, Front	1.8725-1.8715
Front Intermediate	1.8095-1.8085
Rear Intermediate	1.7465-1.7457
Rear	1.2475-1.2465
Wear Limits-Minimum Diameter (under minimum new shaft diameter)	.001
Bushing Inside Diameter, Front	1.8755-1.8745
Front Intermediate	1.8125-1.8115
Rear Intermediate	1.7502-1.7495
Rear	1.2505-1.2495
Bushing Clearance Limits	.004-.002
End Play	.009-.005
Camshaft Bore in Cylinder Black - Finish Reamed Front	2.0000-1.9995
Front Intermediate	1.9370-1.9360
Rear Intermediate	1.8750-1.8740
Rear	1.3750-1.3745

G. INTAKE VALVES

Stem Diameter	.3414-.3406
Wear Limits - Minimum Diameter	.3386
Seat Angle	30^{o}
Stem Clearance Limits	.0026-.0008
Wear Limits-Maximum Clearance	.0046
Desired Stem Clearance	.0015
Valve Angle	1^{o}, 53', 36"

H. EXHAUST VALVES

Stem Diameter	.3385-.3317
Wear Limits-Minimum Diameter	.3357
Seat Angle	45^{o} $\pm$30'
Stem Clearance Limits	.0055-.0037
Wear Limits-Maximum Clearance	.0075
Desired Stem Clearance	.0045
Valve Angle	1^{o}, 53', 36"

I. VALVE GUIDES

Outside Diameter	.6575-.6565
Stem Hole Diameter	.3432-.3422
Wear Limits - Maximum Diameter	.3447
Distance, Cylinder Block to Top of Guide	1.812"
Contact Face to Guide	1.4688"
Length	2.3125"

J. VALVE SPRINGS

Outside Diameter	.9688”
Length - Valve Closed	1.7031”
Load - Valve Closed	47-53 lbs.
Wear Limits - Minimum Weight	42 lbs.
Length - Valve Open	1.4219”
Load - Valve Open	96-104 lbs.
Wear Limits - Minimum Weight	86 lbs.

K. DISTRIBUTOR DRIVE

Shaft Bushing Inside Diameter (ream)	.5015” - .5005”
Shaft Running Clearance	.0005” - .003”

L. TIMING GEAR BACKLASH

Backlash between all gears	.002” - .004”

M. OIL PUMP

Oil pump body Inside Diameter (drive shaft running surface)	.5005” - .501”
Drive shaft Outside Diameter	.499” - .4995”
Drive Shaft running Clearance	.001” - .0002”
Drive Shaft End Play	.003” - .005”
Idler Gear Inside Diameter	.4986” - .4995”
Idler Shaft Outside Diameter	.497” - .4975”
Idler Gear Running Clearance	.001” - .0025”
Radial Clearance between Pump Gear Teeth and Pump Chamber Wall	.0015” - .0025”

N. FLYWHEEL AND HOUSING

Face run-out on wheel	.007” T.I.R.
Housing bore run-out	.010” T.I.R.
Housing face run-out	.006” T.I.R.

O. TORQUE SPECIFICATIONS (lb. ft.)

Cylinder Head	70-75
Main Bearing Caps	85-95
Connecting Rods	40-45
Flywheel	35-40
Manifolds	25-30
Gear Cover	50-55
Oil Pan	12-16
Flywheel Housing	50-55
Camshaft Nut	175-180

TOPIC 2. ENGINE SERVICE AND MAINTENANCE, GENERAL INFORMATION

The disassembly, inspection and reassembly of the engine requires no unusual or special shop equipment. However, the following factors are very important and should not be overlooked.

DO NOT INTER-MIX ENGINE PARTS. Mark for position on disassembly; tag assemblies from different engines; identify parts reground to special sizes.

DO NOT MIX BOLTS, CAPSCREWS AND WASHERS. Capscrews and like parts are of a length, material and heat treatment suited to the place they are used.

INSPECT AS ENGINE IS DISASSEMBLED. Once engine parts have been disassembled and cleaned, many valuable indications of engine condition are lost. Check generally for water leaks, oil leaks and signs of unusual or excessive wear.

PROTECT DELICATE PARTS AND SURFACES. Do not pile engine parts, ignition equipment, carburetors or other miscellaneous items indiscriminately. Oil any surfaces likely to rust. Tape finished surfaces subject to scratching or nicking during repair operations.

CLEAN THOROUGHLY. No engine is completely overhauled if it is not cleaned internally and externally to like-new condition. Thorough cleaning greatly aids disassembly and helps prevent the introduction of dirt onto bearings and running surfaces via the mechanic's hands, tools and the work bench.

WORK ACCURATELY. Use precision gauges where needed. Follow specifications in TOPIC 1. FITS AND TOLERANCES.

IDENTIFY FRONT, REAR, RIGHT, AND LEFT SIDES OF ENGINE. This manual identifies the radiator end of the engine as the front side; the flywheel end as the rear side. The right and left sides are identified when looking at the front of the engine; thus, the starter motor, the oil filter, and the ignition coil are mounted on the right side of the engine; and the air cleaner, the manifold, and the exhaust pipe are mounted on the left side of the engine.

TOPIC 3 MANIFOLD

A. DESCRIPTION

The intake and exhaust manifold (Figure 1) is a one-piece casting which serves as a collector for the incoming fuel-air mixture and the outgoing exhaust gases. The carburetor is bolted to the intake section of the manifold and the exhaust pipe is attached to the exhaust manifold outlet flange. Gaskets are used between the manifold assembly and the cylinder block. Unless cracked or broken, the manifold requires very little attention.

B. REMOVAL

CAUTION: Be certain engine has cooled prior to handling manifold, as severe burns could result from careless exposure.

Manifold can be removed with engine in or out of truck frame. The following procedure is recommended for efficient manifold removal.

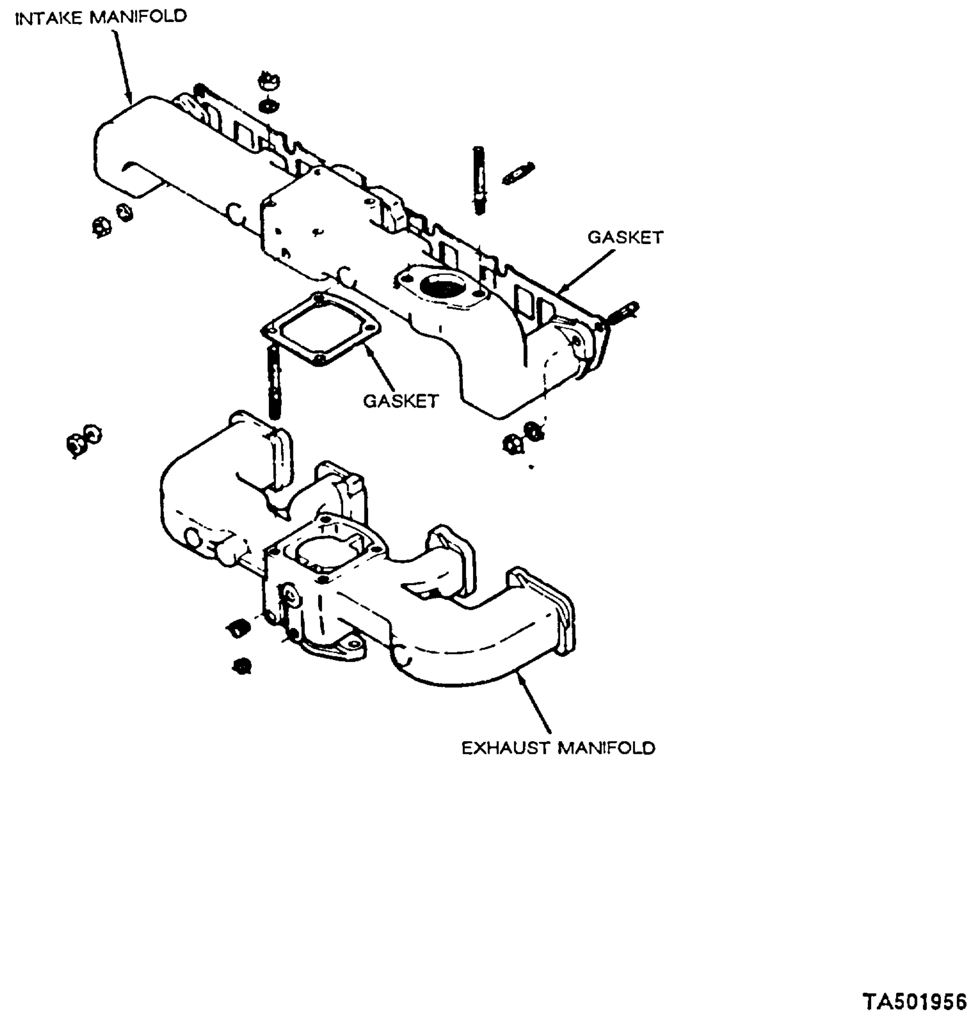


Figure 1. Intake/Exhaust Manifold

1. Remove side panels, air cleaner, seat and seat deck.

2. Remove carburetor air hose, and exhaust pipe.

3. Disconnect choke control, accelerator rod and governor control rod from carburetor.

4. Shut off fuel supply at base of fuel tank and disconnect fuel, line at elbow.

5. Remove carburetor from manifold.

6. Remove PCW valve,, elbows and hoses from manifold.

7. Remove self-locking nuts and washers which attach, manifold assembly, to cylinder head and slide assembly off mounting, studs.

8. Remove retainers and gaskets from, manifold ports.

C. INSPECTION

1. The, manifold, should be checked for cracks and warpage. If cracked. assembly must be replaced. To check for warpage, lay a straight edge across manifold ports. If warped , then machine flat or replace.

2. Remove excessive carbon deposits with a scraper and wire brush.

3. Manifold caskets must be in good condition to prevent entry of dirt, and to maintain correct fuel-air ratio of intake mixture.

D. INSTALLATION

1. Install new, gaskets and retainers on manifold ports.

2. Position manifold assembly on the mounting studs, and install washers and lock nuts. Torque to 25-30 lb. ft.

3. Install elbow in manifold and install hoses and FCV valve.

4. Replace carburetor gasket, and install carburetor, connect fuel line, governor control rod, choke control cable, and accelerator linkage. (Guard against altering any linkage adjustments during removal/installation.)

5. Connect exhaust pipe to exhaust manifold flange, using new, gasket, and replace carburetor air cleaner hose.

6. Install air cleaner-, seat assembly and hood.

7. Open fuel shut-off valve and start engine.

8. Check for noisy or hissing leaks at all manifold flanges.

9. Establish cause of leak, if any, and repair.

TOPIC 4 VALVES-INTAKEAND, EXHAUST

A. GENERAL

Valves require grinding at various intervals during the engine service life. These intervals cannot be exactly specified because many variable factors are involved, often without the operator's knowledge. Of these factors, the following have been found, to a greater or lesser degree, to cause reduced valve life:

1. Fuels that break down to form deposits that impair seat contact and prevent heat induction.
2. Deposits from either fuels, or oils that accumulate on the valve stems, and cause burning and sticking.
3. Oil not reaching valve guides due to dirt or sludge.
4. Shutting down a hot engine without idling for a few minutes. Exhaust valves, that happen to be off the seat when the engine stops may warp; so that, burning occurs on restarting.
5. Tappet clearances not correctly maintained.
6. Lean mixtures due to incorrect carburetor or Incorrect carburetor adjustments.
7. Pre-ignition due to incorrect timing, wrong plugs, carbon deposits, or excessive operating temperatures.

B. CHECKING COMPRESSION

A compression check is the best method of determining whether or not valves need grinding. Since different pistons will develop different cranking compression pressures due to compression ratio variations, no specific figures can be given for this test. Most significantly, the pressures in all the cylinders must be within a 10 p.s.i. variance. If it is felt that compression is leaking past the piston rings, inject some heavy engine oil through the spark plug hole before making the test. This will temporarily seal the rings. In addition, a quick knowledge of salve condition may be gained by listening at the carburetor entrance (remove air cleaner connection) and the exhaust outlet while the engine is cranked over. Piston ring blow-by may be heard at the oil filler opening as the pistons are slowly brought into compression and the air allowed to seep past. If valves are leaking badly, the piston ring leakage may not be noticeable. Another indication of leaking valves is an unsteady vacuum reading, particularly at idling speed.

C. REMOVING VALVES

The cylinder head as well as the valve tappet cover must he removed to gain access to the valves and valve springs. The end of each valve stem is fitted with a shallow steel retainer that surrounds the end of the valve spring, and is held to the stem by a pair of wedge keepers or retainers. These retainers must be removed before the valve carp be removed.

With a valve spring lifter (Figure 2) compress the springs and remove the lock; or pins from the valve stems which are in a closed position. Close the other valves by rotating the crankshaft and remove the locks (or pins) from these valves in the same manner. Remove all valves and place them in order, in a rack with holes numbered for both intake and exhaust valves, so they will be reinstalled in their original positions.

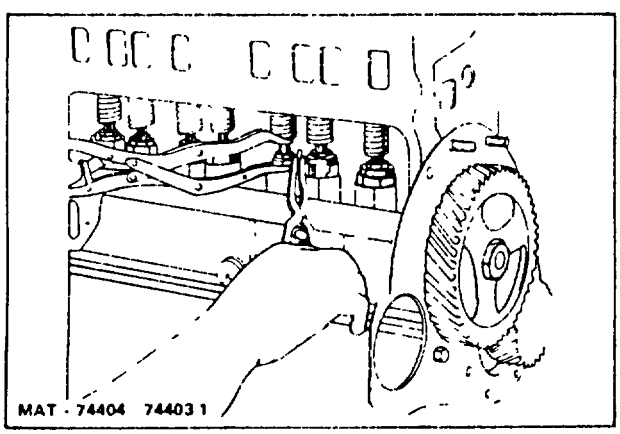


Figure 2. Valve Removal

D. SERVICING OF VALVES AND COMPONENTS

Upon removing each valve, examine it carefully. Remove all carbon and burned oil, and check the valve stem and its fit in the guide. Excessive wear in either the stem or guide will make it impossible to secure a tight seat by grinding, unless the valve or guide, and possibly both, are replaced. Check valves and seats for excessive burning, cracks or pitting. Check the valve guides by inserting a valve and noting the amount of side play. Worn valve guides should be replaced. Refer to following subparagraph 1. Valve Guides.

Whenever the valve chamber cover is removed, the valve and spring mechanism should be examined for evidence of inadequate lubrication due to sludging. Excessive sludge in the valve spring area is an indication of too low oil operating temperature, poor filtering action, or an oil that breaks down and is unsuited for the operation involved.

Carefully inspect the crankcase for cracks around the exhaust valve areas

Inspect spring coils for bright spots that may be an indicator, of spring weakness when found beyond the closely spaced dampening coils at the spring ends. Over-speeding the engine can cause this condition. Replace any rusted, weak, cracked or broken springs.

Check the tension of each valve spring with a spring scale designed for the purpose. Refer to following subparagraph 5. Valve Springs.

1. Valve Guides

   Clean the valve stem guides, removing lacquer or other deposits by running a valve guide cleaner or wire brush through the guides.

   Check guides for wear by using a "Go and No-Go" plug gage, or a telescope gage and a 1" micrometer. Replace all guides that are worn bell-mouthed and have increased .00]5" in diameter. Refer to TOPIC 1. FITS AND TOLERANCES for maximum diameter permissible, to determine actual amount the diameter has increased. When necessary, remove all valve guides; use an arbor press and press them out from the combustion chamber side with a driver slightly smaller than the O.D. of the valve guide.

   Valve guides are a press fit, and service guides are especially machined to press in place and give correct stem clearance without further machining. However, the valve seat MUST be re-cut concentric with the new guide whenever new guides are installed.

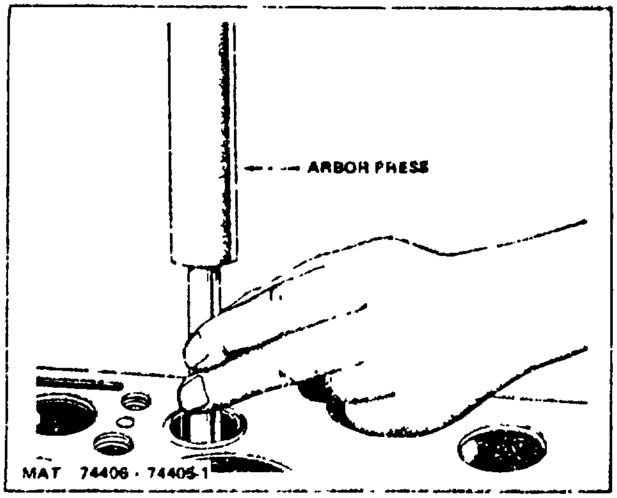


Figure 3. Removing Valve Guides

Replace worn guides as required by using a suitable driver and an arbor press from the combustion side to the correct depth below the valve seat. Refer to Figure 4 and TOPIC 1.
FITS AND TOLERANCES.

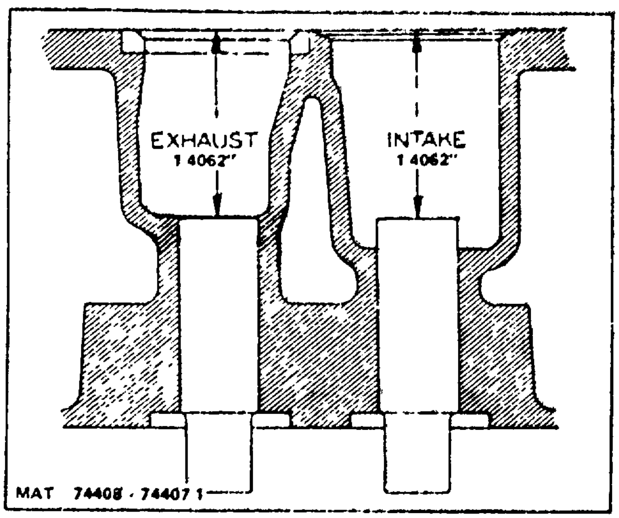


Figure 4. Distance from Block Face to Tap of Valve Guide

CAUTION: When replacing guides that are ferrox coated, do not ream, since these are all pre-reamed before being ferrox coated - any further reaming will remove the coating.

2. Valve Seat Inserts

The exhaust valve seat insert is held in place by a shrink fit.

Inspect all exhaust valve inserts in the block and replace any that are loose, cracked or otherwise damaged. Use puller for removing faulty insert as shown in Figure 5.

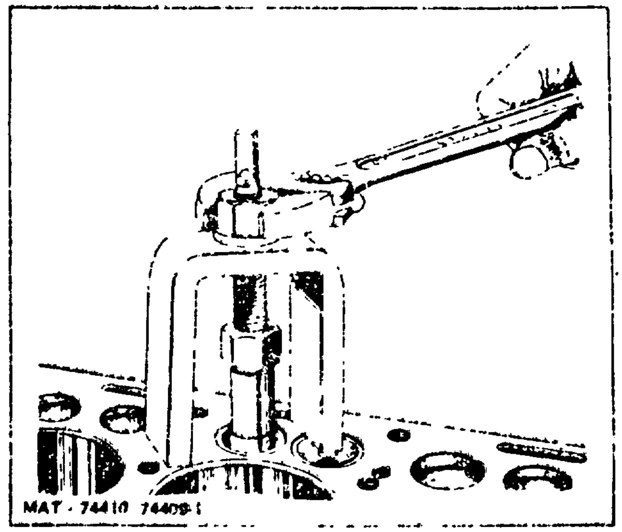


Figure 5. Removing Exhaust Valve Seat Insert

When required to replace with new insert, clean and counterbore for .010" larger insert using counterbore tool with correct fitting pilot.

When machining the counterbore, be sure to go deep enough with the tool to clean up the bottom; so that, the insert will have full contact to carry away the hear.

It is not recommended to install new inserts having the same outside diameter as the one removed. Refer to Dimensions of Standard Inserts and Counterbores shown in Figure 6.

A - O.D. of insert.. 1.3485"-1.3475"
B - I.D. of
Counterbore..... 1.3445"-1.3435"
Press Fit.............. .003"-.005"

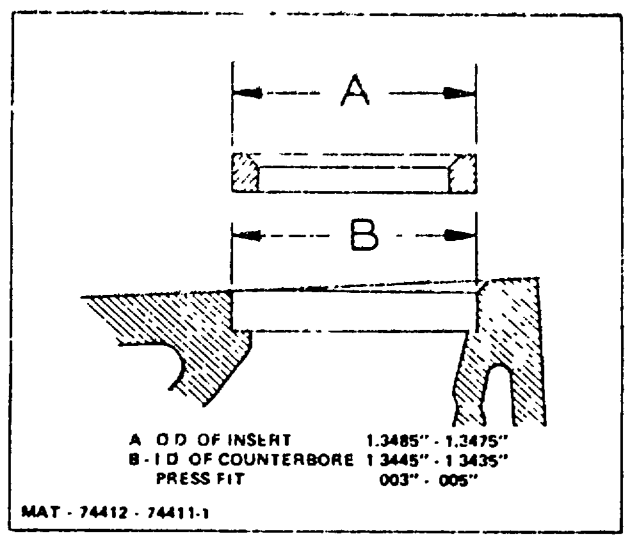


Figure 6. Insert and Counterbore Dimensions

When OVERSIZE inserts are used, dimensions of the insert and counterbore in crease proportionately .010" to .020" - depending on the oversize.

New insert installation should have a press fit. Chill insert in container with dry ice for 20 minutes before assembling.

Insert may then be installed in the counterbore using a piloted driver, tapping in place with very light hammer blows, without the possibility of shearing the side walls (Figure 7). This assures that the insert is seated firmly on the bottom of the counterbore.

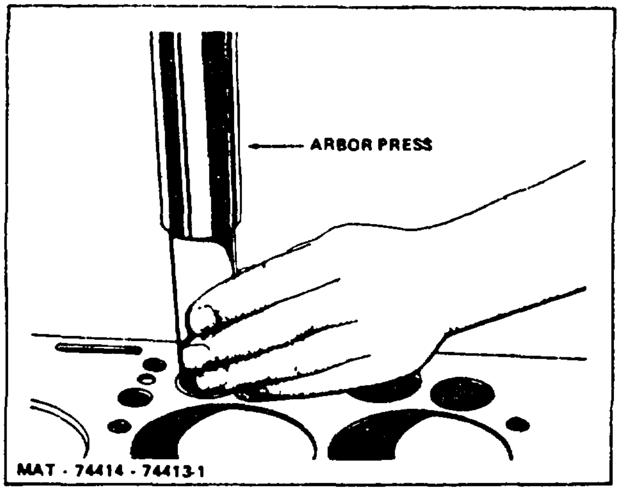


Figure 7. Installing Valve Seat Insert with an Arbor Press

3. Valve Seat Grinding

Grind the intake and exhaust valve seats in the block (Figure 8) in accordance with specified dimensions in TOPIC 1. FITS AND TOLERANCES. Before removing the arbor, indicate the seat. Total indicator reading of the run-out must not be more than .002". Use a pilot having a solid stem with a long-taper, as all valve seats must be ground concentric and square with either new or worn valve stem guide holes (Figure 9).

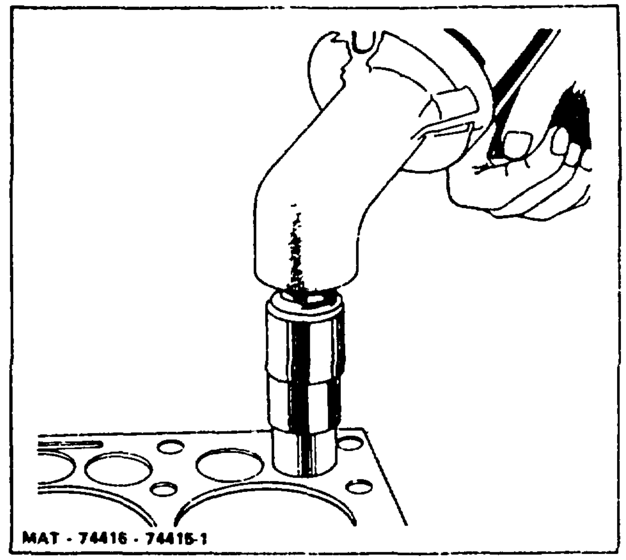


Figure 8. Grinding Valve Seat

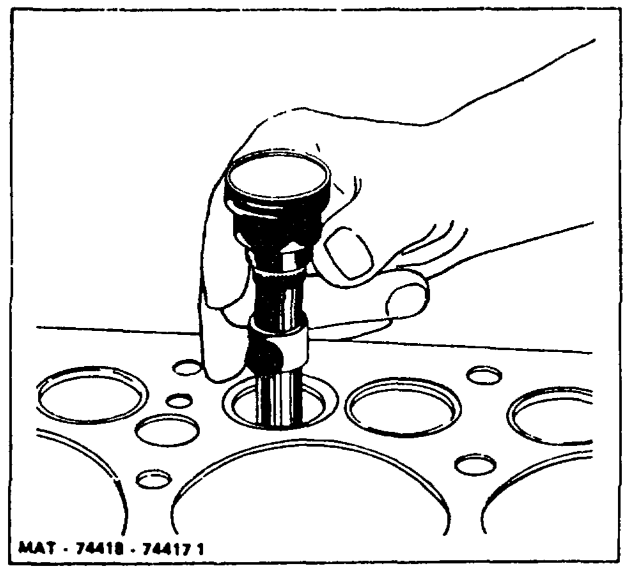


Figure 9. Indicating Valve Seat

4. Valves

Inspect valves for condition and replace any that are "necked", cracked or burned, also any on which valve stems are bent or worn more than .002" over the maximum allowable limits. Reface or replace all valves.

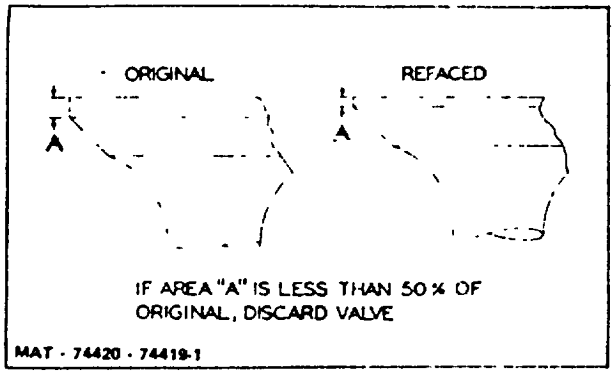


Figure 10. Allowable Head Thickness of Refaced Valves

Replace all valves having less than 50% margin thickness (outer edge of valve head) after refacing has been completed. To check this dimension, compare the refaced valve with a new valve (Figure 10).

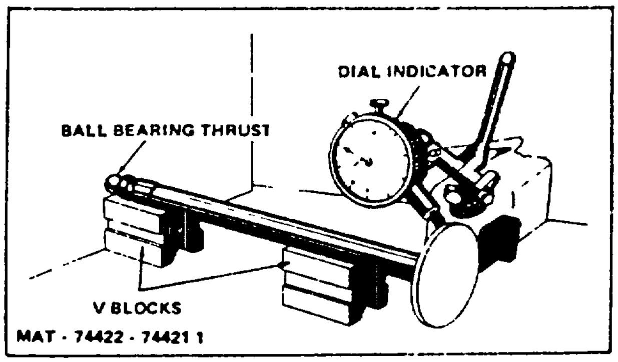


Figure 11. Checking Valve Face in "V" Blocks

Check all refaced or new valves in V-blocks with indicator (Figure 11) to determine if the contact face is true with the stem within .002". If not, repeat the refacing operation.

After the valves and seats have been refaced and reground, coat the seat lightly with Prussian blue and drop the valve into position, oscillating it slightly to transfer the blue pattern to the valve face. This should show a contact width of .0625" to .0938", and should fall well within the width of the valve face, leaving at least .0625" on either side where the blue does not show. If the contact is over .0938" wide, the seat in the head may be narrowed by using a 15° stone to reduce the outside diameter, or using a 60° or 75° stone to increase the inside diameter (Figures 12 and 13).

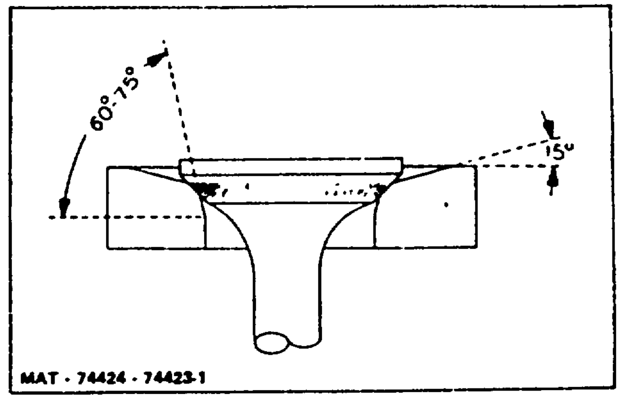


Figure 12. Method of Narrowing Valve Seats

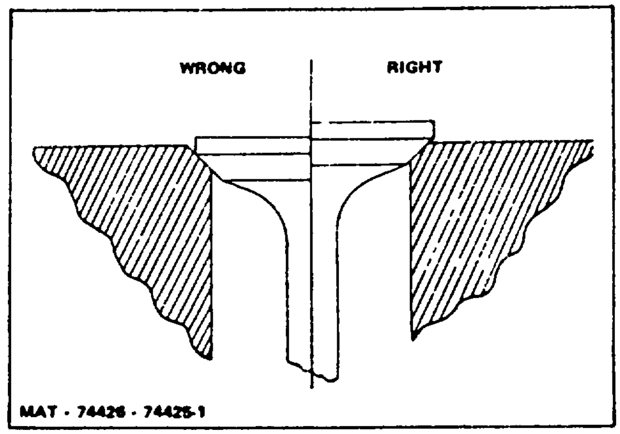


Figure 13. Valve Position in Cylinder Block

CAUTION: Never allow valves to set down inside the seat.

After the narrowed-down seat is brought within specifications, the seat should be retouched lightly with the original stone to remove burrs or feathered edge.

"A poor valve grinding job cannot be corrected by valve lapping."

Coat the valve stem with a light film of engine oil.

5. Valve Springs

Check all valve springs on a spring tester (Figure 14) to make sure they meet specifications regarding weight and length. When compressed to the "valve open" or "valve closed" length, new springs must fall within specifications. Refer to TOPIC 1. FITS AND TOLERANCES. Used springs showing more than 10% loss must be replaced.

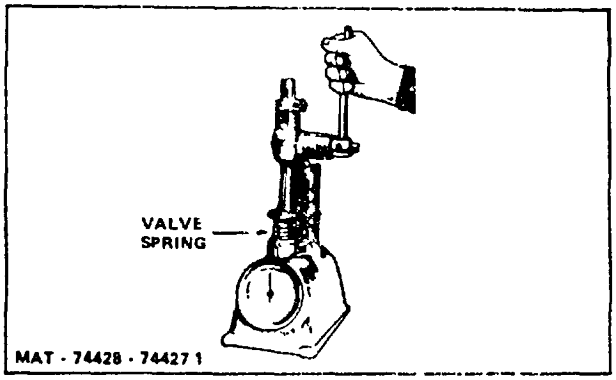


Figure 14. Valve Spring Tester

Reassemble the valves and springs in the block with the retainer and retainer lock.

6. Valve Tappets

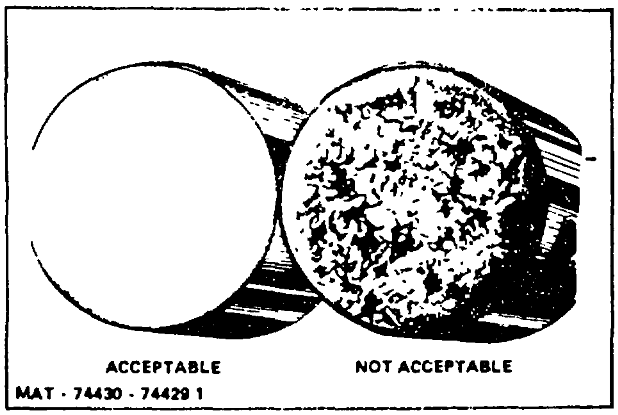


Figure 15. Valve Tappet Wear Comparison

Inspect each tappet carefully. A slightly pitted contact face is acceptable; more than that calls for replacement of the tappet. See Figure 15.

Check the tappet outside diameter with micrometers to determine if replacement is necessary because of wear.

The tappets ride in a tappet bore in the cylinder block. The tappet bore may be reamed oversize, and oversize tappets installed. Oversize tappets are available as required.

The following specifications apply:

Tappet Outside Diameter... .9990"
Bore in Block Diameter ...... 1.0000"
Total Maximum
Wear Limit .... .0050"

E. VALVE/VALVE TAPPET CLEARANCE ADJUSTMENT

Accurate valve clearance settings materially prolong engine life and aid performance. Excessive clearances are detrimental to cams and tappets as well as to the rest of the mechanism. On the other hand, when clearances are too low, timing is again disturbed, and the possibility of burned valves becomes much greater.

Valve tappet clearances should be as follows (See Figure 16):

Intake .... .012"
Exhaust .... .020"

To adjust tappet clearances proceed as follows (See Figure 17):

1. Disconnect the high tension coil wire to prevent accidental starting of the engine.

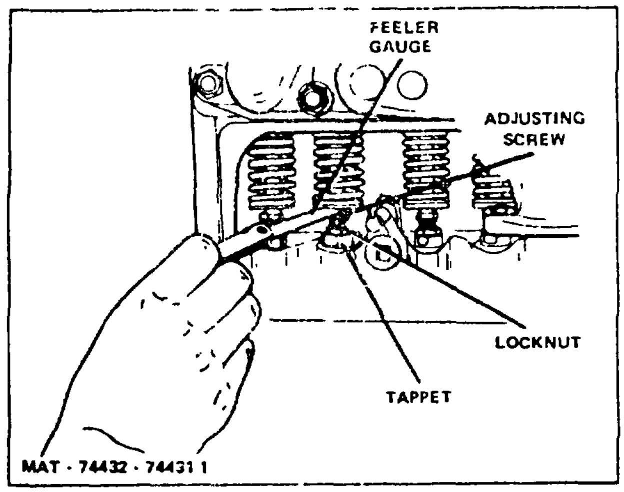


Figure 16. Checking Tappet Clearance Engine at Room Temperature

2. Remove valve tappet cover from left side of engine. This includes disconnecting and removing fuel pump with front cover.
3. Remove the spark plug from No. 1 cylinder.
4. Place thumb over the spark plug opening and slowly crank the engine until an outward pressure can be felt. Pressure indicates No. 1 piston is moving toward top dead center of the compression stroke. Continue cranking until the timing mark on the flywheel is in center of opening in flywheel housing. Both valves are then closed on the compression stroke of No. 1 cylinder.
5. Use two thin open end wrenches when making adjustment. The lower wrench is used to raise or lower the tappet adjusting screw after the locknut has been loosened. Never attempt to adjust without first loosening the adjusting screw locknut. The feeler gauge should pass between the valve stem and

tappet adjusting screw with a slight drag when the valve lash is properly adjusted.

6. Crank the engine one-half revolution at a time, and check the clearance of each valve; adjust if necessary. Do this on each set of cylinder valves in succession, according to the firing order of the engine: 1-3-4-2.

7. Replace the valve tappet cover and other removed parts. Make sure cover makes an oil-tight seal with the crankcase. Replace gasket.

8. Replace the spark plug and coil wire.

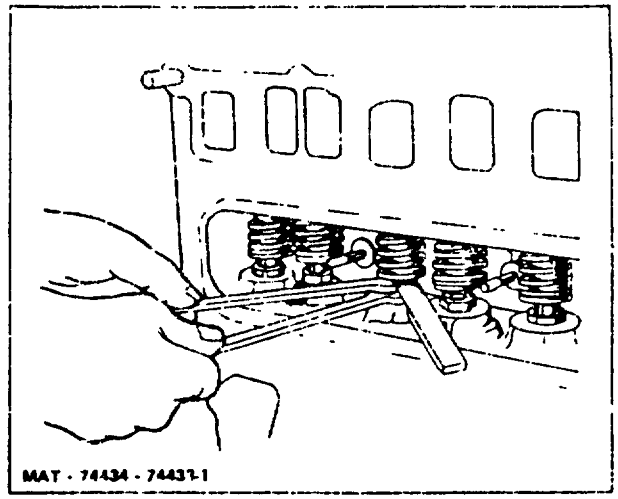


Figure 17. Adjusting Valve Tappet Clearance

TOPIC 5. CYLINDER HEAD

A. DESCRIPTION

The cylinder head is an alloy cast iron unit, secured to the engine block with special hardened studs and capscrews. The head seals the top end of the cylinders to form the combustion chambers and passages for the intake of the air-fuel mixture, and the expulsion of exhaust gases, as well as cored passages through which the coolant flows to prevent overheating.

B. REMOVAL

1. Drain water from block by opening water drain cock.
2. Drain radiator.
3. Loosen clamps on tipper radiator hose and remove hose, taking care not to damage thermostat located at cylinder head end of hose.
4. Disconnect water bypass tube from water pump.
5. Disconnect wire from water temperature sender.
6. Disconnect spark plug ignition cables from spark plugs, and identify each cable.
7. Remove spark plugs, and cap or tape exposed ports.
8. Remove capscrew holding distributor clamp to cylinder head. Remove distributor.
9. Remove cylinder head mounting capscrews and stud nuts.
10. Lift the cylinder head and gasket off the engine and place it on a work bench.
11. With a clean, dry cloth wipe all exposed engine internal areas free of water and place a protective cover, such as a plastic sheet, over exposed cylinders.

C. SERVICING

1. Using a scraper and wire brush, remove all carbon from combustion areas. See Figure 18.

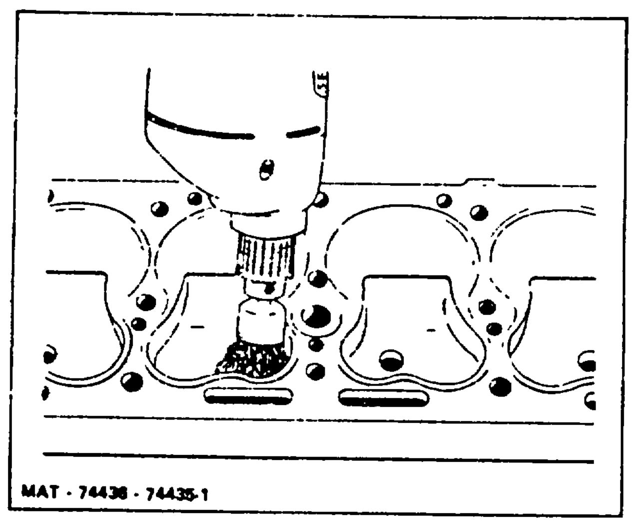


Figure 18. Cleaning Carbon from Combustion Chamber

2. Clean the cylinder head thoroughly with an acceptable cleaning solvent and dry thoroughly with compressed air.
3. Make sure that gasket contact surfaces on the head are clean, smooth and flat.
4. Inspect cylinder head for cracks, holes and warpage. Replace damaged heads.

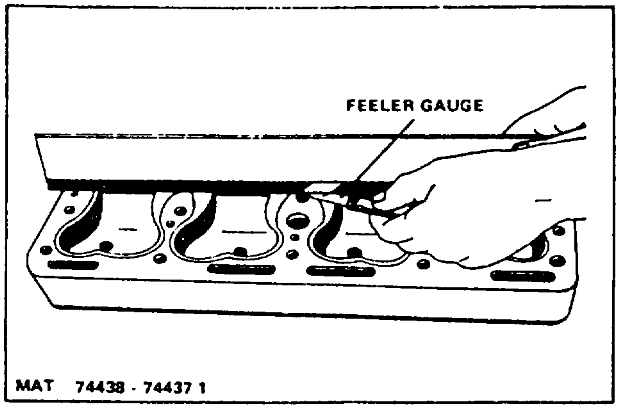


Figure 19. Checking Cylinder Head Flatness Lengthwise

5. Check out-of-flatness with straight edge and feeler gauge: maximum permissible is .00075" per inch of width or length (Figures 19 and 20). Thus, for a cylinder head 16" long, maximum permissible lengthwise out-of-flatness is .012". Out-of-flatness should vary gradually and uniformly from end to end and side to side. Localized depressions or high spots should not exceed .003".

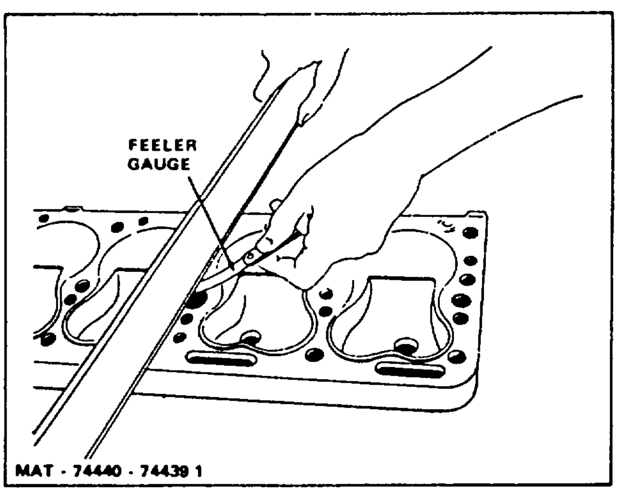


Figure 20. Checking Cylinder Head Flatness Crosswise

D. INSTALLATION

1. Install new head gasket and replace cylinder head on cylinder block.

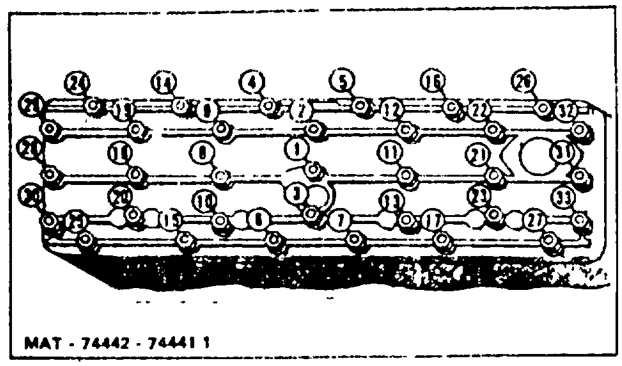


Figure 21. Cylinder Head Torquing Sequence

2. Refer LU Figure 21 for correct cylinder head capscrew torquing sequence.

NOTE: Capscrews should be tightened in successive stages and in such order as will ensure even pressure over the entire surface of the cylinder head and gasket. If all the outside capscrews are pulled up first, Instead of the center ones, the head will be cocked and the gasket will not fit tight enough to prevent burning or blowing out between cylinders. A good torque wrench is recommended for this purpose. It is good practice to hold tension on each capscrew for a few seconds before releasing the wrench.

It Is recommended that several passes be made in tightening down the head so as to avoid any warpage. At the first pass apply approximately one half of the recommended torque, and then increase the torque one-half each succeeding pass until the recommended torque is attained. Torque all capscrews to 70-75 lb. ft.

3. Install distributor and secure it with clamp and capscrew.
4. Remove covering from spark plug ports and, after checking the Insulation for cracks and verifying correct gap, reinstall spark plugs.
5. Attach respective spark plug ignition wiring to plug caps.
6. Connect temperature sender wire.
7. Secure water by-pass tube to water pump. Do not over-tighten connector.
8. Re-install upper radiator hose, thermostat and attaching clamps.

9. Add engine oil, allowing for extra half-quart if oil filter was changed.
10. Close radiator and cylinder block water drain cocks.
11. Refill radiator.
12. Refer to TOPIC 16. ENGINE RUN-IN SCHEDULE for compression check.

TOPIC 6. CRANKSHAFT AND CRANKSHAFT COMPONENTS

A. DESCRIPTION

The crankshaft translates the reciprocating motion of the connecting rods and pistons into a rotary motion. The crankshaft is forged of a special heat treated steel and rifle drilled for pressure lubrication of the connecting rods and main bearings. End thrust is controlled by flanges on the center main bearing. The crankshaft timing gear is keyed to the camshaft gear, and the camshaft gear, in turn, is keyed to the governor gear. The crankshaft is sealed on each end by filler blocks with oil seals, The filler blocks are secured to front and rear of the cylinder block. The main bearings are thin wall shells held in place by precision machined bearing seats and caps.

B. REMOVAL

The following teardown procedure is recommended for proper crankshaft removal.

1. Drain radiator, cylinder block, and oil pan.
2. Remove upper and lower radiator hoses and clamps. Remove transmission cooling lines if applicable.
3. Disconnect water by-pass tube.
4. Remove fan blade and water pump.
5. Disconnect arid label attaching wires to alternator, and remove mounting capscrews, remove alternator.
6. Remove distributor, cable support bracket, and spark plug wiring.
7. Remove spark plugs, and cap or tape exposed spark plug ports.
8. Disconnect and label attaching wires to starter motor. Remove capscrews and carefully pull starter free of housing.
9. Remove starter motor.
10. Disconnect from carburetor the linkage, fuel line, and air intake hose.
11. Remove capscrews securing intake/exhaust manifold, and remove manifold with attached carburetor as a complete assembly.
12. Remove governor assembly.
13. Remove oil filter lines at engine.
14. Disconnect tube and hose from hydraulic pump and reservoir. Remove capscrews and remove hydraulic pump. Remove retaining rings and remove pump gear and sleeve.
15. Ensure that all external connections to engine have been disconnected.
16. Attach hoisting chain to engine, remove three motor mount capscrews, disengage transmission linkage, oil lines, and drive shaft at universal joint.
17. Remove engine and transmission assembly.
18. Remove securing bolts and transmission assembly.
19. Remove flywheel by first removing the six bolts that attach the flywheel to the crankshaft. These bolts are special and should not be mixed with any others.
20. Carefully rotate the entire engine, so that the oil pan faces up. (If cylinder head has been removed, take care not to damage any extended valves.)
21. Remove oil pan capscrews and oil pan (Figure 22).

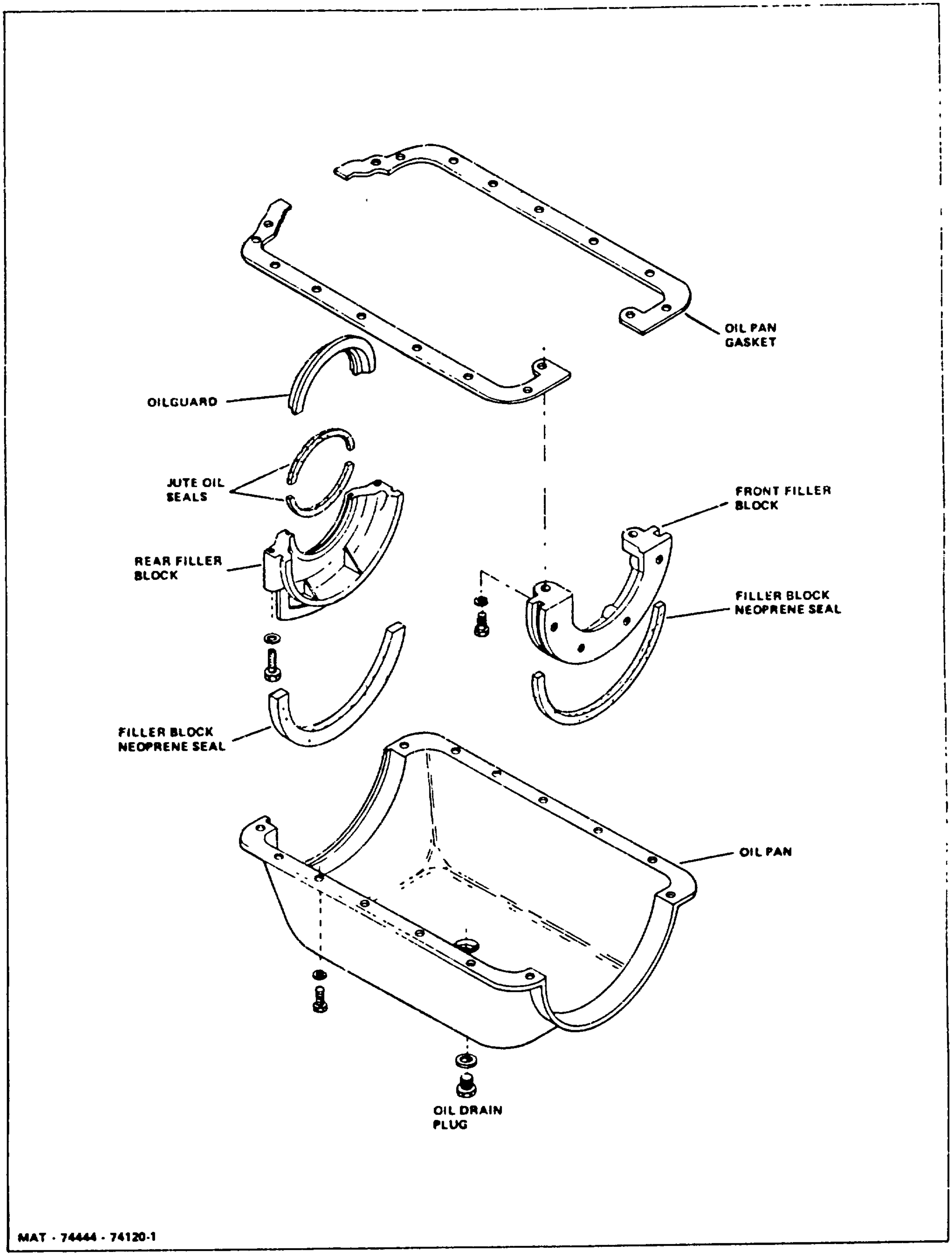


Figure 22. Oil Pan Assembly

22. Remove front and rear filler blocks. Refer to TOPIC 14. FILLER BLOCKS AND OIL GUARD.
23. Remove fan drive pulley, drive adapter and shaft from gear cover.
24. Remove retaining ring and pump coupling. Pull timing gear from crankshaft (Figure 23).

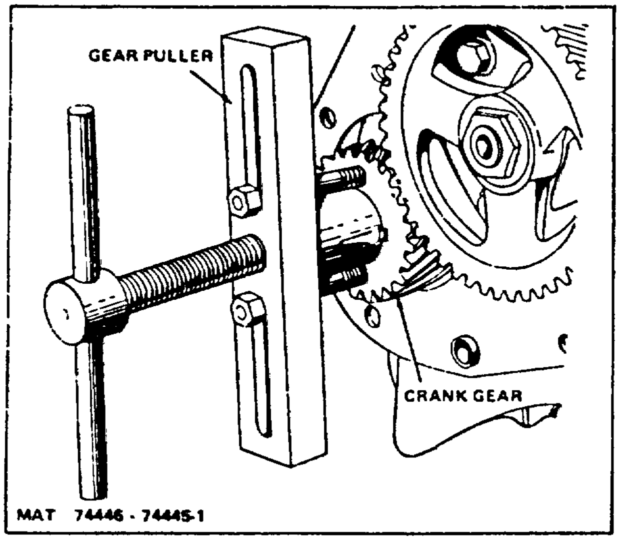


Figure 23. Removing Crank Gear

25. Remove timing gear cover.
26. Drop the oil pump, by removing nut holding pump to center main bearing cap.
27. Remove connecting rod cap nuts and bearing caps.
28. Remove main bearing cap bolts and bearing caps.
29. Carefully lift the crankshaft (Figure 24) from the bearing mountings. Avoid nicking or bumping the bearing surfaces while handling.

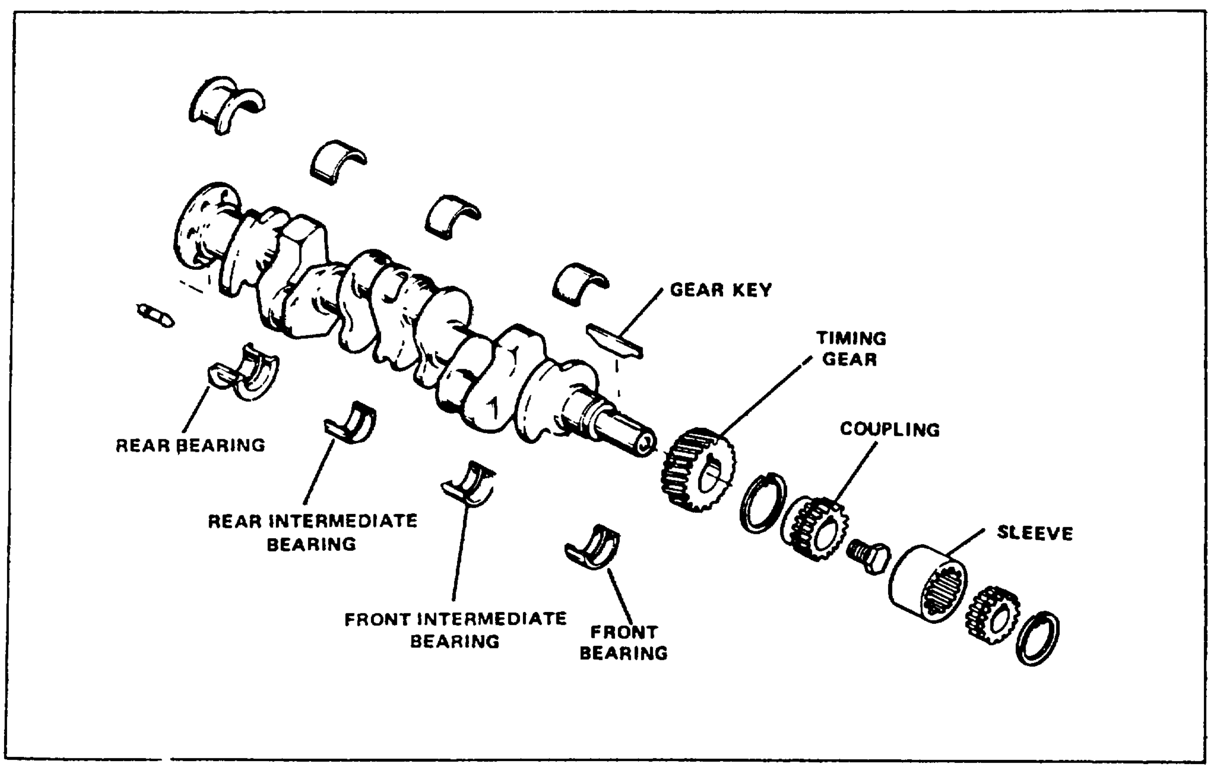


Figure 24. Crankshaft Assembly

C. CRANKSHAFT INSPECTION AN4D SERVICING

Check for run-out by mounting the crankshaft in 'V' blocks at the front and rear main bearing journals. Insert oil-soaked paper strips in the 'V' blocks to avoid marring the shaft. The dial indicator reading should be taken at the center main bearing journal.

The run-out, or total variation in the indicator reading during one complete revolution of the crankshaft, is limited to .002". Straighten crankshaft, if necessary, to be within .002" reading.

Check the connecting rod and main bearing journals for out-of-round and tapered condition. The limit is .0005".
If the crankshaft is scored, or worn enough so that new bearings will not fit with the required clearance, the crankshaft should he reground.

Standard crankshafts may be reground to decrease the diameter a maximum of .040". When reground, the fillet radii must be within dimensional limits and must be perfectly blended into thrust and bearing surfaces (Figure 25).

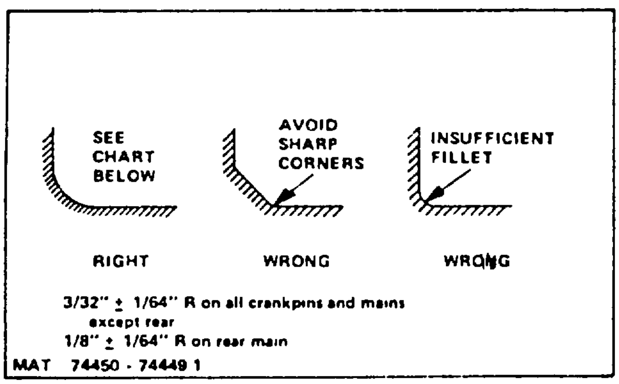


Figure 25. Crankshaft Fillet Radii

D. BEARING INSPECTION AND INSTALLATION

1. General

Both the connecting rod and main bearings are of the steel-backed, precision type. Due to the close machining of this type of bearing, no fitting, filing, scraping, boring or other adjustment is required or permissible. Replacement must be in complete bearing units. Never replace only one-half of a bearing. Service bearings are available in .010", .020", and .040" undersize for use on reground crankshafts. Never attempt to adjust a bearing by filing, grinding, or lapping the bearing cap. The bearing seats are precision ground with the caps in place. Any metal removed from either side prevents the proper fit of a connecting rod bearing in the rod, and in the case of a crankcase, makes the entire crankcase unsuited for further use.

2. Bearing Inspection

NOTE: Inspect the bearing shell and crankshaft Journals. IT there is any indication of distortion, scoring or actual wear, the bearing shells must be replaced.

Some models use tri-metal bearings which, when new, are smooth and highly polished. However, <u>a very few hours of operation will change their appearance completely</u>. The bearing surface becomes a leaden gray in color and develops minute craters, almost cellular in appearance (Figure 26) which follow the pattern of the matrix. <u>This appearance is a natural characteristic of this type bearing and in no way indicates failure.</u>

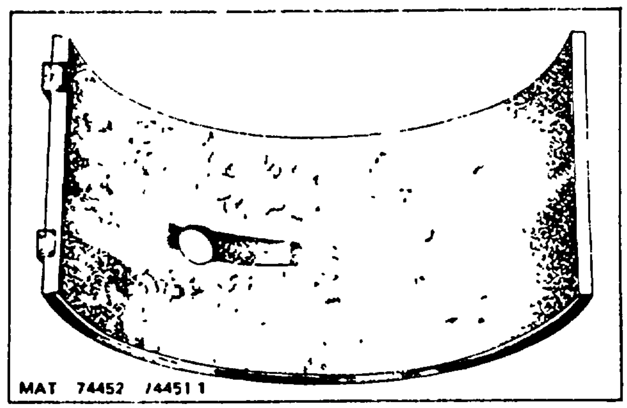


Figure 26. Appearance of a Good Bearing.

Refer to Figures 27 and 28 for the appearance of corrosion and scoring damage to bearings.

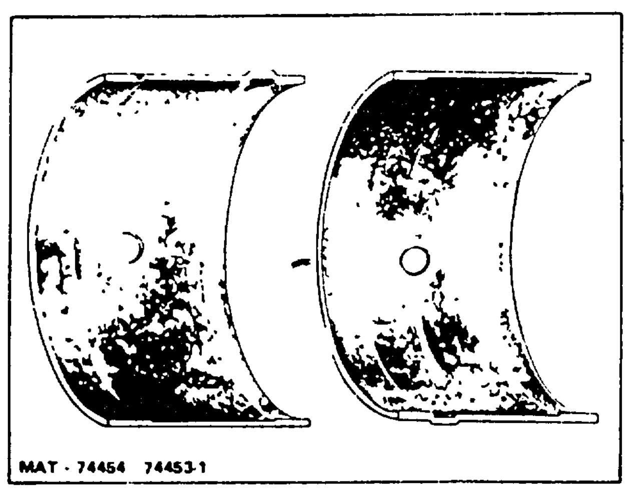


Figure 27. Bearing Damage Due to Corrosion

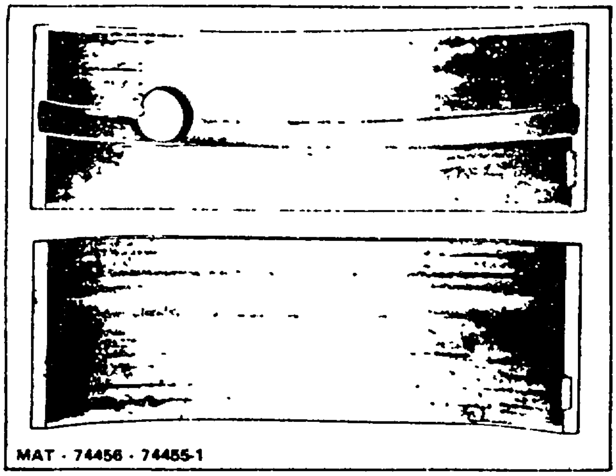


Figure 28. Scored Bearing Due to Dirt or Lack of Lubrication

If the visual inspection appears satisfactory, bearings should be removed and checked for thickness using a ball micrometer.

To remove the upper half of the bearing shell use a special tool obtainable at most parts houses, which is a pin with an angular head (Figure 29). This tool may be inserted in the oil hole of the crankshaft and, as the crankshaft is turned in a clockwise direction, the head of the pin picks up the bearing shell and forces it out of the bore in the block.

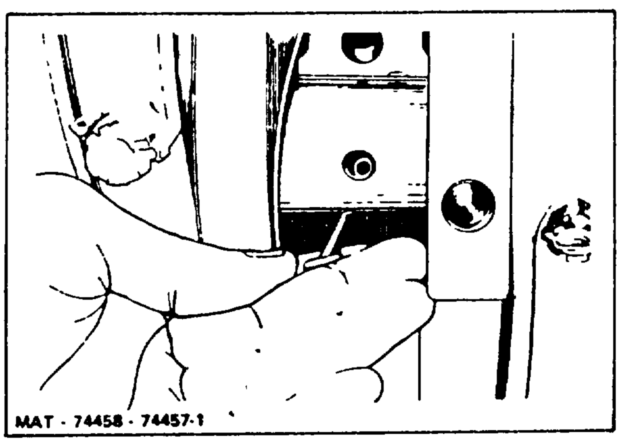


Figure 29. Removing Upper Half of Main Bearing Shell

The thickness of the bearing shells is given in TOPIC 1. FITS AND TOLERANCES. If this thickness has been reduced more than .0005" beyond the maximum allowable tolerance the bearing shell must be replaced (Figure 30).

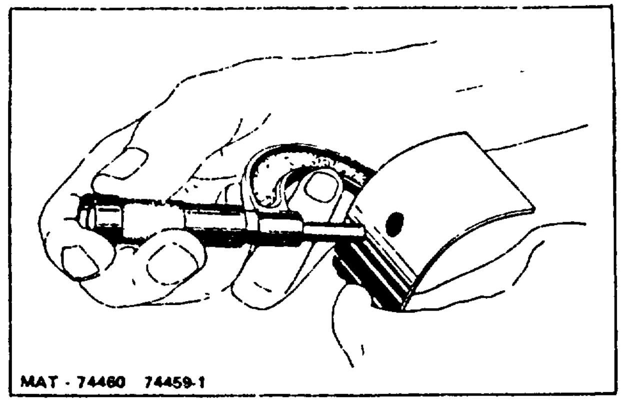


Figure 30. Measuring Bearing Thickness

If visual inspection of the crankshaft has shown no indication of excessive wear or scoring, the clearance of the bearings should be checked with feeler stock.

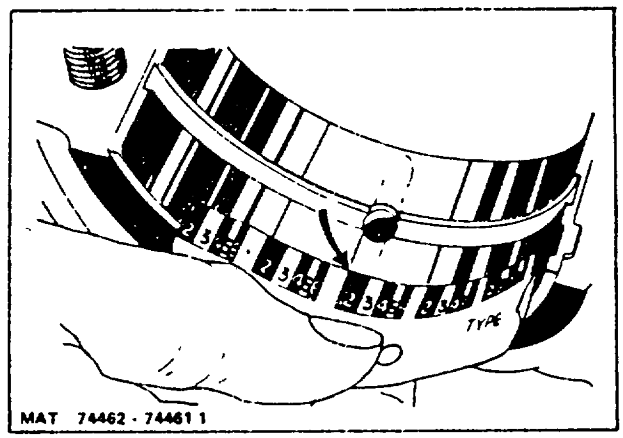


Figure 31. Checking Bearing Clearance with Plastigauge

Check each bearing, one at a time, by using a piece of Plastigauge of a diameter specified to check certain clearances.

CAUTION: When using this method DO NOT TURN the crankshaft, as that would destroy the Plastigauge.

By placing the Plastigauge in the bearing and tightening it in place, the width of the Plastigauge after crushing determines the bearing clearance, as shown in Figure 31.

The term "crush" is generally understood as the projection of the bearing edges above flush with the mating surfaces of the bearing seat and cap. This crushing action forces the bearing halves into close contact with their seats for greater rigidity and good heat conduction.

The correct amount of crush has been allowed during the manufacture of the bearings, and no attention to that detail is necessary at the time of replacement. The use of a torque wrench for tightening bearings is necessary to insure sufficient "crush" on the bearings, to force the shells against the crankcase metal without distortion.

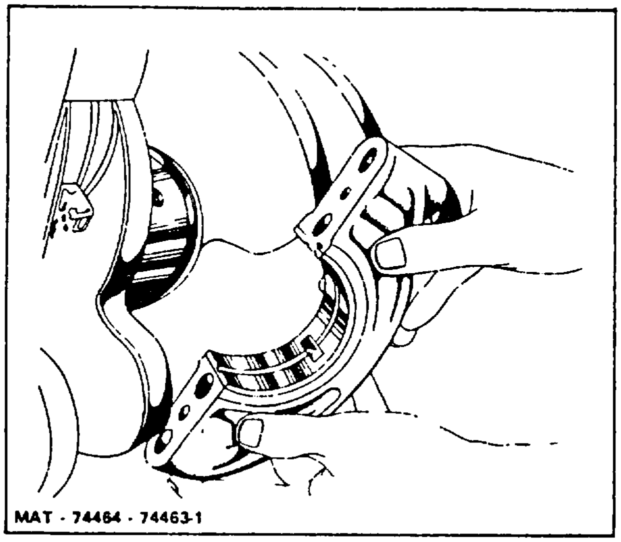


Figure 32. Checking Bearing Clearance with Feeler Stock

An alternative method (Figure 32) is to use a piece of 1/2" feeler stock lengthwise in the bearing shell, on a film of oil. The thickness of the feeler stock should be equivalent to the maximum clearance permissible in the bearing. Assemble the bearing cap and tighten the screws, torquing them to specification, then try to turn the crankshaft by hand to determine whether or not a drag is felt.

If a definite drag is felt and the piece of feeler stock is equivalent to, but no more In thickness than, the maximum clearance specified, neither the crankshaft nor the bearing is worn excessively as far as clearance is concerned. When using new bearings with a crank-' shaft that is not worn, checking may be done with a piece of feeler stock as outlined above This should lock up the crankshaft, making it possible to turn only by use of a bar or wrench.

Generally, the test on main bearings consists of tightening each bearing cap in turn, and turning the crankshaft to detect binding.

It is emphasized that any unusual bending or run-nut in a crankshaft makes it impossible to fit bearings accurately. For this reason, the time spent in making a run-out check is well worth while. Magnetic inspection of the crankshaft and other stressed parts is also recommended if the proper equipment is available.

Connecting rod bearings and crank pins may be checked in the same manner as main bearings with one exception: do not try to turn the crankshaft when the connecting rod bearing is tightened on it with a piece of feeler gauge assembled; rather, try to move the connecting rod from side to side (Figures 33 and 34).

The familiar test of connecting rod bearing clearance consists of manually gripping the rod cap after the bearing bolts are tightened and attempting to move the rod from side to side in the direction of end clearance. If the crank pin is not worn. a well-fit bearing is usually just loose enough to be "snapped" from side to side, without actually feeling so loose as to push easily. Sometimes a slightly snug bearing will not move under pressure but will move readily under light blows from a soft-faced hammer. This conditioning is usually considered satisfactory, providing the engine is given adequate break-in time.

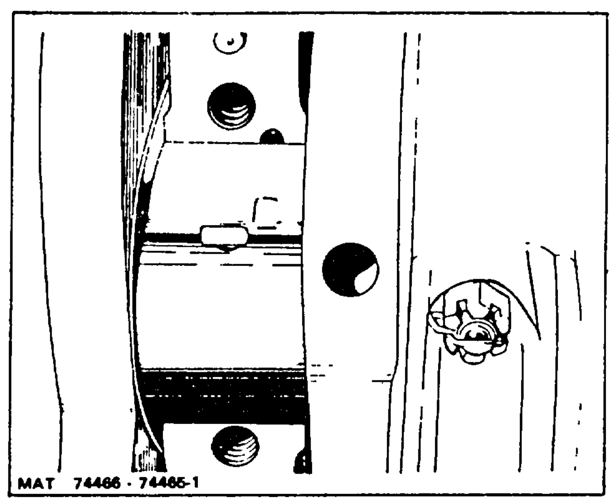


Figure 33. Replacing Bearing

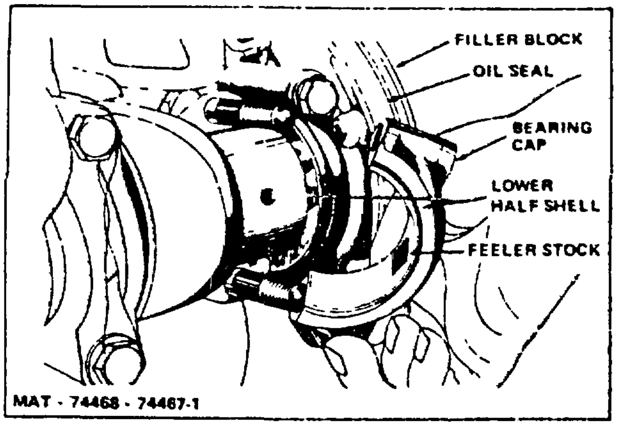


Figure 34. Checking Connecting Rod Bearing with Feeler Stock

3. Bearing Installation

NOTE: Coat all running surfaces with clean, fresh engine oil when installing bearings.

Be sure that the bearings seat on absolutely clean surfaces and that the back of each bearing is wiped perfectly clean. The slightest bit of dirt or carbon squeezed between the back of a bearing and its seat can cause rapid bearing failure by developing a localized high spot.

Equally important in obtaining maximum bearing life is the correct tension on the bearing cap nuts. Pull down on all nuts evenly, going from one side of the bearing to the other. Apply final tension with a torque wrench using a slow steady pull and holding the wrench "on torque" for a few seconds when the proper value is reached.

Main bearings should be torqued to 85-95 lb. ft. and connecting rod bearings should be torqued to 40-45 lb. ft.

It is preferable to go to a slightly higher tension if necessary. If it is apparent that the cotter pin cannot be installed without bringing the tension dangerously near the limit of the bolt, remove the nut and try again with another nut at the same location. Previous over-torquing, or some other damage to the bolt or nut is sometimes encountered and will be felt by the torque "softening up" so that the nut can be turned without any appreciable increase in wrench tension. Never allow a bolt or a nut in this condition to remain in the engine.

E. CRANKSHAFT INSTALLATION

1. Carefully install oil guard in crankcase, and install crankshaft in bearing mountings; secure main bearing caps and cap bolts. Torque to 85-95 lb.ft. Refer to preceding paragraph D. BEARING INSPECTION AND INSTALLATION in this section.
2. Install connecting rod bearing caps and cap nuts. Torque to 40-45 lb.ft.
3. Install oil pump. Refer to TOPIC 12. OIL PUMP.
4. Install the crankshaft gear and pump coupling on crankshaft. Tighten capscrew to 140-150 lb. ft. Refer to TOPIC 10. GEAR TRAIN for timing marks line-up. Use a driving sleeve to tap the gear snugly into place. Hard driving is not necessary and indicates that the gear is either too cold or is cocked on the shaft.
5. Install timing gear cover; inspect seal and replace if necessary. Gasket between cover and engine block should always be replaced.
6. Loosely bolt timing gear cover to engine block.
7. Install pump sleeve and gear. Install shaft, drive adapter- and fan pulley on gear cover.
8. Replace governor.
9. Replace front and rear filler blocks. Refer to TOPIC 14. FILLER BLOCKS AND OIL GUARD.
10. Replace oil pan and change gaskets. Secure oil pan capscrews.
11. Replace flywheel housing and secure bolts.
12. Replace flywheel, ensuring the same bolts removed are re-installed. Torque bolts to 35-40 lb.ft.

13. Rotate engine to upright position and re-install transmission.
14. Install engine/transmission and secure engine to motor mounts.
15. Reconnect transmission linkage oil lines and drive shaft.
16. Connect engine oil filter lines.
17. Install intake/exhaust manifold, use new gasket.
18. Reconnect carburetor linkage, fuel line and air hose.
19. Install hydraulic pump and connect tube and hose to pump and reservoir.
20. Install starter motor.
21. Hook up temperature sender wire.
22. Remove covering from spark plug ports, and after verifying proper spark gap reinstall spark plugs.
23. Replace distributor, and spark plug ignition wiring. Hook up spark plug wiring to respective plugs.
24. Replace alternator.
25. Install water pump with alternator adjusting bracket.
26. Install and secure fan blade.
27. Adjust alternator strap for approved fan belt tension and lock - '1/2" depression @ 10 lbs. of force)
28. Reconnect and tighten water bypass tube.
29. Reconnect upper and lower radiator hoses. Secure both with respective hose clamps. Connect transmission oil cooler lines.
30. Ensure following conditions exist:
    a. Oil pan drain installed/secure.
    b. Engine block pipe-plug installed/tightened.
31. Fill radiator, including anti-freeze, if required.
32. Fill crankcase with recommended engine oil, allowing extra half-quart if oil filter was changed.
33. Start engine, check for proper idle/operation and check for any water. oil or fuel leaks.
34. Turn engine off

TOPIC 7. FLYWHEEL AND HOUSING

A. DESCRIPTION

The flywheel is a kinetic energy device which is set in motion by the starter motor to initially turn the crankshaft. When the engine starts, the crankshaft drives the flywheel. which then employs its kinetic energy to develop torque conversion and smooth rotation required by the transmission.

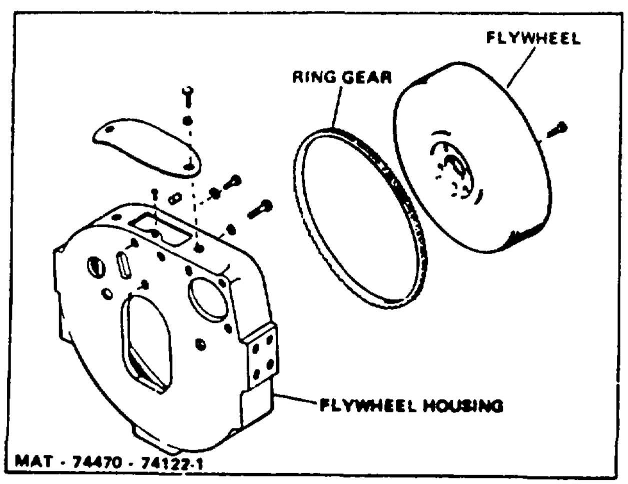


Figure 35. Flywheel, Ring Gear, and Flywheel Housing

The flywheel is bolted securely to a flange on the rear end of the crankshaft. One of the capscrew holes is offset and the flywheel can be attached to the crankshaft flange in only one position The ring gear. which meshes with the starter motor gear, Is mounted around the flywheel.

The flywheel housing is bolted to a machined surface of the crankcase, and in its upper outer edge it contains an opening through which the timing (T.D.C.) mark on the flywheel can be observed.

Even though the flywheel is machined and balanced so that the clutch face and locating counterbore run true with its axis, the flywheel or its housing seldom need replacement However, when either component part is removed, both should be checked for run-out. When run-out is not within limits specified in TOPIC 1. FITS AND TOLERANCES, the assembly should be checked to determine the cause and corrected.

B. REMOVAL

1. Flywheel

To service flywheel or flywheel housing, it is necessary to first remove transmission. Refer to proper Repair Manual Module - TRANSMISSIONS.

Remove two capscrews which are opposite each other and install guide studs.

Remove remaining capscrews and slide flywheel off over guide studs.

2. Flywheel Housing

If more than one engine is being rebuilt at a time, the housing should be identified with its original cylinder block and should be reassembled so that it is mounted on the same cylinder block in the rebuilding process.

Loosen capscrews on oil pan to relieve pressure at pan section of oil seal in flywheel housing.

Remove two capscrews opposite each other and install guide studs.

3. Ring Gear

Remove ring gear from flywheel by grinding a notch through gear at root of one of the teeth, then expand ring and drive it from its position. 0o not attempt to remove the ring gear without first expanding it.

C. INSPECTION

It is very important that all burrs and nicks be removed from surface of flywheel that fits against flange of crankshaft. If surface is not smooth and true, flywheel may wobble, which will result in improper torque converter operation and engine vibration.

To be sure that the crankshaft flange has not been sprung or otherwise damaged or that the counterbore in the flywheel, which locates it on the crankshaft, is not damaged, mount an indicator on the flywheel housing and check the flywheel for run-out (Figure 36). Maximum indicated reading must not be more than .008".

CAUTION: When checking run-out remove spark plugs to allow engine to be turned over freely.

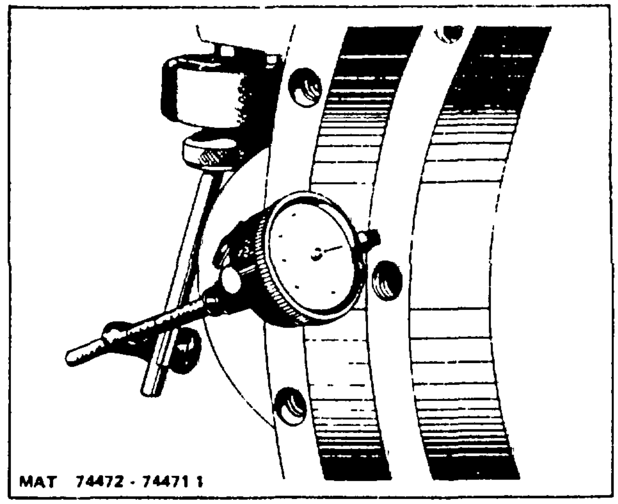


Figure 36. Checking Flywheel Run-Out

The indicator should be set up so that it contacts the clutch face or the vertical surface of the clutch counterbore. then turn the flywheel at least one full revolution at the same time holding against the crankshaft to offset the possibility of end play.

Excessive run-out of the flywheel, in either position, is probably caused by dirt In or damage to counterbore locating the flywheel on the crankshaft flange.

Relocate the indicator to check the inside diameter of the counterbore (Figure 37). Maximum indicator reading must not be more than .008".

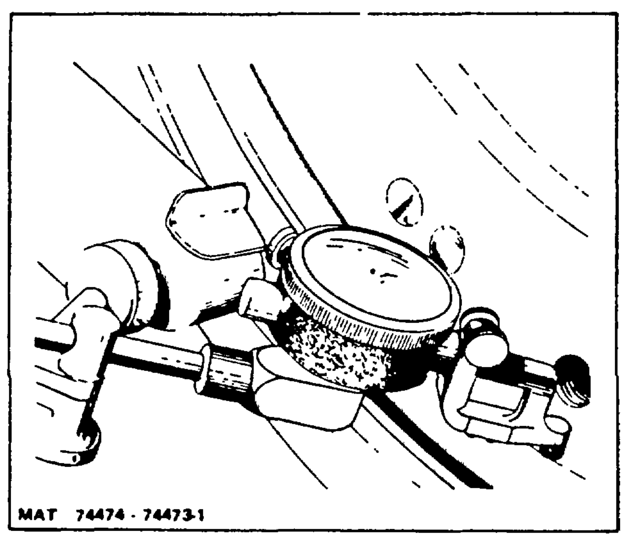


Figure 37. Checking Flywheel Counterbore

When assembled, mount the indicator on the flywheel so that it contacts the housing face and turn the crankshaft, at the same time holding against it to counteract end play (Figure 38). Maximum indicator reading must not exceed .008".

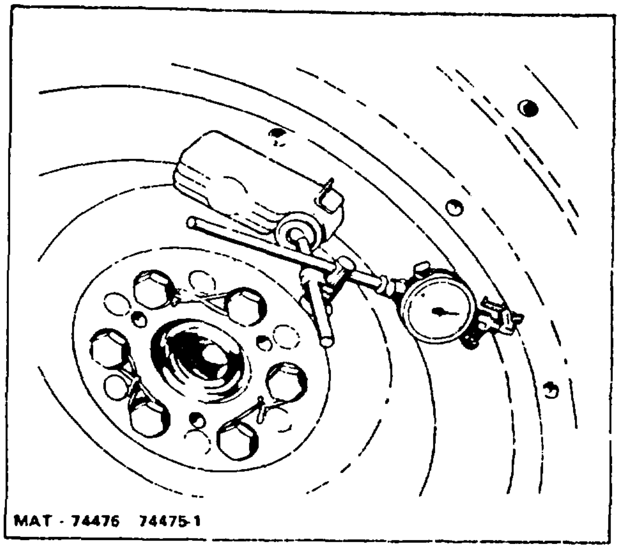


Figure 38. Checking Flywheel Housing Face

Relocate the indicator to contact the housing bore and check this in the same manner (Figure 39). The same run-out limits prevail.

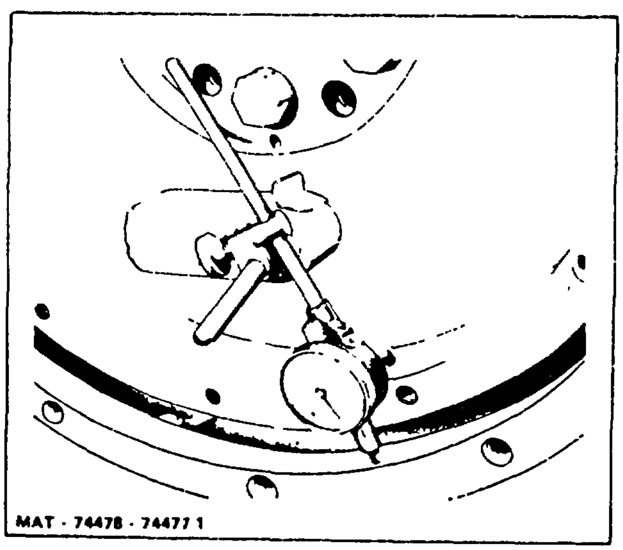


Figure 39. Checking Flywheel Housing Bore

D. INSTALLATION

1. Flywheel Housing

   Install flywheel housing by sliding housing on studs, making certain mating surfaces of flywheel housing and cylinder block are clean and smooth. Remove studs and secure mounting capscrews.

   Before installing starter motor and transmission, it is good practice to dial indicate housing and check for housing run-out. Total run-out should never exceed .008"

2. Ring Gear

   The ring gear is uniformly heated to approximately 400°F., (red heat visible in the dark) so that it can be shrunk fit on the flywheel which should be at room temperature. Do not heat ring gear to a bright red, since at that excessive temperature the heat treatment given the ring gear at the factory would be destroyed.

   After proper heating, start the ring gear on the flywheel so, when installed, the chamfered ends of the teeth engage with the drive pinion of the starter motor. Drive the ring gear down tight against the shoulder of the flywheel. Allow the ring gear to cool slowly. DO NOT cool with water.

3. Flywheel

   Prior to installing a new flywheel, check the timing marks on both the old and the new flywheels. The flywheel car be installed in only one position because of the offset capscrew hole.

   When assembled, mount the indicator on the flywheel so that it contacts the housing face, and turn the crankshaft, at the same time holding against it to counteract end play. The maximum indicator reading must not exceed .008".

   Torque as specified in Topic 1, FITS AND TOLERANCES, Paragraph D.

TOPIC 8. PISTONS AND CONNECTING RODS

A. DESCRIPTION

The pistons used are aluminum and use four rings - two compression rings, one scraper ring and one three-piece oil control ring.

The rifle drilled forged connecting rods are precision ground at the large end to receive precision type thin-wall bearing shells (Figure 40). No shims are used, since oversize bearing shells are available to provide a tight fit.

A bronze bushing is burnished and diamond bored in place in the upper end of the connecting rod.

Pistons are available in .010", .020", .030" and .040" oversizes to provide correct tolerances when cylinders are bored and honed due to wear. Piston rings are available in the same oversizes to match specific pistons.

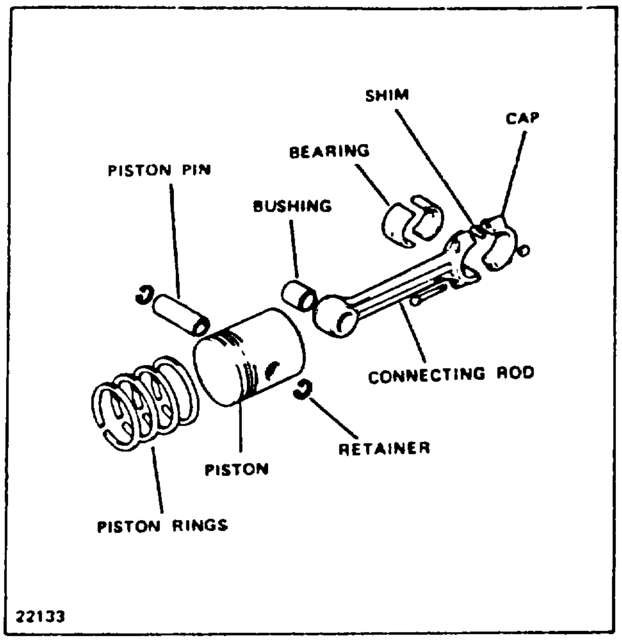


Figure 40. Piston and Connecting Rod Assembly

B. REMOVAL

Piston and connecting rod replacement is accomplished with the engine out of the truck. (Refer to TOPIC 6. CRANKSHAFT AND CRANKSHAFT COMPONENTS).

All piston and rod assemblies are removed from the top of the bore. Before removing, however, it is important that the ridge at the top edge of the bore be removed by using a Ridge Cutting tool. If the same bearings are to be reused, be sure the bearing shells are kept in order with respect to which rod they go in, which is top and which is bottom.

However, it is usually good practice to replace bearing shells with new ones. Inspect pistons for score marks or for worn, stuck or broken rings. Inspect for excessive carbon deposits on piston walls and in ring grooves. Check ring grooves for excessive wear and worn edges. Check pistons for cracks.

When fitting replacement pistons and rings, four different precision checks should always be made: check ring gap, check ring to land clearances, check pin clearance in piston boss, and check piston skirt clearance.

C. INSPECTION

1. Checking Piston Ring Gap

   Check the piston rings in the cylinders for gap. To do this, insert a piston in the cylinder bore in an inverted position and then insert each ring, one at a time, about 2" down in the bore and bring the bottom edge of the piston up against the ring to square it up in the cylinder bore (Figure 41).

   Check the gap between the ends of the ring with a feeler gauge in accordance with specifications shown in TOPIC 1. FITS AND TOLERANCES.

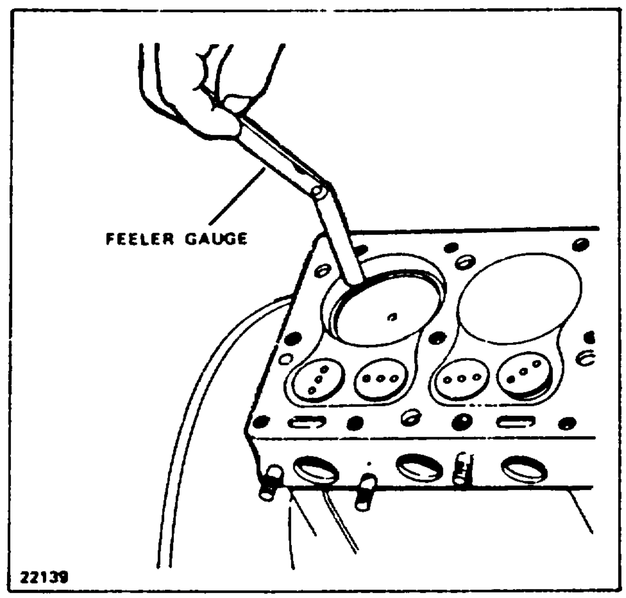


Figure 41. Checking Ring Gap (Typical)

   Those rings with gaps less than specified should be carefully dressed off with a flat cut file until the correct clearance is obtained. Fairly wide ring gaps, near the top limit, are far less detrimental to engine performance than gaps which are too tight. The two top rings require greater end gap than the lower rings because they are subjected to the most heat and the least lubrication.

2. Checking Ring-to-Land Clearance

Piston ring side clearance must always be checked when fitting rings to pistons which have been in service (Figure 42). The object of the check is to spot any pistons in which the ring grooves may have worn excessively wide. A piston in this condition must be replaced.

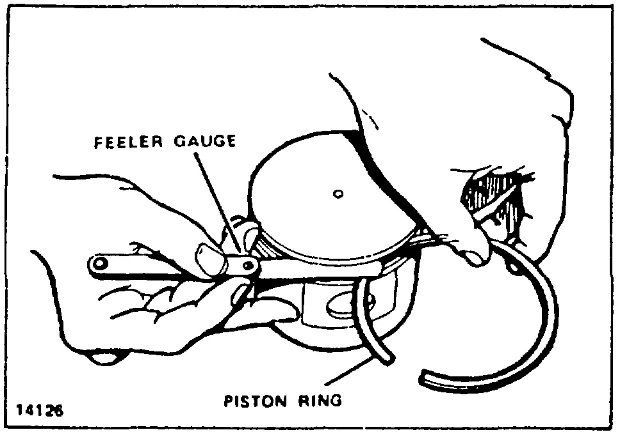


Figure 42. Checking Land-to-Ring Clearance

To check the side clearance, select a feeler gauge of the maximum clearance specified. With the ring in place, insert the feeler if possible between the ring land and the ring held well back in the groove. If the feeler slides in at any point, it indicates the clearance is at or over allowable maximum. A snug fit of the feeler suggests further consideration as to whether the piston warrants reinstallation since the groove wear may be at the top limit.

On all pistons passing the above check, make an inspection for minimum clearance with a feeler gauge of the specified minimum thickness. This feeler should slide freely all around the groove as the piston and ring are rotated.

D. CONNECTING RODS AND PISTON RINGS - REMOVAL FROM PISTON

To avoid breaking piston rings, the use of a ring remover and installer is recommended (Figure 43). Care must be taken not to overstress piston rings by spreading ends more than is necessary to remove them from piston. Before removing rings, inspect for wear and side clearance in grooves. However, removal will be necessary in order to clean carbon from grooves.

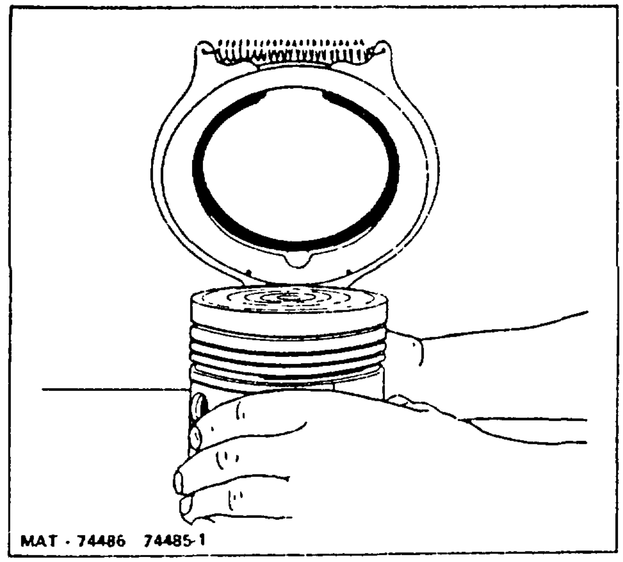


Figure 43. Removing or Installing Piston Rings

Using suitable tool remove piston pin retainer ring at each end of piston pin.

Using a driving tool, drive piston pin from piston. Use a wood block or brass drift as a driver (Figure 44). In some Instances it may not be necessary to drive piston pin from piston. Specified clearance between piston and pin at room temperature is .0002" to .0004" loose.

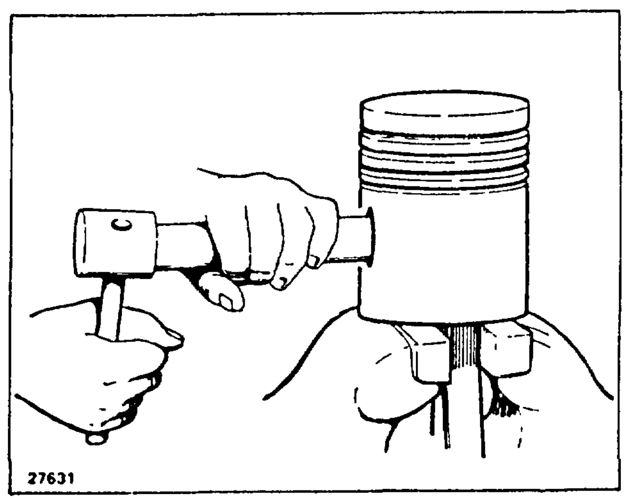


Figure 44. Removing Piston Pin from Piston

A pin that is loose enough to drop through the piston by its own weight is considered too loose. From a service standpoint, a fit of this kind, if not due to severely worn parts, will cause an engine to be somewhat noisy but will not necessarily impair performance or reduce engine life: If oversize pins are installed, do not forget to check the fit of the pin in the connecting rod bushing since the new pin will be too snug in a standard rod.

Fitting a piston pin is a precision job. Oversize pins of .005" and .010" are available, if desired. The specified pin clearance in the piston bosses will permit a "hand push" at ordinary room temperatures.

E. PISTON AND PISTON RING INSPECTION

As gummy deposits are not always easily removed with fuel from piston walls and ring grooves, these parts may be cleaned with a solvent and then blown off with dry compressed air. After cleaning, piston skirt, piston rings; and ring grooves should be thoroughly inspected.

CAUTION: Do not use solvents containing chemicals injurious to aluminum alloy.

Piston skirt should be carefully inspected for score marks or other indications of improper piston clearance. Any scored pistons should be replaced. Inspect inside of piston for cracks, any of which make it unfit for further use. Make certain that drilled holes in piston walls are open and clean.

Check piston for wear by inserting it into cylinder bore and measuring clearance between piston and cylinder wall. The cylinder walls and pistons must be perfectly clean and dry when fitting pistons in the cylinder bores. Pistons should be fitted with the block and piston at room temperature (68° - 70°F).

Check the piston fit in the bore using a half inch wide strip of feeler stock, .003" thick, attached to a small scale of approximately 15 lbs. capacity (Figure 45).

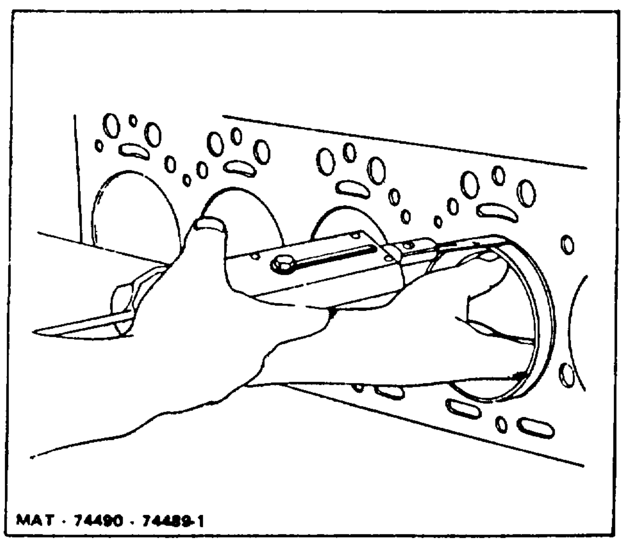


Figure 45. Checking Piston Fit in Bore

When the correct fit is obtained, the feeler may be withdrawn with a pull of 5-10 pounds on the scale, with the feeler inserted between the piston and the cylinder, midway between the piston pin bosses where the diameter of the piston is the greatest. Check the fit of the piston when it is approximately 2" down in the cylinder bore in an inverted position.

Piston skirt diameter of a new piston is 3.412 to 3.417", measured at right angles to the piston pin.

New piston rings must always be used with new pistons. If engine has been in service for some time, even though same pistons are used again, it is advisable to use new rings when the engine is re-assembled.

F. CONNECTING ROD INSPECTION

Wash connecting rod assembly in clean solvent. Measure outside diameter of piston pin to determine wear. Specified diameter of a new piston pin is .8591" to .8593". Check the bushing in the upper end of the connecting rod for wear. Specified inside diameter of connecting rod bushing is .8595" to .8597". These dimensions of pin and bushing provide a clearance of .0002" to .0006". If clearance is close to or beyond this limit, replace connecting rod bushing.

If bushing is worn, and the original pistons are to be used with a service set of rings, an oversize piston pin may be obtained in .003" or .005" oversize.

The piston pin hole in the piston and the bushing in the connecting rod may be honed to increase their diameter, and to obtain the desired fit as shown in TOPIC 1. FITS AND TOLERANCES.

NOTE: While the chart specifies a light push fit of the pin in the piston, there is a definite clearance of the piston pin in the connecting rod.

Replace the bushing in the connecting rod if new pistons and sleeves are used. Using an arbor press (Figure 46) press out the old bushing and press in the new one - after which the bushing must be honed to obtain tie correct fit of the pin in the bushing as shown in TOPIC 1. FITS AND TOLERANCES.

If there is an excess of stock In the piston pin bushing, it may be reamed first, then honed. In any event, the final operation should be done with a hone to obtain the desired fit with better than 75% bearing area on the pin.

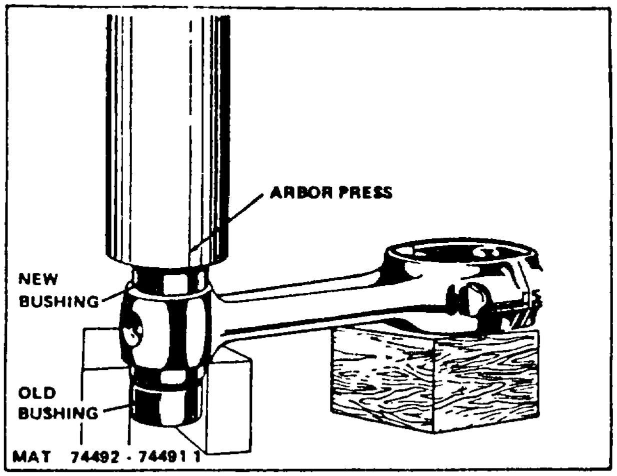


Figure 46. Pressing in Piston Pin Bushing

Inspect connecting rod bearing shells for scoring, chipping, corrosion, cracking, or signs of over-heating; discard bearing shells if any of these conditions are apparent. Back of bearing shells should be inspected for bright spots and discarded if any are found, as this condition indicates they have been moving in their supports.

Inspect bearing shells for wear. Specified inside diameter of bearing shells when installed with bearing cap retaining bolts tightened to specified torque is 2.5675" to 2.5622". This provides a running clearance of .0007" to .0028", new bearing shells must be installed when this clearance exceeds .0028". Refer to TOPIC 6, paragraph D. BEARING INSPECTION AND INSTALLATION, and measure the connecting rod bearings for wear and clearance with the crankshaft in a similar manner. If crankshaft is worn or damaged and must be reground, bearing shells of .002", .010", .020" and .040" undersize, are available.

G. PISTON AND ROD ALIGNMENT

The piston pin hole in the connecting rod must be parallel to, and in plane with, the large bore in the bearing end of the connecting rod.

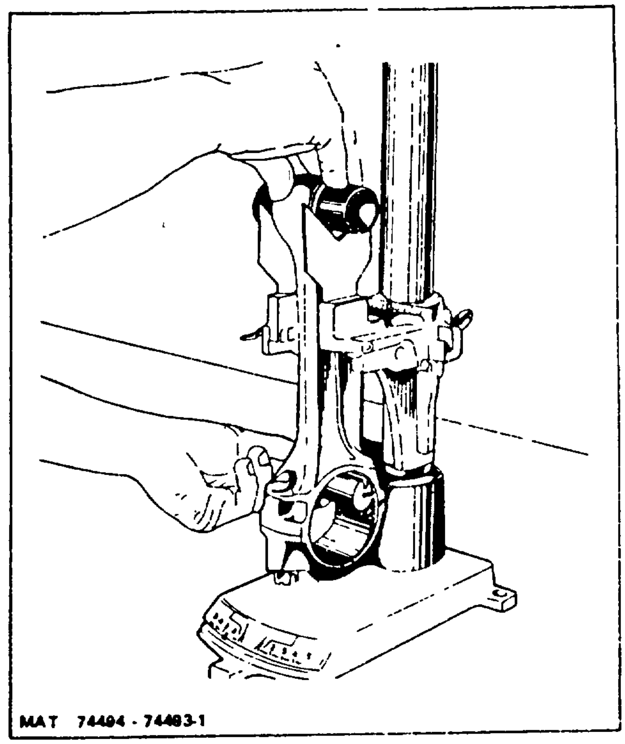


Figure 47. Checking Connecting Rod for Twist and Alignment

Alignment may be checked on a fixture with the piston pin assembled in the rod before assembling the piston (Figure 47). The connecting rod may be found twisted or bent out of alignment due to wear on the rod bushings or bearings. In this case, the rod may be carefully straightened with a bending bar.

Assemble the pistons on the connecting rod by first heating them in some form of oven or in hot water to a minimum temperature of 160°F. When heated, the piston pin enters the piston very easily, and can be tapped through the connecting rod and into place without distorting the piston.

For each piston, first install one of the piston pin retainer rings, next heat the piston, and then insert the piston pin and install the other retainer ring.

Pistons are cam and taper ground, and this must be taken into consideration when checking alignment of the assembly, since the diameter in line with the piston pin would be less at the top of the skirt than at the bottom.

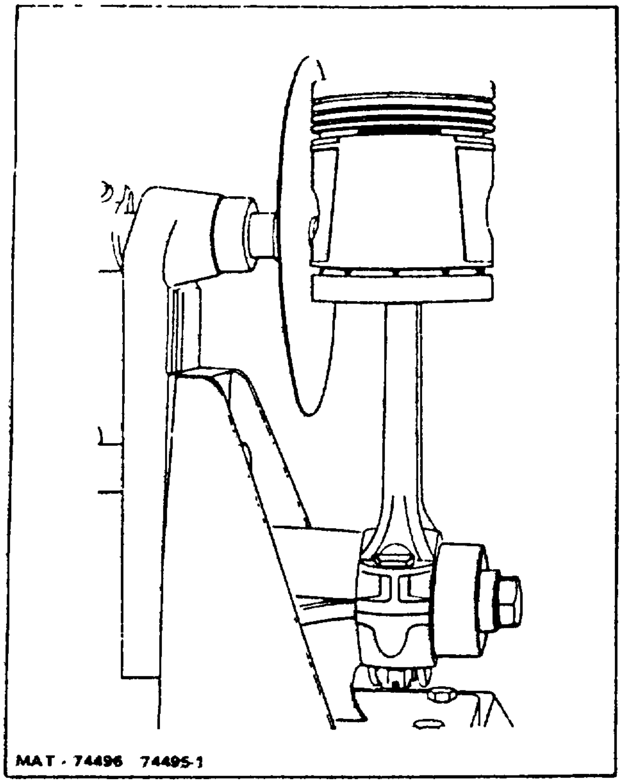


Figure 48. Checking Connecting Rod Assembly for Alignment

NOTE: Ring lands at top of piston are smaller than skirt; therefore, check alignment of rod along full length of skirt only.

Regardless of the preliminary check made on the connecting rod, the completed piston and rod assembly (Figure 48) must he rechecked and there must not be more than .002" twist or out of squareness checked over a spread of approximately 4 inches. The connecting rod can be bent or twisted with a bending bar to meet this specification.

The snap rings must be assembled in the grooves, making sure they are fully seated in place.

H. FITTING PISTON RINGS

Check gap between ends of piston rings before rings are installed on piston. Select rings to be installed on each piston and insert them one at a time into cylinder bore in which they are to operate. Use a piston to push ring squarely into cylinder bore so that it is parallel with top of cylinder block (Figure 41).

Check the ring side clearance with a feeler (Figure 42) at various positions, in accordance with the tolerances shown in TOPIC 1. FITS AND TOLERANCES.

Measure ring-to-groove clearance (top of ring to top of groove in piston). Specified clearances are as follows: top ring - 002" to .004". compression rings - .0025" to .0041(" and oil control ring - .25" to .0075".

After rings have been properly fitted, install them on piston, using a piston ring remover and installer. Take care not to spread rings more than necessary. Stagger ring gaps evenly around piston so that no two are in line.

Grip the connecting rod in a vise with lead lined jaws to hold the piston firmly and roll each of the straight side rings in its groove to be sure there are no burrs or other interference with the free action of the ring in the groove.

The 3-piece oil ring (Figure 49) should be installed first on the piston, from the top side so that the piston skirt will not be scratched.

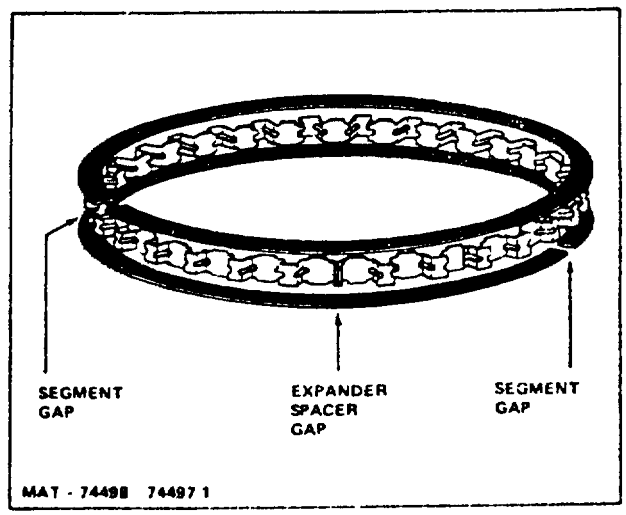


Figure 49. Three-Piece Oil Ring

Install oil control ring as follows:

1. Place stainless steel expander spacer of three piece ring in oil groove with ends butted.
2. Install steel segment on top of expander spacer with gap of segment approximately 90° beyond gap of stainless steel expander, making certain expander remains butted.
3. Install second segment on bottom side of expander spacer with segment gap approximately 90° from expander spacer gap in opposite direction from which top segment has been positioned.
4. Recheck installation - oil control ring should be free to move in the groove: however, a slight drag will be noticed due to side sealing action of steel segments. Make sure expander spacer remains butted.

5. Pin milled application - install gap o expander spacer 90° from pin, with hump of expander over pin and ends butted. Install top segment, then bottom segment with gaps of segments over pin.

To install the balance of the rings, use a ring tool with recess side up and place the ring in with the bottom side up. Start with the lowest ring first.

Some piston rings are taper faced. These are clearly marked "TOP" on the side to be up when assembled on piston (Figure 50).

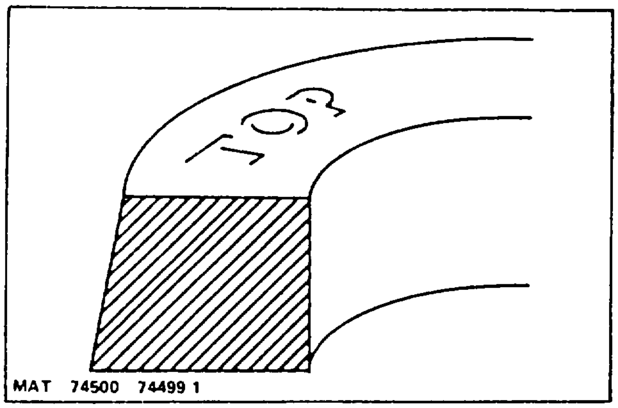


Figure 50. Install Tapered Rings with "Top" Side Up

Position ring in the tool so the expanding fingers will fully engage both ends.

Apply pressure on handles so ring is completely expanded. Pass the expanded ring and tool recessed side down over the piston to the proper groove.

CAUTION: If piston is equipped with a steel groove insert, this insert must be installed on top of the number one ring. (The steel groove insert is not part of the re-ring kit, and can be re-used when replacing rings.)

I. INSTALLATION

Oil all rings and pistons before installing them in the cylinder bore.

Replace pistons in the same manner as they are removed, through the top of the cylinder bore. Care should be taken to keep the piston rings properly seated and staggered during insertion.

Secure connecting rod to crankshaft, replace rod bearing cap and capscrews and torque to 40-45 lb.ft.

NOTE: Ensure that pistons, connecting rods and rod caps ate all replaced in their respective cylinder locations as removed.

When pistons are ready for installation in the cylinders, compress rings carefully using a good ring compressor. A light tap on the head of the piston will allow the assembly to go into the cylinder very easily. If any difficulty in tapping piston and ring assembly into the cylinder is encountered, the compressor should be removed and rings checked for correct installation in the groove.

Measure the running clearance between piston and cylinder bore as described in preceding paragraph E. Piston and Piston Ring Inspection. The clearance is critical and should be accurate. Pistons are available for redimensioned cylinder bores in .020", .030", .040" and .060" oversizes.

Hold the feeler stock along the side of the cylinder bore (Figure 45) then with rod connected to the piston, insert the piston into the cylinder bore in running position. With the correct clearance between the piston and cylinder bore, the .003" feeler gauge can be withdrawn with a slight pull. The pull should not exceed 5 to 10 pounds. Test the clearance at the end of the piston pin and at points 90° from the ends of the pin. Too low or too high a scale reading indicates too much or too little clearance.

When fitting a piston to a new or accurately resized bore, the bore inner diameter should be the same at top and bottom. Therefore, the clearance may be taken at either end. In bores that have been worn, but not resized, some taper giving extra clearance at the top of the bore is likely. In such cases, the clearance must be checked at the bottom of the bore where the wear Is least and the fit is closest.

NOTE. Although the connecting rod bearing side clearance is less critical than the bearing running clearances, no bearing should be assembled without checking the side clearance.

Check the side play of the rods by forcing the connecting rod fully to one side or the other. Insert a feeler gauge between the crankshaft and bearing edge. The desired side play is from .0100" to .006". If the clearance is excessive, the rod must be replaced. If there is no side play, the piston and connecting rod must be removed and checked to determine cause of binding.

Reinstall oil pan gasket and oil pan. (Refer to TOPIC 15. OIL PAN.)

Reinstall engine. (Refer to TOPIC 17. ENGINE REMOVAL/INSTALLATION.)

TOPIC 9. CAMSHAFT (CAMSHAFT BEARINGS AND VALVE TAPPETS)

A. REMOVAL

1. Refer to TOPIC 17, ENGINE REMOVAL/INSTALLATION for camshaft access.
   Remove camshaft gear nut.
2. Using a duller, remove the cam and crank gears (Figure 51).

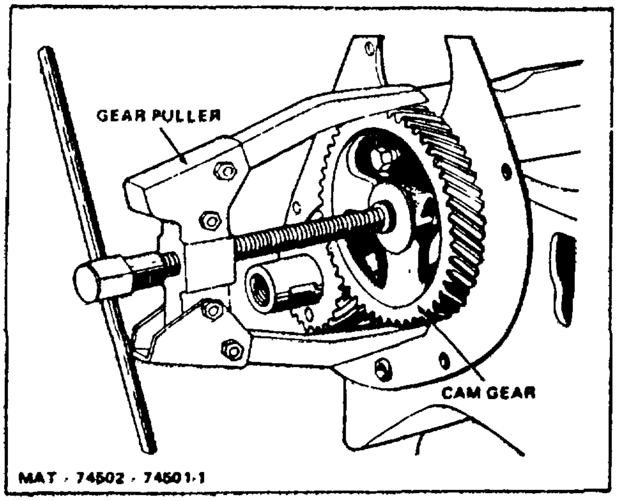


Figure 51. Removing Cam Gear with Puller

3. Remove the screws holding the camshaft thrust plate to the front of the cylinder block, which makes it possible to pull the camshaft forward out of the bearings,
4. Unless engine is lying on its side, tappets must be removed or lifted before camshaft can be pulled.
5. Remove tappet chamber cover.
6. Tappets can then be lifted out and lined up in sequence, for installation in the same location unless inspection shows that they require replacement. Refer to TOPIC 4. VALVES - INTAKE AND EXHAUST.
7. Before pulling the camshaft completely, check the clearance of the bearing journals in the bushing (or block in some models). To do this use strips of feeler stock .25" wide with edges dressed with a stone to eliminate any burrs or feathered edges.
8. If clearance is equal to or greater than the wear limits specified in TOPIC 1. FITS AND TOLERANCES, check the diameter of the camshaft journals to determine the next step. Excess wear at these positions require replacement of the shaft.
9. If wear is found to be in the bushings instead, these must be replaced using precision service bushings, available for that purpose, which require no reaming, only care in assembly, to line up oil holes, and not damage the bushings as they are being pressed in.

CAUTION: When installing camshaft use special care to prevent camshaft bumping, and loosening expansion plug which cause an oil leak.

B. INSPECTION

1. Checking Camshaft End Play

   Camshaft end play is controlled by the thrust plate. The actual distance which the shaft may move forward or rearward depends upon the distance between the rear face of the gear and the front face of the cam journal, minus the thickness of the thrust plate. Thus, when a condition of excessive camshaft end clearance is found, it may be corrected by reducing the distance between the Journal and the gear, or by installing a new thrust plate to replace the one which has been worn too thin. If both the thrust plate and the thrust surfaces of the gear and journal are worn, it will be necessary to machine a small amount from the shoulder against which the rear face of the gear hub seats.

   Remove enough so that a .005" to .009" feeler gauge may be fitted between the front of the journal and the rear of the thrust plate when the gear is assembled (Figure 52). If a condition of insufficient end play is found, use one or two thin shims between the shoulder and the gear.

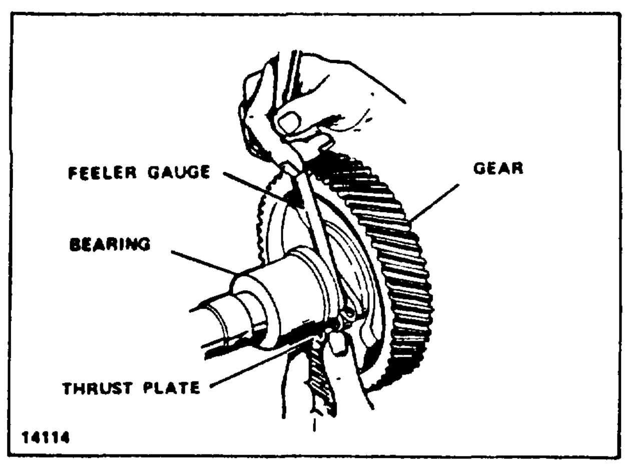


Figure 52. Checking Camshaft Thrust Clearance

2. Camshaft Bushings

Camshaft bushings are a thin wall, steel back, babbit lined type with a split line which must close together when the bushing is pressed in the crankcase. For proper installation it is necessary to have suitable driving tools with an arbor and shoulder of the correct diameter to drive the bushing into place true and straight without battering or buckling. The press fit is approximately .005". It should be noted that a chamfer is provided on one edge of the bushing to aid in starting the installation. It is very Important to locate the bushing in the case so the oil passage holes align with the holes in the crankcase.

The bushings must be finish reamed after installation to provide finished inside diameters as follows:

Front	2 0000-1.9995
Front Intermediate	1.8125 1.8115
Rear Intermediate	1.7502-1.7495
Rear	1.2505-1.2495

To ensure satisfactory alignment, the reaming should be done with a piloted tool which maintains the same center through the crankcase.

C. INSTALLATION

Carefully slide camshaft into block, making sure that cam gear is in correct timing with crank gear. Replace valve tappets in their respective locations. Ensure camshaft is properly supported by cam bearings and secure with thrust plate and capscrews. Tighten to recommended torque.

Release valve and spring restraining tape or wire and be sure that normal cam lobe displacement of component parts is restored.

Replace side cover plate and secure. Install oil pump, distributor drive, oil pan and oil pan capscrews. (Refer to respective Installation sections if necessary.)

Replace manifold and carburetor, if removed. (Refer to TOPIC 3. MANIFOLD.)

See ENGINE REMOVAL AND INSTALLATION for installation instruction.)

TOPIC 10. GEAR TRAIN

A. DESCRIPTION

The gear train (Figure 53) consists of the crankshaft gear, camshaft gear, and the governor gear. The crankshaft gear drives the camshaft gear, which, in turn, drives the governor gear.

Correct timing sequence of the gear train is critical to proper engine operation; it is accomplished by meshing the camshaft drive gear and governor drive gear timing marks, with their respective timing marks on the crankshaft timing gear.

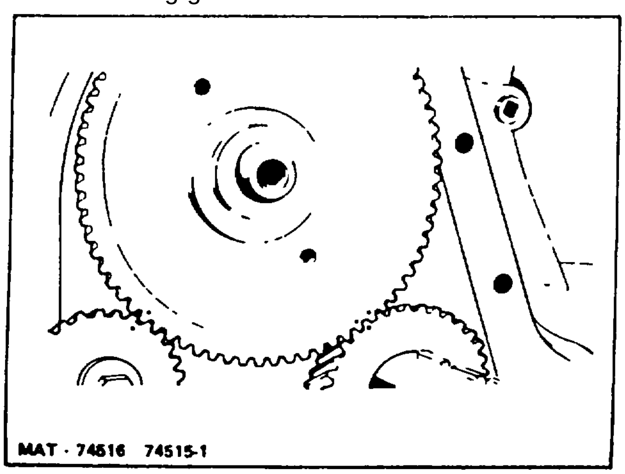


Figure 53. Gear Train

B. REMOVAL

Refer to respective sections for crankshaft, camshaft and governor removal and installation. Also see TOPIC 17. ENGINE REMOVAL/ INSTALLATION.

The crankshaft, camshaft and governor gears should be thoroughly cleaned and Inspected for cracked or chipped teeth before reassembly. It is generally desirable to replace all the gears when one or more are worn badly enough to require replacement; however, ,such drive train replacement is not recommended as a field procedure because of the need for selecting gears with the proper running clearance.

Replacement crankshaft and camshaft gears are furnished in standard size, under size, and over size. Gears marked "S" are standard; if they are marked "U" with the number 1, 2, or 3, it signifies .001", .002", or .003" under size. Similarly, oversize gears are marked "0" with the number 1, 2, or 3.

NOTE: A standard crankshaft gear with a .002" oversize cam gear on the engine, could be replaced with a .001" crank gear and a .001" oversize cam gear, or any other combination that gives a .002" oversize dimension.

C. INSPECTION

Timing gears and timing gear fits must be checked carefully. To check the fit, use a screw driver to force the mating teeth as far apart as possible and check this clearance with a feeler gauge (Figure 54). If this clearance is .002" or greater, or if the gear teeth are badly scuffed and worn, the gear must be replaced. Timing gears must be replaced in pairs.

Gears fitted with excessive backlash usually chatter at idling speeds while gears too tightly fitted will howl or whine. It is better for gears to be slightly loose than to ride hard.

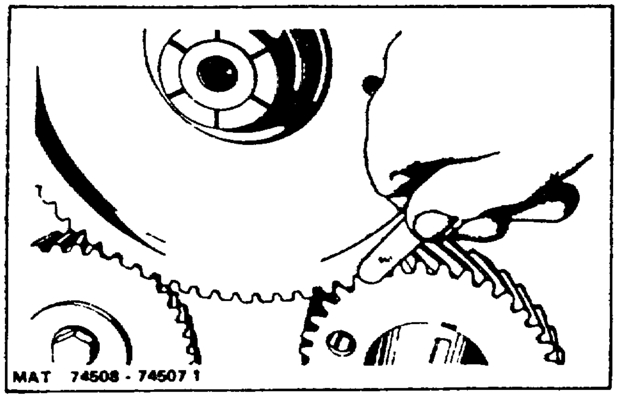


Figure 54. Checking Timing Gear Backlash

Gears marked same as the original as far as sizes are concerned should be used as replacements.

Carefully examine the camshaft thrust plate (Figure 55) for scoring and wear and if-any indication of either shows, a new thrust plate should be assembled without question.

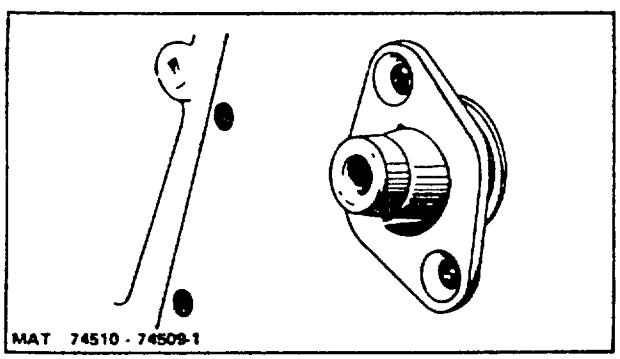


Figure 55. Camshaft Thrust Plate

D. INSTALLATION

1. Refer to sections covering crankshaft, camshaft, governor and engine removal and installation.
2. Assemble the cam gear to the camshaft by driving or pressing it on, at the same time holding the camshaft forward with a suitable bar through the fuel pump opening in the block so there is no possibility of the camshaft bumping the expansion plug at the rear end and forcing it out of position, thus causing an oil leak.
3. Install the cam gear nut (Figure 56). Torque 175-180 lb.ft.

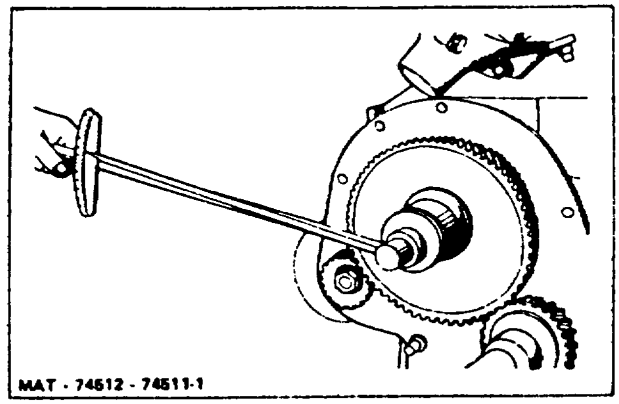


Figure 56. Torquing Cam Gear Nut

4. Check camshaft end play as shown in Figure 57. Refer to TOPIC 1. FITS AND TOLERANCES section for the correct dimension.

CAUTION: NEVER USE THE CAMSHAFT NUT TO PULL THE GEAR ONTO THE CAMSHAFT. This will damage threads of the steel camshaft.

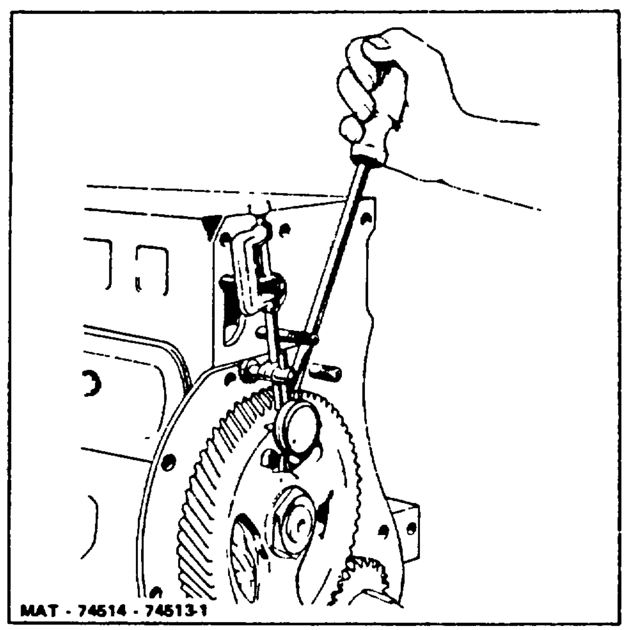


Figure 57. Checking Camshaft End Play

5. Inspect crankshaft thrust washers for wear and scoring. Replace if necessary before reassembling gear.
6. If the crankshaft gear requires replacement then a suitable puller will be necessary as this gear is shrink fitted on the shaft.
7. Use a driving sleeve to tap the gear snugly into place. Hard driving is not necessary and indicates that the gear is cocked on the shaft.
8. Drive the crank gear on the shaft making sure that the marked teeth on the cam gear straddle the marked tooth on the crank gear (Figure 58) which assures that the crankshaft and camshaft are in time.

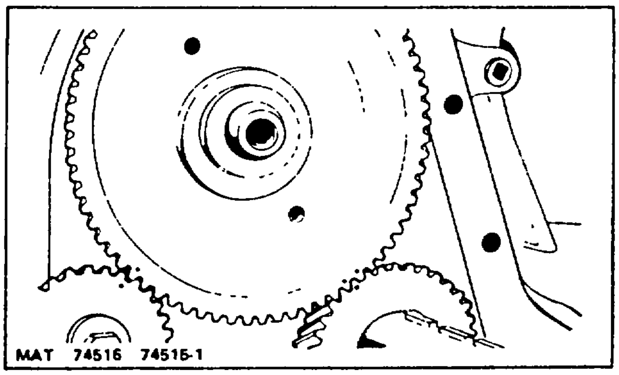


Figure 58. Timing Gears Assembled According to Timing Marks

9. To be certain that there is enough clearance, hold finger at the junction of the two gears and, with a light hammer, tap the rim of the cam gear and note if there is vibration felt at this point (Figure 59).
10. If there Is vibration and a .0015" feeler gauge will not enter the gap between the two gear teeth, the gear fit is within specifications.

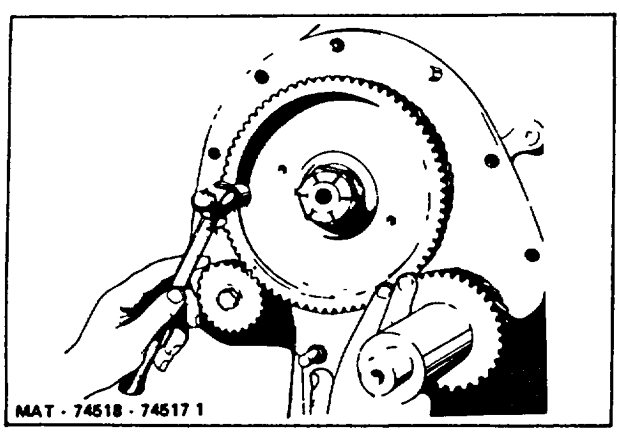


Figure 59. Checking Gear Fit

11. Check the crankshaft end play before replacing the gear cover.
12. At all times when checking end play, the crank gear must be tightened firmly against the shim pack. This can be done with a sleeve, or with the crank pulley, slipping it over the crankshaft and using the standard assembly parts to tighten pulley and gear in place.
13. Crankshaft thrust is controlled by flanged center bearings (Figure 60) which require no shims. If end play exceeds .006" (using a feeler gauge) replace the flanged bearings. End play should be between the .002" and .006" limits.

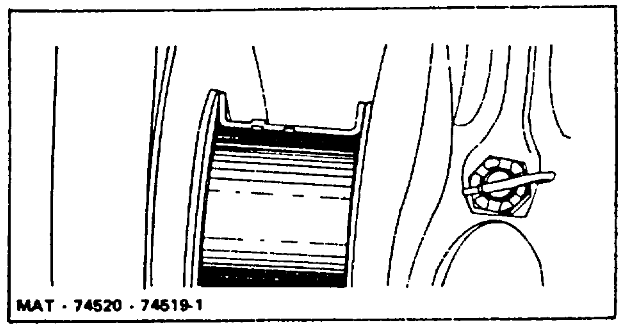


Figure 60. Flanged Bearing Controls Crankshaft End Play.

14. When installing the timing gear cover, the seal should be replaced. Always replace the gasket between the cover and the engine.
15. Bolt the cover loosely to the engine block and then install the crankshaft pulley. This procedure is recommended in order to eliminate off center rotation between the oil seal and the crankshaft pulley. After this Is done, tighten all of the gear cover bolts.

TOPIC 11. CYLINDER BLOCK

A. DESCRIPTION

The cylinder block and crankcase (Figure 61) are cast as a single unit. Bearing crosswalls and water baffles are generously filleted, and the honed cylinder bores are exposed to the coolant for their entire length. Intake and exhaust ports are arranged along the upper left side of the cylinder block. Directly below is the valve and tappet chamber covered with a cover plate. The lower left side of the crankcase is ribbed lengthwise to incorporate a rifle drilled oil passage. A spring loaded oil pressure relief valve is mounted just below the center of this oil passage to provide a means of adjusting the oil pressure. Towards the front is an oil outlet providing lubrication for the governor.

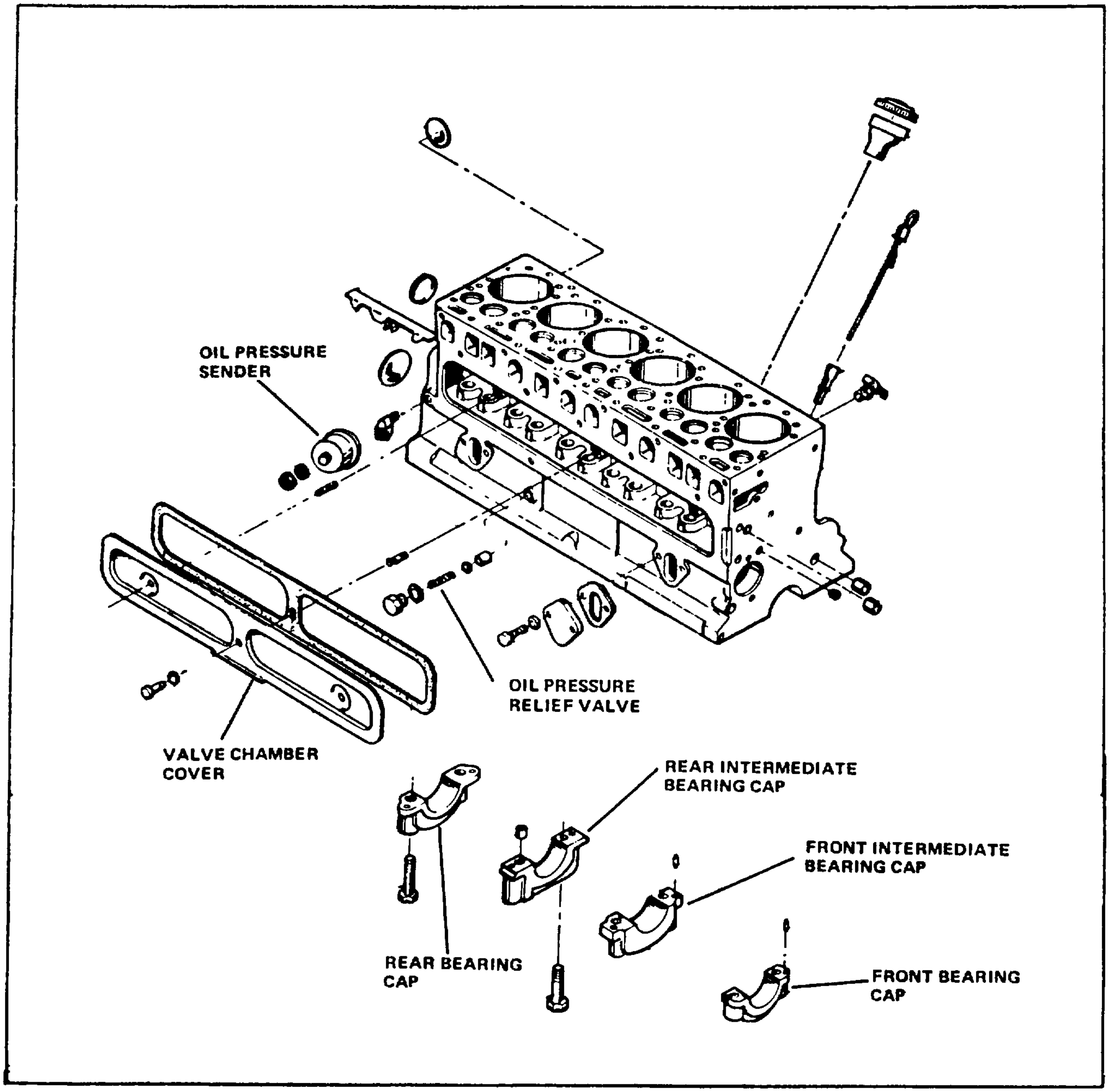


Figure 61. Cylinder Block Components

The rear face of the crankcase provides an accurately machined surface for mounting the flywheel housing. A semi-circular groove in the rear face of the crankcase around the rear main bearing receives a semi-circular oil guard, and a filler block which is held in place by two machine screws. Oil guard and filler block contain a pressed-in oil seal to prevent the entrance of foreign material around the main bearing.

The camshaft extends the length of the left side of the crankcase and runs in three pressed-in bushings which are drilled for pressure lubrication from drilled passages in the crankcase.

The three main bearing locations are machined to receive thin-wall precision type bearings. No shims are used between the case and the bearing cap. The center main bearing is flanged on both sides to absorb crankshaft end thrust and to locate the crankshaft lengthwise. The three main bearing caps are doweled on both sides to provide for an accurate and rigid alignment. The upper and lower halves of the precision type bearing shells are alike and are located by small tabs which fit recesses in the case. The front and center bearings have a single groove in each shell which extends out a short distance from the oil hole and blends into the bearing contour. The rear bearing has two holes connected by an oil channel.

If the same connecting rod bearings are to be re-used, be sure the bearing shells are kept in order with respect to which connecting rod they go in, which is top and which is bottom. However, re-use of bearing shells is not recommended.

B. REMOVAL

Refer to ENGINE REMOVAL AND INSTALLATION.

Refer to relevant sections for removal/ installation instructions.

C. INSPECTION'

Important points on cleaning and inspection to be observed are as follows:

1. Clean oil pan thoroughly. Remove oil gallery plug and clean all passages with solvent and compressed air. Clean valve compartment thoroughly. Clean crankshaft oil passages.
2. Carefully inspect the condition of the crankshaft journals and crank pins. These surfaces must not be scored or burred and should be checked with a micrometer against specifications as tabulated in TOPIC 1. FITS AND TOLERANCES.
3. Clean pistons of all carbon, being particularly careful to see that the ring grooves are clean and oil drain holes in oil ring groove are clean of all carbon. Inspect pistons for any cracks in head or in piston pin bosses.
4. Clean oil passage in each connecting rod and check each piston and rod assembly for correct alignment..
5. Clean valve guides and valves to remove head and stem deposits. Check fit of valves in guides and tension of valve springs.
6. Check that valve tappets are free fit in block without perceptible side play or shake. Inspect for rough or grooved faces, and be sure heads of adjusting screws are smooth.
7. Check general condition of camshaft. Journals should not be scored or burred. Cams should be smooth and free from burrs or grooving.
8. Inspect crankcase for cracks, especially in the exhaust valve area.
9. Clean the ring of carbon from around the top of the cylinder bore formed above the travel of the top ring.
10. Determine the original diameter of the cylinder barrel by checking this unworn area with a pair of inside micrometers at intervals of approximately 45°.

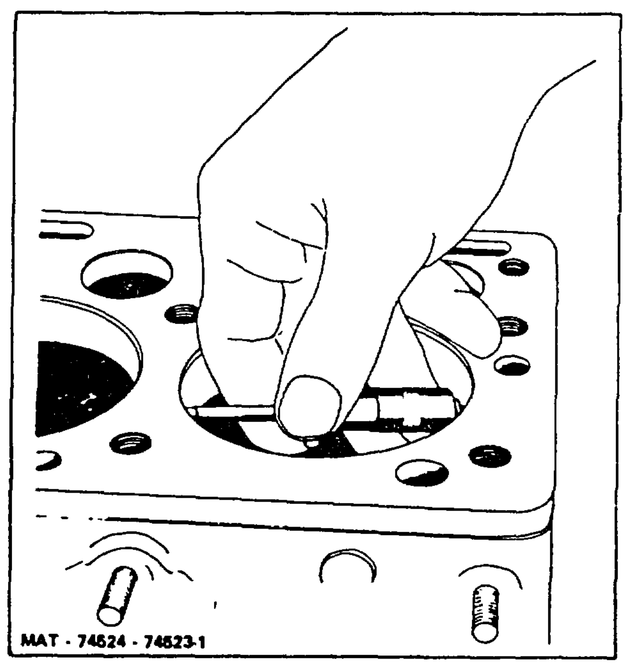


Figure 62. Measuring Original Bore Diameter Above Ring Travel.

11. Check in same manner the top of the ring travel area, approximately 1/4" below the shoulder.
12. The maximum difference in checks 10 and 11 indicates the amount of cylinder bore wear. If this difference Is less than .008", re-ringing will be suitable, and if over .008" re-boring is recommended.

D. PREPARING CYLINDER WALLS FOR RE-RINGING OR RE-BORING.

1. Ridge ream the cylinders to remove the unworn area at the top so that new rings, when assembled, will not bump and distort both themselves and the piston lands (Figure 63).

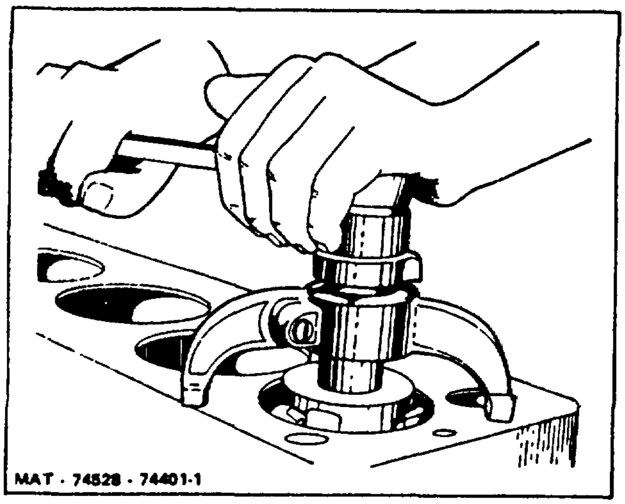


Figure 63. Ridge Reaming Top of Cylinder Bore.

Several good makes of ridge reamers are available which will ream the top of the bore in direct relation to the worn area so that should the worn area be off center slightly there will be no partial ridge remaining.

2. When re-boring the cylinders allow .002" for finishing by honing.
3. To get the correct cross hatch pattern (Figure 64) with a cylinder hone, use a top quality electric drill with a speed of 500 RPM or less.

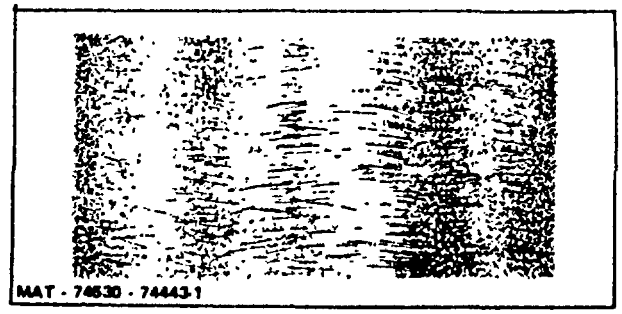


Figure 64. Desirable Cross Hatch Pattern After Cylinder Hone.

E. GLAZE BREAKING OPERATION

It is important to remove the glaze on the cylinder bores by using a cylinder hone which has an adjustable stone tension (Figure 65). Glaze breaking assures quick seating of new piston rings. If the cylinder glaze is not removed, there will be no assurance as to when the rings will begin to function properly and control the oil; this is especially true when chrome rings are used.

The following step by step procedure is recommended:

1. When the crankshaft has not been removed, cover the entire crankshaft with a clean, slightly oily cloth to prevent abrasives and dirt from getting on the crankshaft.

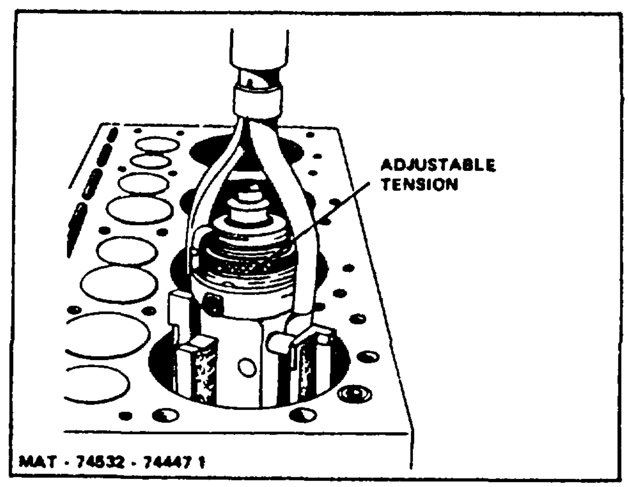


Figure 65. Honing Cylinders

2. Remove the excess carbon deposits from the top of the cylinder wall before beginning the glaze breaking operation. This prevents loading the stones.
3. Insert hone in cylinder and expand to cylinder wall with slight tension. Using a clean brush, wet cylinder wall and stones with kerosene. Use a hand drill and surface hone cylinder with a rapid up and down motion to produce a good cross hatch pattern (Figure 64). Apply kerosene occasionally as needed and increase tension on hone adjustment until a good pattern and finish are obtained. A smooth finish of 10 to 15 micro inches is desired.
4. Clean the loose abrasives from the stones by using kerosene and a wire brush.

NOTE: Stones must be used wet. Keep applying kerosene during honing to prevent stones from drying out and causing an incorrect honing pattern.

5. The most desirable cylinder finish is 10-15 micro inches; with this finish the depressions in the surface tend to keep the supply of lubrication between the mating parts. This finish can be obtained by using 280 grit stones on the hone.
6. Clean all bores thoroughly with a clean oiled rag to pick up all the small particles of dust that may be embedded in the walls. Follow this with a clean cloth to make certain the walls are CLEAN.

F. PREVENTIVE MEASURES

When cylinders and pistons are scored or worn excessively, the following most common causes should be considered, in order to eliminate those conditions during future operation of the engine.

1. Stuck Piston Rings:

   Use a less severe combination of piston rings and allow sufficient piston ring end gap.

2. Gum or Varnish Deposits:

   Use heavy duty lubricating oil, change the oil more often or reduce the oil temperature.

3. Piston Skirt Clearance Inadequate:

   When fitting new pistons, follow the recommendations listed in TOPIC 1. FITS AND TOLERANCES.

4. Insufficient Cooling:

   Thoroughly clean the cooling system, check the thermostat and water pump. Make sure hoses have not collapsed.

5. Dirt Entering Intake Manifold:

   Adopt improved air cleaner servicing procedures. Make sure the air cleaner connections are tight.

6. Carbon Deposits on Ring Lands:

   Use a severe combination of piston rings.

G. INSTALLATION

(Refer to TOPIC 17. ENGINE REMOVAL/ INSTALLATION.)

TOPIC 12. OIL PUMP

A. DESCRIPTION

The lubricating oil pump (Figure 66) is a positive, gear type assembly. It consists of a single cast pump housing and mounting extension with a precision cavity to receive the driver and idler gears. The driver gear is mounted at the end of the pump shaft, and the idler gear is mounted on a stud which is pressed in place in the pump body.

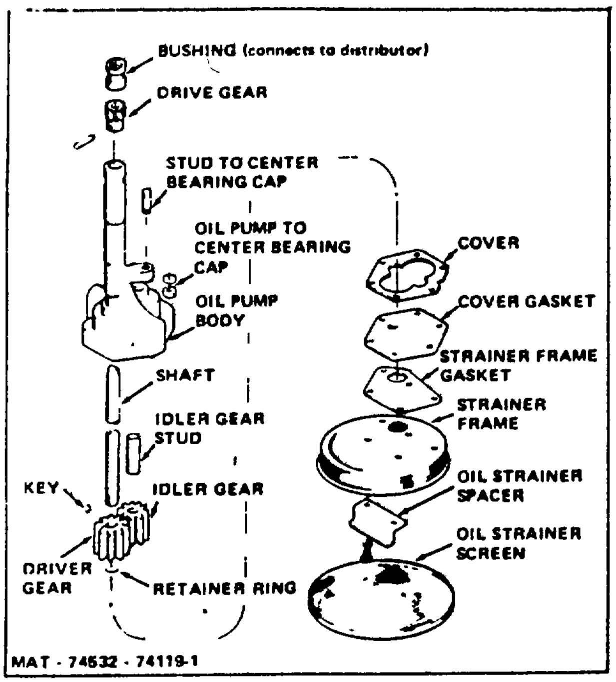


Figure 66. Oil Pump, Exploded View

The oil pump is assembled to the center main bearing cap held in position vertically against a machined pad by studs.

The extended portion of the pump body acts as a pilot, fitting closely in a reamed hole in the main bearing web, maintaining definite relationship between the camshaft and the oil pump drive shaft.

A gear assembled to the upper end of the drive shaft is driven by a mating gear cut on the camshaft. The mating gear drives the oil pump gear which is assembled to the lower end of the pump shaft.

The pump shaft is carried in two bronze bushings assembled in the cast iron housing, which is also a part of the oil distributing system, transmitting oil to the drilled passages.

B. REMOVAL

1. Refer to TOPIC 17. ENGINE REMOVAL/INSTALLATION.
2. Drain oil pan, and remove the capscrews securing the oil pan. Remove the oil pan and its gasket.
3. With the engine resting on its side, remove nut and washer holding the oil pump assembly to the center main bearing cap. Remove the oil pump assembly (Figure 67).

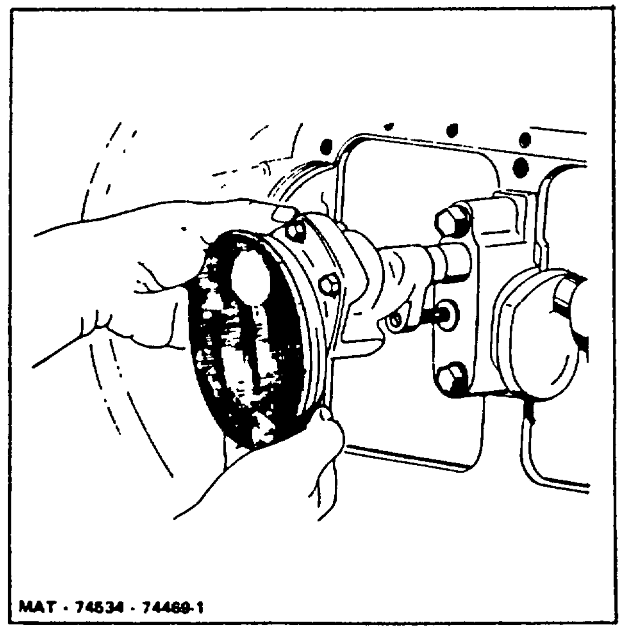


Figure 67. Oil Pump Removal

C. DISASSEMBLY

1. Remove oil pump cover and gasket.
2. Support spiral gear at the upper end of pump on a wood block and drive out retaining pin with a drift. Press shaft out of spiral gear and remove shaft and drive gear from pump body.
3. Remove retainer ring from drive gear end of shaft and place shaft on suitable support in an arbor press. Remove gear from shaft, then remove the screws and lockwashers from mounting baffle on pump body and remove baffle and gasket. Remove oil screen from pump body.
4. Clean all parts in an acceptable solvent and dry with compressed air.

D. INSPECTION

1. When the pump is removed, examine the drive gear carefully for wear, inspecting the gear on the camshaft at the same time. If scored or worn badly, both the camshaft and the gear on the pump must be replaced.
2. Examine the pick-up screen for clogging or damage.
3. Remove the cover, being careful not to damage the lead gasket which acts as a spacer as well as a gasket to seal the joint.
4. Examine the gears and pump body for any sign of wear indicating lack of clearance. The gears should have from .001" to .003" clearance in the chamber and should make no contact with the walls (Figure 68).

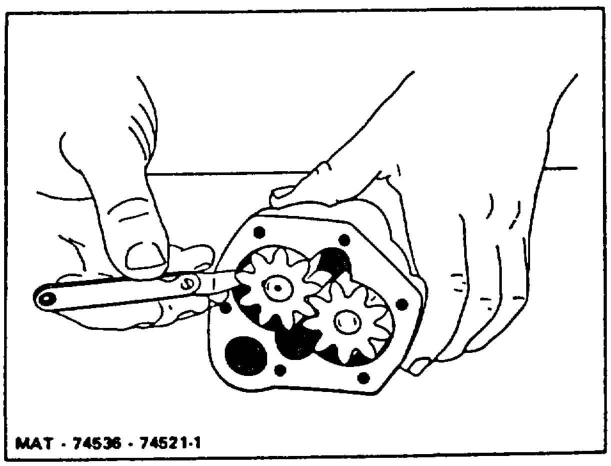


Figure 68. Checking Oil Pump Gear Clearance in Pump Body

5. Inspect the cover and face of the gears for excessive wear or scoring. With the gasket assembled to the body there should be .0015" to .006" clearance between the gears and the cover (Figure 69).
6. Worn or scored gears can be replaced, as can a worn cover. If the body shows wear in the chamber, it can be replaced; but, in a case like this, a new pump would be the most economical.
7. Engine oil pressure must be maintained to specification for satisfactory engine life.

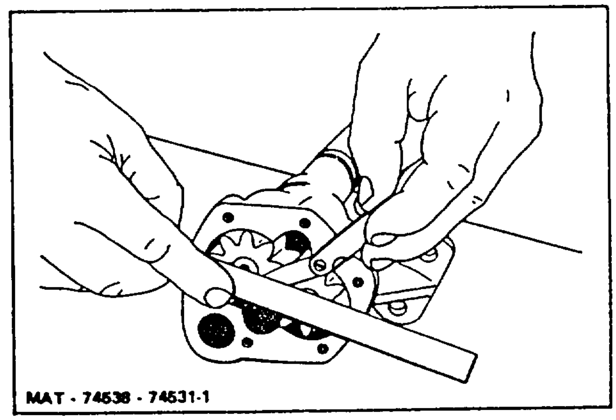


Figure 69. Checking Oil Pump End Clearance

E. ASSEMBLY

Replace screen. Install baffle, with gasket, and three screws and lockwashers. Press drive gear on its shaft' and install shaft in pump body. Secure with snap ring. Press spiral gear back on end of drive shaft and replace retainer pin. Replace idler gear, if it was removed, and install oil pump cover and gasket.

F. INSTALLATION

1. Re-install oil pump assembly on center main bearing cap. Carefully manipulate the pump assembly to allow the spiral gear to mesh with the camshaft mating gear, and with the bushing connecting to the distributor drive. Make sure the oil pump assembly is properly seated on the center main bearing cap, and secure with lockwasher and nut.
2. Install oil pan with new oil pan gaskets. Secure oil pan with attaching capscrews and make sure drain plug is installed.
3. Install engine in truck (refer to TOPIC 17. ENGINE REMOVAL/INSTALLATION.
4. Upon complete re-assembly, ensure that proper weight and capacity of oil have been poured into crankcase, refer to Maintenance Module LUBRICANT AND FUEL SPECIFICATIONS.
5. Start engine, check for oil leaks.
6. Refer to TOPIC 13. OIL PRESSURE RELIEF VALVE ADJUSTMENT to verify proper oil pressure setting.
7. Turn engine off.

TOPIC 13. OIL PRESSURE RELIEF VALVE

A. DESCRIPTION

Stabilized lubricating oil pressure is maintained within the engine at all speeds, regardless of oil temperature, by means of the oil pressure relief valve. This valve is located on the left side of the engine, directly below the carburetor (Figure 61). The valve assembly consists of a plunger, compression spring, adjusting washer or washers, copper gasket, and a plug screwed on the crankcase valve opening (Figure 70). When oil pressure at the valve exceeds the 30-40 P.S.I. limit, the plunger is lifted off its seat, and oil from the main gallery is by-passed to the engine oil pan.

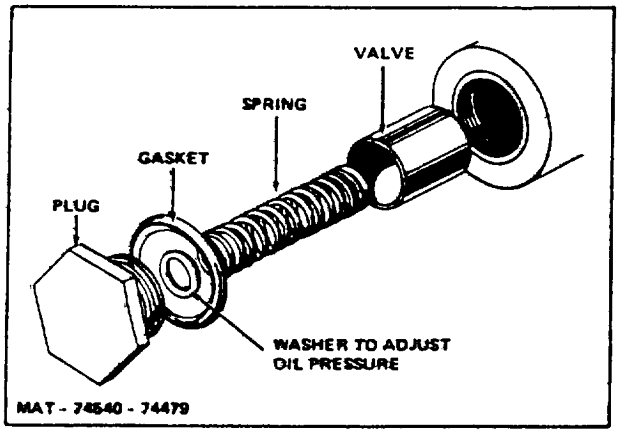


Figure 70. Oil Pressure Relief Valve Assembly

B. REMOVAL

Under normal conditions, the valve requires very little attention. However, if the lubricating system has been allowed to sludge up, the regulator valve may not work freely, thereby remaining open or closed. Whenever the lubricating oil pump is removed for repairs or inspection, the regulator valve should also be disassembled, thoroughly cleaned, and parts inspected.

C. DISASSEMBLY

If, with the proper grade of oil, and the engine warmed up and running at normal governed speed, and after adjusting the relief valve the oil pressure is unusually high or low, the following corrective measures should be tried:

1. Remove and clean relief valve parts of dirt, sludge, or carbon.
2. Check oil temperature and condition of oil.
3. If both the relief valve and oil are in good condition, be sure to check the oil pressure gauge and its connections before going any farther.
4. A common source of low oil pressure is clogging of the oil pump intake screen with sludge and carbon. Remove such deposits with a solvent.
5. Unusual looseness, grooving, or damage to the camshaft bearings or oil pump will also cause low oil pressure. Such conditions call for replacement of worn parts.

D. INSPECTION

Clean oil pressure relief valve parts with a solvent and dry with compressed air. Replace the spring if it is worn, bent out of shape, cracked, or weak. Replace copper gasket to form an oil tight seal.

E. ADJUSTMENT

The only adjustment variation is, either to install a new compression spring, or to assemble or remove washers from behind the existing spring. Up to four washers can be assembled.

Whenever a relief valve adjustment is necessary, it should be done AFTER the engine and oil have reached normal operating temperatures. It is equally important that all other factors such as grade and condition of oil, bearing clearances, and security of line connections be satisfactory before any adjustment is attempted. Proceed as follows :

1. Allow engine to run until oil reaches normal operating temperature.
2. Check oil pressure at oil pressure gauge on instrument panel; verify adjustment using calibrated oil pressure gauge.
   a. Recommended pressure with engine hot at an idle is 5 to 10 P.S.I.
   b. Recommended pressure with engine hot at full throttle is 30 to 40 P.S.I.
3. To increase pressure, assemble washers one by one. If after assembling four washers pressure is still low, replace compression spring.
4. To decrease pressure remove the existing washers, one by one. If pressure is still low, replace compression spring.
5. After adjustment is completed, install a new copper gasket, install and tighten plug.

TOPIC 14. FILLER BLOCKS AND OIL GUARD

A. DESCRIPTION

The rear and front main bearings are sealed to the cylinder block and the oil pan by a rear oil guard, rear filler block, and a front filler block; these three components are semicircular die castings equipped with jute seals and neoprene seals (Figure 22). The oil guard fits in the cylinder block, just to the rear of the rear main bore. The rear filler block is assembled to the cylinder block with capscrews, directly under the oil guard.

Jute seals are mounted on the inner semicircular grooves of the rear oil guard and filler block, where contact is made with the crankshaft. The outer semicircular groove of the rear filler block also has mounted a neoprene seal where contact is made between the filler block and the oil pan.

The front filler block is assembled to the front of the cylinder block with capscrews. A neoprene seal is mounted on the outer semicircular groove of the front filler block to seal the connection with the oil pan.

B. REMOVAL

1. Refer to TOPIC 6. CRANKSHAFT COMPONENTS for access to Filler Blocks and oil Guard.
2. With the engine resting on its side, remove the rear and front filler blocks.
3. Remove the crankshaft.
4. Remove the oil guard.

C. SERVICING

1. Remove the jute seals and neoprene seals from the oil guard and the filler blocks'; thoroughly clean inner and outer seal grooves to remove all dried cement and grease.
2. Install jute seals on the oil guard and the rear filler block. Refer to Figures 71 and 72.
3. Jute packing for crankshaft seal as it is received is approximately one-third larger in diameter than the width of the groove. To fit the grooves in the filler block, the packing must be crushed in a vise or flattened with a hammer on a flat surface so the jute packing is narrow enough to fit into the grooves.

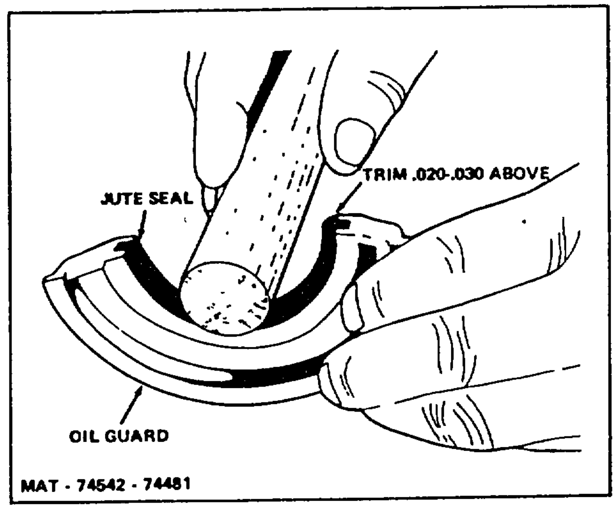


Figure 71. Installing Jute Seal in Oil Guard

4. Press packing seal into the grooves of both the filler block and the oil guard. Then, using a piston pin, a smooth hammer handle, or some other instrument with a rounded surface, iron this packing into the groove so that it is seated firmly and expanded so that is seizes the sides.

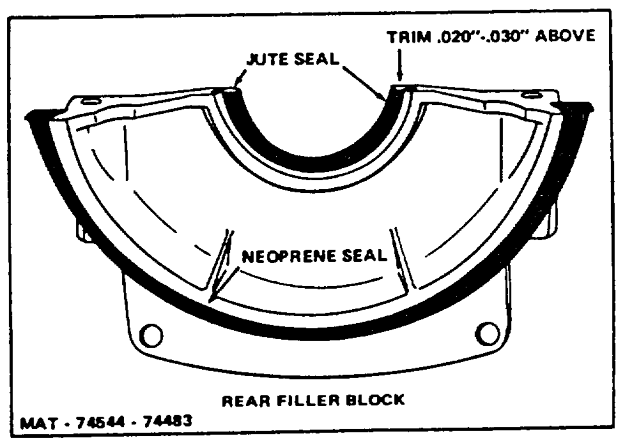


Figure 72. Installing Jute Seal in Rear Filler Block

NOTE: After installation, the jute packing will protrude from the grooves at either end in varying amounts. With a sharp knife, or razor blade, cut this off to projection .020"-.030" above, making the cut parallel to the surface of the casting. Then slip it into place, either around the crankshaft, if the engine is still assembled, or directly into the groove if the crankshaft is out.

Replace the neoprene seal by holding it in place for assembly (Figure 72 and 73). Use only a small spot of non-hardening cement in center of the contacting surface, before insert ing seal in groove. No other cement is required.

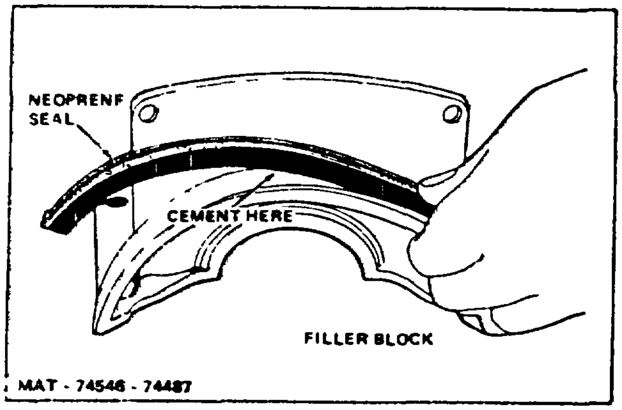


Figure 73. Installing Neoprene Seal in Rear Filler Block

Install the neoprene seal in the front filler block in the same manner as in the rear filler block (Figure 74).

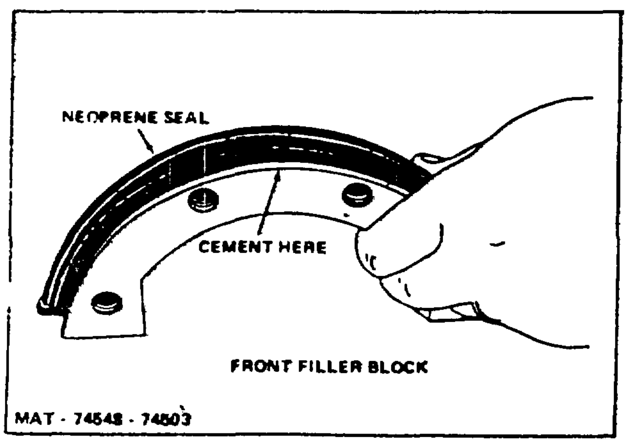


Figure 74. Installing Neoprene Seal in Front Filler Block

D. INSTALLATION

NOTE: When replacing the front filler block capscrews, make certain capscrews include a nylock patch to lock screws firmly in place.

Torque nylock patch screw to 15-20 pounds foot.

Lubricate outside of rear and front neoprene seals before installing oil pan to prevent possible distortion of seals.

When replacing gear cover, cement cover with a quick drying gasket cement and reassemble to engine block (Figure 75).

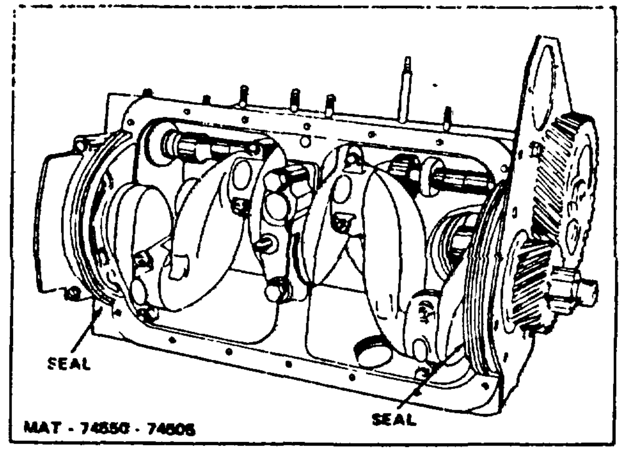


Figure 75. Neoprene Seals in Place

In order to prevent possible oil leaks, it is imperative to use only genuine Allis Chalmers replacement gaskets and seals--since these have been engineered and designed to do a superlative job. However, it has been determined that 90% of all rear main oil leak complaints checked are leaks in the pan gasket, rocker covers, side covers, etc., and are not leaking rear main oil seals.

The following is a suggested procedure to determine the exact location of an oil leak:

1. Wipe the under side of the engine to clean all dirt and oil from the oil pan, etc.
2. Plug breather pipe and oil filler opening with rags.
3. With the engine idling, blow compressed air (35 p.s.i. or less) into the dip stick pipe or opening.
4. Watch for oil leak and trace to the source.
5. Determine whether the oil is coming from the pan gasket, pan gasket end seal, leaky fitting, rocker cover gaskets, push rod cover gasket, or from any source other than the rear main oil seal.
6. A small mirror and flashlight are handy tools to use in checking hard to see places.

REPAIR MANUAL
"MEMO"

NO. 152

MODULE R104; R105;
LR-100; LR-101

SUBJECT: RTV OIL PAN GASKETS AND THREAD SEALANT

MODELS: ALL TRUCKS W/CONTINENTAL ENGINES

Continental engines have been changed to use RTV liquid gasket material around the oil pan and the front and rear filler blocks. Engines with series numbers 8500 and higher use RTV gaskets in these areas. The series number may be found on the engine dataplate, directly after the model designation. Apply the RTV as shown in Figure 1. The new style oil pans may NOT be used on engines with series numbers below 8500; the old style fiber gasketed pans may not be used on engines with series numbers 8500 and above. The RTV should be allowed to cure for at least 5 minutes before assembly.

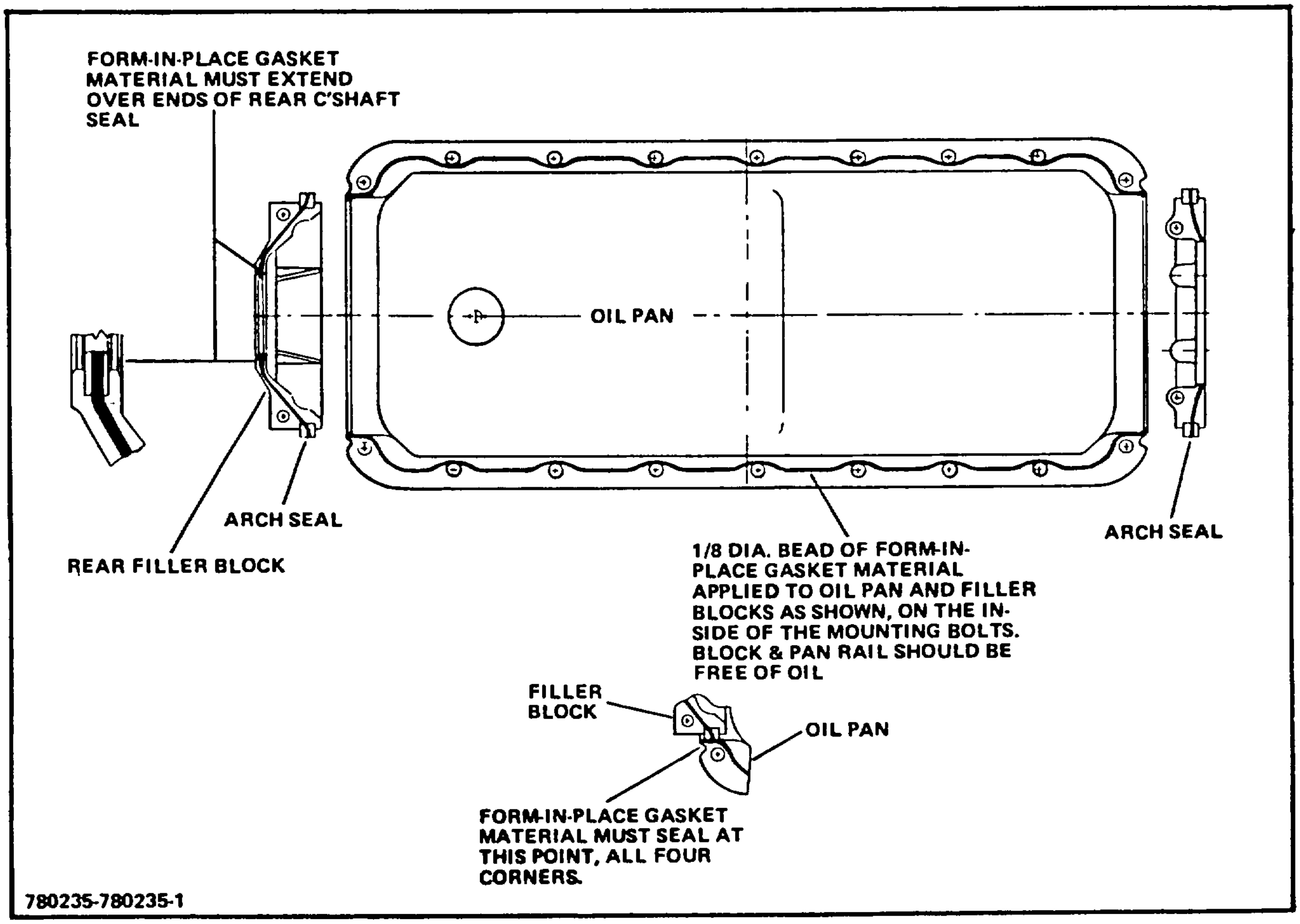


Figure 1.

A non-hardening sealant must be used on the threads of all the engine fastening hardware. Some of the capscrews and studs penetrate water jackets, oil galleys and the crankcase. The sealant will prevent leakage of oil or water around the mounting hardware. Use a sealant such as Permatex #3 or an equivalent.

TOPIC 15. OIL PAN

A. DESCRIPTION

The oil pan (Figure 22) which is the reservoir for engine lubricating oil, contains a drain plug which is removed for periodic draining of oil. The oil pan is sealed and secured to the crankcase assembly with a gasket and capscrews. Front and rear of the oil pan have semi circular cuts which receive the filler blocks assembled to the cylinder block. The filler blocks contain oil seals and guards to prevent foreign material from entering the front and rear main bearings. Refer to TOPIC 14. FILLER BLOCKS AND OIL GUARD.

B. REMOVAL

Engine must be removed in order to detach oil pan.

1. Run engine until normal operating temperature is reached.
2. Remove oil pan drain plug, and drain oil
3. Remove engine (see ENGINE REMOVAL.)
4. With the engine resting on its side, remove capscrews from edge of oil pan, and remove oil pan.

C. INSPECTION

1. Wash oil pan with cleaning solvent and dry with compressed air.
2. Inspect oil pan for evidence of cracks or other damage. Inspect drain plug boss for evidence of leakage. Make necessary repairs or replacement.
3. If engine has not been overhauled, inspect filler block neoprene seals to make certain they are in good condition. If seals need replacement follow the procedure in TOPIC 14. FILLER BLOCKS AND OIL PAN.

D. INSTALLATION

1. Cement new gasket to oil pan side rails and to oil pan ends.
2. Position oil pan on cylinder block rails and secure with capscrews and lockwashers. Torque capscrews 18 to 21 ft. lbs.
3. Install drain plug in oil pan.
4. Install engine. (See ENGINE INSTALLATION.)
5. Fill oil pan with correct oil and replace oil filter.

NOTE: When changing oil, the oil filter must also be changed, and 4 1/2 qts. of oil replaced.

For different climates the following oil weights are recommended:

Temperatures below 32°F,	S.A.E. 20
between 32°-90°F,	S.A.E. 30
above 90°F	S.A.E. 40

6. Run engine and check for oil leaks around oil pan and at filter.

TOPIC 16. ENGINE RUN-IN SCHEDULE

A. PURPOSE

After installation of new engine, or one in which new pistons and piston rings have been installed engine must be run-in to allow piston rings to seat and avoid possibility of cylinder bore scoring and excessive oil consumption.

When engine is first started after installation of new pistons and piston rings, excessive smoke, raw fuel and lubricating oil may appear in the exhaust. This condition should correct itself as engine is run-in.

Test run engine after overhaul and make adjustments as are found necessary for smooth and efficient engine operation.

B. TEST RUN CHECKS

The following procedure is recommended with engine installed in truck.

CAUTION: Ensure engine has been cleared of all rags, tools, parts, oil, water, etc., prior to engine run-in.

1. Fill crankcase to correct oil level with oil specified in Maintenance Module, LUBRICANT AND FUEL SPECIFICATIONS.
2. Fill cooling system with proper coolant for summer or winter operation. Refer to COOLING SYSTEM Section.
3. Inspect air cleaner to determine if properly serviced. Lubricate all points where lubrication is required.
4. Start engine and allow to run at approximately 600-700 R.P.M. Check for oil, fuel or coolant leaks. Check coolant and oil levels. If engine is run indoors, pipe exhaust gases outside.
5. Check oil pressure gauge. If gauge does not register during first 30 seconds after starting, stop engine at once and refer to TROUBLE SHOOTING Section.
6. Check ammeter. If not functioning correctly, check electrical system for grounds, shorts or loose connections.
7. Check engine timing. Refer to FUEL SYSTEM Section.
8. After engine has reached normal operating temperature, remove rocker arm cover and check valve clearances.
9. A run-in period of six to eight hours is recommended. Start with no load and gradually increase engine load until operating at full load for the last two hours.
10. At end of run-in gradually slow down engine and allow it to idle for a few minutes, allowing engine to cool gradually.
11. Torque cylinder head capscrews.
12. Recheck crankcase oil level and any points of adjustment, making necessary corrections.
13. Warm up engine to operating temperature. Blow dirt out of pockets around spark plugs and insert compression gauge in first spark plug hole, holding it firmly. Crank engine until the highest gauge reading is obtained. (Approximately four compression strokes). Check all cylinders in this manner. If readings are low in two adjacent cylinders, a blown head gasket is indicated. If readings are low and vary widely (more than 10 PSI), pressure is being lost either at the pistons, rings or valves. To determine where pressure loss is occurring, insert about one tablespoon of SAE 30 engine oil through the spark plug hole. Take a new reading. If this reading is higher than the initial reading, the piston rings are faulty. If reading is the same as the initial reading, the valves may be leaking or the cylinder head gasket is damaged.

TOPIC 17. ENGINE REMOVAL/INSTALLATION

Engine removal and installation is easily and safely accomplished when reasonable care and attention to detail is exercised. The following procedure is recommended for efficient engine removal and installation.

A. REMOVAL

CAUTION: Disconnect battery leads before attempting removal. Remove battery and battery tray. Disconnect and label any attaching wiring.

1. Attach an acceptable hoist chain to counterweight eyelets and take up slack in chain.
2. Remove securing counterweight capscrews and remove counterweight, taking care not to damage radiator or hydraulic pump.
3. Remove radiator cap slowly, to ensure against scalding, and open petcock at base of radiator and on engine block, to drain water from block and radiator.
4. Remove upper and lower radiator hose clamps and hoses. (Guard against damage to thermostat mounted at base of upper hose.) Disconnect transmission cooling oil lines.
5. Remove radiator.
6. Remove fan blade attaching capscrews and fan blade.

7. Loosen alternator adjusting brace, remove and inspect fan belt for possible cuts or cracks. Replace if necessary upon engine installation.
8. Disconnect and immediately cap hydraulic lines at hydraulic pump. Remove hydraulic pump and pump gear and sleeve.
9. Disconnect and label attaching alternator wiring.
10. Remove securing alternator capscrews and alternator.
11. Disconnect spark plug ignition wires at plugs and mark.
12. Remove spark plugs and cap or tape exposed ports to prevent contamination.
13. Remove distributor cap with attaching ignition coil and spark plug wiring.
14. Cover exposed distributor base to prevent entrance of foreign particles.
15. Disconnect and label temperature sender wire.
16. Remove attaching clamps, capscrews and nuts, and disconnect exhaust pipe. Tape exposed exhaust manifold port.
17. Remove oil pan drain plug and drain crankcase.
18. Remove transmission drain plug and drain transmission oil.
19. Disconnect and label engine oil filter lines. Remove oil filter and attaching bracket.

CAUTION: Cover or plug all open lines to prevent contamination of engine systems.

20. Loosen air cleaner hose clamps and wing nut. Remove air cleaner and attaching parts.
21. Disconnect transmission oil filter lines, where applicable, and label.
22. Disconnect accelerator linkage and choke control at carburetor.
23. Close fuel tank shut-off valve and disconnect fuel line to fuel strainer.
24. Disconnect transmission linkage, and cooling lines.
25. Disconnect universal joint at transmission.
26. Firmly attach hoisting chain to hoist studs and take up slack in chains.

CAUTION: Make certain that all electrical wiring, mechanical linkage and attachments, and hoses are free and clear of engine/transmission attachment or obstruction prior to removal or installation.

27. Remove engine motor mount bolts.
28. Remove transmission mounting bolts.
29. Slowly hoist engine assembly free of frame ensuring that engine and attached transmission do not bind or bump against the frame resulting in possible injury or unnecessary damage.
30. Once free of the frame, lower engine onto engine support and after proper seating and weight support is ascertained, remove hoisting chain.
31. With transmission properly supported by attaching hoist chain, remove securing capscrews and carefully disengage transmission assembly from engine.

B. INSPECTION

Look engine over closely for any signs of damage, wear or evidence of leaks. Necessary action should be taken to correct any abnormal conditions.

C. INSTALLATION

1. Ensure that engine is free of rags, tools, unwarranted parts, excess water, oil, fuel cleaning agents.
2. Make certain that any maintenance performed was properly done and that nuts and capscrews are all torqued to specification.
3. Using hoisting chain as a support, maneuver transmission towards engine flywheel housing and carefully engage transmission forward shaft in with the converter assembly, and secure to flywheel housing. Torque capscrews to 20 lbs. ft.
4. Properly attach hoisting chain to engine and transmission hoist studs and take up slack in chain.

CAUTION: Be certain that frame, engine and transmission mounting areas are clear of any obstructions such as wiring, hoses, mechanical linkage, etc., prior to installation.

5. Carefully maneuver engine assembly into mounting position and slowly, guarding against any binding, lower assembly onto engine and transmission mounts.

6. Install and secure mounting bolts. Torque to 20 lbs. ft.
7. Disengage hoisting chain and clear from work area.
8. Connect and secure universal joint at transmission.
9. Connect transmission linkage and cooling lines. Replace transmission drain plug.
10. Connect transmission oil filter lines and inspect filter for contamination or scheduled replacement. Change if required.
11. Remove transmission oil level stick and fill with specified transmission oil to full mark, as indicated on oil level stick.

CAUTION: Do not over-fill transmission.

12. Replace oil pan drain plug, and close drain cock at radiator and cylinder block.
13. Install oil filter base and mounting bracket. Replace oil filter cartridge and connect oil filter lines to engine as labeled.
14. Connect accelerator linkage and choke control at carburetor.
15. Connect fuel line to fuel strainer.
16. Install exhaust pipe and attaching clamps and hardware.
17. Verify proper electrode gap, .025", and install spark plugs. Torque plugs 25-30 lbs. ft.
18. Replace distributor cap with attaching ignition wires. Remove labeling tape as ignition coil and spark plug wires are properly affixed.
19. Connect temperature sender wire.
20. Install alternator and mounting hardware but do not lock adjusting brace at this time. Connect associated alternator wiring.
21. Inspect belt for wear, replace if necessary, and mount on fan drive, water pump and alternator pulleys.
22. Secure alternator adjusting brace for fan belt depression of 1/4" - 1" with 10 lbs. of pressure applied.
23. Install air cleaner and attaching hardware, hoses and clamps. Inspect filter element for contamination and replace If necessary.
24. Replace fan blade and secure capscrews.
25. Install hydraulic pump, sleeve and gear and install pump. Connect hydraulic lines to pump. If contamination of hydraulic oil is suspected, drain reservoir, change filter and replace oil, after filtering oil through a 10 micron, or finer, filter.
26. Install radiator, taking care not to damage cooling fins, and replace upper and lower radiator hoses, thermostat and hose clamps.
27. Connect transmission oil cooling lines.
28. Replace counterweight and secure capscrews.

CAUTION: Use extreme care when replacing counterweight to prevent personal injury or damage to equipment.

29. Replace grille and secure.
30. Replace angle braces, seat plate, engine cover and side panels, and seat. Replace floor and toe plate.
31. Install battery tray and battery. Connect any wiring removed from tray attachment and connect battery terminal leads.
32. Fill radiator to capacity with water. Add anti-freeze if required.
33. Fill crankcase with 4.5 quarts of recommended engine oil. Check oil level stick for full reading.

NOTE: Ensure that all hoses, electrical lines and mechanical linkages have been completed. Be sure all capscrews, braces and mounts are secure.

34. Check fuel tank for water condensation; drain if necessary.
35. Fill tank to recommended limit with proper octane gas and open fuel cutoff valve.
36. Start engine, run at idle for approximately 5 minutes, then shut off and check radiator water level, crankcase dipstick and transmission oil level stick for full capacities.
37. Check for evidence of oil, fuel or water leaks.
38. Continue with engine run-in schedule as specified.

TOPIC 1. FUEL SYSTEM

The following components make up the fuel system: The fuel tank, fuel pump, strainer and filter, the carburetor, accelerator linkage and the governor assembly.

The fuel tank is the fuel reservoir and, via the fuel lines, fuel pump, strainer and filter, supplies the carburetor with raw fuel to be vaporized and mixed with fresh air for controlled combustion.

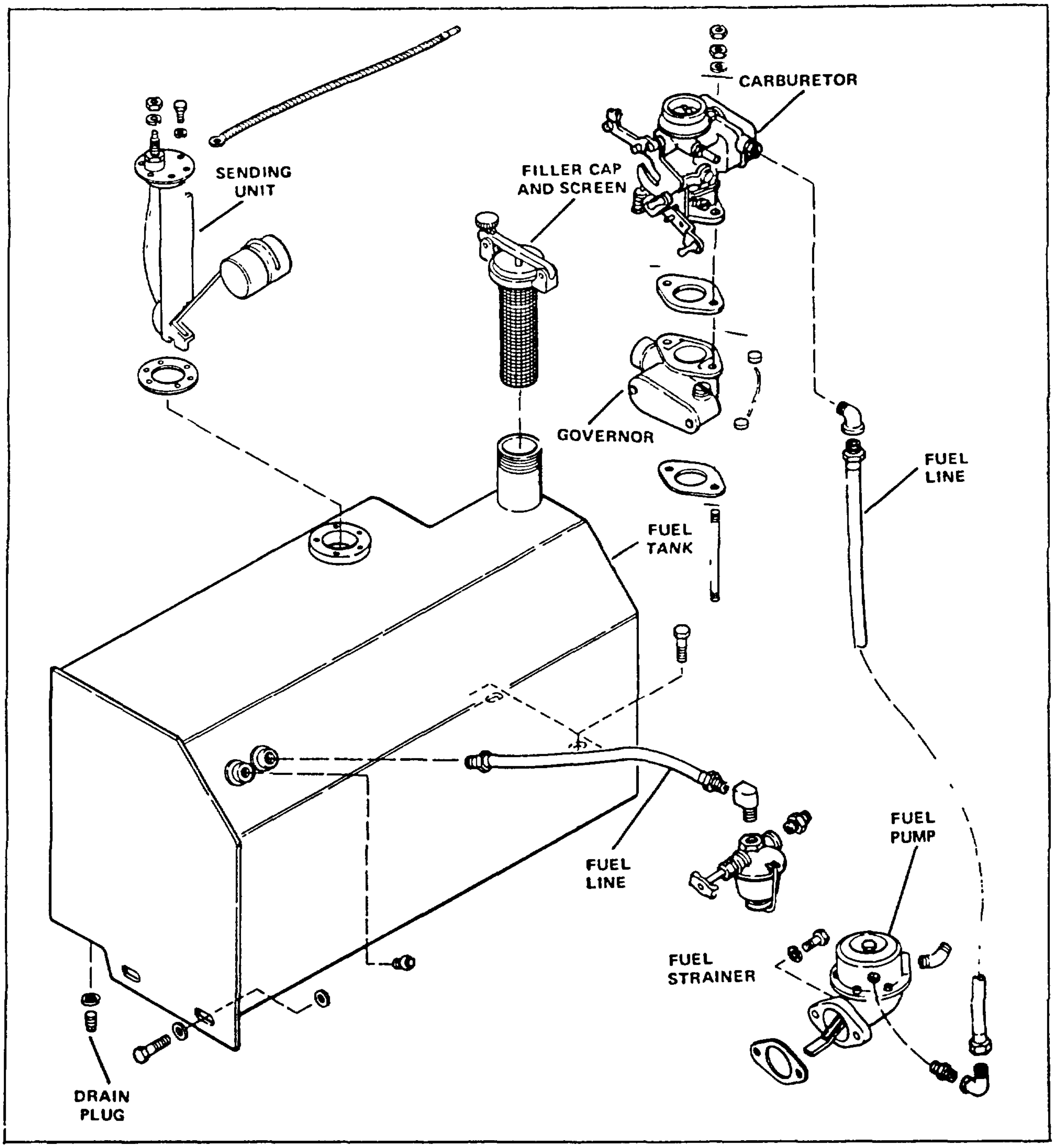


Figure 1. Fuel System

TOPIC 2. FUEL TANK

A. DESCRIPTION

The fuel tank is of steel construction and welded seams. It includes a fuel level sender unit, a filler cap with filter screen and the fuel outlet line and fittings.

The fuel tank requires little, if any, service other than periodic cleansing of the fuel filter.

B. REMOVAL

1. Remove the fuel tank drain plug from bottom of tank and allow fuel to drain.
2. Remove the floor and toe plates.
3. Raise the left side of the truck sufficiently to allow removal of the fuel tank.
4. Remove hose from top of tank and the fuel gauge sender wire.
5. Remove the filter cap assembly.
6. Remove the capscrews, lockwashers, and washers which secure the fuel tank to the truck.
7. Carefully remove the fuel tank from the under side of the truck.

C. DISASSEMBLY AND INSPECTION

1. Remove necessary fittings from tank and allow remainder of fuel to drain.
2. Clean filler cap and filter screen assembly with acceptable solvent and dry thoroughly with compressed air.
3. If removal of fuel sending unit is necessary, remove capscrews and lockwashers (Figure 1) that secure sending unit to tank. Carefully lift unit out of tank being certain not to bend float arm.

D. ASSEMBLY AND INSTALLATION

1. If removed, carefully install fuel sending unit, ensuring against any damage to float arm.
2. Install capscrews and lockwashers and secure.
3. Replace the fuel tank drain plug.
4. Replace fuel filler assembly.
5. Before Installing tank, disconnect fuel line at fuel pump and blow out line with compressed air.
6. Inspect copper fuel line and fuel hose for damaged connectors, crimped line, cracks or oil soaked hose. Replace damaged lines.
7. Install fuel tank as removed and replace capscrews, washers and nut which secure the top and rear of the tank to the truck. Lower truck to ground level.
8. Attach fuel sender wire.
9. Replace previously removed fittings and hose.
10. Fill fuel tank to recommended capacity with proper octane fuel.
11. Check all fittings and lines for any leaks. Repair, if required.

TOPIC 3. FUEL PUMP AND FUEL FILTER

A. DESCRIPTION

The fuel pump is a mechanical diaphragm type with an attached strainer and sediment bowl. The pump is mounted on the side of the engine and is operated by an eccentric on the engine camshaft.

Fuel from the tank enters the strainer sediment bowl on the suction stroke of the pump and is forced to the carburetor on the pressure stroke. Action is controlled by two valves in the cover assembly.

B. SERVICE AND INSPECTION

Quite often engine malfunctioning can be traced to a clogged fuel pump; therefore, periodically clean sediment bowl and strainer screen.

Loosen capnut, swing clamp wire to one side, and remove bowl. Thoroughly clean bowl and screen. If there is excessive dirt on the screen or in the bowl, check fuel tank and source of supply.

If pump is supplying Insufficient fuel, engine will stall or falter. Check the following:

1. Make sure there is fuel in the tank and the shut-off valve at sediment bowl is fully open.
2. Disconnect fuel outlet line from pump. Remove high tension wire from ignition coil and turn the engine over several revolutions. If fuel spurts from pump outlet, it Indicates pump, gas lines and fuel tank are not at fault.
3. If little or no fuel flows, perform the following:
    a. Check for leaking gasket at sediment bowl or top cover of the pump.
    b. Remove and clean fuel screen in sediment bowl.
    c. Inspect copper fuel line for restrictions. Blow out with compressed air or replace if damaged.
    d. Inspect flexible fuel line for breaks or a porous condition. Replace if necessary.
    e. Make certain all pump cover screws are tight.
    f. Test pump for proper operating pressure by disconnecting outlet line and attaching test gauge to fuel outlet port. Run engine at 1800 r.p.m. on fuel remaining in carburetor and note pressure on gauge. Pressure should be between 3-1/2 P.S.I. minimum and 4-1/2 P.S.I. maximum. Pressure below minimum indicates excessive wear. It may also indicate a ruptured diaphragm, worn, dirty or gummy valves and seats. Any of the above require removal of the pump for replacement.

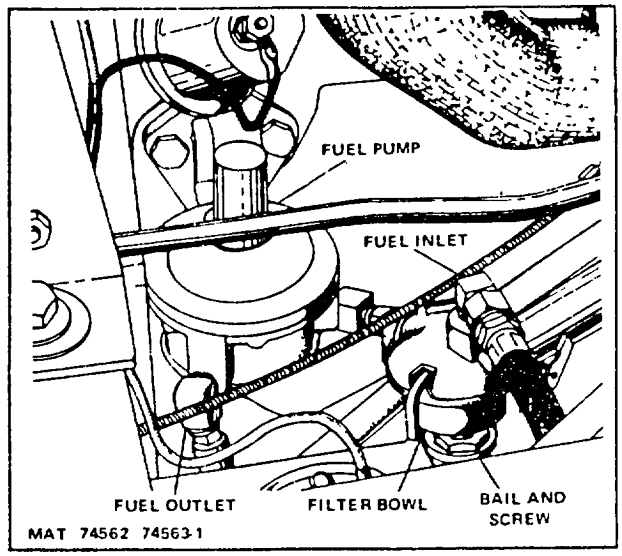


Figure 2. Fuel Pump and Filter Mounting

If pump is supplying too much fuel, it will drip from the carburetor, or the engine will not idle smoothly, and will be hard to start. Check the following:

1. Perform Step f above for testing the pump for proper operating pressure.
2. A pressure above maximum indicates too tight a diaphragm or too strong a diaphragm spring. Poor riveting on a diaphragm assembly may also result in too high a pressure due to fuel seeping between diaphragm layers, bulging the diaphragm and causing it to act as if it were stretched too tightly. The above requires removal of the fuel pump for replacement.

3. Loose fuel line at carburetor.
4. Excessive use of hand choke.
5. Punctured carburetor float.
5. Defective carburetor needle valve.
7. Incorrect carburetor adjustment.

C. PUMP REMOVAL

1. Close shut-off valve at sediment bowl.
2. Lift operator's seat, and swing open right hand side panel.
3. Disconnect fuel outlet line to carburetor and disconnect fuel inlet hose from supply line from fuel tank.
4. Remove the pump mounting capscrews and lockwashers and lift pump from engine.
5. Wash pump and sediment bowl with a solvent and dry with compressed air.

D. FILTER DISASSEMBLY

1. Remove flexible fuel line and elbow from fuel filter cover. Leave shut-off valve open.
2. Loosen clamp nut, move clamp to one side and remove sediment bowl, gasket and screen.

E. INSPECTION

Clean and rinse all parts in an approved solvent and dry with compressed air.

Make a visual check for cracks and breakage. Examine all threaded holes and filter screen. Replace broken or damaged parts.

F. FILTER ASSEMBLY

1. Install filter cover nipple and filter cover on fuel pump cover. Tighten securely to prevent fuel leakage.
2. Install filter screen and gasket in filter cover, place bowl in position and tighten clamp.
3. Install elbow and flexible fuel line in top of filter cover.

G. PUMP AND FILTER INSTALLATION'

1. Secure pump and filter assembly to engine with capscrews and lockwashers.
2. Attach fuel lines from tank and carburetor. Make certain all connections are tight.
3. Open shut-off valve at filter and start engine. Check all connections for leaks.
4. Swing shut the right hand side panel and lower the operator's seat.

TOPIC 4. CARBURETOR

A. DESCRIPTION

The carburetor is of the single barrel downdraft design, composed of two major assemblies. The main body contains the float, fuel inlet valve, fuel bowl, air inlet, venturi, choke mechanism, economizer diaphragm and stern assembly, accelerating pump and the main well and economizer body. The main well and economizer body assembly includes many of the fuel metering parts and fuel passages of the carburetor. The throttle body mounts to the manifold and contains the throttle plate, idle discharge ports and the idle speed and mixture adjusting screws.

B. OPERATION

1. Fuel Inlet System

All fuel used by the four basic fuel metering systems enters the carburetor through the fuel inlet needle valve and seat assembly. The fuel, under pressure from the engine's fuel pump, flows past the needle valve and into the float chamber. The float rises and falls with the fuel level in the float chamber, moving the fuel inlet needle valve correspondingly to control the amount of fuel admitted to the carburetor. When the fuel in the float chamber reaches a specified level, that float moves the needle valve to a position where it restricts the flow of fuel so that only enough fuel is admitted to replace that being used. Any slight change in the fuel level causes a responsive movement of the float, opening or closing the fuel inlet needle valve to immediately restore the proper fuel level. The fuel Inlet system must constantly maintain this specified level of fuel because the basic fuel metering systems are calibrated to deliver the proper mixtures only when the fuel is at this level.

A spring and pin, inside the hollow fuel inlet needle valve, cushions the needle valve for protection against road shocks and vibration. A fuel valve clip is attached to the bottom of the needle valve under the tab of the float lever to insure that the needle will open properly when the float drops.

The float chamber is vented to the carburetor air inlet through interconnected passages near the top of the float chamber. These passages lead to the balance tube in the air inlet. Some applications have a protected exterior vent at the top of the float chamber which allows fuel vapor and fumes created in the fuel lines during hot operation to pass out of the carburetor bowl.

2. Idle System

At idle and low speeds, the air flow through the carburetor is slow and the vacuum created in the venturi is not sufficient to operate the main metering system. Intake manifold vacuum is high, due to the great restriction to air flow by the nearly closed throttle plate. This high manifold vacuum is used to provide the pressure differential which will operate the idle system.

At idle, fuel flows through the main jet into the bottom of the main well. The high manifold vacuum, acting on this fuel through the idle system passages, draws the fuel from the main well through a horizontal passage to the idle

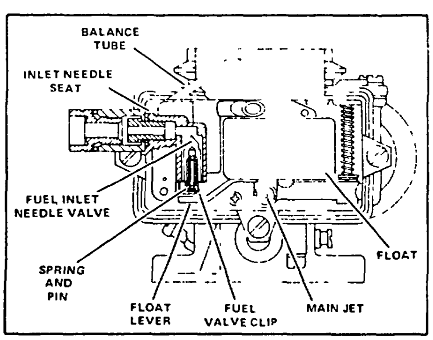


Figure 3. Fuel Inlet System

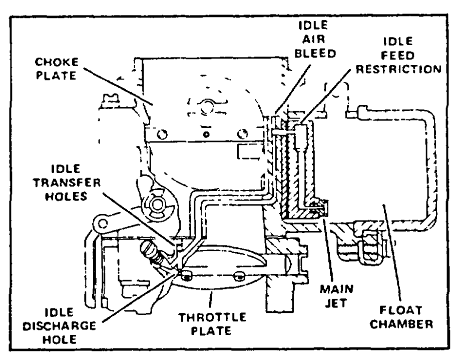


Figure 4. Idle System

well. The restriction in the upper portion of the idle well is calibrated to flow the proper amount on fuel. The fuel passes out the top of the idle well and into the idle system passages in the main body. The top of the vertical idle system passage in the main body contains the idle air bleed which admits a metered flow of air to the fuel. The idle air bleed also vents the idle system to prevent any siphoning effect at higher speeds or when the engine is stopped. The fuel continues down through the idle passage and past the idle transfer holes in the throttle body. The idle transfer holes acts as additional air bleeds at curb idle. The fuel is discharged from the idle discharge hole into the strong manifold vacuum below the throttle plate. The pointed tip of the idle adjusting needle is set a short distance off its seat at the idle discharge hole. The setting of the idle adjusting needle controls the fuel-air mixture discharge at idle, thus providing a means of adjusting the idle mixture. Turning the idle adjusting needle in, moves its pointed tip closer to the seat, restricting the fuel flow out the idle discharge hole. This results in a leaner idle mixture. Conversely, turning the needle out, moves the tip farther from the seat, allowing more fuel to flow out the idle discharge hole for a richer idle mixture.

During off-idle operation, the throttle plate is moved slightly past the transfer holes, which begin discharging fuel as they are exposed to manifold vacuum. As the throttle plate is opened still wider, and engine speed increases, the air flow through the carburetor is also increased. This creates a vacuum in the venturi strong enough to bring the main metering system into operation. The flow from the idle system tapers off as the main metering system begins discharging fuel. The two systems are engineered to provide a smooth, gradual transition, from idle to cruising speeds.

3. Main Metering System

Air drawn in by the downward movement of the pistons in the engine passes through the carburetor venturi. This creates a drop in pressure, commonly called vacuum, in the venturi. The strength of the vacuum is proportional to the velocity of the air being drawn through the venturi, which, in turn, is governed by the speed and power output of the engine.

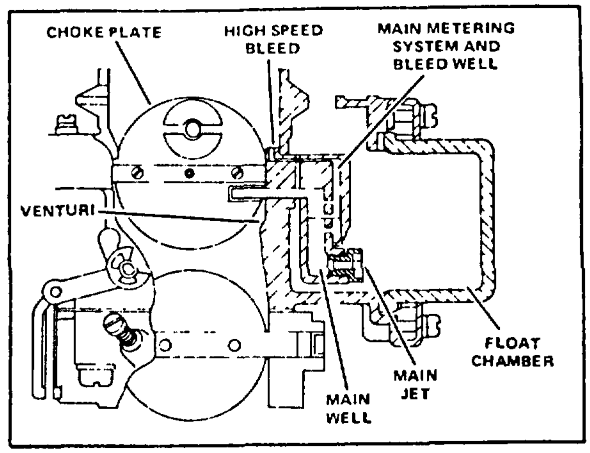


Figure 5. Main Metering System

At normal cruising speeds, the difference in pressure between the normal air pressure in the top of the float chamber and the vacuum in the venturi, forces a metered flow of fuel from the float chamber through the main metering system and out the main nozzle, which is located in the venturi. The fuel is metered (or measured) by the main jet as it flows into the bottom of the main well. The fuel moves up the main well past the narrow air bleed passages. Filtered air from the carburetor air inlet passes through the high speed bleed into the air bleed well, and enters the fuel flow in the main well through the short horizontal air bleed passages. The high speed bleed meters a proportionally increasing amount of air to the fuel at higher speeds, stabilizing the fuel discharge. This emulsion of fuel and air, being lighter than the raw fuel, respond faster to any change in venturi vacuum. It also vaporizes more readily then raw fuel when it is discharged.

The fuel continues up the main well and flows into the main nozzle where it is sprayed into the venturi. The action of the air stream distributes the fuel evenly over the lower portion of the choke plate and from that area it is vaporized and mixed with the air flowing through the carburetor. The distributor pin, extending horizontally from both sides of the choke shaft, diverts the air flow in the carburetor to aid in providing further distribution of the mixture to all cylinders of the engine.

4. Choke System

When starting a cold engine, much of the vaporized fuel from the carburetor condenses to a liquid on contact with the cold surfaces of the intake manifold. This results in hard starting, loss of power, and stalling. Closing the choke plate in the venturi confines manifold vacuum within the carburetor, thus drawing a rich flow of fuel from the idle and main metering systems. When the engine starts, enough air is drawn through the spring-loaded poppet valve in the choke plate to allow the engine to run. The curved extension of the choke lever, called a fast idle cam, contacts the throttle stop screw at idle and is designed to increase the throttle plate opening at idle during choking. This allows the engine to operate at a fast idle to prevent stalling.

5. Accelerating Pump System

Air flow through the carburetor responds almost immediately to any increase in throttle opening. The fuel, however, having more inertia, will lag behind and cause a momentary lean condition. To overcome this condition the accelerating pump system mechanically supplies fuel until the other systems can supply the proper mixture.

The accelerating pump is the diaphragm type with an inlet and outlet check valves. Both check valves are steel balls with their seats staked to prevent leaking. The outlet check valve ball is backed-up by either a brass weight or a spring and retainer. This prevents the check ball from being raised off its seat due to the vacuum created at the pump discharge nozzle.

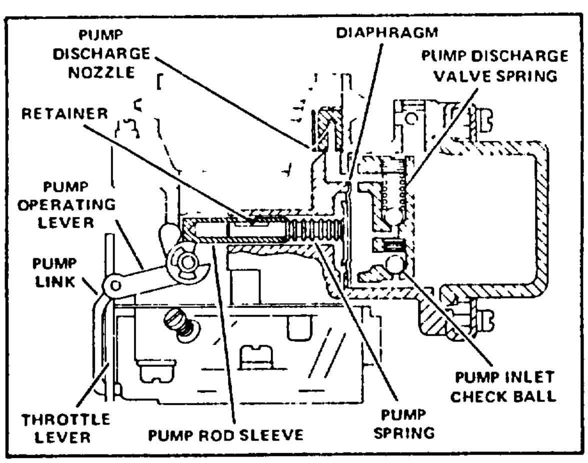


Figure 6. Accelerating Pump System

With reference to the cut-away view of the accelerating pump system, the parts that make up the pump are- the pump link; the pump operating lever; the push rod sleeve; the pump spring; the diaphragm and rod assembly; and the pump return spring.

In operation, fuel is drawn into the pump fuel chamber through the inlet check valve. When the throttle is opened, the pump operating lever pushes the pump push rod sleeve to the right. Because the pump discharge nozzle restricts the discharge of the fuel, the pump spring is compressed which provides the actual operating force. The fuel forces the outlet check valve off its seat so that an instantaneous even flow of fuel is discharged out of the pump discharge nozzle into the air stream in the venture.

The pump discharge nozzle is calibrated in conjunction with the pump spring to provide the proper duration of fuel discharge for each model engine. The discharge nozzle is also constructed with a cavity which helps break the vacuum created by the air flow past the nozzle.

6. Power Enrichment System

When high-power output is required, the carburetor delivers a richer mixture than that supplied for normal cruising when no great load is placed on the engine The added fuel for high power operation is provided by the power enrichment system, sometimes called the economizer system.

The power enrichment system is actuated by manifold vacuum, which gives an accurate indication of the power demands placed on the engine. Manifold vacuum is strongest at idle, when there is no load on the engine, and it is reduced correspondingly as the load on the engine increases, the throttle plate must be opened wider to maintain any given speed. Manifold vacuum is reduced because the throttle plate offers less resistance to the air flow entering the intake manifold.

Manifold vacuum, at the bottom of the throttle bore below the throttle plate, is transmitted through the vacuum passage to the top of the economizer diaphragm in the vacuum chamber. The vacuum acting on the economizer diaphragm at idle and normal cruising speeds, is strong enough to hold the economizer diaphragm and stem up, thus compressing the spring on the stem.

When high power demands place a greater load on the engine and reduces the manifold vacuum beyond a predetermined point, the economizer spring expands and forces its stem down. The stem depresses the pin in the center of the power valve, opening the valve. Fuel from the float chamber flows into the valve and passes through a horizontal passage to the main well where it is a added to the fuel flow in the main metering system, enriching the mixture for full power. The drilled plug in the passage, between the power valve and the main well, is a calibrated restriction which meters the flow of fuel through the power enrichment system.

C. REMOVAL

1. Disconnect choke cable and accelerator cable from carburetor.
2. Disconnect fuel inlet line from carburetor.

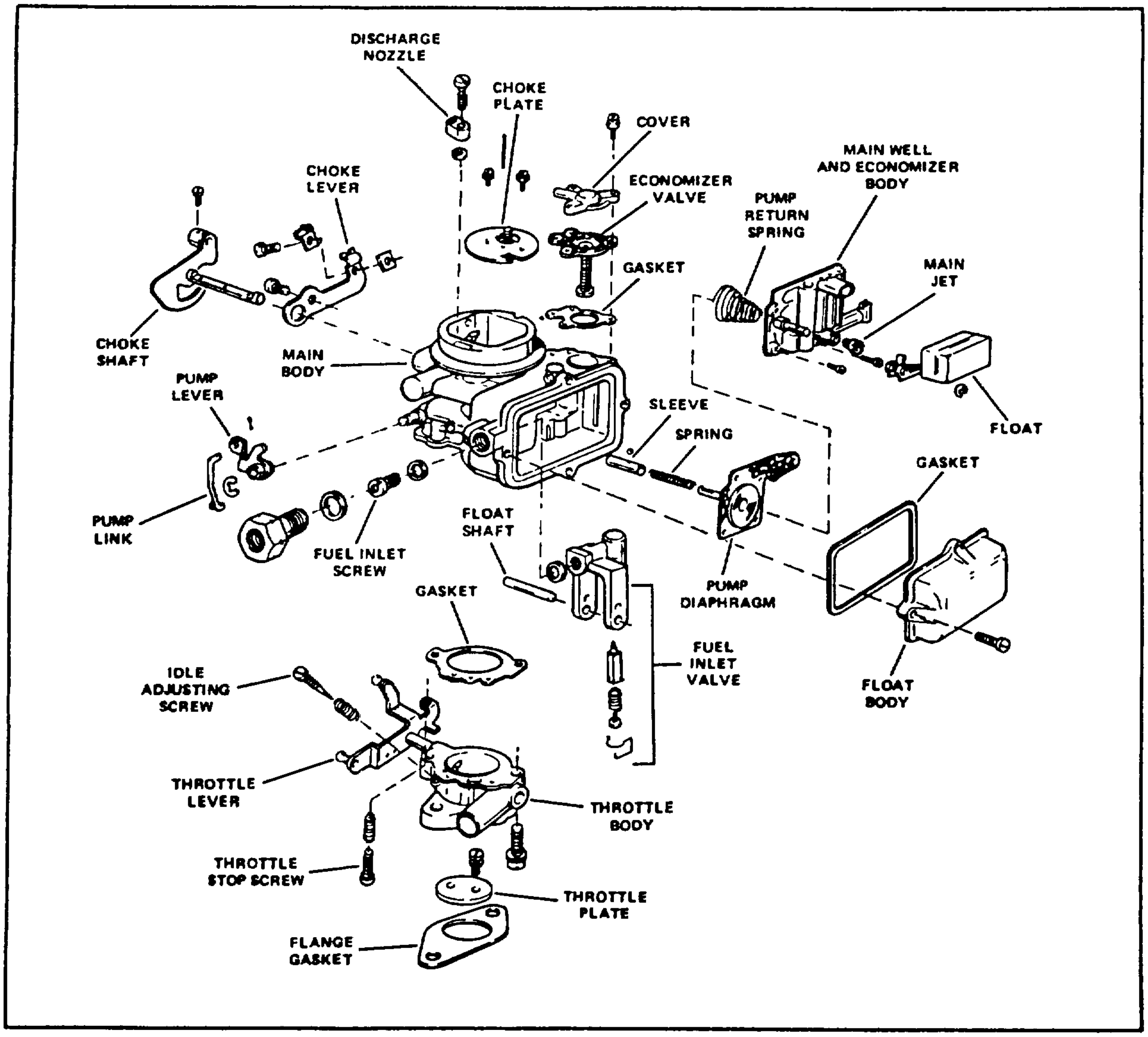


Figure 7. Carburetor

3. Loosen clamp and lift air line and bonnet from top of carburetor.
4. Remove two nuts and lockwashers and remove carburetor from manifold.

D. DISASSEMBLY

1. Remove cotter pin and remove pump operating link.
2. Remove two screws and lockwashers and separate throttle body and main body. Remove gasket.
3. Remove screws and remove float bowl and gasket from main body.
4. Remove fuel inlet fitting and gasket. Remove fuel inlet retainer screw from inlet fitting bore.
5. Remove float and fuel inlet valve and seat as an assembly from fuel bowl.
6. Remove screws and remove economizer body cover, diaphragm and stern assembly and gasket. Separate cover and diaphragm and stern assembly.
7. Hold body in position and remove screws. Remove main well and economizer body. Remove main jet from body. Remove pump return spring.
8. Remove accelerating pump and spacer gasket from main body. Remove pump rod sleeve retainer ball and remove sleeve and spring.

CAUTION: Use care when removing pump diaphragm and rod assembly. Pump rod is under considerable spring tension. Pull assembly straight out and do not rotate sleeve while removing.

9. Remove retaining ring and remove pump operating lever.
10. Remove screw and remove choke bracket. Remove choke plate screws and remove choke plate. Remove choke shaft and lever assembly.
11. Remove screw and remove pump discharge nozzle and gasket.
12. Remove idle adjusting screw and spring from throttle body. Scribe marks on throttle plate and shaft to and in reassembly. Remove throttle plate screws and remove throttle plate.
13. Remove throttle shaft and lever from throttle body.

E. CLEANING AND INSPECTION

1. Clean all metal parts in a cleaning solution. Rinse parts in hot water remove all traces of cleaning solution. Use a stiff bristle brush to clean foreign matter from parts.
2. Clean all passages with compressed air. Do not use a drill on wire to clean passages.
3. Check all parts for damaged threads, inches and scratches. Check venturi carefully for damage to main discharge nozzle. Replace damaged parts.
4. Check choke and throttle shafts for bent and damaged condition.
5. Discard float and lever assembly if float leaks.
6. Discard nicked or damaged choke and throttle plates.
7. Discard damaged or defective springs.

F. REASSEMBLY

1. Install throttle lever and shaft assembly into throttle body. Place throttle plate on shaft with scribe marks aligned.
2. Install screw to hold throttle plate but do not tighten completely. Hold throttle body up to a light. If little or no light shows between throttle plate and throttle bore and plate does not bind when rotated, tighten screws firmly and stake.
3. Install idle adjusting screw and spring in throttle body. Turn needle in gently until it seats, then back it off one full turn.
4. Place choke bracket and shaft in main body. Install choke bracket screw but do not tighten. Rotate choke lever until curved extension of choke lever contacts choke bracket screw.
5. Install choke plate in slot in choke shaft with stem and spring of poppet valve extending toward balance tube. Use care when installing choke plate so as not to damage tip of main nozzle.
6. Rotate choke lever counterclockwise to

close choke plate. Choke plate must be centered when closing so as not to damage venturi. Install two choke plate screws but do not tighten. Move choke lever through extent of its travel and check choke plate for binding. If plate moves freely, tighten screws and stake.

7. Tighten choke bracket screw.
8. Use a new gasket and install pump discharge nozzle. Secure nozzle with screw.
9. Install pump operating lever on shaft and secure with retaining ring.
10. Install pump spring and sleeve on shaft of diaphragm and rod assembly. Position sleeve on shaft with small hole in sleeve aligned with center of flat cutaway portion of shaft. Press sleeve on shaft and insert retainer ball in small hole in sleeve.
11. Install assembled pump assembly in main body.
12. Install main jet in main well and economizer body. Install pump return spring on body, with large end of spring seated in metal disk of pump diaphragm.
13. Align holes in body with holes in pump diaphragm and gasket and with holes in main body.
14. Press main well and economizer body into place against pump diaphragm. Apply pressure to compress pump spring and pump return spring. Apply pressure evenly to prevent misalignment of holes in body and gaskets.
15. Hold against spring pressure and install screws only fur enough to just begin compressing lockwashers. Release pump rod sleeve. This will allow pump return spring to expand, ensuring full travel of diaphragm when pump is operating. Tighten screws.
16. Use a new economizer body gasket and install economizer diaphragm and stern assembly and cover in position on main body. Install screws to secure cover. Check to insure economizer stern rests on power valve.
17. If fuel inlet valve was disassembled assemble valve and secure with clip.
18. Install float and lever assembly on fuel inlet valve and install float shaft.

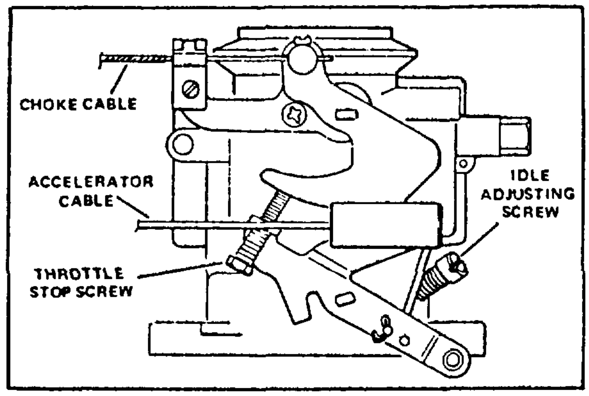


Figure 8. Carburetor Adjustment

19. Install new gasket on fuel inlet seat retainer screw and install screw in fuel inlet bore. Install new gasket on end of screw and install fuel inlet valve and float assembly in main body. Tighten fuel inlet retainer screw into fuel inlet valve to secure valve and float.
20. Use a new float bowl gasket and install float body on main body. Secure float body with screws.
21. Install new gasket between throttle body and main body. Align holes in gasket and body and install throttle body on main body. Install screws and alternately tighten screws to compress gasket evenly.
22. Install pump link in hole in throttle lever closest to throttle shaft. Install other end of link in pump operating lever and secure link to throttle lever with cotter pin.

G. INSTALLATION

1. Install new flange gasket on manifold and install carburetor on manifold studs.
2. Secure carburetor to studs with nuts and lockwashers. Tighten nuts evenly to compress flange gasket correctly.
3. Check operation of throttle and choke levers to see that they operate freely.
4. Connect accelerator and choke cables to carburetor.
5. Install bonnet on carburetor and tighten clamp to secure bonnet and carburetor connection.

H. ADJUSTMENT

1. Idle Adjustment

   a. Operate engine and bring to operating temperature.

   b. Check idle speed. Low idle speed should be 400-600 RPM and high idle should be 2350 to 2450 RPM.

   c. Adjust idle adjusting needle to obtain smoothest running and highest idle speed.

   d. Adjust accelerator cable to operate throttle for correct idle and operating speeds.

2. Choke Adjustment

   a. With engine stopped push choke control all the way in.

   b. Loosen clamp and lift bonnet from carburetor.

   c. Check setting of choke plate. Choke plate should be wide open. If not, loosen screw securing choke cable and adjust cable until choke is completely open. Tighten screw.

   d. Pull choke control all the way out. Choke plate should be completely closed.

   e. Install bonnet on carburetor and secure with clamp.

MEMO

TOPIC 6. GOVERNOR

A. GOVERNOR DESCRIPTION

The governor prevents engine speed from exceeding a predetermined maximum. The governor is mounted between the carburetor and manifold flanges. It consists of a main body, which contains a throttle shaft, a throttle valve and a main governor spring. The main governor spring is attached by linkage to the governor shaft and the spring force holds the throttle valve open.

When the engine starts, air flows through the carburetor throat and the governor throat. The velocity of the air creates a pressure above the throttle valve. When this force exceeds the force exerted by the spring, the throttle will move to a closed position. The adjusting screw varies the spring tension (Figure 10).

When the closing action of the valve exactly balance the spring, governing action takes place and maximum speed is fixed at this point.

When load is applied the velocity of the gas through the manifold and the pressure against the governing valve is reduced and the spring opens the valve to feed more gasoline to the engine to handle the increased load demand. This maintains an almost constant speed whether the engine is running with or without load.

B. GOVERNOR REMOVAL

1. Remove the nut, lockwasher and stud securing the governor to the carburetor.

2. Disconnect the governor from the manifold fitting and remove lock wire and seals.

3. Remove governor, seals and space from the carburetor.

C. INSPECTION

1. Wash governor in a clean solvent and dry with compressed air.

2. Check governor for wear, cracks or damaged surfaces.

D. INSTALLATION

1. Install new gaskets and spacer on carburetor.

2. Position governor on carburetor and connect manifold fitting. Secure with studs, lockwasher and nuts.

3. Install lock wire and seals.

E. GOVERNOR ADJUSTMENT

NOTE: The desired engine speed is obtained by increasing or decreasing the governor spring tension.

Turn adjusting screw (Figure 10) in or out, to increase or decrease pull on the spring.

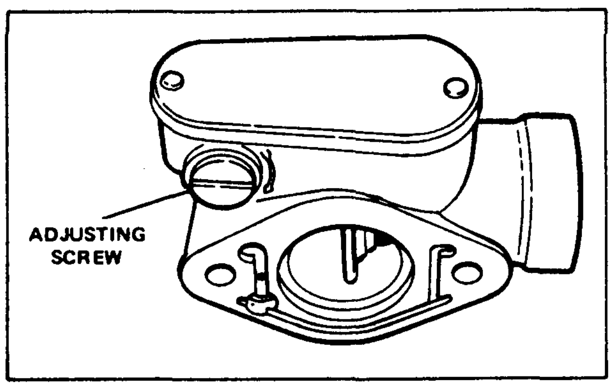


Figure 10. Velocity Governor

TOPIC 7. AIR CLEANER

REFER TO PAGE 2-14 FOR AIR CLEANER REPAIR INSTRUCTIONS.

TOPIC 1. BATTERY

A. GENERAL DESCRIPTION

The lead-acid storage battery is an electrochemical device for converting stored chemical energy into electrical energy.

Active materials within the battery react chemically to produce a flow of direct current whenever cranking motor or other current consuming devices are connected into the battery circuit. This current is produced by chemical reaction between the active materials of the plate and the sulphuric acid of the electrolyte. '

The internal construction of a lead-acid battery consists of the combination of positive and negative plates forming a cell. The plates consist of special active materials contained in cast grids of lead-antimony alloy. Charged negative plates contain sponge lead, and charged positive plates contain lead peroxide. If the positive and negative plates contact one another, a short circuit is produced and the cell fails immediately. To prevent a short circuit between the plates, separators are used. The cell is assembled by alternating the plates of the positive group between the plates of the negative group, Neg. - Pos. - Neg., etc. The negative plate group always has one or more plates than the positive group. Separators have one ribbed side and are assembled with the ribs vertical and facing the positive plate. In this position, the space between the ribs allows better circulation of the electrolyte to the positive plates and forms a channel by which normally loosened particles of positive active material may reach the sediment spaces in the bottom of the cell.

A vent cap screws into a threaded hole located in each cell cover. The cap serves two purposes. First, it closes the opening in the cell cover through which electrolyte can be checked and water added, if necessary, and second, it provides a means for the escape of gases formed during charging. The visual level fill is an aid to proper servicing. Electrolyte level should be maintained by adding distilled water to the bottom of the filler hole. This gives a margin of safety against the dangers of low-level operation. Overfilling should be avoided at all times, since it causes loss of electrolyte which will result in premature battery failure and poor performance. Electrolyte lost by overfilling causes excessive corrosion of cables, connections and other equipment.

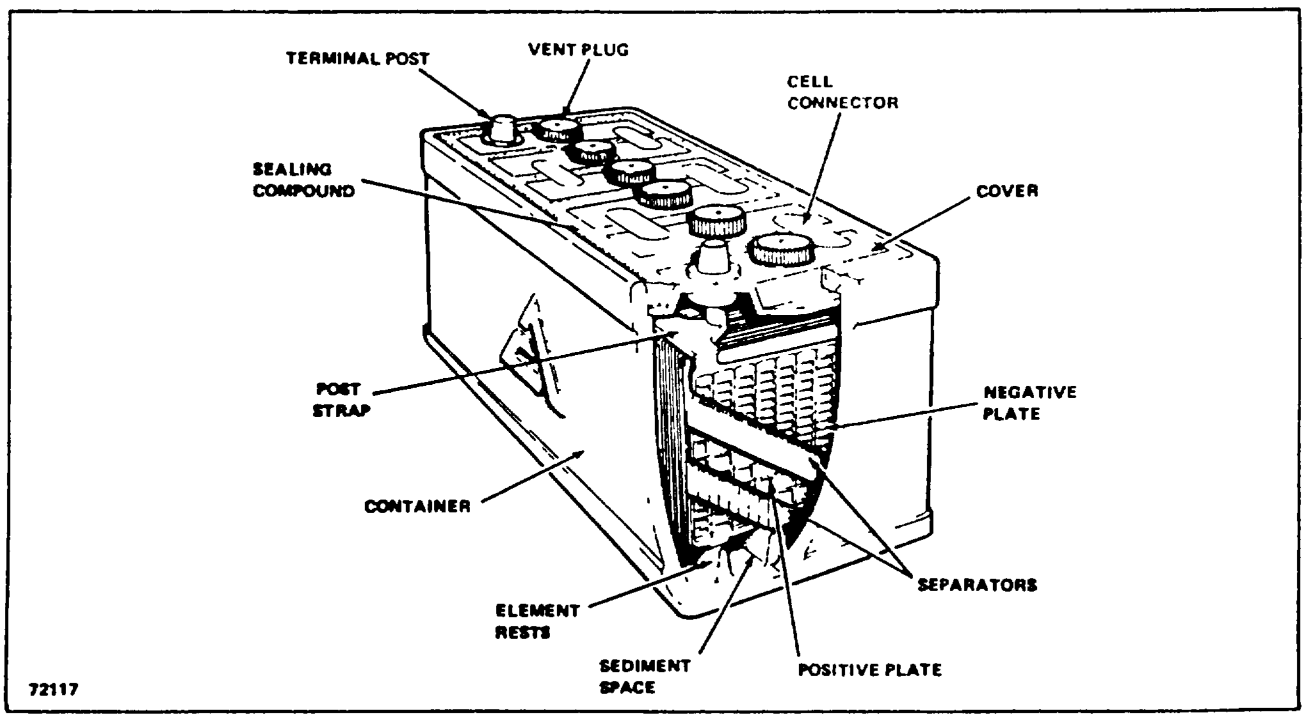


Figure 1. Battery (Typical)

1. Chemical Action of Discharge

When a cell is discharged by completing an external circuit, the sulphuric acid acts on both positive and negative plate active material to form the chemical compound lead sulphate. The sulphate is supplied by the acid solution (electrolyte) which becomes weaker in concentration as the discharge proceeds. The amount of acid consumed is in direct proportion to the amount of electricity used from the cell. When the acid in the electrolyte is partially used up by combining with the plates, the battery is said to be discharged. This gradual weakening of the electrolyte in proportion to the electricity delivered is a very useful action because with the use of a hydrometer it can be determined how much unused acid remains with the water in the electrolyte, thus it can be judged how much electrical energy is left in the cell.

2. Chemical Action of Charge

By passing electric current through the battery in a direction opposite to that of the discharge, the lead sulphate is decomposed. The sulphate is expelled from the plates and returns to the electrolyte, thereby gradually restoring it to its original strength. This action frees the plate active materials of sulphate and they are restored to their original chemical condition, ready to deliver electricity again. Hydrogen and oxygen gases are given off at the negative and positive plates respectively as the plates reach the fully charged condition. This is the result of the decomposition of the water by an excess of charging current not utilized by the plates.

3. Inspection

The battery contains no electrolyte until it is activated for service in the field. Consequently, it is referred to as a "dry-charge" battery.

Unless the batteries are kept dry until ready for use, they may lose a portion of their activating capacity due to moisture oxidizing the pre-dried plates.

Dry charged batteries must be handled with care to protect them against breakage. This may not be evident until the battery is activated by adding electrolyte. Battery cartons should be checked for evidence of either dampness or damage when the battery is received. If visual inspection of the carton indicates possible damage to the battery during transit or storage, it should be opened and the battery carefully checked.

4. Care of Stock Batteries in Original Equipment

Batteries normally leave the manufacturing plant in good condition, but excessive temperature and unusual vibration or jolts over long hauls by trucks or railroads might affect the condition of the battery. Always inspect for damage when a shipment arrives. Check batteries for possible cracks or damage and check cell readings with a hydrometer. If not fully charged, recharge and if breakage has occurred, file your claim with the carrier.

Although many makes of batteries can discharge quite rapidly while standing idle, especially in warm weather, Allis-Chalmers batteries are built with an exclusive manufacturing process which reduces self-discharge of wet batteries to a minimum. Normally, no care will be required unless the battery remains in stock for unusually long periods of time. However, it is recommended that the battery be inspected every 30 days and when the specific gravity falls below 1.220, corrected to 80°F., the battery should be recharged. The battery will be fully charged when all the cells are gassing or bubbling freely and the specific gravity reading is 1.255 or higher.

If the batteries are allowed to remain in a partially discharged state for a period of time, the lead sulphate which forms on the plates during the normal chemical process of discharging hardens and reduces the capacity of the battery. When the plates in a battery are in this condition, the battery is referred to as "sulphated."

Fast charging a sulphate battery will only supply a surface charge and will not reconvert all of the hard lead sulphate to its original chemical state. The hardened lead sulphate remaining on the plates will then continue its growth during normal operation, eventually resulting in a completely discharged battery. Additional fast charging of a sulphated battery will damage the plates and lead to premature battery failure.

It is the dealers responsibility to properly maintain batteries in inventory equipment.

5. Care and Handling of Dry Charge Batteries Inspect each shipment as received and if damage is present, file claim with carrier.

   Store batteries and electrolyte on racks in a dry location at a temperature between 60°F. and 90°F. With batteries stored at the ideal temperature of 70°F., they will require a minimum amount of charging to properly activate the battery before delivery to a customer.

   The following precautions should be considered when handling and storing electrolyte.

   a. When storing electrolyte, avoid placing of other material on containers.

   b. Electrolyte should be used in an area where water is readily available for flushing in case the electrolyte comes into contact with the skin.

   c. Refer to the instructions on the side of the electrolyte container for antidotes to use if electrolyte comes into contact with the skin.

6. Activating Batteries To prepare batteries for service, use battery-grade acid electrolyte (1.265 sp. gr. at 80°F.). Electrolyte is commonly packaged in cartons sufficient for the filling of one battery. Activate the new battery before removing the old battery from the vehicle. For best performance, the temperature of the battery and the electrolyte should be between 60°F., and 90°F., during activation. The following procedure is recommended for filling the battery.

   a. Remove battery from its original carton.

   b. Remove vent plugs.

   c. With the electrolyte carton right side up, open the carton and cut a small hole in the corner of the liner.

CAUTION: Do not attempt to remove the liner from the container. The liner is sealed to the container and any attempt to remove it may cause a rupture in the liner.

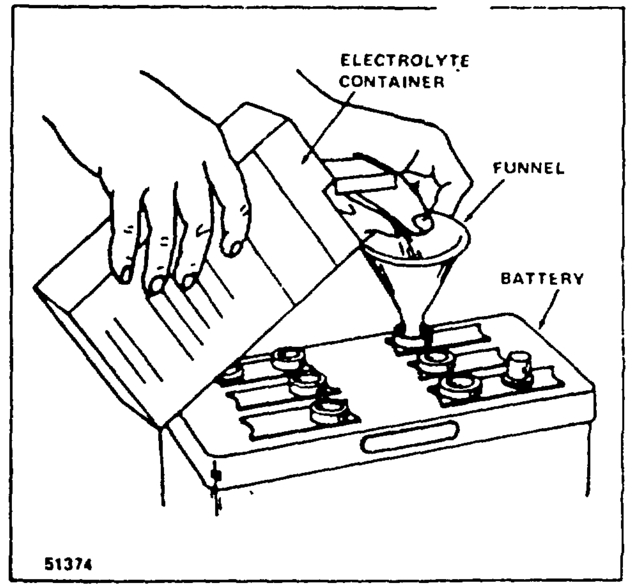


Figure 2. Activating Battery

   Do not make the opening longer than required since a larger opening will increase the tendency of the electrolyte to spatter as It is emptied from the container.

   d. Using a glass or acid-proof funnel, fill each battery cell with electrolyte.

NOTE: Do not use a metal funnel for filling the battery.

   e. Fill each cell to indicator level with electrolyte solution of 1.250 - 1.265 specific gravity. Temperature of battery and solution must be between 60°F. and 90°F.

   f. Allow battery to stand at least 20 minutes. Check each cell and add electrolyte as necessary, to restore level to indicator.

   g. Before discarding an electrolyte container, empty and rinse thoroughly with water to remove any electrolyte remaining in the container. Discarded packages containing electrolyte may prove to be dangerous or harmful to persons who are unfamiliar with the poisonous and corrosive characteristics of sulphuric acid electrolyte.

h. Give battery a minimum charge. Charge 12 volt batteries at 35 amps. for ten minutes or until the temperature of the electrolyte reaches 80°F.

i. Be sure to date code the battery before installing it in the vehicle. Use a date code ring and gently stamp the code indicating the month and year when it is installed on top of the negative post.

j. If the outdoor temperature is below 40°F., or if the battery is not to be put into service within 24 hours after activation, it should be fully charged (1.255 or higher specified gravity).

k. After electrolyte has been added to a dry charged battery, it becomes a "wet" battery and should be maintained in the same way as any other "wet" battery.

7. Storage for thirty Days or More

If any battery equipped vehicles are to remain in inventory storage for longer than thirty days, the batteries should be handled as follows

a. If necessary, add distilled water to bring the electrolyte to the proper level. Charge the battery if the specific gravity is 1.240 or below, corrected to 80°F. Then, remove the battery from the unit and store in a cool, dry location shielded from direct sunlight and away from heat duct outlets. Do not stack batteries on top of one another as damage to the plates may result.

   Indicate the date the battery is placed in storage with chalk on the battery case.

b. Check the electrolyte level and specific gravity every 30 days.

c. Whenever the specific gravity falls to 1.220 or below, corrected to 80°F, recharge the battery. This will be necessary approximately every thirty days in warm weather and a longer period in cooler weather. Before recharging be sure the electrolyte level is correct.

   The date batteries in storage are recharged can also be indicated on the battery case with chalk.

d. As new units are sold, install proper batteries that were in storage for the longest period.

   Should a sulphated battery be encountered, the battery must be slow charged at five to six amps by a constant current type of charge in order to reconvert the plates to pure lead and lead peroxide. The battery is fully charged when all cells are gassing or bubbling freely and the specific gravity reading remains constant at 1.255 or higher, corrected to 80°F., for two successive readings taken at hourly intervals.

e. If a battery is installed in equipment used as a demonstrator, it should be checked and recharged. if necessary, at least every other thirty days. Although the battery may continue to start the equipment for several months, it will be damaged if it is allowed to become sulphated.

B. SERVICE - (TESTING)

1. Use of a Hydrometer

a. Squeeze the rubber bulb and insert the nozzle in the cell, release the bulb slowly, drawing electrolyte up into the barrel.

b. Adjust the electrolyte level in the barrel so the float rides free of the bottom, but is not striking the top.

c. fold the hydrometer in vertical position, making certain the float moves freely, then read the scale at the level of the electrolyte in the barrel.

NOTE: For accurate results in extreme temperatures, make corrections as described in Paragraph 5, this Section.

d. Return electrolyte to the cell from which it was removed.

CAUTION: Handle hydrometer carefully when making tests, after completing tests, flush hydrometer with clean water.

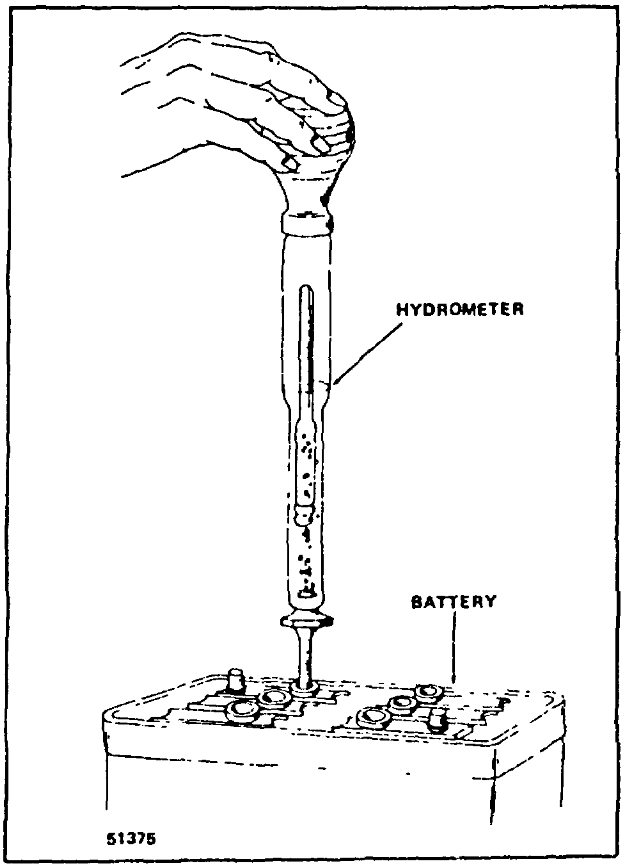


Figure 3. Testing Battery with Hydrometer

2. Use of a Voltmeter

Voltmeters designed for testing storage batteries have scale ranges suitable for testing individual cells. Some are equipped with prod contacts which are properly spaced to bridge a battery cell. Readings are obtained by pressing the prod points firmly into the post or cell connectors of each cell and observing the position of the voltmeter pointer with respect to the scale. The proper polarity must be observed, the red prod makes contact with positive post, the black prod a negative post.

NOTE: A cell connector must be regarded as positive when testing one cell, and negative when testing the adjoining cell. (The cell connector connects the positive post of one cell with the negative post of an adjoining cell.)

Some batteries are made with buried cell connectors, which are covered with sealing compound. Voltage readings of batteries constructed in this manner are obtained by pressing the prod points through the sealing compound and contacting the cell connectors. After the test is made, the pierced sealing compound should be pressed back in place.

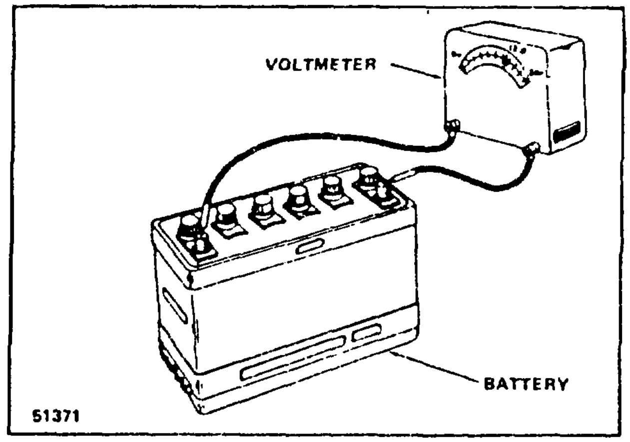


Figure 4. Testing Battery with Voltmeter

CAUTION: It is not recommended that a voltmeter be used to test batteries with buried connectors, unless the user is certain of the proper cell connectors. If through error, the voltmeter contacts two or more cells, there is a possibility it will be damaged.

3. Test After Activation

The dry charge battery may be put into service immediately after activating.

To assure good battery performance, the following activation tests are recommended.

a. Five minutes after adding electrolyte check the open circuit voltage. More than 6 volts or more than 12 volts, depending upon the rated voltage, indicates the battery is ready for service. From 5 to 6 volts or from 10 to 12 volts indicates oxidized negative plates and the battery should be recharged before use. Less than 5 or less than 10 volts depending on the rated voltage, indicates a reverse cell or an open circuit and the battery should be replaced. Refer to Paragraph 2, this Section, pertaining to the use of voltmeter.

b. Check the specific gravity of all cells. If the specific gravity corrected to 80°F. shows more than a thirty point (.030) drop from the initial filling with electrolyte, or if one or more cells gas violently after addition of electrolyte, the battery should be fully charged before use. Refer to Paragraph 1, this Section pertaining to the use of a hydrometer.

c. For best performance in cold weather (32°F. or less), or if the battery and the electrolyte are not at 60°F. or above at time of activation, warm the battery by boost charging. Refer to Paragraph 8, this Section.

4. Safety Precautions

When batteries are being charged, an explosive gas mixture forms beneath the cover of each cell. Part of this gas escapes through the holes in the vent plugs and may form an explosive atmosphere around the battery itself if ventilation is poor. This explosive gas may remain in or around the battery for several hours after it has been charged. Sparks or flames can ignite this gas causing an internal explosion which may shatter the battery.

The following precautions should be observed to prevent an explosion.

a. Do not smoke near batteries being charged or which have been very recently charged.

b. Do not break live circuits at the terminals of batteries because a spark usually occurs at the point where a live circuit is broken.

Care must be taken when connecting or disconnecting booster leads or cable clamps on fast chargers.

5. Battery Test

The battery condition can be determined by the following:

a. Visual Inspection.

The time spent in visually inspecting a battery may save much time and expense in determining battery condition.

Check for bad odors which indicate that the battery has been filled with something other than battery electrolyte. Note the level of the electrolyte.

If the electrolyte is allowed to get below the top of the plates and water is not added, the active materials become permanently damaged and can never be restored.

Check outside of battery for damage or signs of serious abuse such as broken or cracked case and cell covers. If it shows signs of serious damage or abuse, it should be replaced.

b. Light Load Test

This test should be applied to batteries before they are charged. Otherwise, defective cells that have been charged may pass the test and give a false diagnosis. To check the electrical condition of battery cells the following procedure is recommended:

(1) If the electrolyte level is low, adjust it to the proper level by adding water.

(2) Place a 150 ampere load on the battery for 3 seconds, using a high rate load tester, to remove surface charge.

(3) Place a 10 ampere load on the battery. The load must be placed on the battery for one minute before starting the test and then left on during the test to allow the discharge current to reduce the cell voltage readings in proportion to the capacity of the cells.

(4) After one minute, read the individual cell voltages of the battery with an expanded scale voltmeter that has .01 volt divisions.

The difference in voltage readings between the individual cells can be interpreted as follows:

Uniform Readings -Sufficiently Charged.

If all cells read 1.95 volts or more and the difference between the highest and lowest is less than .05 volts, the battery is good and is sufficiently charged (see Figure 5).

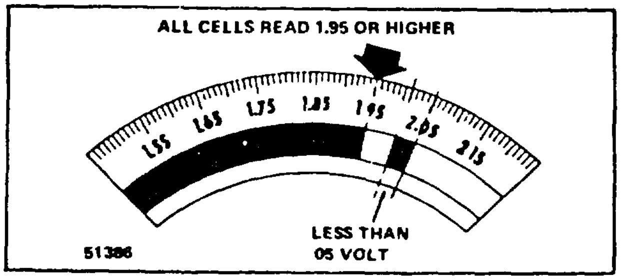


Figure 5. Uniform Readings

Low Readings

If cells read both above and below 1.95 volts and the difference between the highest and lowest cell is less than .05 volt, the battery is good, but requires charging (see Figure 6).

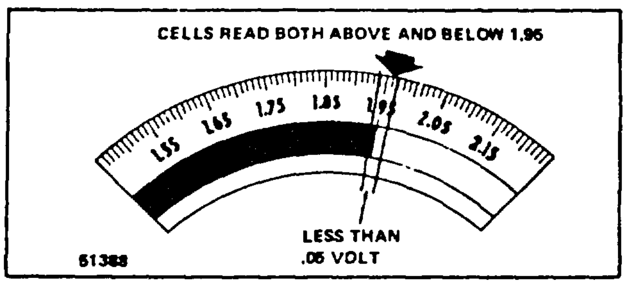


Figure 6. Low Readings

Non-Uniform Readings

If any cell reads 1.95 volts or more and there is a difference of .05 volts or more between the highest and lowest cell, the battery should be replaced (see Figure 7).

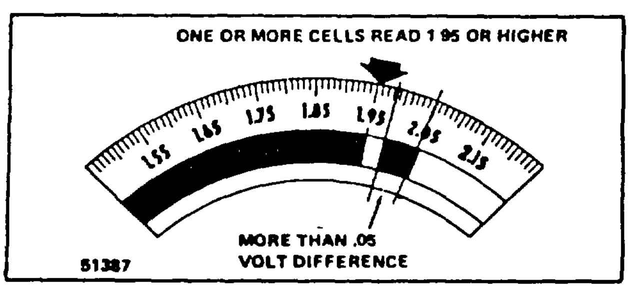


Figure 7. Non-Uniform Readings

Readings Too Low to test

If all cells read less than 1.95 volts, the battery is too low to test properly. Failure of the meter to register con all cells does not indicate a defective battery. Boost charge battery and repeat the test. If the battery is found to be good after boosting, it should be fully recharged for good performance.

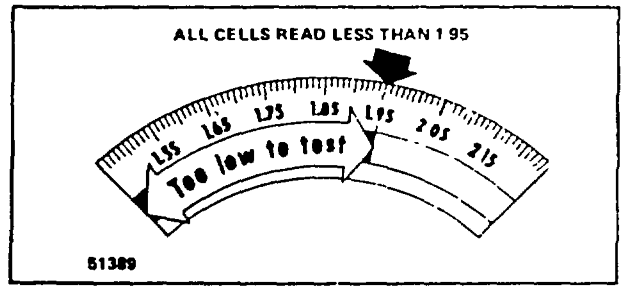


Figure 8. Reading Too Low to Test

If none of the cells comes up to 1.95 volts after the first boost charge, the battery should be given a second boost. Batteries which do not come up after a second boost charge should be replaced.

The procedure outlined below should be used on any battery originally found to be good by the Light Load Test, but has since failed to perform satisfactorily in service and which still tests good by the Light Load Test.

c. Full Charge Hydrometer Test

(1) Use hydrometer - Read accurately to nearest scale division and correct readings for temperature.

NOTE: Hydrometer readings taken on partially charged batteries are unreliable for this test.

(2) Record individual cell readings - unless all cells are fully charged (1.255 specific gravity or higher).

(a) If cell readings range between 1.230 and 1.310 specific gravity, the battery is ready for use. All it needed was, a full charge. Any variation in the specific gravity between cells within this range does not indicate a defective battery.

(b) If any cell reads less than 1.230 specific gravity and the battery has been in service 3 months or less, the battery is good but it has been improperly filled (activated) with electrolyte or water and will give poor performance. To correct this condition, empty the electrolyte from any cell reading less than 1.230 and refill with 1.265 gravity battery grade electrolyte. The battery is then ready for service.

(c) If any cell reads less than 1.230 and battery has, been in service more than 3 months, it is assumed to be worn out and at best will give very little useful service. The battery should be replaced.

The hydrometer readings should always be corrected for the temperature of the battery electrolyte. Add 4 gravity points (.004) to the reading for every 10°F. electrolyte temperature above 80°F. For every 10°F. of electrolyte temperature below 80°F., subtract 4 points from the gravity reading.

d. Test for Serviceability

(1) Cell Differences - Read each cell with a hydrometer. Record individual cell readings.

(2) Serviceable - If the difference between the highest and lowest cell is LESS than 50 points (.050) specific gravity by the hydrometer.

(3) Unserviceable - If the difference between the highest and lowest cell is MORE than 50 points (.050) specific gravity by the hydrometer.

(4) If battery tests "serviceable" by the above tests, but fails to perform satisfactorily in customer's equipment, allow it to stand off charge 72 hours and test again for cell differences as described above.

NOTE: Under the Allis-Chalmers Battery Service Adjustment Policy, only the batteries that are unserviceable as a result of defects in material or workmanship are to be replaced at no charge or on an adjusted basis. The test procedure outlined above must be adhered to as credit to the dealer will be made on the basis of results of tests made on all returned batteries at Allis-Chalmers branches. Batteries returned to the branch that are checked and found serviceable will be returned to dealer at his expense for transportation and battery replacement costs.

6. Charging Battery

There are two separate methods of recharging batteries which differ basically in the amount of charging current supplied, the slow charge method and the fast charge method. The slow charge supplies the battery with a relatively low, amount of current for a relatively long period of time, whereas, in the fast charge, the battery is supplied with a high current for a short period of time.

The following procedure is recommended when charging the battery.

a. Check the electrolyte level in the cells, add water as necessary to obtain proper level.

CAUTION: Do not overfill. If level is too high, adjust to proper level by removing electrolyte. (Store removed electrolyte in a clean Jar.)

b. Leave cell vent plugs in place, check to see that the vent holes are free to permit the escape of gas.

c. With the charger switch in the "OFF" position (or not connected to the power line, if it is not equipped with an "ON" and "OFF" switch):

(1) Connect the positive lead of the charger to the positive post of the battery. Positive on the charger is indicated by (+) or a red cable or connector. The positive battery post is indicated by a (+) or "P".

(2) Connect the negative lead of the charger to the negative battery post. Negative on the charger is indicated by (-) or a black cable or connector, the negative post of the battery is indicated by a (-), or "N" or no mark at all.

d. Turn on charger and continue the charge to the desired point. Normally, a hydrometer is used to determine the state of charge of the battery. For practical purposes, the full charge point of the battery is reached when the hydrometer reads 1.260. If the maximum charge is desired, the charge should be continued until three successive readings at hourly intervals show no increase in specific gravity.

The hydrometer does not give an accurate reading of batteries on fast charge. Some fast charges are equipped with a device that terminates the charge, automatically, when the battery temperature reaches 1250 the point at which it is essentially fully charged. In the absence of such a device, a thermometer should be inserted in the cell vent and the charge should be terminated when it reaches 125°F.

e. Turn the charger "OFF" and disconnect the leads from the battery.

NOTE: If leads are not disconnected from battery, there will be a slight current drain from the battery through the charger.

f. Check the electrolyte level, add water as necessary, or return electrolyte removed prior to charging.

g. Clean and dry the battery top.

NOTE: Before using any type of charger, be sure to read the manufacturer's instructions.

7. Quick-In Vehicle Charging

Fast-chargers are devices which supply current to the battery at a high charging rate. The battery is brought up to a high rate of charge before excessive battery temperatures are reached. Although a battery cannot be brought up to a fully charged condition during a quick-charge, it can be substantially recharged or "boosted." In order to bring the battery to a fully charged condition, the charging cycle must be finished by charging at a low or normal rate.

8. Boost Charging for Light Load Test

The boost charge for the Light Load Test is necessary to condition the battery so that it will be at least 10% to 20% charged when checked. Batteries which are in an extreme discharged condition may require more than one boost charge in order to condition them for the Light Load Test. Batteries should be boosted at 60 amperes for 30 minutes (60 X 30 = 1800 ampere minutes). If the charger being used will not give these rates, charge for an equal number of ampere minutes at best rate available. For purposes of the Light Load Test, do not boost battery more than the amount indicated.

9. Charging After Light Load Test

Batteries to be charged after the Light Load Test are of the following types.

a. Batteries previously requiring a boost charge because they were too low to test.

b. Good batteries with one or more but not all cell voltages reading less than 1.95 volts.

If batteries are to be recharged by means of a fast charger, the charge rate must be tapered (reduced to a safe limit) when the electrolyte temperature reaches 125°F., or when gassing becomes excessive. Failure to do so may harm the battery.

10. Slow Out-Of-Vehicle Charging

A slow charger is a device which will supply current to the battery at d low charging rate which is necessary in order to fully charge it. Due to the low rate during slow charging, plenty of time must be allowed. Charge periods of 24 hours or more are often required.

11. Full Charging for Hydrometer Test

To fully charge a battery, the current input to the battery should be adjusted to a charging rate equivalent to 7% of the 20 hour rate of the battery.

Example: A 100 ampere hour battery should be slow charged at 7 amperes. (7% of 100 AH = 7 amperes charge rate.) If several batteries of different sizes are charged in series, the charging rate is determined by the battery with the lowest ampere hour rating. If the ampere-hour capacity of a battery cannot be determined, charge it at 5 amperes.

Charging should be continued until the battery is fully charged. This is indicated when all cell gravities do not increase when checked with a hydrometer at three intervals of one hour and all cells are gassing freely. When fully charged, all of the plate material in the battery has been reconverted into active material.

12. Slow Charging with Fast Charger

Some chargers are equipped to charge at either a high or low rate, a charger which has provision for finishing the charging cycle at a low rate will permit the battery to become fully charged if sufficient time is allowed.

C. INSTALLATION

The following points are important to properly install a battery.

1. Be sure that the battery tray is clean and that the battery rests level when installed.

2. Tighten the hold-down evenly until snug. Do not draw down tight enough to distort or crack battery case.

3. Be sure the cables are in good condition and the terminal clamps are clean. Grease battery terminals lightly before attaching cable clamps. Make sure the ground cable is clean and tight.

4. Check polarity to be sure battery is not reversed with respect to the generating system.

CAUTION: DO NOT POLARIZE ALTERNATOR

5. Connect "grounded" terminal of the battery last to avoid short circuits which will damage the battery.

TOPIC 3. ALTERNATOR

A. DESCRIPTION

The alternator, Figure 32 and 33, contains a solid state regulator that is mounted inside the alternator slip ring end frame. All regulator components are enclosed into a solid mold, and this unit along with the brush holder assembly, is attached to the slip ring end frame. The regulator voltage setting never needs adjusting, and no provision for adjustment is provided.

The alternator rotor bearings contain a supply of lubricant sufficiently adequate to eliminate the need for periodic lubrication. Two brushes carry current through the two slip rings to the field coil mounted on the rotor, and under normal conditions will provide long periods of attention-free service.

The stator windings are assembled on the inside of a laminated core that forms part of the alternator frame. A rectifier bridge connected to the stator windings contains six diodes, and electrically changes the stator a.c. voltages to a d.c. voltage which appears at the alternator output (BAT) terminal. Alternator field current is supplied through a diode trio which also is connected to the stator windings. A capacitor, or condenser, mounted in the end frame protects the rectifier bridge and diode trio from high voltages, and suppresses radio noises.

No periodic adjustments or maintenance of any kind are required on the entire alternator assembly.

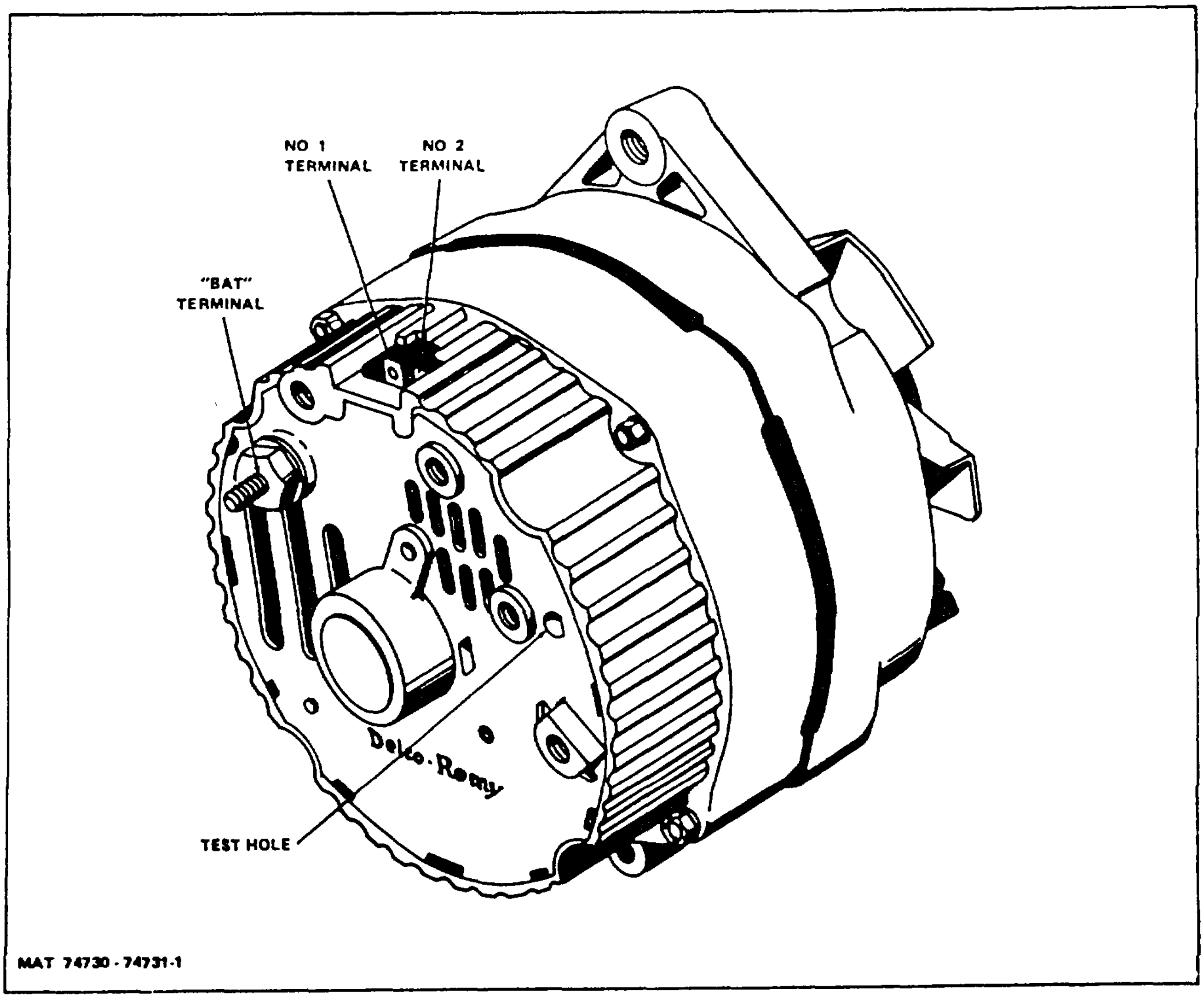


Figure 32. Alternator Assembly

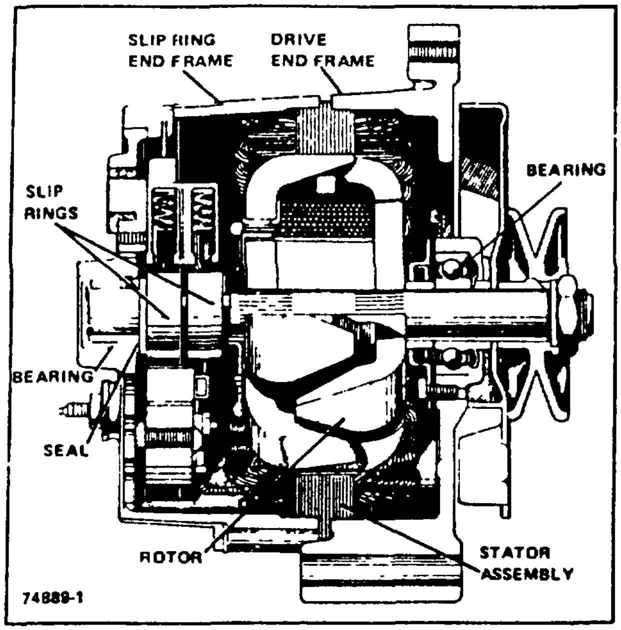


Figure 33. Cross-Sectional View of Alternator

B. PRINCIPLES OF OPERATION

The principles of operation of the alternator are as follows. See Figure 34.

When the ignition switch is closed, current from the battery flows through the 5-ampere fuse and resistor to the alternator No. 1 terminal, through resistor R1, diode D1, and the base-emitter to transistor TR1 to ground, and then back to the battery. This turns on transistor TR1, and current flows through the alternator field coil and TR1 back to the battery. The ammeter shows discharge. The resistor in parallel with the ammeter reduces total circuit resistance to provide higher field current for initial voltage build-up when the engine starts.

With the alternator operating, a.c. voltages are generated in the stator windings, and the stator supplies d.c. field current through the diode trio, the field, TR1, and then through the grounded diodes in the rectifier bridge back to the stator. Also, the six diodes in the rectifier bridge change the stator a.c. voltages to a d.c. voltage which appears between ground and the alternator "BAT" terminal. As alternator speed increases, current is provided for charging the battery and operating electrical accessories. Also, with the alternator operating, the same voltage appears at the "BAT" and No. 1 terminals, and the ammeter shows charge to indicate the alternator is producing voltage.

The No. 2 terminal on the alternator is always connected to the battery, but the discharge current is limited to a negligible value by the high resistance of R2 and R3. As the alternator speed and voltage increase, the voltage between R2 and R3 increases to the point where zener diode D2 conducts. Transistor TR2 then turns on and TR1 turns off. With TR1 off, the field current and system voltage decrease, and D2 then blocks current flow, causing TR1 to turn back on. The field current and system voltage increases, and this cycle then repeats many times per second to limit the alternator voltage to a preset value.

Capacitor C1 smoothes out the voltage across R3, resistor R4 prevents excessive current through TR1 at high temperatures, and diode D3 prevents high-induced-voltages in the field windings when TR1 turns off. Resistor R2 is a thermistor which causes the regulated voltage to vary with temperature, thus providing the optimum voltage for charging the battery.

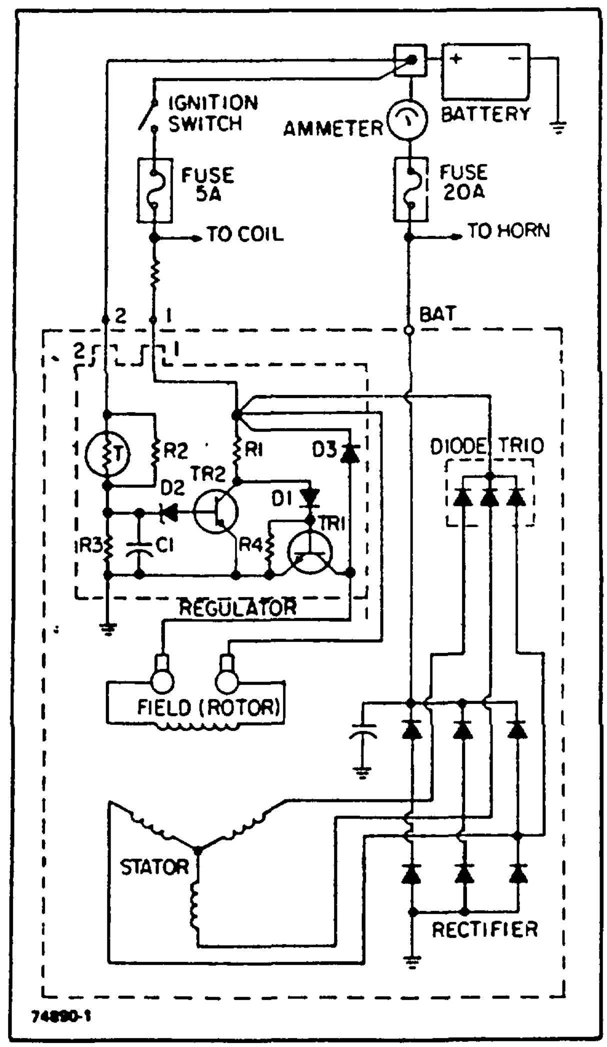


Figure 34. Alternator Internal Circuits, Schematic Diagram

C. TROUBLESHOOTING PROCEDURES

Close adherence to the following procedures in the order presented will lead to the locations of charging system defects in the shortest possible time. Only a portion of those procedures need be performed. It will never be necessary to perform all the procedures in order to locate the trouble.

A basic wiring diagram showing lead connections is shown in Figure 35. To avoid damage to the electrical equipment, always observe the following precautions:

1. Do not polarize the alternator.
2. Do not short across or ground any of the terminals in the charging circuit except as specifically instructed herein.
3. NEVER operate the alternator with the output terminal open-circuited.
4. Make sure the alternator and battery have the same ground polarity.
5. When connecting a charger or a booster battery to the vehicle battery, connect negative to negative and positive to positive.

Trouble in the charging system will show up as one or more of the following conditions:

1. Faulty ammeter operation.
2. An undercharged battery as evidenced by slow cranking and low specific gravity readings.
3. An overcharged battery as evidenced by excessive water usage.

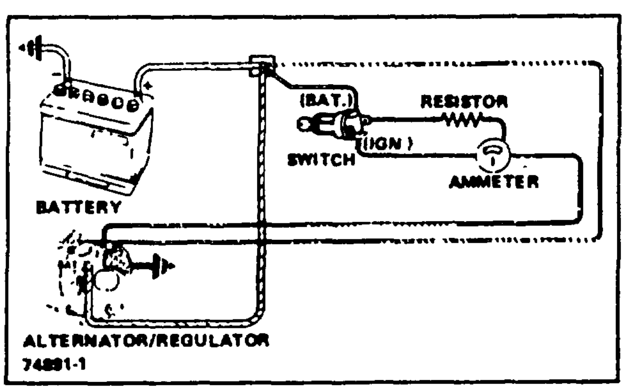


Figure 35. Alternator Typical Wiring Diagram

1. Undercharged Battery

This condition, as evidenced by slow cranking and low specific gravity readings, can be caused by one or more of the following conditions, even though the ammeter may be operating normally.

a. Insure that the undercharged condition has not been caused by accessories having been left on for extended periods.

b. Check the drive belt for proper tension.

c. If a battery defect is suspected, check the battery as described in the Battery Service section.

d. Inspect the wiring for defects. Check all connections for tightness and cleanliness, including the slip connectors at the alternator and firewall, and the cable clamps and battery posts.

e. With ignition on and all wiring harness leads connected, connect a voltmeter from:

alternator "BAT" terminal to ground,

alternator No. 1 terminal to ground, and

alternator No. 2 terminal to ground.

A zero reading indicates an open between voltmeter connection and battery. The alternator has a built-in feature which avoids overcharge and accessory damage by preventing the alternator from turning on if there is an open in the wiring harness connected to the No. 2 terminal. Opens in the wiring harness connected between the No. 2 terminal and battery may be between the terminals, at the crimp between the harness wire and terminal, or in the wire.

f. If previous Steps a. through e. check satisfactorily, check the alternator as follows:

(1) Disconnect battery ground cable.

(2) Connect an ammeter in the circuit at the "BAT" terminal of the alternator.

(3) Reconnect battery ground cable.

(4) Connect a carbon pile across the battery.

(5) Operate engine at moderate speed as required, and adjust carbon pile as required, to obtain maximum current output.

(6) If ampere output is within 10 amperes of rated output as stamped on alternator frame, alternator is not defective; recheck Steps a. through e.

(7) If ampere output is not within 10 amperes of rated output. ground the field winding by inserting a screwdriver into the test hole.

CAUTION: Tab in the alternator test hole is within 3/4 inch of casting surface. Do not force screwdriver deeper than one inch into end frame.

(8) Operate engine at moderate speed, as required, and adjust carbon pile as required to obtain maximum current output.

(9) If output is within 10 amperes of rated output, replace regulator as covered in Alternator Repair section, and check field winding.

(10) If output is not within 10 amperes of rated output, check the field winding, diode trio, rectifier bridge, and stator as covered in Alternator Repair section.

(11) Remove ammeter from alternator.

2. Overcharged Battery

a. To determine battery condition, check battery as indicated in Battery Service section.

b. Connect a voltmeter from alternator No. 2 terminal to ground. If reading is zero, No. 2 lead circuit is open.

c. If battery and No. 2 lead circuit check good, but an obvious overcharge condition exists as evidenced by excessive battery water usage, proceed as follows:

(1) Separate end frames as indicated in Alternator Repair Disassembly section.

(2) Check field winding for shorts. See Figure 36. If shorted replace rotor and regulator.

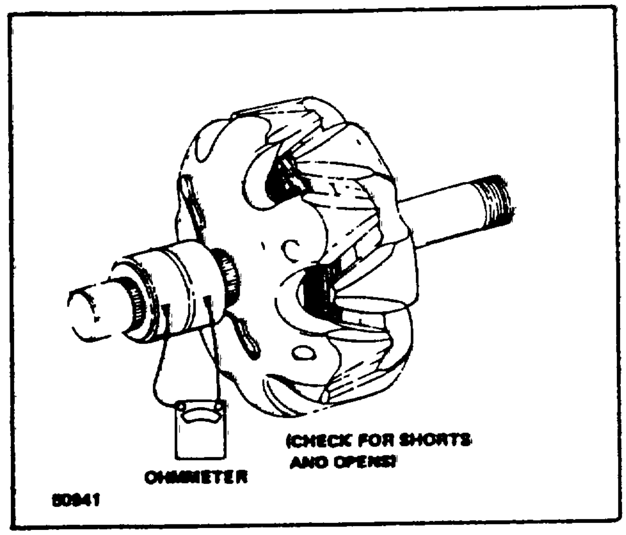


Figure 36. Checking Rotor Field Winding

(3) Check field winding for grounds. If grounded replace only the rotor.

(4) Connect ohmmeter, using lowest range scale, from brush lead clip to end frame as shown in Step 1, Figure 37, then reverse lead connections.

(5) If both readings are zero, either the brush lead clip is grounded or regulator is defective.

(6) A grounded brush lead clip can result from omission of insulating washer (Figure 37), omission of insulating sleeve over screw, or damaged insulating sleeve over screw, or damaged insulating sleeve. Remove screw to inspect sleeve. If satisfactory, replace regulator as indicated in Alternator Repair section.

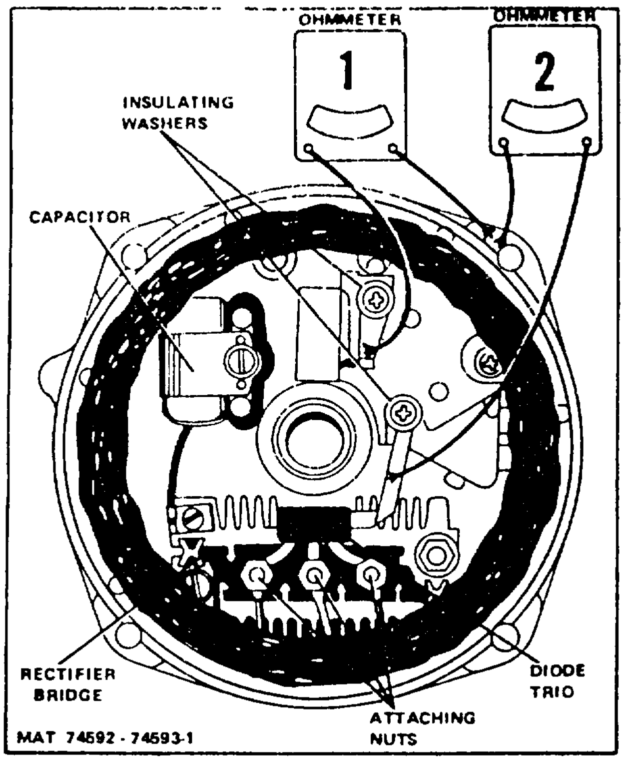


Figure 37. End Frame Assembly, Inside View

D. ADJUSTMENT

Be sure to check the mounting bolts for tightness and the belt for alignment, correct tension and wear. Belt tension should be adjusted to allow approximately 3/8" inward deflection of the belt between the alternator pulley and the fan pulley with a force of about 10 pounds. (See Figure 38.)

When tightening belt tension always apply pressure against the stator laminations, never against the end frames. Inspect the brush springs and brushes for evidence of any damage, wear or corrosion. Replace any brush springs or brushes in doubtful condition.

A noisy alternator can be caused by worn or dirty bearings, loose mounting bolts, a loose drive pulley, a defective diode or a defective stator.

E. REMOVAL

Alternator: After extensive periods of operation or during major engine overhaul, the alternator should be removed from the truck for a thorough inspection and cleaning of all parts. The alternator consists of four main components which includes the two end frames, the stator and the rotor. The following procedures should be used for proper removal:

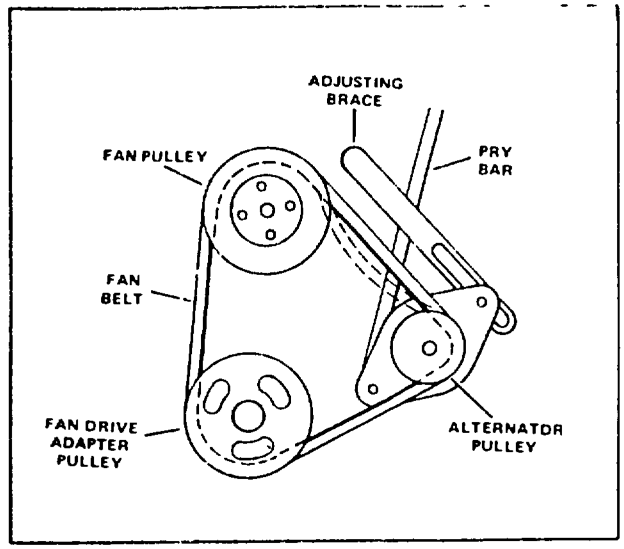


Figure 38. Fan Belt Tension

1. Disconnect the battery from the electrical circuit prior to alternator removal/installation.

2. Disconnect and properly label the "BAT" (Battery), No. 1 and No. 2 terminal leads at the alternator.

3. Loosen the adjusting brace and the pivot mounting bolt, then push alternator towards engine until fan belt is disengaged from the alternator pulley.

4. Carefully remove the alternator from the engine as the pivot mounting bolt and adjusting brace capscrew are removed.

F. SERVICE

Proceed according to the following sequence.

1. Disassembly

   To disassemble the alternator, take out the four thru-bolts, and separate the drive end frame and rotor assembly from the stator assembly by prying apart with a screwdriver at the stator slot. A scribe mark will help locate the parts in the same position during assembly.

   After disassembly, place a piece of tape over the slip ring end frame bearing to prevent entry of dirt and other foreign material, and also place a piece of tape over the shaft on the slip ring end. If brushes are to be reused, clean with a soft dry cloth.

ALTERNATOR SPECIFICATIONS

Rotation Viewing D.E.	Field Current (80°F.)			Cold Output at Specified Voltage					Rated Hot Output (Amps.)
	Grd.	Amps.	Volts	Spec. Volts	Amps.	Approx. R.P.M.	Amps.	Approx. R.P.M.	
CW	Neg.	4.0 - 4.5	12	*	22	2000	33	5000	37

*Voltmeter not needed for old output check. Load battery with carbon pile to obtain maximum output.

CAUTION: Use pressure sensitive tape, and not friction tape which would leave a gummy deposit on the shaft.

To remove the drive end frame from the rotor, place the rotor in a vise and tighten only enough to permit removal of the shaft nut.

CAUTION: Avoid excessive vise tightening as this may cause distortion of the rotor.

Remove the shaft nut, washer, pulley, fan, and the collar, and then separate the drive end frame from the rotor shaft.

2. Rotor Field Winding Checks

To check for opens, connect the test lamp or ohmmeter to each slip ring. If the lamp fails to light, or if the ohmmeter reading is high (infinite), the winding is open (Fig. 36).

Connect test lamp or ohmmeter from one slip ring to shaft. If lamp lights, or if reading is low, the rotor winding is grounded (not illustrated).

The winding is checked for short-circuits or excessive resistance by connecting a battery and ammeter in series with the edges of the two slip rings. Note the ammeter reading and refer to alternator specifications. As ammeter reading above the specified value indicates shorted windings; a reading below the specified value indicates excessive resistance.

An alternate method is to check the resistance of the field by connecting an ohmmeter to the two slip rings (Fig. 36). If the resistance reading is below the specified value, the winding is shorted; if above the specified value the winding has excessive resistance. The specified resistance value can be determined by dividing the voltage by the current given in alternator specifications. Remember that the winding resistance and ammeter readings will vary slightly with winding temperature changes. If the rotor is not defective, but the generator fails to supply rated output, the defect is in the diode trio, rectifier bridge, or stator.

3. Diode Trio Check

The diode trio is identified in Figure 37. First, connect an ohmmeter, using lowest range scale, from diode trio long connector to end frame as shown in Step 2, Figure 37; then, reverse lead connections. If both readings are the same, check for grounded brush lead clip caused by omission of insulating washer (Fig. 37), omission of insulating sleeve over screw, or damaged insulating sleeve. Remove screw to inspect sleeve. If screw assembly is correct, and both ohmmeter readings are the same, replace regulator.

To check the diode trio, remove it from the end frame assembly by detaching the three nuts, the attaching screw, and removing the stator assembly. Note that the insulating washer on the screw is assembled over the top of the diode trio connector. Use the lowest range of an ohmmeter having a 1-1/2 volt cell. Connect the ohmmeter to the single connector and to one of the three connectors (Fig. 39). Observe the reading. Then, reverse the ohmmeter leads to the same two connectors. If both readings are the same, replace the diode trio. A good diode trio will give one high and one low reading. Repeat this same test between the single connector and each of the other two connectors. Also, connect the ohmmeter to each pair of the three connectors (not illustrated). If any reading is zero, replace the diode trio.

NOTE: Figures 37 and 39 illustrate two diode trios differing in appearance. Either one of these diode trios may be used in the alternator, since the two are completely interchangeable.

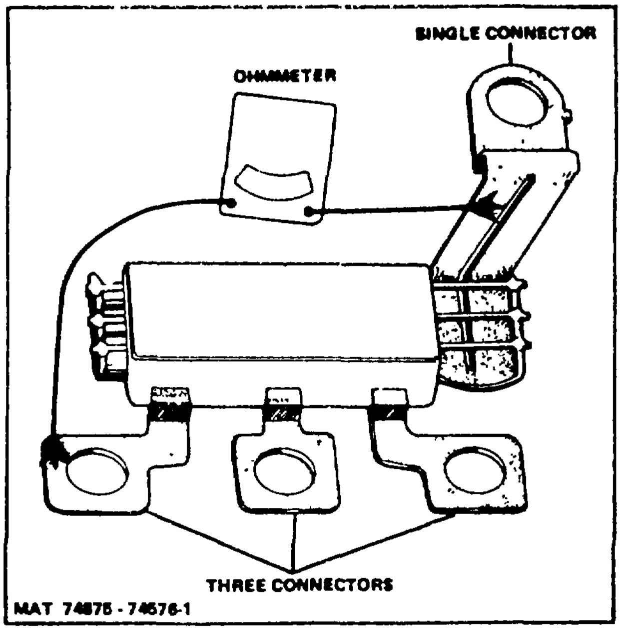


Figure 39. Diode Trio Check

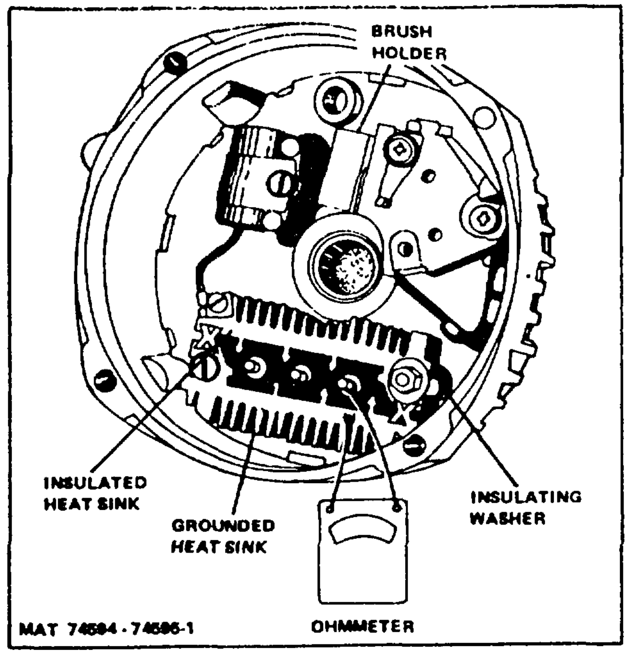


Figure 40. Rectifier Bridge Check

4. Rectifier Bridge Check

   Note that the rectifier bridge has a grounded heat sink and an insulated heat sink connected to the output terminal. Also, note the insulating washer located between the insulated heat sink and end frame.

   To check the rectifier bridge, connect the ohmmeter to the grounded heat sink and one of the three terminals (Fig. 40). IMPORTANT: If rectifier bridge is constructed as shown in Figure 41, connect ohmmeter pressing down very firmly onto flat metal connector, and, not onto threaded stud as in Figure 40. Then reverse the lead connections to the grounded heat sink and same terminal. If both readings are the same, replace the rectifier bridge. A good rectifier bridge will give one high and one low reading. Repeat this same test between the grounded heat sink and the other two terminals, and between the insulated heat sink and each of the three terminals. This makes a total of six checks, with two readings taken for each check. The ohmmeter check of the rectifier bridge, and of the diode trio as previously covered, is a valid and accurate check. DO NOT replace either unit unless at least one pair of readings is the same.

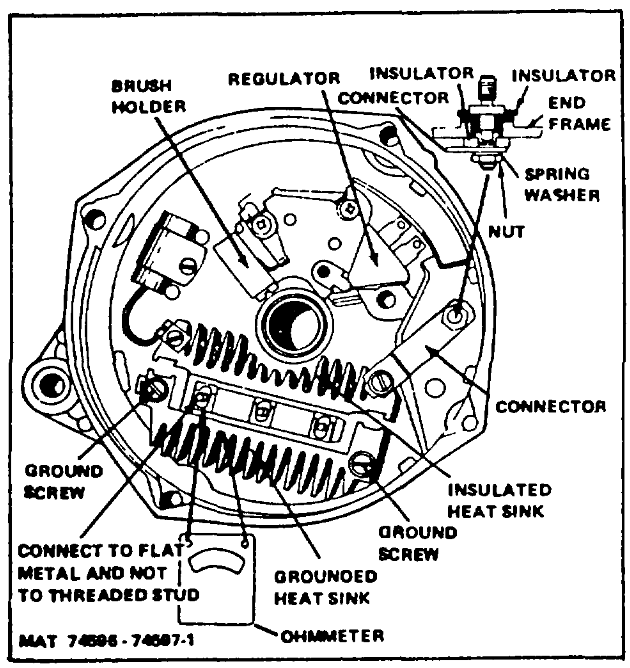


Figure 41. Rectifier Bridge Check

CAUTION: Do not use high voltage to check these units, such as a 110 volt test lamp.

To replace the rectifier bridge, remove the attaching screws, and disconnect the capacitor lead. Note the insulator between the insulated heat sink and end frame (Fig. 40). Rectifier bridges may vary in appearance but are completely interchangeable in these generators.

5. Stator Checks

The stator windings may be checked with a 110 volt test lamp, or with an ohmmeter. If the lamp lights, or if the meter reading is low when connected from any stator lead to the frame, the windings are grounded. If the lamp fails to light, or if the meter reading is high when successively connected between each pair of stator leads, the windings are open (Fig. 42).

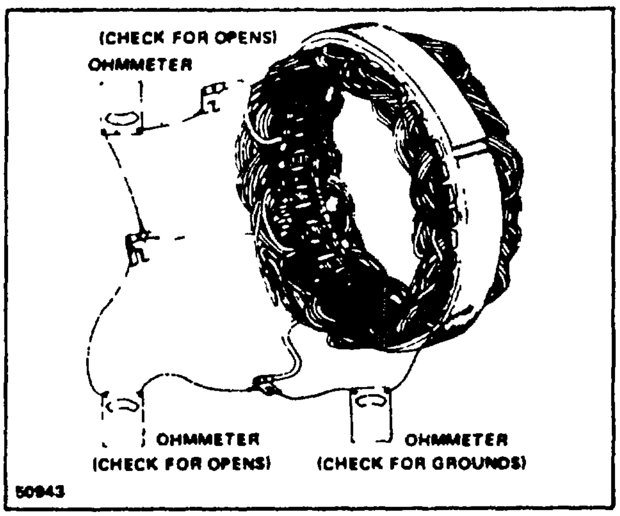


Figure 42. Checking Stator Windings

A short circuit in the stator windings is difficult to locate without laboratory test equipment due to the low resistance of the windings. However, if all other electrical checks are normal and the alternator fails to supply rated output, shorted stator windings are indicated.

6. Brush Holder and Regulator Replacement.

After removing the three attaching nuts, the stator, and diode trio screw (Figs. 40 and 41), the brush holder and regulator may be replaced by removing the two remaining screws. Note the two insulators located over the top of the brush clips in Figure 37; these two screws have special insulating sleeves over the screw body above the threads. The third mounting screw may or may not have an insulating sleeve. If not, this screw must not be interchanged with either one of the other two screws, as a ground may result, causing no output or uncontrolled generator output. Regulators may vary in appearance but are completely interchangeable.

7. Slip Ring Servicing

If the slip rings are dirty, they may be cleaned and finished with 400 grain or finer polishing cloth. Spin the rotor, and hold the polishing cloth against the slip rings until they are clean.

CAUTION: The rotor must be rotated in order to clean the slip rings evenly. Cleaning the slip rings by hand without spinning the rotor may result in flat spots on the slip rings, causing brush noise.

Slip rings which are rough or out of round should be trued in a lathe to .002" maximum indicator reading. Remove only enough material to make the rings smooth and round. Finish with 400 grain or finer polishing cloth and blow away all dust.

8. Bearing Replacement and Lubrication

The bearing in the drive end frame can be removed by detaching the retainer plate screws, and then pressing the bearing from the end frame. If the bearing is in satisfactory condition, it may be reused, and it should be filled one-quarter full with Delco-Remy lubricant No. 1948791 before reassembly.

CAUTION: Do not overfill bearing as this may cause it to overheat. Use only 1948791 lubricant.

To install a new bearing, press in with a tube or collar that just fits over the outer race, with the bearing and slinger assembled into the end frame as shown in Figure 43. It is recommended that a new retainer plate be installed if the felt seal in the retainer plate is' hardened or excessively worn. Fill the cavity between the retainer plate and bearing with 1948791 lubricant.

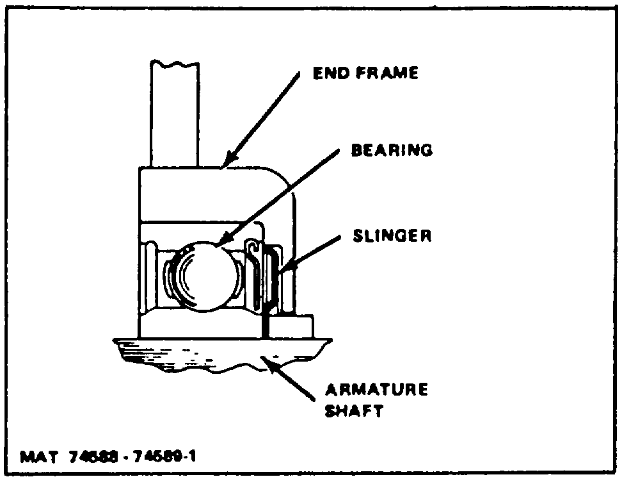


Figure 43. Drive End Bearing Assembly (Some models use flat washer instead of slinger)

The bearing in the slip ring end frame should be replaced if its grease supply is exhausted. No attempt should be made to re-lubricate and reuse the bearing. To remove the bearing from the slip ring end frame, press out with a tube or collar that just fits inside the end frame housing. Press from the outside of the housing towards the inside.

To install a new bearing, place a flat plate over the bearing and press in from the outside towards the inside of the frame until the bearing is flush with the outside of the end frame.

Support the inside of the frame with a hollow cylinder to prevent breakage of the end frame. Use extreme care to avoid misalignment or otherwise placing undue stress on the bearing.

If the seal is separate from the bearing, it is recommended that a new seal be installed whenever the bearing is replaced. Press the seal In with the lip of the seal toward the rotor when assembled, that is, away from the bearing. Lightly coat the seal lip with oil to facilitate assembly of the shaft into the bearing.

9. Reassembly

Assembling the pulley assembly, remembering to secure the rotor in a vise only tight enough to permit tightening the shaft nut to 40-60 lb. ft. If excessive pressure is applied against the rotor, the assembly may become distorted. To install the slip ring end frame assembly to the rotor and drive end frame assembly, remove the tape over the bearing and shaft, and make sure the shaft is perfectly clean after removing the tape. Insert a pin through the holes to hold up the brushes. Carefully install the shaft into the slip ring end frame assembly to avoid damage to the seal. After tightening the thru-bolts remove the brush retaining pin to allow the brushes to fall down into the slip rings.

10. Alternator Bench Check

To check the alternator in a test stand, proceed as follows:

a. Make connections as shown in Figure 45, except leave the carbon pile disconnected. IMPORTANT: Ground polarity of battery and alternator must be the same. Use a fully charged battery, and a 10 ohm resistor rated at 6 watts or more between the alternator No. 1 terminal and the battery.
b. Slowly increase the alternator speed and observe the voltage.

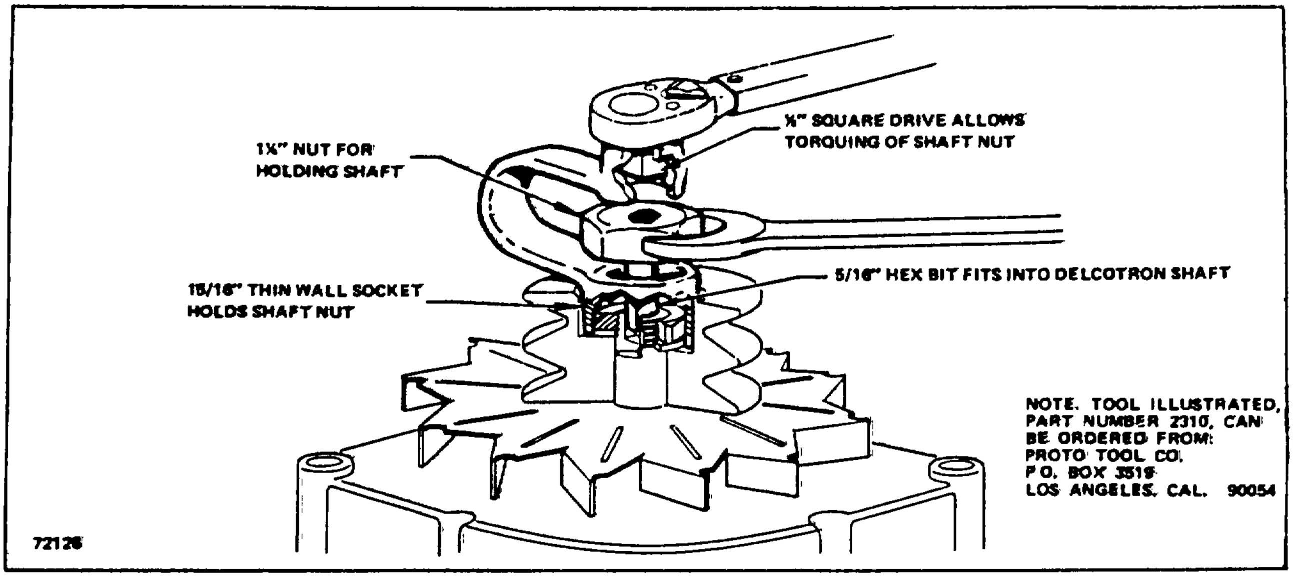


Figure 44. Torquing Alternator Shaft Nut

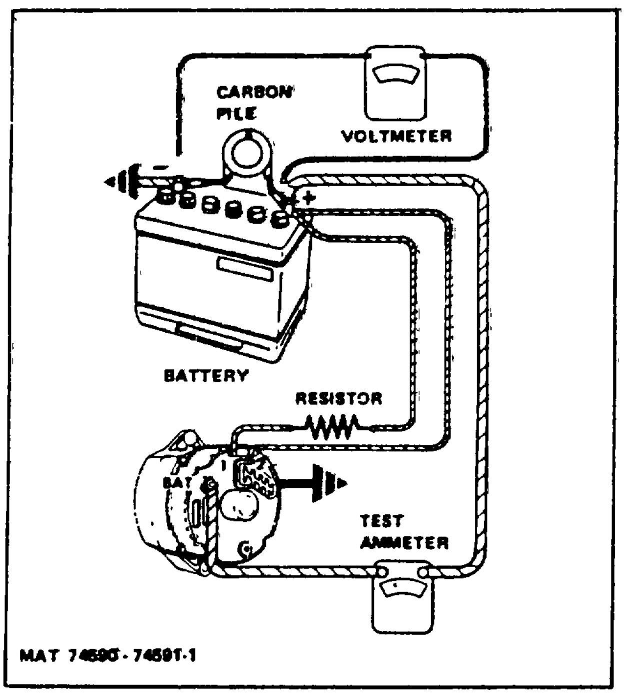


Figure 45. Connections for Bench Check of Alternator (Negative ground alternator shown)

c. If the voltage is uncontrolled with speed and increases above 15.5 volts on the 12 volt system, check for a grounded brush lead clip as indicated in Overcharged Battery section, Step 3. If not grounded, replace the regulator, and check field winding.

NOTE: The battery must be fully charged when making this check.

d. If voltage is below 15.5 volts, connect the carbon pile as shown.

e. Operate the alternator at moderate speed, as required, and adjust the carbon pile, as required, to obtain maximum current output.

f. If output is within 10 amperes of rated output as stamped on alternator frame, alternator is good.

g. If output is not within 10 amperes of rated output, keep battery loaded with carbon pile, and ground alternator field (Fig. 35).

h. Operate generator at moderate speed and adjust carbon pile as required to obtain maximum output.

i. If output is within 10 ampere of rated output, replace regulator as indicated in Regulator Replacement section, and check field winding.

j. If output is not within 10 amperes of rated output, check the field winding, diode trio, rectifier bridge, and stator as previously described.

C. IN VEHICLE TEST

Several checks, both visual and electrical, should be made in a defective cranking circuit to isolate trouble before removing any unit. Before removing a unit in a defective cranking system, the following checks should be made.

1. Determine the condition of the battery, follow the testing procedure outlined in BATTERY Section.

2. Inspect the wiring for frayed insulation or other damage. Replace any wiring, that is damaged. Inspect all connections to the starter motor solenoid, ignition switch and battery, including all ground connections. Clean and tighten all connections and wiring as required.

3. Inspect solenoid and ignition switch to determine their condition. Connect a jumper lead around any switch suspected of being defective. If the system functions properly using this method, repair or replace the bypassed switch.

4. Check engine for tight bearings, pistons, heavy oil, etc., which imposes extra heavy loads on starter motor.

D. STARTER MOTOR REMOVAL

Due to starter motor being completely enclosed, it must be removed from the engine any time it requires service.

1. Lift operator's seat and swing open right hand side panel.

2. Disconnect all electrical leads from starter motor or starter motor solenoid.

3. Remove mounting bolts which attach starter motor to flywheel housing.

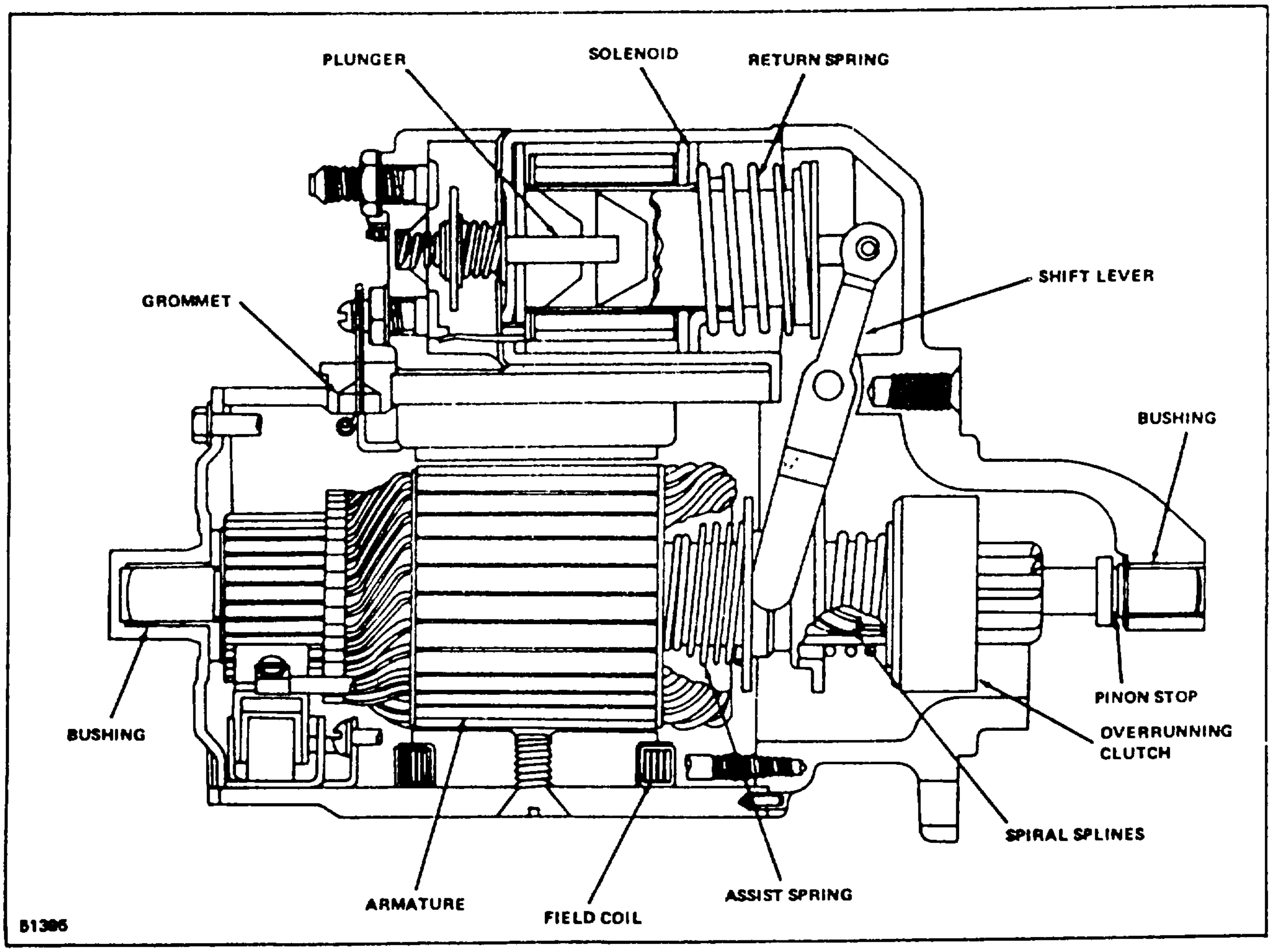


Figure 55. Starter Motor (Sectional View)

STARTER MOTOR TEST SPECIFICATIONS

Rotation Viewing D.E.	Min. Brush Spring Tension (oz.)	No Load Test					Resistance Test		
		Volts	Amps.	Min. Amps.	Max. R.P.M.	Min. R.P.M.	Max. Volts	Min. Amps.	Max. Amps.
C	35	9	50*	80*	5500	10500	4.3	270*	310*

*Includes Solenoid

4. Pull starter out of flywheel housing until drive end clears flywheel housing and tilt commutator end up to remove unit from truck.

E. STARTER MOTOR CHECKS

With the starter motor removed from the vehicle, the pinion should be checked for freedom of operation by turning it on the screw shaft. The armature should be checked for freedom of operation by turning the pinion. Tight, dirty, or worn bearings, bent armature shaft, or loose pole shoe screw will cause the armature to drag and it will not turn freely. If the armature does not turn freely, the motor should be disassembled for repair. If the armature does operate freely, the starter motor should be given a no-load test before disassembly.

1. No-Load Test

Connect the starter motor in series with a fully charged battery of specified voltage, an ammeter capable of reading several hundred amperes and a variable resistance. Also connect a voltmeter, as illustrated in Figure 56. An r.p.m. indicator is necessary to measure armature speed. Obtain the specified voltage by varying the resistance unit. Then read the current draw and the armature speed and compare these readings with the values listed in the starter motor specifications.

Results of Test

a. Rated current draw and no-load speed indicates normal condition of the cranking motor.

b. Low free speed and high current draw indicates:

(1) Too much friction - tight, dirty, or worn bearings, bent armature shaft or loose pole shoes allowing armature to drag.

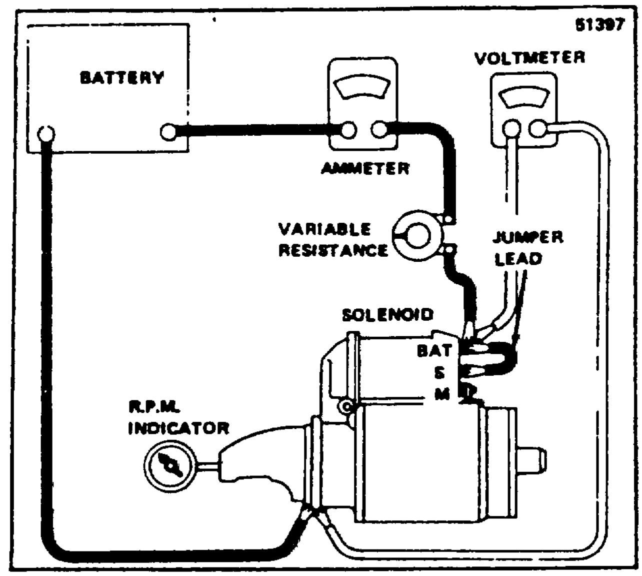


Figure 56. No-Load Test Hookup

(2) Shorted armature. This can be further checked on a growler after disassembly.

(3) Grounded armature or fields. Check further after disassembly.

c. Failure to operate with high current draw indicates:

(1) A direct ground in the terminal or fields.

(2) "Frozen" bearings (this should have been determined by turning the armature by hand).

d. Failure to operate with no current draw indicates:

(1) Open field circuit. This can be checked after disassembly by inspecting internal connections and tracing circuit with a test lamp.

(2) Open armature coils. Inspect the commutator for badly burned bars after disassembly (3), Broken brush springs, worn brushes, high insulation between the commutator bars or other causes which would prevent good contact between the brushes and commutator.

e. Low no-load speed and low current draw indicates:

(1) High Internal resistance due to poor connections, defective leads, dirty commutator and causes listed in Step "d".

f. High free speed and high current draw indicate shorted fields. If shorted fields are suspected, replace the field coil assembly and check for improved performance.

2. Resistance Test

This test requires equipment as illustrated in Figure 57. Lock the pinion securely so it cannot rotate. When the specified voltage is applied, the current should fall in a range as indicated in Starter Motor Test Specification Chart. A high current indicates shorted or grounded conductors, and a low current indicates excessive resistance.

F. DISASSEMBLY

If the starter does not perform in accordance with the specifications, it may need to be disassembled for further testing of the components. Normally the starter motor should be disassembled only so far as is necessary to make repair or replacement of the defective parts. Following are recommended instructions for disassembly procedure.

1. Disconnect the field coil connections from the solenoid motor terminal.

2. Remove the thru-bolts.

3. Remove the commutator end frame and field frame assembly.

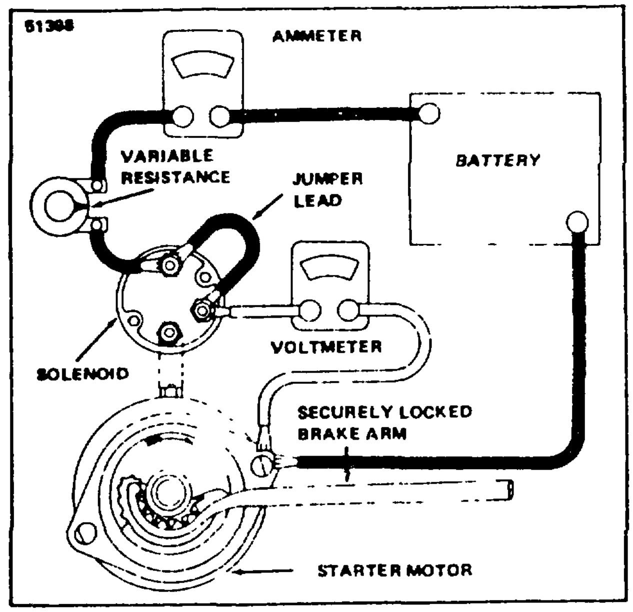


Figure 57. Resistance Test Hookup

4. Remove the solenoid and shift lever assembly from the drive housing.

5. Remove the armature assembly from the drive housing.

6. Remove the thrust collar from the armature shaft.

7. Remove the pinion from the armature by sliding a metal cylinder onto the shaft. Using a hammer, strike the metal cylinder against the retainer, driving the retainer toward the armature core and off the snap ring. Refer to Figure 58.

8. Remove the snap ring from the groove in the armature shaft.

G. INSPECT AND REPAIR

1. Brushes and Brush Holders

Inspect the brushes for wear. If they are worn down to one-half their original length, when compared with a new brush, they should be replaced. Make certain the brush holders are clean and the brushes are not binding in the holders. The full brush surface should ride on the commutator with a spring tension of 35 oz., to give good, firm contact. Brush leads and screws should be tight and clean.

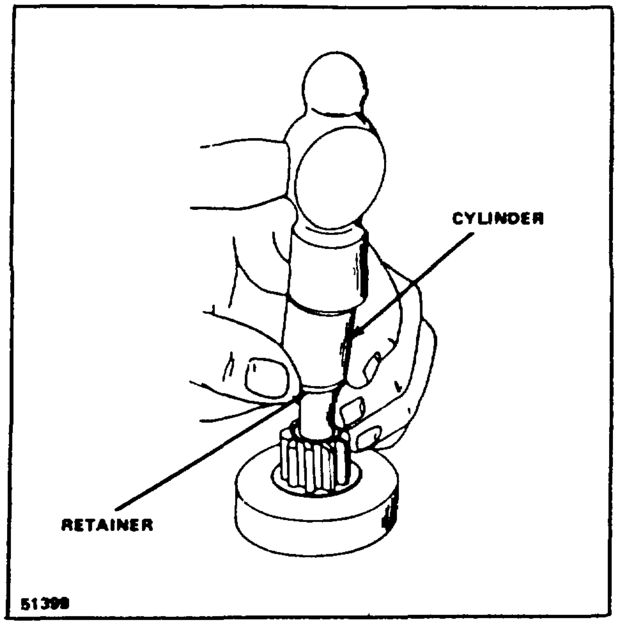


Figure 58. Removing Retainer from Snap Ring

2. Armature

The armature should be checked for short circuits, opens and grounds.

a. Check armature for shorts by placing it on a "growler", and with a steel strip or a hack saw blade held on armature core, rotate armature. If blade vibrates, armature is shorted in area of the core below the vibrating blade. Copper or brush dust in slots between commutator bars sometimes causes shorts which can be eliminated by cleaning out slots. Shorts or crossovers of coils at core end can often be eliminated by bending wire slightly and reinsulating exposed bare wire. If short cannot be eliminated armature must be replaced.

b. Opens may be located by inspecting the points where the conductors are joined to the commutator for loose connections. Poor connections cause arcing and burning of the commutator. If the bars are not badly burned, resolder the leads in the riser bars and turn the commutator down in a lathe. Then undercut the insulation between the commutator bars 1/32".

c. Grounds in the armature can be detected by the use of a test lamp. If the lamp lights when one test prod is placed on the commutator and the other test prod on the armature is grounded. If the commutator is worn, dirty, out of round, or has high insulation, the commutator should be turned down and undercut as previously described.

3. Field Coils

The field coils should be checked for grounds and opens using a test lamp.

a. To check for grounds, disconnect the field coil ground connections. Connect one test prod to the field frame and the other to the field connector. If the lamp lights, the field coils are grounded and must be repaired or replaced.
b. To check for opens, connect test lamp prods to ends of field coils. If lamp does not light the field coils are open. If the field coils need to be removed for repair or replacement, a pole shoe spreader and pole shoe screwdriver should be used. Care should be exercised in replacing the field coils to prevent grounding or shorting them as they are tightened into place. Where the pole shoe has a long lip on the side, it should be assembled in the direction of armature rotation.

H. REASSEMBLY

1. Place the clutch assembly on the armature shaft. To facilitate replacing the snap ring and retainer onto the armature.

a. Place the retainer on the armature shaft with the cupped surface facing the snap ring groove.

b. Place the snap ring on the end of the shaft. With a piece of wood on top of it, force the ring over the shaft with a light hammer blow (See Figure 59), then slide the ring down into the groove.

c. To force the retainer over the snap ring, place a suitable washer over the shaft and squeeze retainer and washer together with pliers (See Figure 60).

d. Remove the washer.

2. Refer to the disassembly procedure and follow in reverse to complete the reassembly.

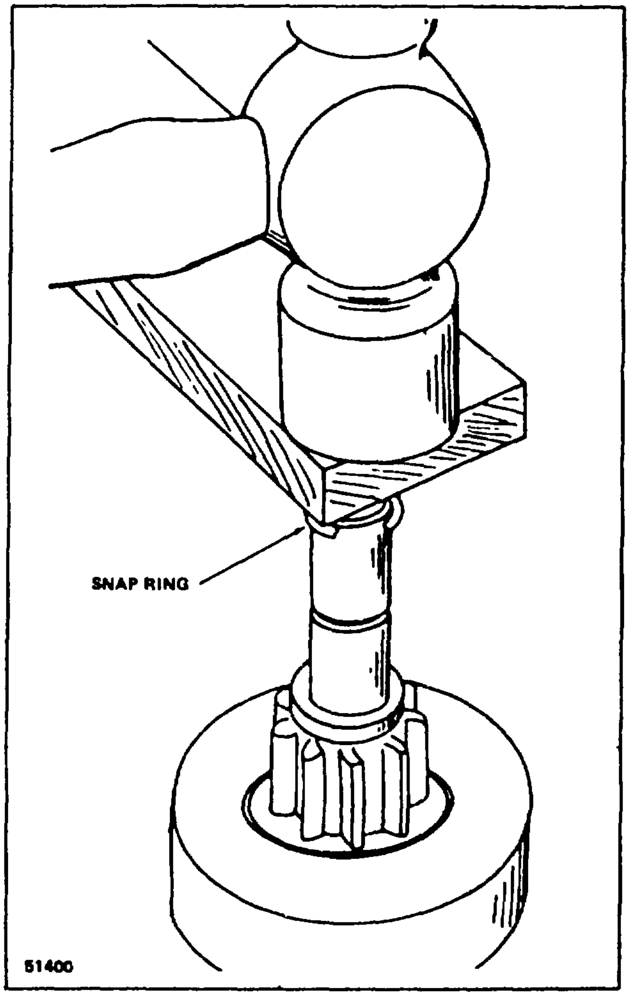


Figure 59. Forcing Snap Ring Over Shaft

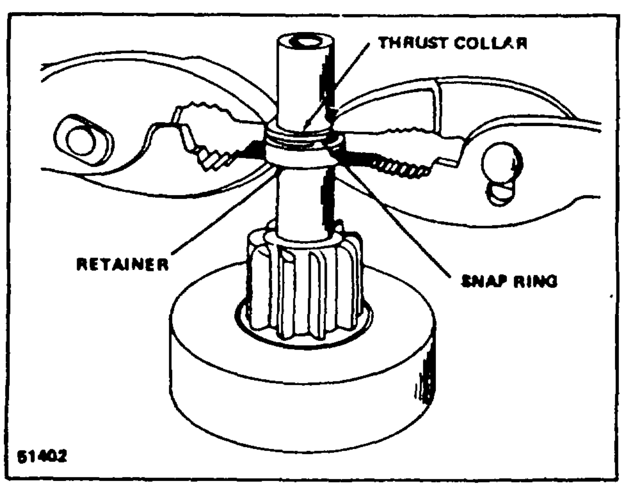


Figure 60. Forcing Retainer Over Snap Ring

3. When solenoid is reinstalled, apply sealing compound between field frame, flange, and solenoid junction.

I. PINION CLEARANCE

The pinion clearance cannot be adjusted but should be checked after reassembly of the motor to ensure proper clearance. Improper clearance is an indication of worn parts.

To check pinion clearance, the following procedure is recommended.

1. Disconnect the starter motor field coil connector from the solenoid motor terminal and insulate it carefully.

2. Connect a battery, of the same voltage as solenoid, from the solenoid switch terminal to the solenoid frame (See Figure 61).

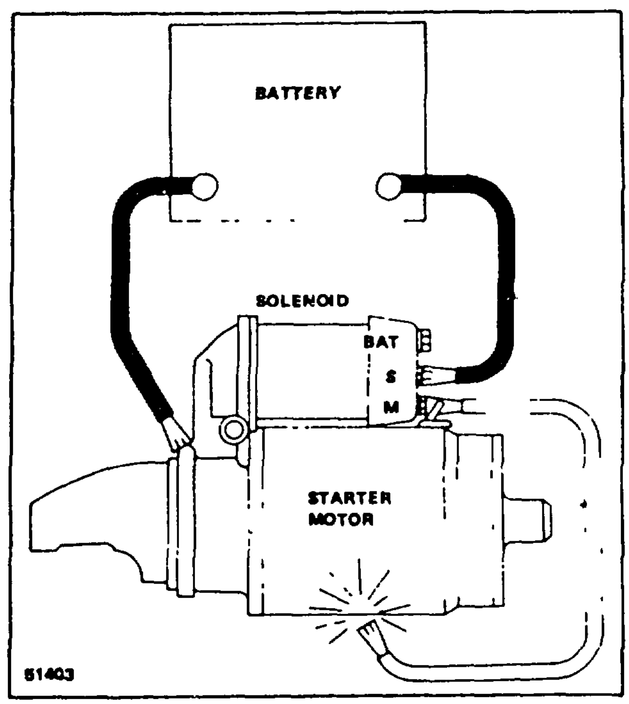


Figure 61. Circuit for Checking Pinion Clearance'

3. Momentarily flash a jumper lead from the solenoid motor terminal to the solenoid frame. This will shift the pinion into cranking position and it will remain so until the battery is disconnected.

4. Push the pinion back toward the commutator end to eliminate slack movement.

5. Measure the distance between pinion and pinion stop (See Figure 62). Pinion clearance should be .010" to .140".

J. STARTER MOTOR INSTALLATION

1. Insert drive end of starter motor in flywheel housing. If drive mechanism is fully extended, mesh pinion gear with flywheel ring gear. Install mounting bolts and tighten securely.

2. Connect all electrical leads to either starter motor or starter solenoid.

3. Close right hand side panel and lower operator's seat.

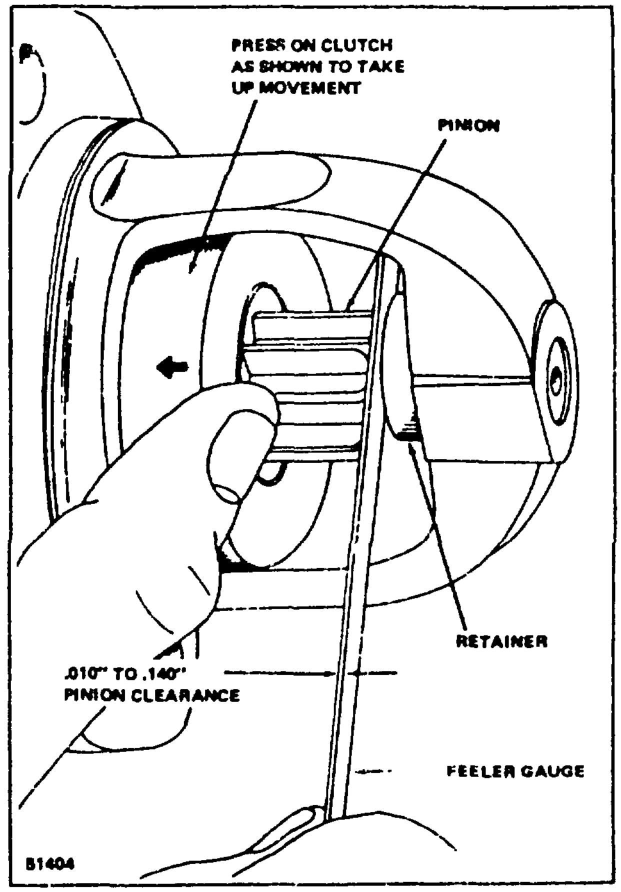


Figure 62. Checking Pinion Clearance

MEMO

GASOLINE AND L.P.G. ENGINES ONLY

A. DESCRIPTION

The distributor is mounted on the cylinder head end is driven off the engine lubricating oil pump extension at one-half the engine crankshaft speed.

The distributor consists of a cast housing into which a shaft and weight base are fitted in a bronze bushing. Centrifugal advance weights are pivoted on studs in the weight base and are free to move against the calibrated weight springs which connect them to the advance cam and breaker cam assembly. The advance cam and breaker cam assembly is slit-fitted to the top of the shaft and rotates with the shaft, being actuated by the advance weights. Lateral movement of the weights advances the cam assembly in relation to the shaft as the speed is increased. The greater the engine speed, the farther out the distributor weights move, which increases the shift in the breaker cam position and in turn, advances the spark.

When the cam breaker is rotated by the centrifugal advance mechanism, each cam lobe passes under the breaker lever rubbing block, separating the contact points and producing a high voltage surge in the ignition circuit. With every breaker cam revolution, one spark will be produced for each engine cylinder. Since each cylinder fires every other revolution in a four stroke cycle engine, the distributor is required to rotate at only one-half the engine crankshaft speed to furnish
Ignition.

Built-in distributor lubrication is made possible with the use of a porous bushing, which extends from the upper to the lower part of the housing. A well is provided which is kept filled with oil. Seepage through the porous bushing provides shaft lubrication.

A dust cover located under the distributor cap completely seals off the breaker compartment from dust or dirt, as well as fumes caused by the spark gap at the rotor tip.

The high tension terminals on the ignition coil and the distributor cap are covered with tight fitting neoprene nipples to prevent moisture and dust accumulation, thereby preventing a conductive path to ground which would cause the engine to misfire.

An indicator arm, which is graduated from 10^0 spark advance to 10^0 spark retard, is clamped to the side of the distributor. This indicator arm is used as a guide to set correct timing for the type of fuel used and the load conditions expected, particularly at part throttle.

NOTE: Refer to ENGINE MAINTENANCE MANUAL, ENGINE TUNE-UP, for specific distributor characteristics and distributor-to-engine timing procedure.

B. DISTRIBUTOR SERVICE

The distributor cap should be removed at regular intervals to examine the contact points, the rotor and cap. (Dust cover, located under cap, must be removed before contact points can be inspected.)

Check the high tension wiring for defective insulation and poor connections at the distributor cap and spark plugs. Wipe the distributor cap and check the cap and rotor for cracks or carbon tracks indicating leakage of high voltage current across the surface.

Check the centrifugal advance mechanism by turning the breaker cam in the direction of rotation and then releasing it. The advance springs should return the cam to its original position without sticking.

Inspect the contact points. If points are badly pitted or burned, they must be replaced as follows:

1. After distributor cap, rotor and dust cover have been removed from distributor housing, remove the nut and washer from the inner end of the primary terminal.

2. Remove the slotted head locking screw attaching the contact support to the distributor breaker plate, and remove the contact points. If condenser is to be replaced, remove screw attaching condenser to breaker plate and remove and discard condenser.

3. Apply a light coat of grease to the distributor cam. Install the replacement condenser, and install the new contact support over pivot post and start the slotted head locking screw, which attaches contact support to the breaker plate, but do not tighten the screw at this time. Install the breaker lever over the pivot post and over the inner end of the primary terminal. Install and tighten nut and washer on the primary terminal.

4. Rotate crankshaft until the breaker lever rubbing block is on a high spot on the cam, thus opening the contact points to their maximum open position. Next, turn the eccentric adjusting screw to obtain the specified contact point gap of .022". (See Figures 66 and 67.) Lock points in this position by tightening the contact point locking screw. After tightening contact screw, recheck the point gap with .022" feeler gauge.

5. Install dust cover, rotor and distributor cap.

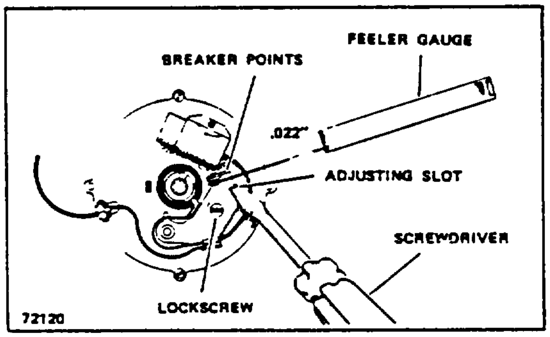


Figure 66. Adjusting Contact Gap

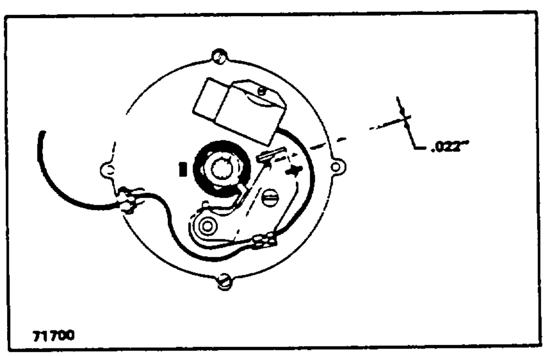


Figure 67. Breaker Point Gap

C. REMOVAL

1. Remove the spark plug cables from the spark plugs, and label each one as it is disconnected. Remove the ignition coil cable from the ignition coil cap.

2. Disconnect the primary lead at the distributor primary terminal.

3. Remove capscrew and washers from the distributor advance arm and carefully lift distributor assembly out of drive housing.

NOTE: Distributor can be removed, overhauled and replaced without retiming engine because of offset tongue and groove drive. When removing distributor, do not loosen or remove advance arm; but, remove distributor and arm as an assembly.

D. DISASSEMBLY

See Figure 68.

1. Unlock distributor cap retaining screws and remove distributor cap, rotor and dust seal.

2. Remove the contact points and condenser.

3. Carefully remove breaker plate assembly from housing, taking care not to tear primary lead or protective rubber grommet.

4. Using a sharp or pointed instrument, scribe a light mark on shaft coupling and shaft prior to removing coupling. This will assist in proper alignment during reassembly.

5. Grind head off coupling retainer pin and remove pin, coupling, and seal from shaft. Shaft and weight support can now be removed from the distributor housing.

6. Remove screws, washers, and weight hold-down plate from weight support base.

7. Remove weight springs, weights and advance cam from shaft.

E. INSPECTION

Clean all parts thoroughly and replace any damaged or worn parts.

NOTE: Do not attempt to clean distributor cap, dust cover, rotor, condenser or housing in any degreasing compound, since this may damage parts.

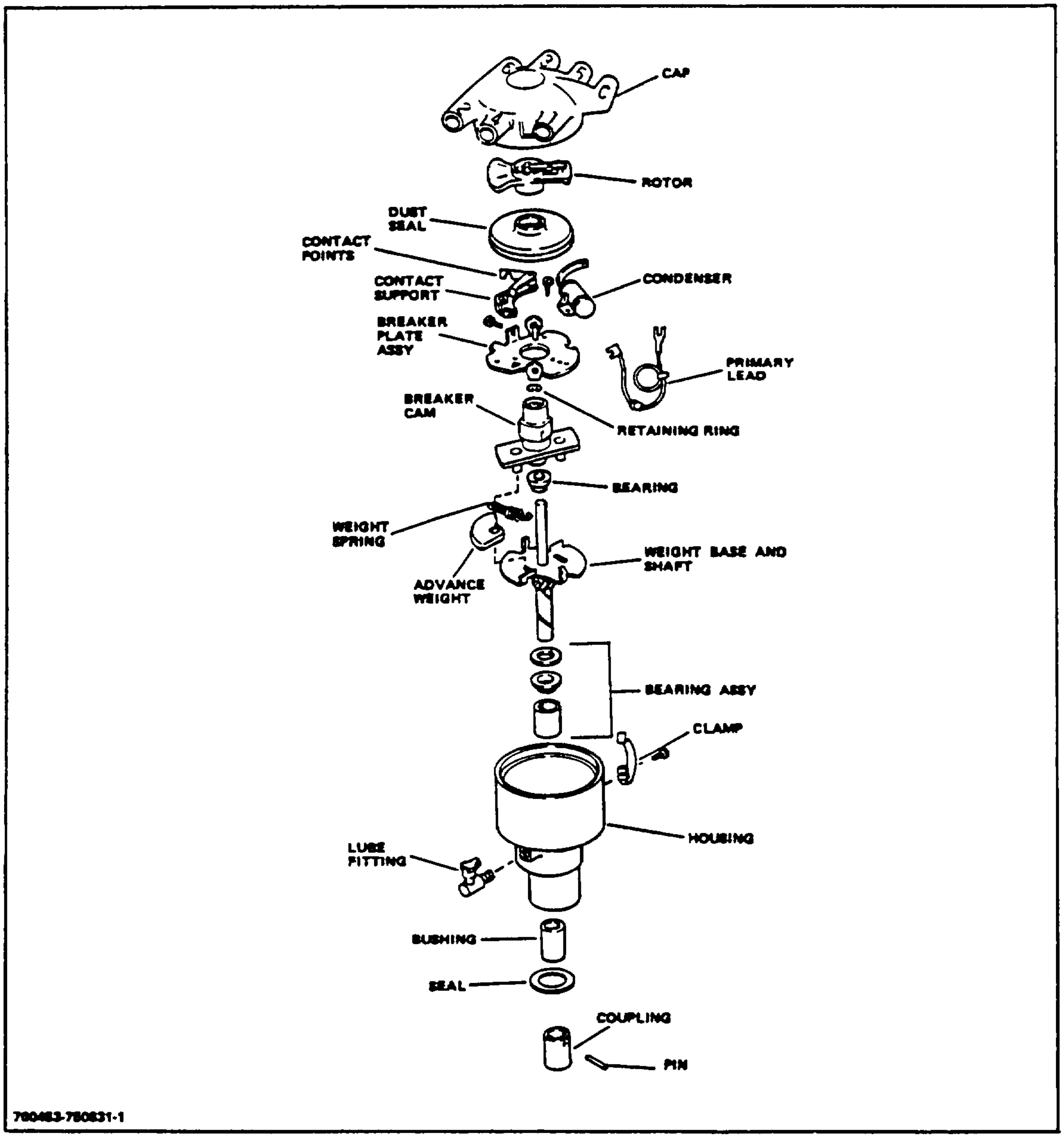


Figure 68. Distributor Assembly

1. Check centrifugal advance parts, weights, springs and plate for evidence of wear or damage.

2. Replace dust cover seal if hard, worn, or dirty.

3. Replace point contact set if worn, burned or badly pitted.

4. Check breaker lever rubbing block for excessive wear.

5. If distributor housing bushing requires replacement, exercise care when replacing so as not to scratch or scuff the inside or outside of the bushing. Do not ream, scrape or file the bushing.

6. Check condenser for leakage. If it cannot be properly tested, then replace it with condenser of same value.

7. Check the distributor cap and rotor for cracks, burning of contacts or carbon streaks.

F. REASSEMBLY

During assembly of the distributor, make certain that all parts operate freely, as any binding may adversely affect the centrifugal advance.

1. Install advance weights on weight base. Place the cam assembly on the shaft and attach the two springs to the anchor posts. Place a drop of oil on the weight pivot pin.

2. Place seal on shaft and install weight base, shaft and seal in distributor housing.

3. Install coupling on bottom of shaft, making sure scribe marks on coupling and shaft are properly aligned. When holes for retainer pin are aligned, check end play of shaft.

NOTE: End play should be .007" ± .003".

If end play is within these limits, install a new retainer pin and peen over ends. If end play is above or below specified limits, then shims may be added or removed until correct clearance is obtained.

4. Install breaker plate along with securing screws.

5. Install condenser and contact points. Using feeler gauge, set and lock contact points at .020" (see Section B, Service, Paragraph 4).

6. Install rotor.

G. INSTALLATION

1. Be sure rubber bushing is properly positioned in engine drive housing, and then install distributor. Using rotor, turn distributor shaft until offset tongue of coupling enters groove in top of oil pump drive gear.

2. Install advance arm washers and capscrew. Remove rotor and install dust cover, rotor and distributor cap. Install spark plug wiring, as labeled, and replace high tension cable to ignition coil. Finally, replace primary lead.

3. Check engine timing. (Refer to ENGINE MAINTENANCE MANUAL, .TUNE-UP SECTION.)

TOPIC 8. CONDENSER

GASOLINE AND L.P.G. ENGINES ONLY

A. DESCRIPTION

An important, and often overlooked, part of the ignition system is the condenser, which is installed in the distributor. The condenser provides an electrical reservoir where current can flow until the contact points are safely separated. The unit is constructed of several layers of foil and insulator material. Alternating layers of foil are connected to either the terminal or ground.

High resistance in a condenser is usually caused by loosening, or corrosion of connections, which in turn causes the condenser to be slow in taking a charge and also causes high voltage at the contact points. Arcing and rapid wear of contacts, along with missing during starting and low speed operation, may be indications of this condition.

B. SERVICE

Original equipment condensers are designed for use over a broad speed range of the engine. Contact pitting will result if a condenser of incorrect capacity is used. Examine contact points for excessive pitting: If pitted and the crater is on the positive contact, then the condenser is over capacity. If crater is on the negative contact, then condenser is under capacity. Under these conditions a new condenser should be installed which has a slightly higher or a slightly lower capacity than conditions call for. The correct condenser capacity is .18 to .23 microfarads.

TOPIC 1. COOLING SYSTEM DESCRIPTION

The function of the cooling system is to prevent the temperatures in the combustion chamber, which may reach as high as 4000°F., from damaging the engine and, at the same time, keep the operating temperatures within safe limits.

Maintaining the cooling system efficiency is important, as engine temperatures must be brought up to and maintained within satisfactory range for optimum operation; however the system must be kept from overheating, in order to prevent damage to valves, pistons and bearings.

See Figure 1. The system coolant is water which is force-circulated by a water pump. A thermostat and a by-pass hose, which form part of the system, serve to direct coolant flow through the engine only, or through the engine and the radiator.

Coolant from the water pump is first directed in the block against the exhaust valve seats and into passages connecting the cylinder head. This method provides the coldest water reaching the parts subjected to the highest temperatures.

The cylinder walls, in turn, are cooled their full length by convection currents only, which keep the cylinder barrels at a more uniform temperature and, thereby, reduce crankcase oil dilution and sludge formation. Upon leaving the cylinder head, the coolant enters the thermostat housing in which is mounted the bypass type thermostat. Coolant passage to the radiator is controlled by the thermostat. Upon being discharged from the thermostat housing, the coolant enters the radiator, where it is cooled before re-entering the engine through the water pump.

Teledyne Continental L-Head gasoline engines operate most efficiently with water temperatures of 180° to 200°F; the thermostat and bypass hose are used to control these temperatures.

Before a cold engine reaches operating temperature, the thermostat valve is closed, passage to the by-pass hose is open, and the coolant recirculates through the engine block only. This provides for both rapid and even temperature increase of all engine parts during the warm-up period. When proper temperature is reached, the thermostat valve opens and allows the coolant to circulate through both the engine and the radiator.

Water has always been the most commonly used coolant for internal combustion engines because it has excellent-heat transfer ability and is readily obtained everywhere. Like all liquids it expands when heated, the rate of expansion being 1/4 pint per gallon when the temperature is raised from 40° to 180°F.
For example: If a 4 gallon cooling system is filled completely full of water at 40°F, 1 pint will be lost through the radiator overflow pipe by the time the water temperature reaches 180° F.

Water boils at 212°F under atmospheric pressure at sea level. This pressure becomes less at higher altitudes and the reduced pressure causes water and other liquids to boil at a lower temperature. The chart shown in Figure 2 shows the effect on boiling point of water and anti-freeze solution.

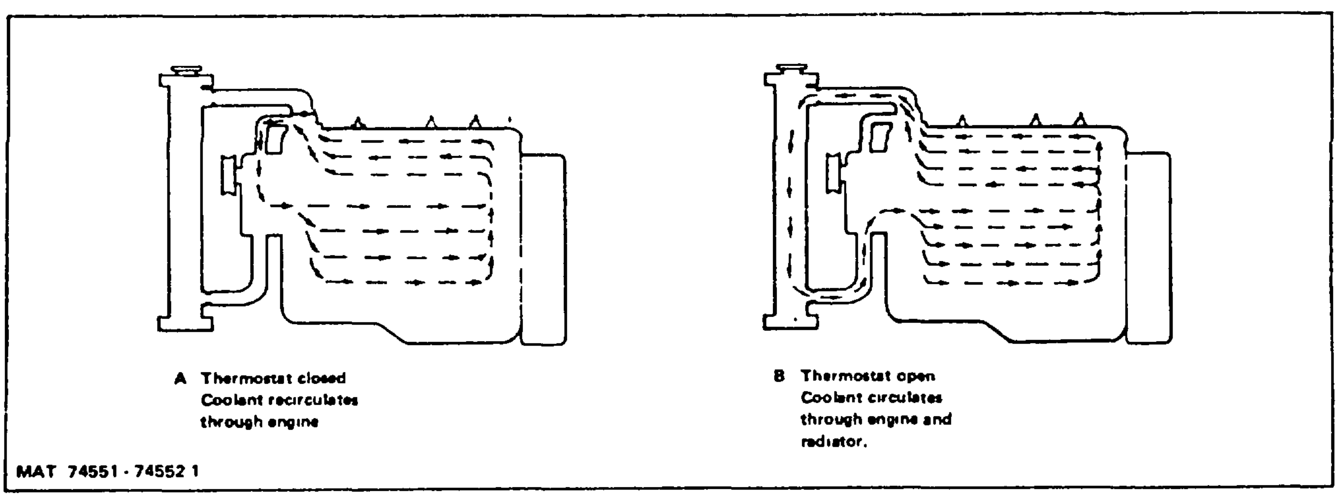


Figure 1. Cooling System, Cross Sectional View

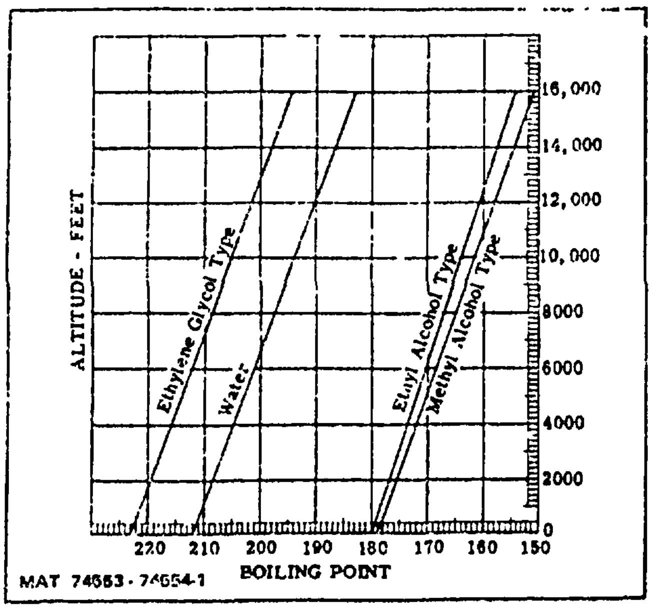


Figure 2. Effect of Altitude on Boiling Point of Coolant

Water freezes at 32°F., forms solid ice and x:)W,-s about 9% in volume-which causes tremendous pressure and serious damage when allowed to freeze inside the cooling system.

When operating temperatures are below 32°F. an anti-freeze liquid must be added which will lower the freezing point a safe margin below the anticipated temperature of outside air.

The most desirable and economical antifreeze is Ethylene Glycol, or permanent type, because of the temperature ranges it maintains for efficient operation of the engine. When no leaks are present, add water only to make up for evaporation, as follows:

Temperature Range	Parts Glycol	to	Parts Water
32° to 10°F	1		4
+10° to -10°F	2		5
-10° to -30°F	1		1

TOPIC 2. WATER PUMP

A. DESCRIPTION

Liquid coolant is circulated through the engine and the radiator by a centrifugal water pump. The pump is enclosed in a sealed, cast metal housing and is flange mounted to the engine block. The pump impeller is pressed on one end of a steel shaft and the fan drive pulley is pressed on the other end. The shaft is supported at the drive end by a sealed, double row ball bearing, and is prevented from moving endwise by a retainer ring and a shoulder in the pump housing.

Coolant is prevented from seeping along the shaft at the impeller end by a spring-loaded neoprene seal, which is retained in the pump housing by a bearing against the face of the impeller. Any coolant which does seep past the impeller is thrown from the shaft by a slinger before the coolant can enter the shaft bearing. The pump shaft and the bearing constitute one assembly and are serviced as such. The shaft bearing is the shielded type and is filled with lubricant when assembled, therefore no further lubrication is necessary.

The construction of the water pump is conducive to long life with minimum attention if clean coolant is used in the system. Water containing scale forming elements is especially harmful to the pump parts due to corrosion.

B. SYSTEM REVERSE FLOW FLUSHING

When it becomes necessary to remove the water pump for service or replacement, the cooling system should be thoroughly cleaned first, by flushing the radiator and the water cooling jacket in the forward and reverse directions. Purge the cooling system from all rust and scale by running the engine with a cleaning or flushing solution added to the coolant. The flushing solution is then drained through the radiator drain cock and the block drain cock located underneath the ignition coil After draining it is advisable to reverse flush the radiator first. The engine should be allowed to cool as much as possible prior to its own reverse flushing. Refer to TOPIC 3. RADIATOR.

C. WATER PUMP REMOVAL

Proceed as follows:

1. Remove the engine side panels and raise the operator's seat.

2. Loosen the alternator adjusting bracket capscrew and the alternator pivot mounting capscrew and push the alternator towards the engine until the fan belt tension is relieved. Remove the fan belt.

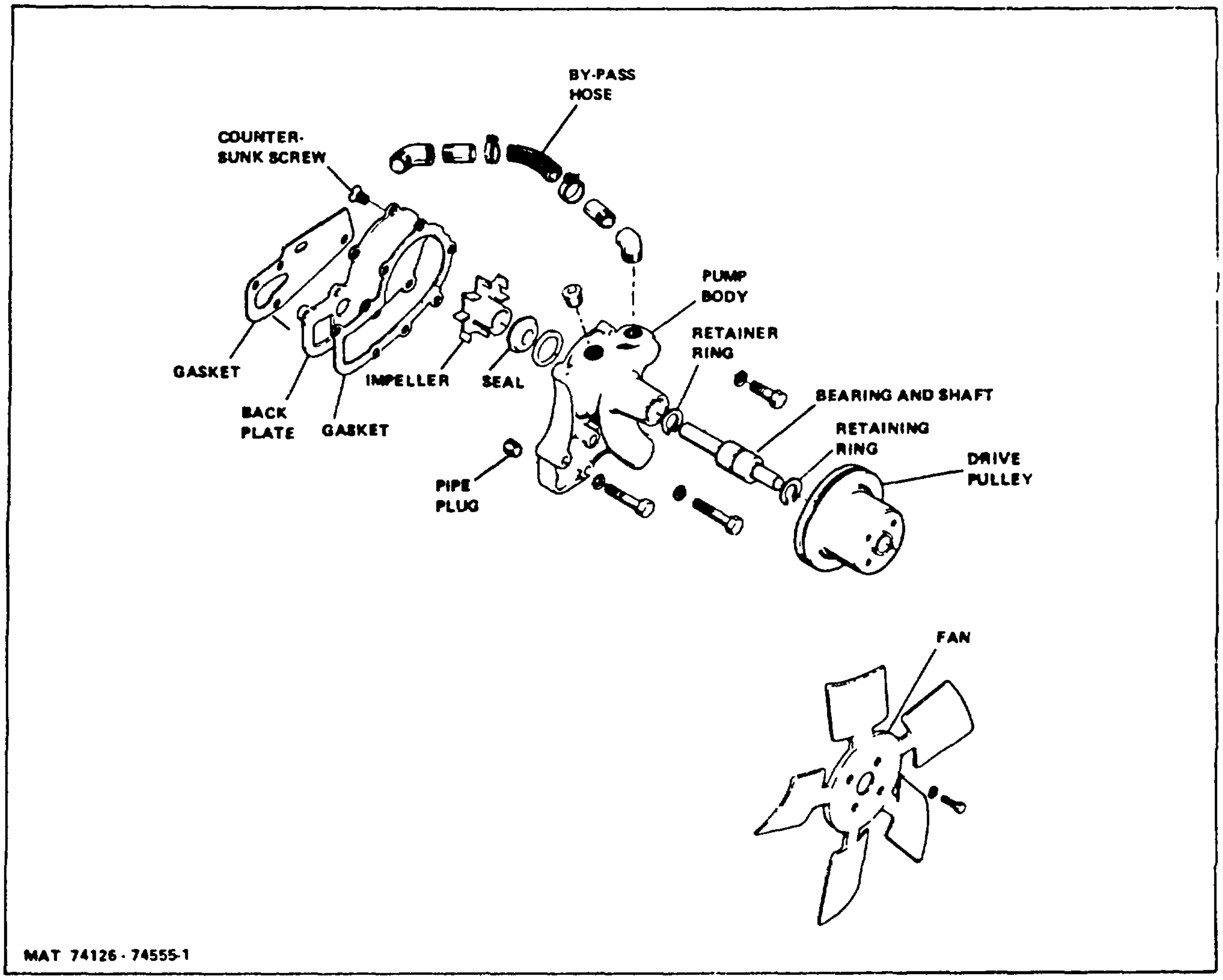


Figure 3. Water Pump. Exploded View

3. Remove the fan blade mounting capscrews and lockwashers then remove the fan.

4. Remove the radiator pressure cap, open the drain cocks located beneath radiator and the ignition coil, and drain the cooling system.

5. Loosen the hose clamp and remove the bottom hose leading from radiator.

6. Loosen the clamp at each end of the coolant by-pass hose, and remove the hose.

7. Remove the capscrews which secure the water pump to the cylinder block, then remove the water pump and the flange gasket.

D. DISASSEMBLY

When disassembling the water pump. an arbor press and suitable pressing blocks are required. Disassembly must be performed in the following sequence to prevent damage to the pump. See Figure 3.

1. Remove the back plate from the pump and measure the distance from rear of pump body to rear of pulley flange, see Figure 4. This measurement, "A" shown in Figure 4, insert, is used during pump Installation.

2. Use a puller to remove pulley from shaft, see Figure 5.

3. Remove the impeller using a puller. Take precautions to prevent damage to the pump body.

4. Remove the impeller seal and gasket.

5. Using long-nose pliers, remove the retainer ring that holds the bearing and shaft assembly in the pump body.

6. Using an arbor press or a lead hammer, force the bearing and shaft assembly out through the front.

CAUTION: DO NOT attempt to drive the water pump shaft out through the rear. To do so, will damage the pump body beyond repair.

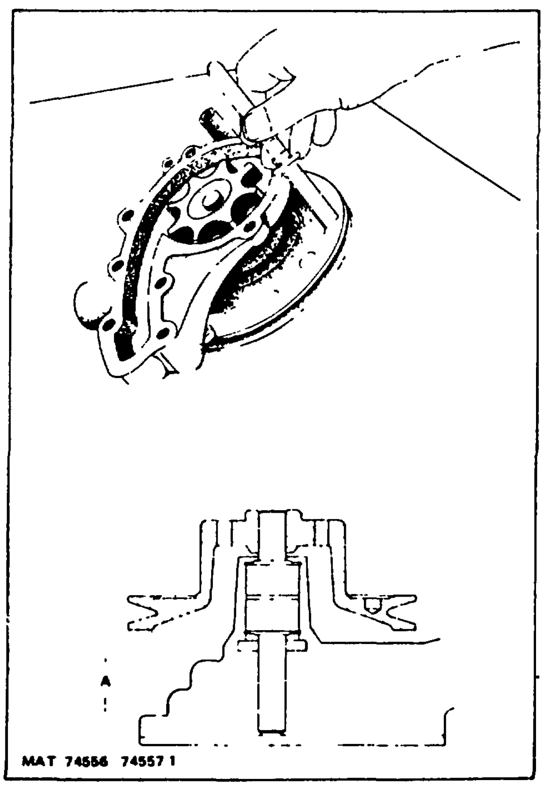


Figure 4. Measuring Distance Between Pump Body and Rear of Pulley Flange.

E. INSPECTION/REPAIR

Repair to the water pump will consist of replacement of any parts that are worn or damaged.

1. Clean rust or other deposits from pump parts and inspect for corrosion, cracking, external damage or damage from pressing, or other defects which might impair efficient operation.

2. Check the bearing and shaft assembly by rotating the bearing. If movement is rough or the bearing is binding or running dry from lack of lubricant, the shaft and bearing assembly must be replaced.

CAUTION: Do not wash the bearing assembly as it is permanently lubricated at the factory.

3. Inspect the face of the impeller hub, where it contacts the seal, for any scoring or pitting. The face must be smooth so as not to damage the seal.

4. Check the Impeller seal for a smooth, flat surface. A light film of lubricant applied to the face of the seal facilitates seating and sealing.

5. Always use a new pump gasket when reassembling.

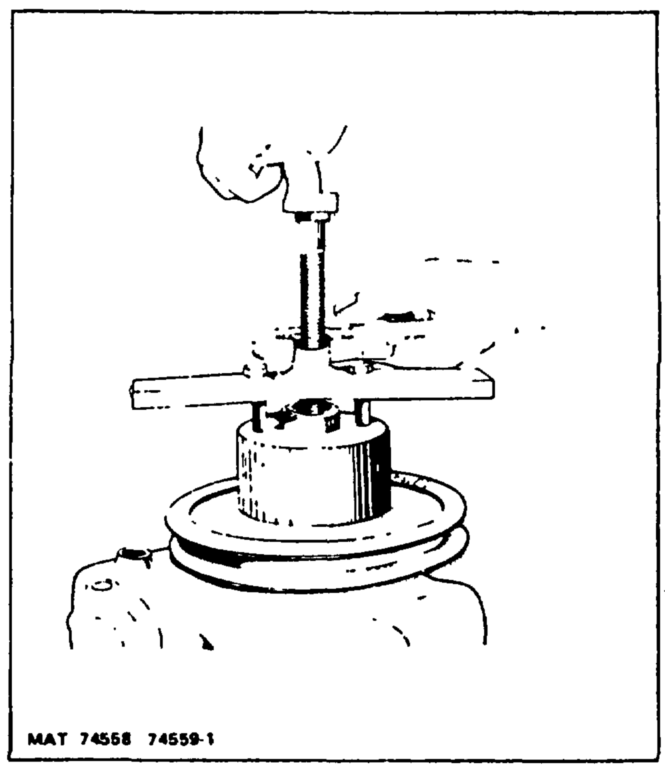


Figure 5. Removing Water Pump Pulley

F. ASSEMBLY

Reassemble the water pump by referring to Figure 3 for the relative location of the parts, and reversing the sequence of the disassembly procedure as follows:

1. When the bearing and shaft assembly is installed, use thick soap suds on the assembly and the impeller seal to prevent damage to the seal.

2. Install a new seal in the pump body. When installing the seal make certain it is square with the seal bore and is firmly seated.

3. Place the pump housing in an arbor press on a suitable support and press the shaft and bearing assembly into the bearing bore until the bearing is firmly seated against the inside housing shoulder.

NOTE: Care must be taken during this operation to prevent damage to the seal.

4. Install the retainer rings in the front and rear of the bearing.

5. Using an arbor press, install the impeller on the pump shaft until the impeller is flush with the end of the shaft. Revolve the impeller to make certain that it is free to turn and firmly seated on the seal.

NOTE: If the impeller is properly seated on the seal, a slight drag caused by the mating faces of the seal assembly and the impeller will be felt.

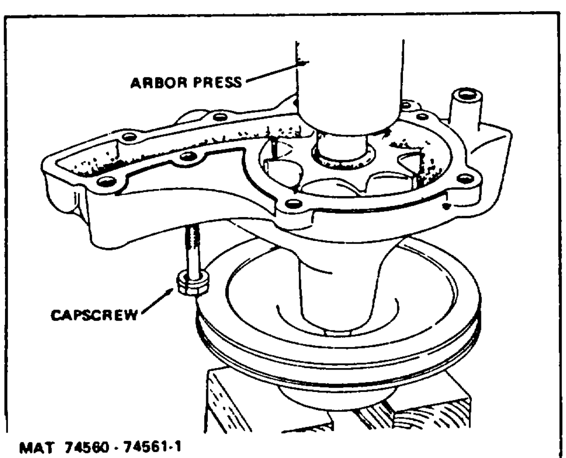


Figure 6. Water Pump Assembly Showing Inserted Capscrew, Prior to Pulley Press Fit.

G. INSTALLATION

1. Measure pulley and shaft. Recommended minimum press fit is .001". (Pulley must fit snugly on shaft).

2. Insert capscrew in pump body BEFORE pressing pulley on to shaft (Figure 6). Coat inside of pulley bore with Loctite retainer compound.

3. Place the pulley on a flat surface, see Figure 7, pressing on END of shaft with arbor to dimension determined in the Disassembly section (Figure 4). Pulley should rotate freely.

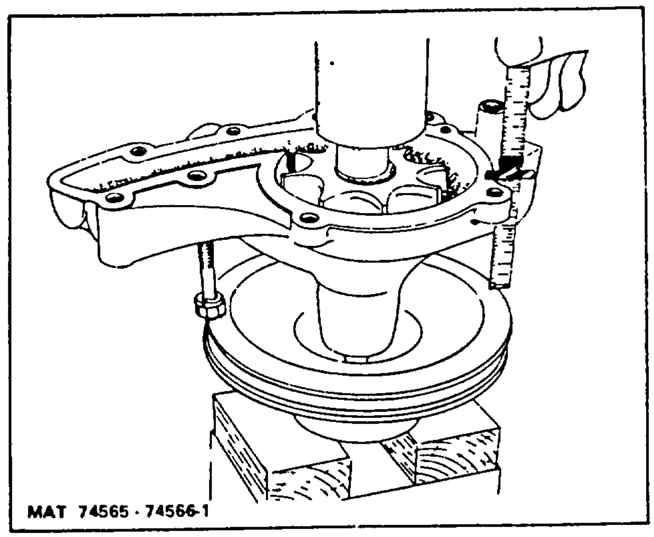


Figure 7. Pressing Water Pump Pulley to Correct Depth

4. Clean the gasket mounting surfaces on the water pump flange and on the cylinder block, and install new gasket. Use approved sealing compound as required.

5. Install and secure the water pump with mounting capscrews.

6. Replace the coolant by-pass tube and tighten the end nuts.

CAUTION: Do not overtighten end nuts as this could cause by-pass tube to fracture or split.

7. Replace the lower hose connecting the radiator to the pump. Secure clamps.

8. Replace the by-pass hose connecting the pump to the thermostat housing on the cylinder head.

9. Close the drain cock at the bottom of the radiator and beneath the ignition coil.

NOTE: Ensure that the fan belt has been placed on the fan pulley prior to installing and securing the fan blade.

10. Install the fan blade with the mounting capscrews and lockwashers. Tighten capscrews securely.

11. Properly align fan belt at crankshaft pulley, fan pulley and alternator pulley and adjust fan belt tension. After proper adjustment, secure alternator capscrews,

12. Fill the cooling system with clean water, including anti-freeze, if climate dictates. Replace radiator pressure cap.

CAUTION: DO NOT run the engine without water in the system. Running a pump dry will damage-the seal and shorten pump life.

13. Operate the engine until the normal operating temperature has been reached, then check the cooling system for any evidence of leaks. Correct if necessary. After thermostat opens, coolant level should be topped-up.

14. Replace the engine side panels and lower the operator's seat.

TOPIC 3. RADIATOR

A. DESCRIPTION

The radiator is the fin and tube type and is vertically supported by angle bracing to the truck frame. The front of the radiator is protected from structural damage by a heavy grille mounted in the counterweight. An overflow tube is connected to the filler neck and leads to the bottom of the radiator.

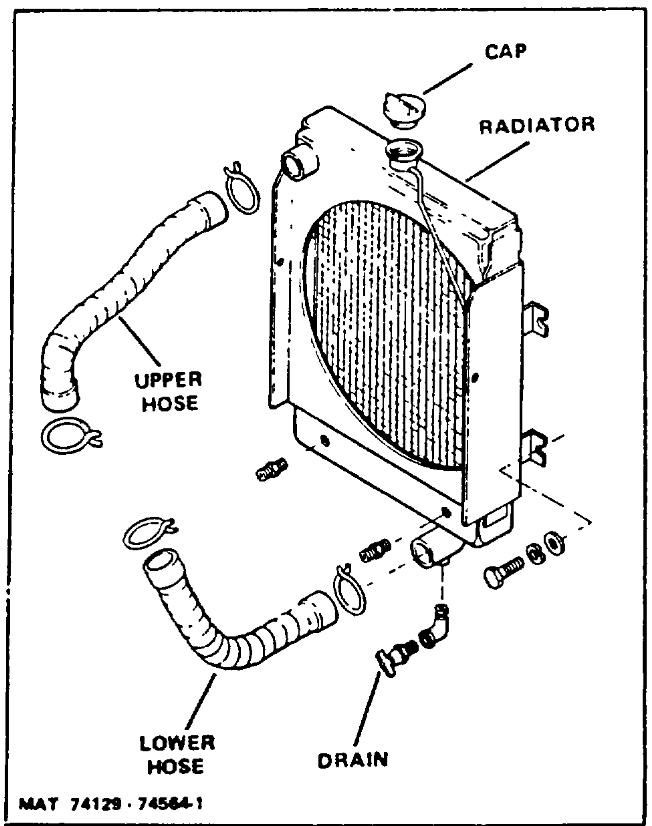


Figure 8. Radiator Assembly

B. REMOVAL

When it becomes necessary to remove the radiator for service, the following procedure is recommended:

1. Remove the engine side panels and raise the operator's seat.

2. Remove the radiator cap, open the drain cocks beneath radiator and Ignition coil, and drain the cooling system.

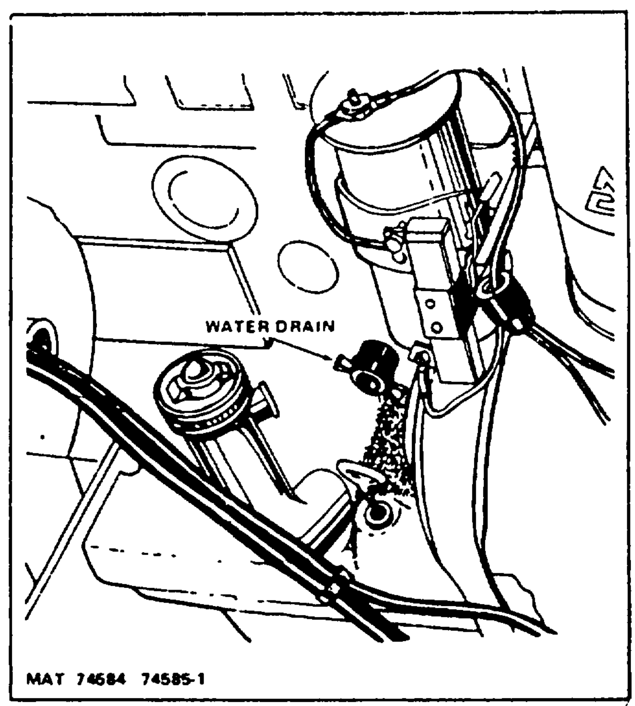


Figure 9. Water Drain Cock Location

CAUTION: When removing the filler cap, rotate the cap very slowly; if hissing of vapor is encountered, tighten cap immediately and wait for system to cool sufficiently to allow removal of cap.

3. Loosen the retaining hose clamps and remove the inlet and outlet hoses from the top and bottom of the radiator.

NOTE: On models equipped with a "Power Shift" transmission, an oil cooler is an integral part of the bottom of the radiator to prevent overheating of the transmission. The oil cooler lines must be removed prior to removing the radiator.

4. Remove the securing capscrews and the radiator grille from the back of the counterweight.

5. Remove the capscrews which hold the radiator in position on the mounting bars located on the frame inside the counterweight.

6. Slide the bottom of the radiator out of position. After the filler neck of the radiator has cleared the inside top of the counterweight, the radiator can easily be removed.

C. INSPECTION-SERVICE

If the tubes in the radiator become clogged, the obstructions may sometimes be removed by reverse flushing the radiator.

NOTE: It is not necessary to remove the radiator to perform reverse flushing. Simply disconnect the upper and lower radiator hoses and proceed as follows.

When the clogging is caused by leaves or other similar foreign material it usually is deposited at the top of the tubes.

1. Radiator Reverse Flush

   Proceed as follows (see Figure 10):

   a. Disconnect the hoses at the engine.

   b. Put radiator cap on tight.

   c. Clamp the flushing gun in the lower hose with a hose clamp.

   d. Turn on the water and let it fill the radiator.

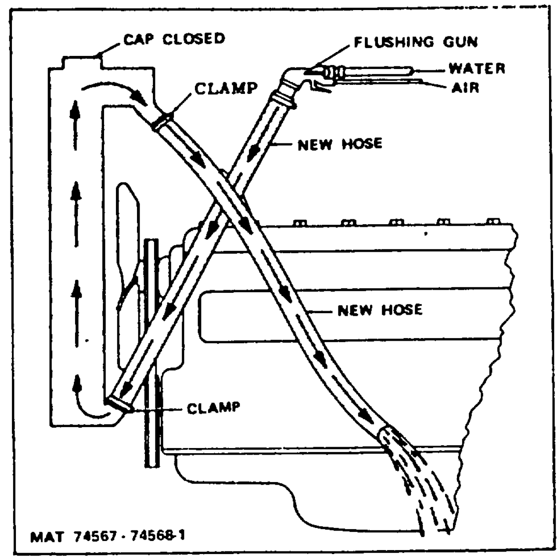


Figure 10. Reverse Flushing Radiator

   e. Apply air pressure (6 lbs. max) gradually, to avoid radiator damage.

   f. Shut off the air, again fill the radiator with water and apply air pressure-repeat until the flushing stream runs out clear.

   g. Clean and inspect radiator cap.

2. Engine Water Jacket Reverse Flush

   Proceed as follows (see Figure 11):

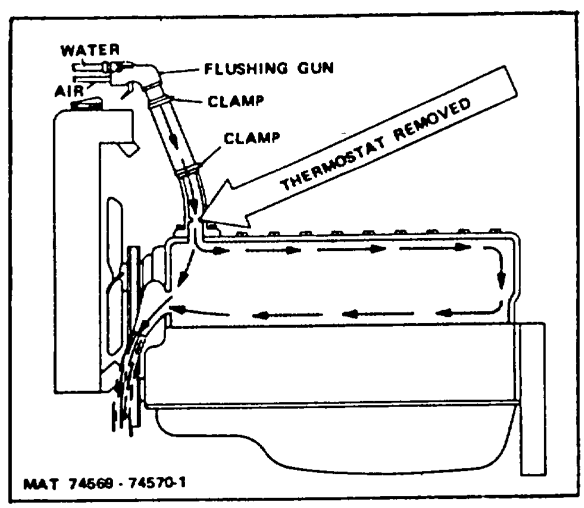


Figure 11. Reverse Flushing Engine

a. Remove the thermostat.

b. Clamp the flushing gun in the upper hose.

c. Partly close the water pump opening to fill the engine jacket with water before applying air pressure.

d. Follow the same procedure outlined above for the radiator by alternately filling the water jacket with water and blowing it out with air pressure (6 lbs. max.) until the flushing stream is clear.

To clean the cooling fins, it is best to direct an air blast carrying a grease solvent, such as oleum spirits or carbon tetrachloride, directed at the back side of the core and passing through to the front or engine side.

CAUTION: Never use gasoline, fuel oil or kerosene to clean the radiator.

WARNING: Always provide adequate ventilation of the working area during this operation to avoid possible toxic effects of the cleaning spray.

3. For regular periodic service of radiator cooling fins, simply direct a dry air blast against the rear of the radiator core to dislodge dust or lint which may have accumulated due to dusty operating conditions.

4. The "Power Shift" transmission oil cooler is an integral part of the lower tank of the radiator. To properly clean oil cooler, flush tank with an acceptable cleaning solvent and blow out with compressed air.

5. Oil cooler should be periodically checked for leaks or clogging.

6. If any fractures or breaks are discovered during radiator inspection, then the radiator should be brazed for proper sealing.

D. INSTALLATION

1. Slide the radiator up into mounting position within the counterweight, ensuring against any damage to filler neck or cooling fins.

2. With radiator properly aligned tighten all mounting capscrews through radiator mount to frame support bars.

3. Install the radiator grille and tighten securely.

NOTE: On models equipped with a "Power Shift" transmission, the oil cooler lines will have to be replaced and tightened.

4. Replace the upper and lower radiator hoses and secure the retaining clamps. If hoses are cracked or cut, they must be replaced.

5. After radiator is installed, measure the distance between the leading edge of the fan blades and the radiator core. This dimension should be approximately 7/8". Also ensure that the cooling fan is properly centered within the radiator shroud.

6. Close the cooling system drain cocks beneath radiator and ignition coil and fill system to recommended capacity with coolant, replace the radiator pressure cap and check for leaks.

NOTE: Allow engine to reach normal operating temperature. The thermostat will then open and the coolant will flow Into the engine. Coolant level must then be 'topped-up”.

7. Replace the engine side panels and lower the operator s seat.

E. CLEANING AND FLUSHING

It is recommended that the cooling system be cleaned at least twice a year, usually at the beginning of the cold weather season, before the anti-freeze solution is put into the system, and again after the anti-freeze solution is removed.

Cleaning at these intervals will reduce the possibility of clogging or overheating, and will minimize the necessity of removing the radiator for special cleaning. If hard water has been used, the necessity for cleaning is even greater, since lime deposits or scale will form in the radiator, cylinder head and block. This lime deposit is detrimental to the engine and the radiator core.

Flushing the radiator will remove obstructions in the radiator tubes and other water passages, which, if not removed, would eventually clog these passages. It is also important that the air passages between the radiator tubes be kept free of obstructions and that the exterior of the engine be kept free from thick deposits of dust and oil. The following procedure is recommended to properly clean and flush the cooling system:

1. Sal Soda is a very effective and safe solvent for removal of lime, scale and other foreign deposits in the cooling system. It should be used in the proportions indicated and according to the directions printed on the container in which it is purchased. Many good cleaning solvents for this purpose are on the market; they should always be used according to directions.

CAUTION: Never mix anti-freeze compounds or inhibitors with any cleaning, neutralizing or flushing compounds

2. After the solvent has been in the cooling system the prescribed length of time, the system should be completely drained, and after the engine has cooled sufficiently, thoroughly flush with clean water.

3. The use of certain cleaning compounds requires the use of a neutralizer solution which is usually packed and sold with the cleaning compound, and should be used as directed.

4. If radiator is badly clogged. then reverse flushing is required. (Refer to Paragraph C, INSPECTION/SERVICE, this Topic).

5. After the cooling system has been cleaned or flushed, and before new coolant is added to the system, a complete inspection should be made to detect and correct any leaks that may have been uncovered.

   a. Inspect all hoses and fittings for signs of deterioration. Replace as is necessary.

   b. Check the cylinder head capscrews, hose clamps, and fitting connections. Tighten or replace where necessary.

EXHAUST SYSTEM

TOPIC 1. EXHAUST SYSTEM

A. DESCRIPTION

The purpose of the exhaust system Is to safely and quietly channel the exhaust gases from the engine to the rear of the truck where the gases are vented into the air. The following components make up the typical exhaust system: The exhaust pipe, muffler, tail pipe and the attaching capscrew and clamp hardware items. (Figure 1.)

After combustion has occurred within the engine, the exhaust gases are released from the combustion chamber via the exhaust valves. From here, the gases are channeled through the exhaust manifold to the attaching exhaust pipe. The exhaust pipe carries the gases to the muffler which is so constructed as to greatly reduce the engine combustion noises and to entrap any glowing particles that might be suspended In exhaust gas.

The exhaust gases leave the muffler and are vented at the rear end of the truck via the tall pipe.

It is very important that the exhaust system remains tight and In good repair not only to keep the operating noise at a low level, but because of the danger of randomly escaping gas.

B. INSPECTION

1. Inspect muffler and exhaust anti tail pipes carefully for any holes, fractures or corrosion. Replace defective component immediately when found.

2. Inspect each component juncture for security and tightness of connection.

3. Ensure that all components of exhaust system are properly clamped to the truck frame.

C. REMOVAL

When it becomes necessary to replace any or all of the exhaust system components, the following procedure is recommended:

1. Remove left hand side engine panel and raise left side of truck to gain access to muffler location.

WARNING: Before proceeding further, be absolutely sure that engine has not been running for at least an hour or two. this will ensure that exhaust system has cooled adequately.

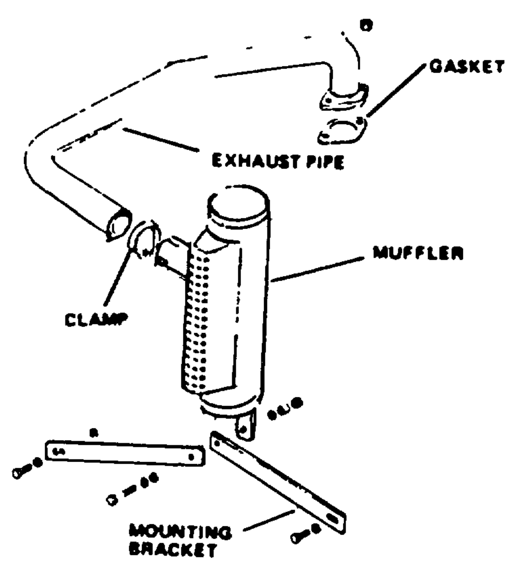


Figure 1. Exhaust System: Muffler, Exhaust and Tail Pipe (Typical)

2. To remove exhaust pipe, loosen clamp securing It to muffler and remove capscrews mounting exhaust pipe to exhaust manifold.

3. To remove tail pipe, loosen clamp securing it to muffler, and remove clamp securing it to truck frame.

4. To remove muffler, disconnect exhaust and tail pipes and remove the capscrews and washers securing it to the truck frame.

5. After muffler has been removed from truck, remove the rubber grommets from the mounting bracket.

D. INSTALLATION

1. Install rubber grommets in muffler mounting bracket and install muffler.

2. Secure exhaust pipe to muffler with clamp, and using new gasket, secure to manifold with capscrews.

3. Secure tail pipe to muffler and truck frame with clamp.

4. Inspect all connections for exhaust leaks. Repair as is necessary.

5. Lower left side of truck and replace the left hand side engine panel.

TOPIC 1. TRANSMISSION

A. DESCRIPTION

The “Power-Shift” transmission consists of three major components: The torque converter, a hydraulically actuated clutch pack and a single speed, constant mesh transmission. A single lever type shift control is mounted on the steering column to control the direction of travel through a control valve mounted on the transmission housing.

Power from the engine is delivered to the torque converter which, in turn, drives a pump and clutch pack. Housed in the clutch drum are two double faced clutch plates which, when activated, move the truck forward or reverse through splined hubs, transmitting power tot he gear train.

If the reverse clutch is activated, power is delivered to the transmission through a hollow shaft which connects the reverse gear and reverse clutch. If the forward clutch is actuated, power is delivered to the transmission through a solid shaft, which rotates inside the hollow reverse shaft, connecting the forward gear and forward clutch.

TORQUE CONVERTER: The torque converter is composed of three members: The impeller or drive member, the turbine or driven member, and the stator or reaction member. The impeller forms the outer shell of the converter, and the turbine and stator operate within the impeller but turn free of the impeller. The complete unit is mounted on the engine flywheel and always turns at engine speed. (Refer to Figure 1.)

The torque converter is filled with oil and when the impeller is rotated by the engine, the oil in the impeller vanes also rotates; and being subjected to centrifugal force, causes the oil to flow outward. At the beginning, the turbine is stationary, and there is no centrifugal force on the oil in it. Therefore, the oil in the impeller, due to its centrifugal force, enters the turbine near its outer circumference and forces oil from the turbine back into the impeller near its inner circumference. A circulation of oil is set up, which continues as long as there is a difference between the speeds of the impeller and the turbine.

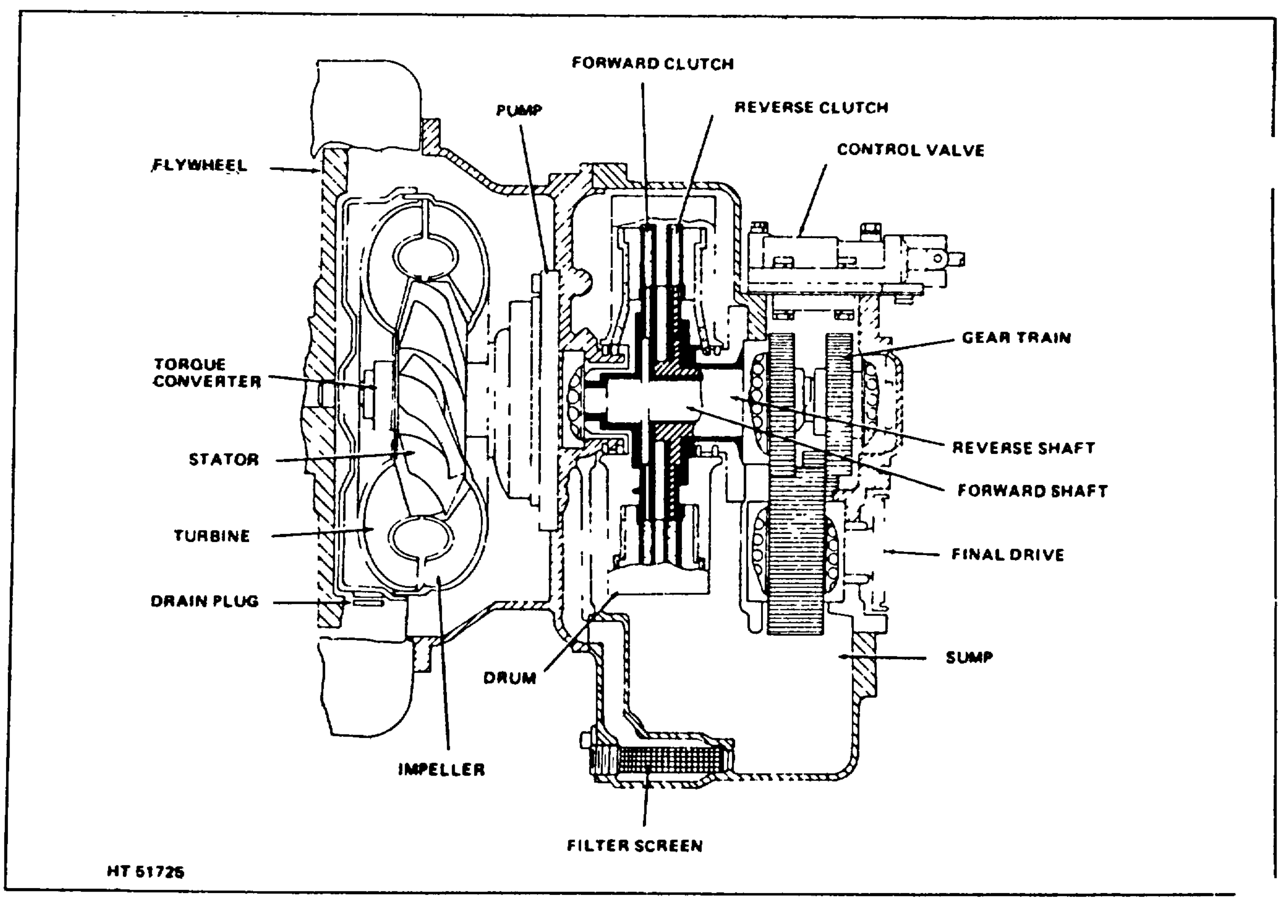


Figure 1. Power Shift Torque Converter Drive

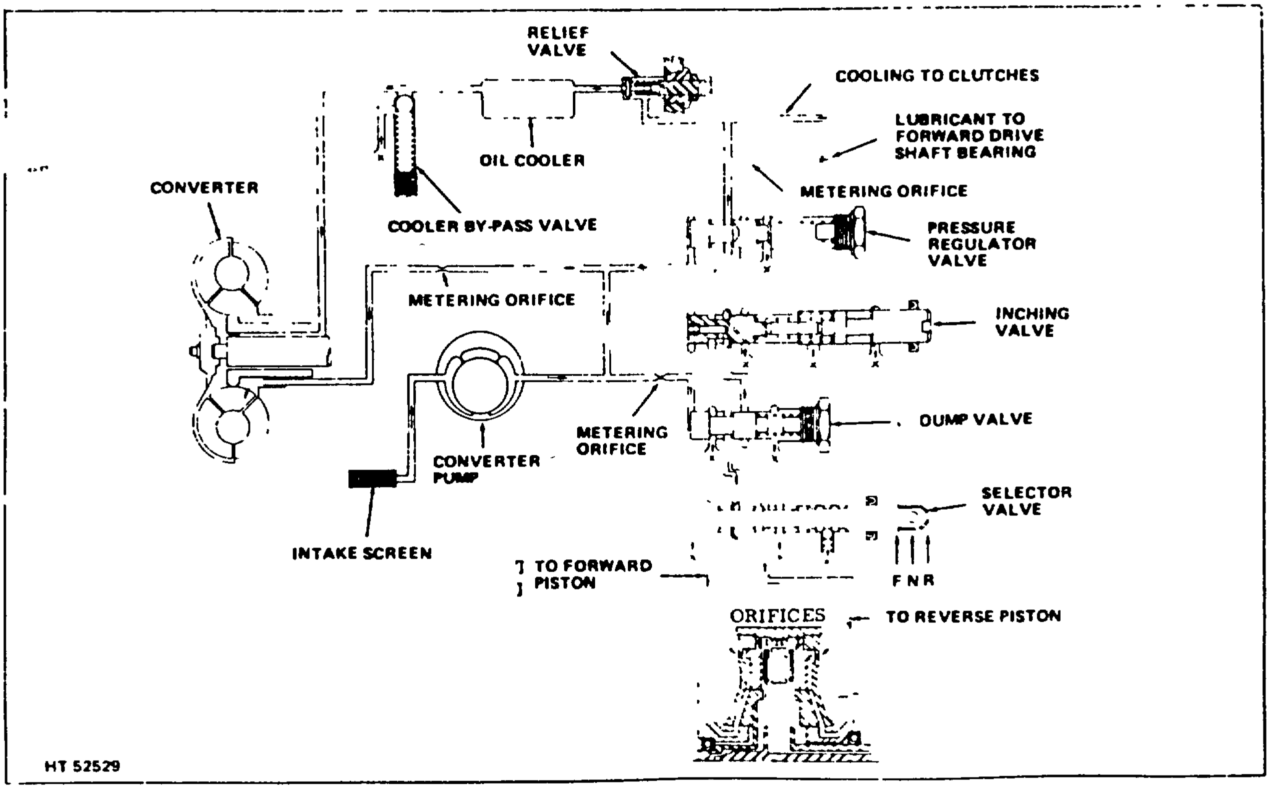


Figure 2. Power Shift - Hydraulic Schematic

In normal lift truck operation the turbine rally turns at a slower speed than the impeller and since both are the same dimension, the centrifugal force on the oil in the impeller is always greater than that of the oil in the turbine. It is this difference plus the pressurized oil from the pump which causes the oil to circulate in and through the converter.

From the above it can be seen that the oil in the converter has a dual motion. It travels with the impeller and the turbine around the outer circumference of the converter and it also flows around the inner circumference or central core of the converter. As a result of these motions the oil carries a certain amount of kinetic energy. The velocity of the oil in the converter increases as the oil passes from the impeller to the turbine and decreases as it passes from the turbine back to the impeller.

Since the velocity increases in the impeller, its kinetic energy increases and this gain in kinetic energy can come only from the impeller that is to say, when increasing the velocity of oil In its vanes, the impeller encounters a resistance, and it takes power (from the engine) to keep the impeller running against this resistance. In the turbine the oil is slowed down and presses forward against the !s, and when the turbine is moving under this force, power to drive the truck is produced. Thus, all the oil passing through the impeller picks up energy and gives it to the turbine. Up to this point operation is the same as a fluid coupling and there is not torque multiplication.

To transmit velocity to the oil at the inner circumference of the converter, a third member, the stator, is added to the fluid coupling, between the impeller and the turbine. It is here that the fluid coupling becomes a torque converter. With the impeller rotating and the turbine stalled, the oil is driven through the curved blades of the turbine. The curved blades redirect the oil In the opposite direction from which it was received. As the oil leaves the turbine blades, it strikes the stator blades causing a reaction which produces torque multiplication.

The stator directs the oil back to the impeller where any remaining kinetic energy combines with the kinetic energy of the impeller oil, producing additional torque multiplication. When the output torque becomes high enough, the turbine starts to turn and the truck will move. As the turbine speeds up and its speed approaches Impeller speed, there is no longer any reaction on the stator and it starts to turn with the turbine. At this point the unit becomes a fluid coupling since there is no longer any torque multiplication.

POWER SHIFT HYDRAULIC SYSTEM: The transmission hydraulic system consists of the torque converter, a converter driver, pump, the control valve and the clutch pack.

Control Valve: The control valve is mounted on the transmission housing and forms the top closure of the gear case. Machined porting plates are attached to the bottom of the valve to eliminate external piping. Passages in the plates align with passages drilled or cast into the transmission housing.

Clutch Pack: The clutch pack consists of a drum, a forward and a reverse clutch, and pistons and cylinders. The clutches are engaged by oil pressure applied behind the clutch pistons, which causes engagement within the drum.

Oil Pump: The gear type oil pump provides hydraulic pressure for the converter and the clutch pack. It is directly driven from the input side of the converter. Since the converter is mounted on the engine flywheel, the pump is in operation whenever the engine is running. This means that there is hydraulic pressure even with the engine idling.

With the converter pump operating, the oil is taken from the sump and pumped under pressure to the converter and to the pressure regulator of the control valve.

Oil pressure in the converter is reduced from pump pressure by a metering orifice in the passage between the pump and the converter.

Oil from the converter flows back to the sump through the turbine shaft, to the oil cooler, then through an external pressure regulating valve and into the clutch pack for cooling the clutches. Ahead of the cooler is a spring loaded bypass valve which relieves excessive pressures which may develop in the cooler circuit. If oil is restricted in the circuit the valve ball will unseat between 50 - 70 p.s.i.

To assure a constant flow of oil for cooling, with controlled pressure, especially at engine idle speed or slightly below (500 r.p.m.), the pressure regulating valve is set for 18 to 30 p.s.i., with the oil temperature at 120 to 140 degrees F.

At the same time oil is being pumped to the converter and cooling circuit, it is also being delivered under full pump pressure to the pressure regulator valve in the control valve. The regulator controls the oil pressure delivered by the pump. The spring is calibrated to provide between 80 - 150 p.s.i., so that oil under controlled pressure is ready for delivery to the clutch pack at 2000 p.s.i. The regulator also controls the amount of oil being delivered for clutch cooling. Also, a portion of the cooling oil is diverted for lubricating the front bearing of the forward drive shaft. Pressure is reduced by forcing the oil through a metering orifice.

From the regulator valve, oil passes to the inching valve. This valve is a variable regulator which permits the operator to vary pressure on the clutch plate from 105 p.s.i. maximum to 0 p.s.i. minimum. When an "inching" operation is performed, actuating the inching pedal relieves spring pressure on the inching valve . spool.

This action allows oil pressure in back of the spool to move it far enough to restrict the flow of oil to the selector valve, thus controlling pressure on the clutches. This allows a "feathering" effect during "inching" operations.

The forward and reverse clutch supply or dump valve is placed in the circuit to control the flow of oil to the selector valve. The valve spool is pressurized by the converter pump through a metering orifice in a branch circuit from the main supply line. Pump pressure at this orifice is reduced to 3 p.s.i., maximum with the engine at full governed speed

Oil flowing through the dump valve enters the selector valve. With the selector valve plunger in the neutral position, oil is blocked at this point and the truck will not move. As soon as the directional lever is moved to either forward or reverse, the selector valve plunger opens the ports to either the forward or reverse clutch pistons. Movement of piston, due to the oil pressure in the circuit, causes the clutch to engage the rotation clutch drum, thereby moving the truck. The orifices in the clutch drum cylinders are for the purpose of accelerating the release of pressure whenever the operating pressure to the clutches is blocked off or lowered.

An oil cooler is installed in the "Power-Shift" hydraulic system to control the temperature of the oil being delivered to the. clutch pack. The cooler unit is located in the bottom of the radiator.

B. SERVICE

At the truck lubrication period, remove the floor plate and on the right side of the transmission check the oil level of the transmission sump by use of the dipstick. Engine must be running for this check. Add automatic transmission fluid, if necessary, to bring the oil level up to the FULL mark on the dipstick. When so noted (each 1000 operating hours), the transmission sump should be drained and refilled with new oil.

No specific time intervals are given, but the shift control adjustment should be checked on occasion. (Refer to SHIFT CONTROL ADJUSTMENT, REPAIR MANUAL.)

The transmission operating pressures should be checked whenever the unit Is not operating efficiently or after any internal parts have been replaced. Make certain the oil cooler plates are tight.

At periodic inspections, make sure all mounting capscrews are tight. Make certain no oil is leaking past the output shaft and that the universal joints are tight.

C. REMOVAL

When it becomes necessary to remove the transmission and/or converter for repair, the following procedure is recommended:

1. Remove the floor and toe plates, seat deck assembly, batter case and battery, and one corner post.

2. Drain oil from transmission by removing drain plug at rear of sump.

3. Disconnect the cooler lines at the bottom and at the right side of the sump.

4. Remove all control linkage.

5. Disconnect the universal Joints at the transmission.

6. Remove the capscrews and lockwashers which mount the converter to the flywheel. Use a suitable tool to rotate the flywheel.

7. Attach a lifting chain and chain hoist to the transmission assembly and carefully remove from truck.

CAUTION: Ensure that all attachments to transmission assembly that could hinder removal, have been disconnected.

D. DISASSEMBLY

After transmission is removed from truck, place on a suitable work area, and proceed as follows for complete disassembly:

1. Remove capscrews from valve block, and remove from transmission. (See Figure 3.)

2. Slide converter off turbine shaft. Then mark the pump and the housing to ensure the proper reinstallation, and remove capscrews holding the pump and collector ring to converter housing. It may be necessary to tap the pump assembly with a rawhide hammer to free it from the gasket. (See Figure 4.)

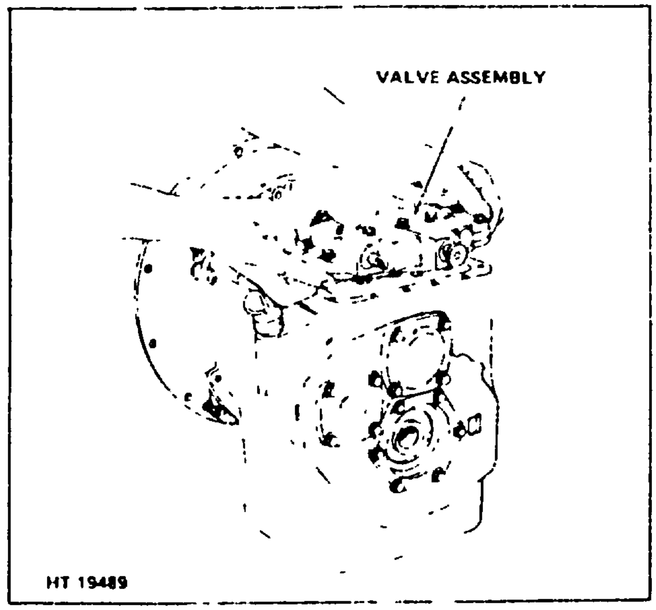


Figure 3. Removing Valve Block

3. Lay the transmission on the gear case side as shown in Figure 5. Remove capscrews which mount the converter housing to the gear case. Then, attach a chain to the housing and remove housing and disc drum assembly as a unit, taking care not to damage the seal rings in collector ring on gear case.

4. To remove the converter housing from the disc drum, remove snap ring on the turbine shaft and slide housing from drum assembly. Bearing will remain in housing. (Figure 6.)

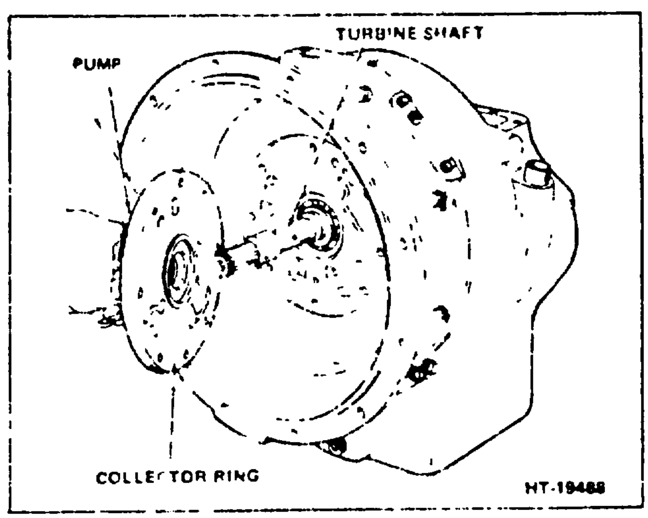


Figure 4. Pump Removal

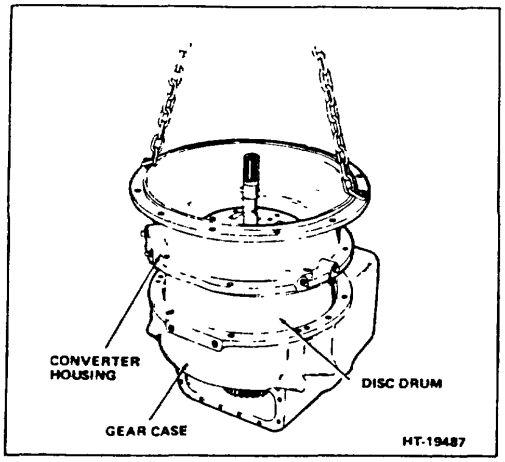


Figure 5. Removing Housing and Drum

5. Remove forward gear and shaft:

   a. Remove capscrews and lockwashers holding cap to housing and remove cap.

   b. Remove inner snap ring from the splined section of the forward shaft. Using a rawhide hammer, tap shaft at the clutch end and while holding forward gear, pull shaft from the gear box.

6. Remove reverse gear and shaft:

   a. Remove inner snap ring from the splined section of the reverse shaft.

   b. Properly identify collector ring and housing to ensure correct installation.

   c. Remove capscrews that secure the collector ring to the housing and remove the ring. If rings have to be replaced, unhook at ring opening and remove.

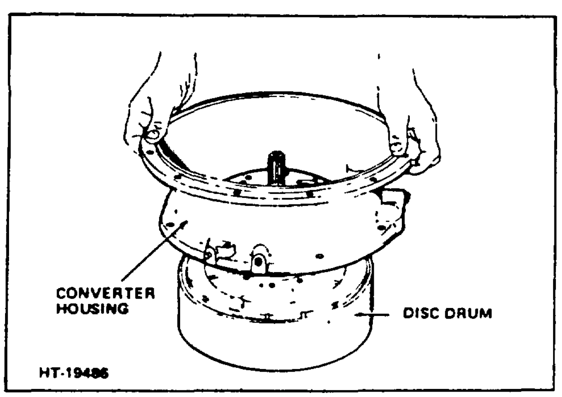


Figure 6. Removing Clutch Drum from Converter Housing

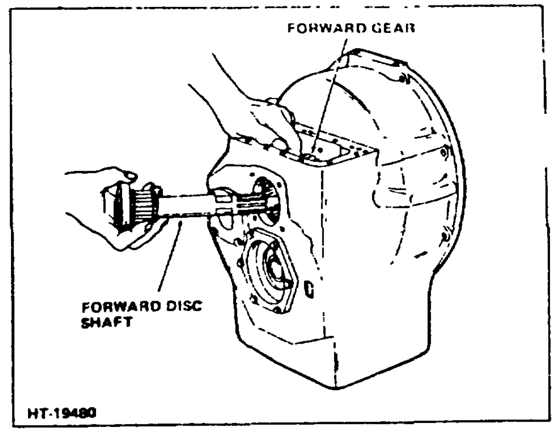


Figure 7. Removing Forward Gear and Shaft

   d. Remove the shaft while holding the reverse gear in the gear box.

   e. The bearings on both the forward and reverse drive disc shafts can be removed by removing the snap rings and pressing the bearings from the shafts.

7. Remove idler gear and shaft:

   a. Remove capscrews holding idler gear shaft and cap to housing and remove cap and shaft. Note position of retaining pin holding shaft in cap to ensure proper reinstallation.

   b. Remove idler gear.

8. Remove output gear and shaft:

   a. Remove capscrews holding output shaft cap to housing.

   b. Remove output shaft and cap, while holding output gear inside gear box. It may be necessary to tap the output shaft from inside the clutch housing to facilitate removal.

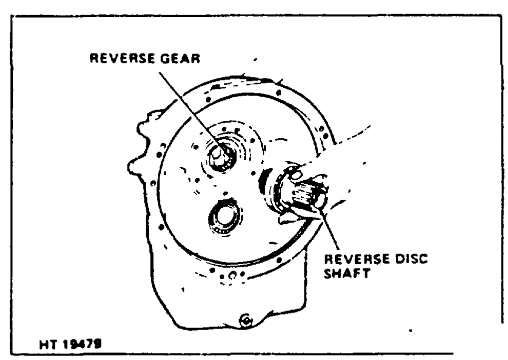


Figure 8. Removing Reverse Gear and Shaft

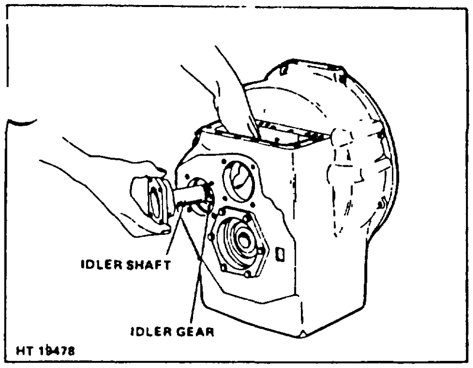


Figure 9. Removing Idler Gear and Shaft

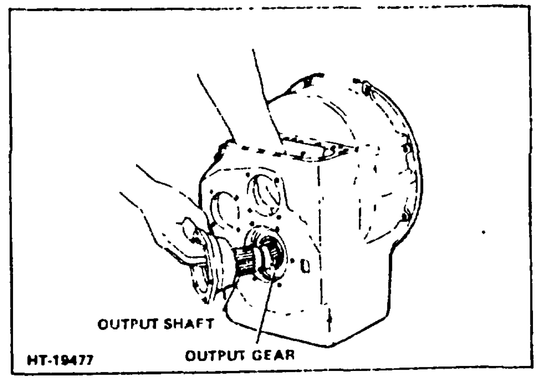


Figure 10. Removing Output Shaft and Gear

c. Remove output gear.

9. Remove the sump strainer by removing the capscrews inside the sump housing.

E. INSPECTION

Wash all parts, except oil seals, with suitable solvent. Blow out passages in housings with compressed air. Inspect bearings, seal rings, splined shafts, and gears for wear or damage. Inspect sump screen for clogged or damaged screen. Install new replacement gaskets.

NOTE: Thoroughly clean the intake screen. In addition to soaking and washing, air streams should be directed from the outside toward the inside to remove material clogged in the screen.

F. REASSEMBLY

To reassemble the transmission, reverse the disassembly procedure and take note of the following precautionary measures:

1. Make certain spring is in place when installing the oil filter screen in housing.

2. Make sure output shaft is installed with the internal splines facing towards the outside of the gear case.

3. Make sure that the machined reliefs in the idler shaft cap are positioned down so that the oil in the cap will drain into housing.

4. As the gears and bearings are being installed, coat all surfaces with an acceptable lubricant and make sure they rotate freely in their respective locations.

5. When installing the collector ring, be certain to align the match marks made during disassembly. Make sure rings rotate freely on the collector ring and that rings are properly hooked together at ring ends.

6. When installing the forward and reverse drive disc shafts and gears, check to make sure that the snap rings holding the gears on the shafts are properly installed and seated.

7. Care should be exercised when installing the converter housing on the turbine shaft of the disc drum, so that misalignment does not occur during reassembly. Make sure that the snap ring holding the converter housing to the turbine shaft is properly seated.

8. When installing the converter housing and disk drum (as a unit) into transmission housing, care should be exercised so as not to damage the collector rings fitting into the disc drum. Damage to these rings will cause the reverse piston and disc to be inoperative.

9. Use new gasket when replacing control valve. Use new gaskets whenever old gaskets have been removed.

G. INSTALLATION

Refer to CONVERTER ALIGNMENT AND INSTALLATION PROCEDURE in Topic 2, then proceed as follows:

1. Attach lift chain and chain hoist to transmission assembly and maneuver transmission into position for Installation.

CAUTION: Ensure that transmission mounting area is free and clear of any obstacles, such as linkage or hoses, to prevent unnecessary damage.

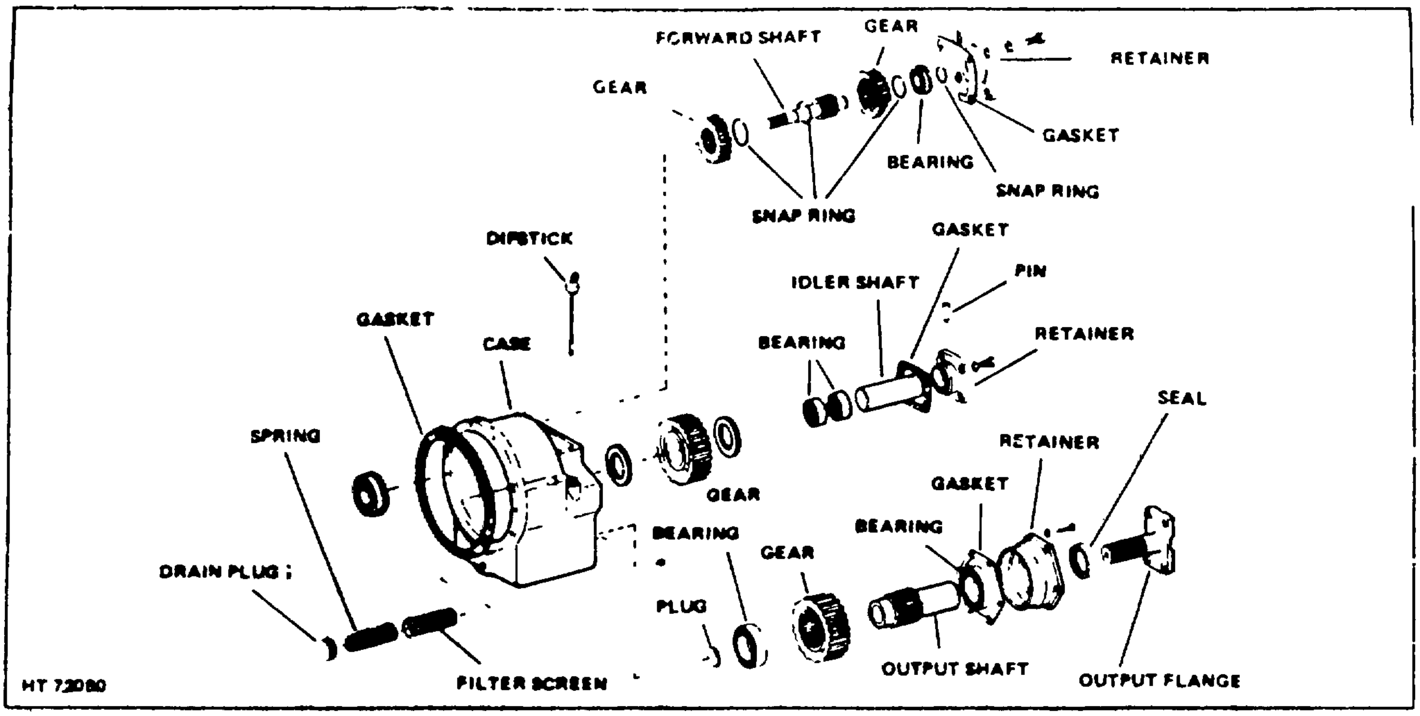


Figure 11. Transmission

2. Mark the flywheel and one mounting strap for identification and remove converter from the flywheel, being careful not to damage or lose shims, if any, on converter pilot.

3. Position the converter in the pump at the back of the transmission, making sure that the converter hub tangs properly engage the pump driven gear.

4. Reinstall the transmission on the flywheel bell housing, connect the universal joints and note the following:

   a. Mount the converter to the flywheel by installing the attaching capscrews and lockwashers through the inspection plate in the flywheel bell housing.

   b. After the converter has been securely installed, rotate until the filler hole appears and add one quart of oil.

   c. After installation is completed; drain plug replaced, cooling lines reconnected and linkage replaced, add 10 quarts of proper type transmission fluid to transmission.

NOTE: Oil should be changed every 1000 operating hours. Use transmission fluid as recommended. (Use quality 'A' or suffix 'A.')

5. Replace battery case and battery, ensure that battery connections are properly made. (Refer to ELECTRICAL SYSTEM.)

6. Replace and secure the deck assembly and the floor plates.

TOPIC 2. TORQUE CONVERTER AND PUMP

As noted previously, the function of the torque converter within the "Power-Shift" transmission is to translate the engine power into a driving force to operate the transmission hydraulic pump and the clutch pack.

The torque converter is a sealed unit and other than the periodic replacement of the oil contained therein, cannot be disassembled and serviced.

When Installing the converter, the tang depth and rotational concentricity must be carefully adjusted.

A. REMOVAL - INSPECTION

1. After the transmission has been removed from the truck, carefully remove the torque converter and take note of the number of shims located on the converter pilot.
2. Inspect converter housing for evidence of cuts or fractures and leaks.
3. It is good practice to remove the converter oil plug, and drain the oil.
4. Thoroughly clean and flush the converter with an acceptable, non-corrosive solvent. Ensure that all solvent is drained from converter prior to re-installation.

Pump:

1. Remove capscrews which mount the pump assembly to the housing and remove pump. (See Figure 4.)

NOTE: It may be necessary to lightly tap the pump with a rawhide hammer during removal in order to free it from gasket.

2. Remove all capscrews holding pump to collector ring and separate.
3. Remove the seal rings and oil seal. (See Figure 12.)
4. Remove the pump collector ring and bushing. Install new bushing.
5. Carefully inspect pump, and if gears, bushing or housing show wear or damage, then the entire pump assembly will have to be replaced.
6. Check the face of the pump collector ring for score marks caused by tangs of converter. If marks are present, it indicates that the converter is not properly shimmed at the flywheel mounting surface. (Refer to CONVERTER REPLACEMENT.)

B. REASSEMBLY

Converter:

1. When installing the torque converter, it is important that the tangs of converter extend the proper depth into the pump. In order to ensure the proper installation, follow the procedure outlined below:

   a. Without placing any shims on the converter pilot, install the converter

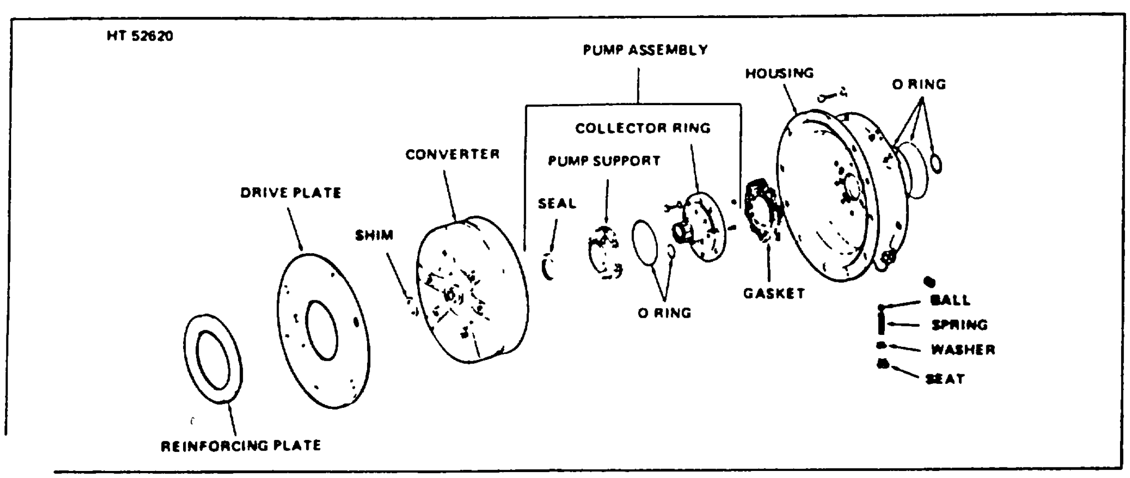


Figure 12. Torque Converter and Pump Assembly

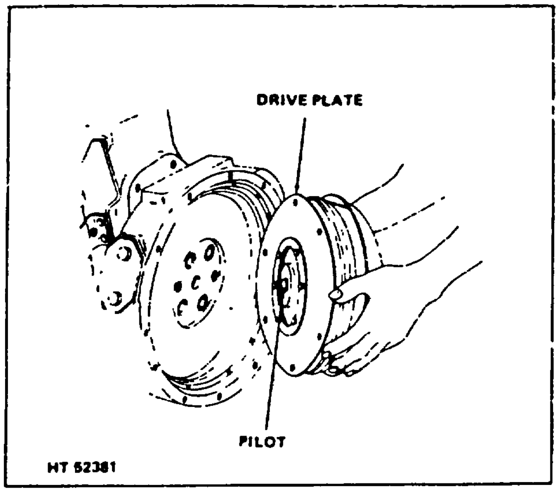


Figure 13. Installing Converter

on the flywheel. Tighten the mounting capscrews. (See Figure 13.)

b. Place a scale or rule across the tangs of the converter and another scale from the face of the flywheel housing to the scale across the converter tangs. (See Figure 14.)

c. Record the measurement from the face of the tangs to the face of the housing as illustrated in Figure 14, and compare measurement to proper valve on chart.

d. If the measurement is less than what is specified for the particular converter, then add necessary shims behind converter pilot to obtain the

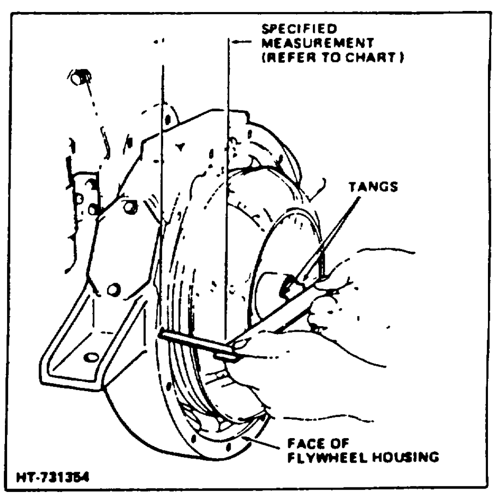


Figure 14. Checking Tang Depth

specified measurement. Then reinstall the converter.

Converter Size	Number of Tangs	Size Measurement
11.0"	2	3.07 ± 0.01
11.0"	4	2.95 ± 0.01

e. If the measurement is more than the specified dimension, then insert a gasket between the converter housing and the flywheel housing.

CONVERTER SIZE: Simply measure the converter housing O.D. to determine size; 9.5" converter = 10.186" O.D. and the 11.0" converter = 12.228" O.D.

NOTE: Make the gasket of required thickness to obtain the specified dimension.

NOTE: When installing converter, it is necessary to check its rotational concentricity. Follow procedure outlined below under alignment.

2. Alignment:

a. Mount a dial indicator as shown in Figure 15.

b. Rotate the converter and note the dial indicator reading. The hub runout should not exceed .005" (.010 T.I.R.).

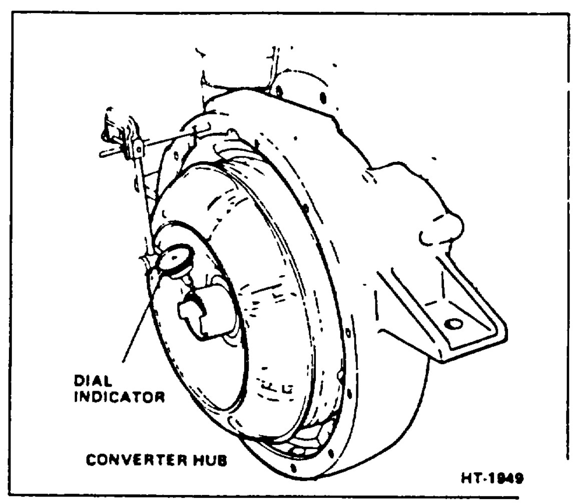


Figure 15. Checking Converter Alignment

NOTE: Do not use shims between the plate and flywheel.

c. After the proper alignment has been obtained, recheck the tang depth measurement, as outlined above.

d. Refer to TRANSMISSION INSTALLATION for proper installation of torque converter on truck.

Pump:

1. Install new seal rings and new oil seal.
2. Lubricate all parts with a light engine oil.
3. Install the pump on the pump collector ring, making sure the holes are properly aligned. (See Figure 12.)
4. The pump can now be reinstalled on the converter housing; use a new gasket and ensure that the mounting holes are properly aligned.
5. Refer to TRANSMISSION INSTALLATION.

TOPIC 3. DRUM AND DISC ASSEMBLY

The drum and disc assembly is comprised of a drum, the forward and reverse discs, pistons and cylinders. The discs are engaged by oil pressure applied behind the disc pistons which causes engagement with the drum. The unit operates in oil at all times, both for cooling and lubrication.

It is necessary to remove the transmission in order to gain access to the drum and disc assembly for service or repair. (Refer to TRANSMISSION REMOVAL and DISASSEMBLY.)

A. REMOVAL

1. With transmission out of truck, remove the capscrews from valve assembly and remove valve assembly.
2. Slide converter off the turbine shaft. Then mark the pump and the housing to ensure the proper reinstallation, and remove capscrews holding the pump and collector ring to converter housing. It may be necessary to tap the pump assembly with a rawhide hammer to free it from the gasket. (See Figure 4.)
3. Lay the transmission on the gear case side as shown in Figure 5. Remove the capscrews which mount the converter housing to the gear case. Then attach a chain to the housing and remove housing and drum and disc assembly as a unit, taking care not to damage the seal rings in collector ring on gear case (Fig 5).
4. To remove the converter housing from the disc drum, remove the snap ring on the turbine shaft and slide housing from drum assembly. Bearing will remain in housing. (See Figure 6.)

B. DISASSEMBLY

1. Place the drum and disc assembly in an arbor press. Then apply pressure on the turbine shaft until the cylinder is depressed enough to remove the large snap ring from the drum (Fig 16).
2. Slowly release the pressure on arbor press and remove the cylinder, making sure it is kept in alignment to prevent binding in the drum. If cylinder binds in drum, tap lightly with a rawhide hammer until it is released.
3. Remove piston, drive disc, and springs. Ensure that piston ring is not damaged or binding.
4. Turn drum over and remove snap ring, cylinder, piston and drive disc.
5. Examine all parts for wear or damage. Should excessive wear or score marks be evident on drive discs, pistons or drum, they should be replaced. Check piston rings, making sure they are free in piston groove.

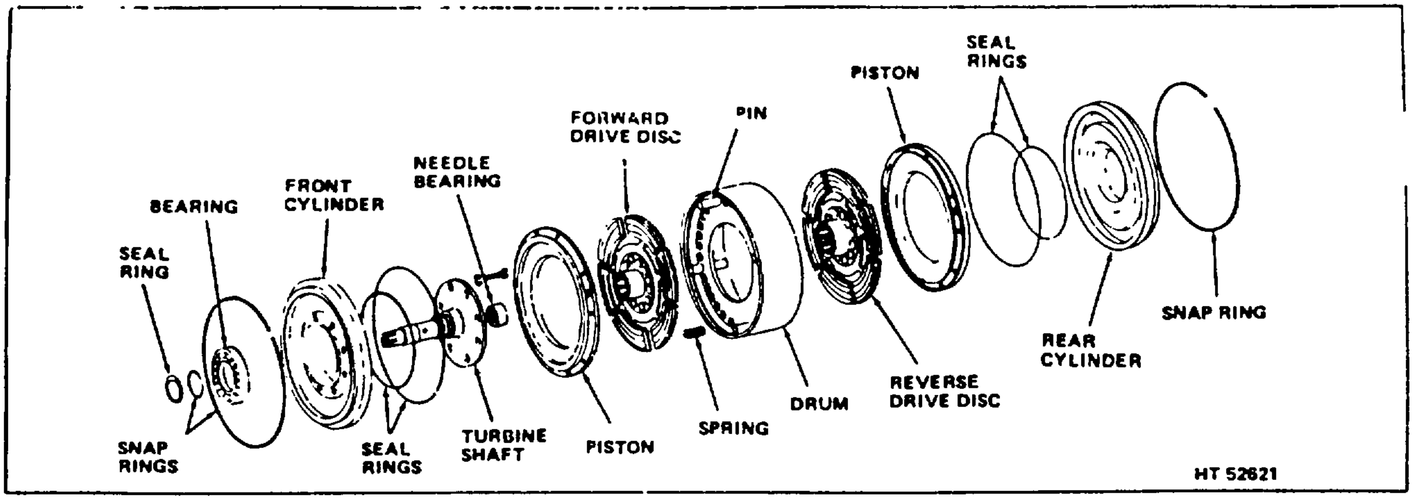


Figure 16. Drum and Disc Assembly

C. REASSEMBLY

1. Install the reverse drive disc, piston, seal rings, and rear cylinder. Make sure that the rear cylinder and the piston do not bind in the drum or on dowel pins. Install large snap ring holding cylinder and assembled parts in place. (See Figure 16.)

2. Turn the drum assembly over and install the springs, drive disc, piston, seal rings and the front cylinder.

3. Place the entire assembly in an arbor press. Apply pressure on the turbine shaft, making sure cylinder does not bind in the drum or on the dowel pins. Install the large snap ring holding the front cylinder in place and when properly seated, release pressure in the arbor press.

D. INSTALLATION

1. Slide the converter housing on the disc drum turbine shaft and replace the retaining snap ring.

2. Attach a hoisting chain to the converter housing and then maneuver housing so that turbine shaft will be properly engaged as the disc drum and housing are reattached to transmission gear case. (See Figure 5.)

CAUTION: Take care not to damage the seal rings in the collector ring on gear case during reassembly.

Install securing capscrews and tighten.

3. Install new gasket, then align previously made marks and replace the collector ring and pump on the turbine shaft. Secure with mounting capscrews.

4. Refer to TRANSMISSION INSTALLATION for CONVERTER AND TRANSMISSION INSTALLATION procedure.

TOPIC 4. CONTROL VALVE ASSEMBLY

As noted previously, the direction of travel of the truck is obtained by operating a control valve which is mounted on the transmission housing. The valve controls the pump pressure, direction of travel, inching and the piston dump.

When control valve repair or replacement is necessary, the following procedure should be used:

A. REMOVAL

NOTE: It is not necessary to remove transmission from the truck in order to service or replace the control valve.

1. Remove floor plates, seat deck assembly, battery case and battery, and one corner post for easier access.

2. Disconnect the control linkage at the control valve.

3. Loosen the control valve mounting capscrews and remove control valve assembly. Remove and discard gasket, then place a clean covering over exposed area of transmission to prevent unnecessary contamination.

4. Place control valve assembly in a clean work area for disassembly.

B. DISASSEMBLY

1. After control valve has been removed from transmission housing, make sure all dirt and foreign material is removed from the valve body.

NOTE: Take care not to damage valve body during disassembly. Use tools properly.

2. Refer to Figure 17 and remove the cover.

3. Remove the capscrews at the front of large base plate and remove plate and gasket.

4. Remove the spring, detent ball and retainer from the valve body at the forward and reverse plunger.

5. Remove the forward and reverse plunger

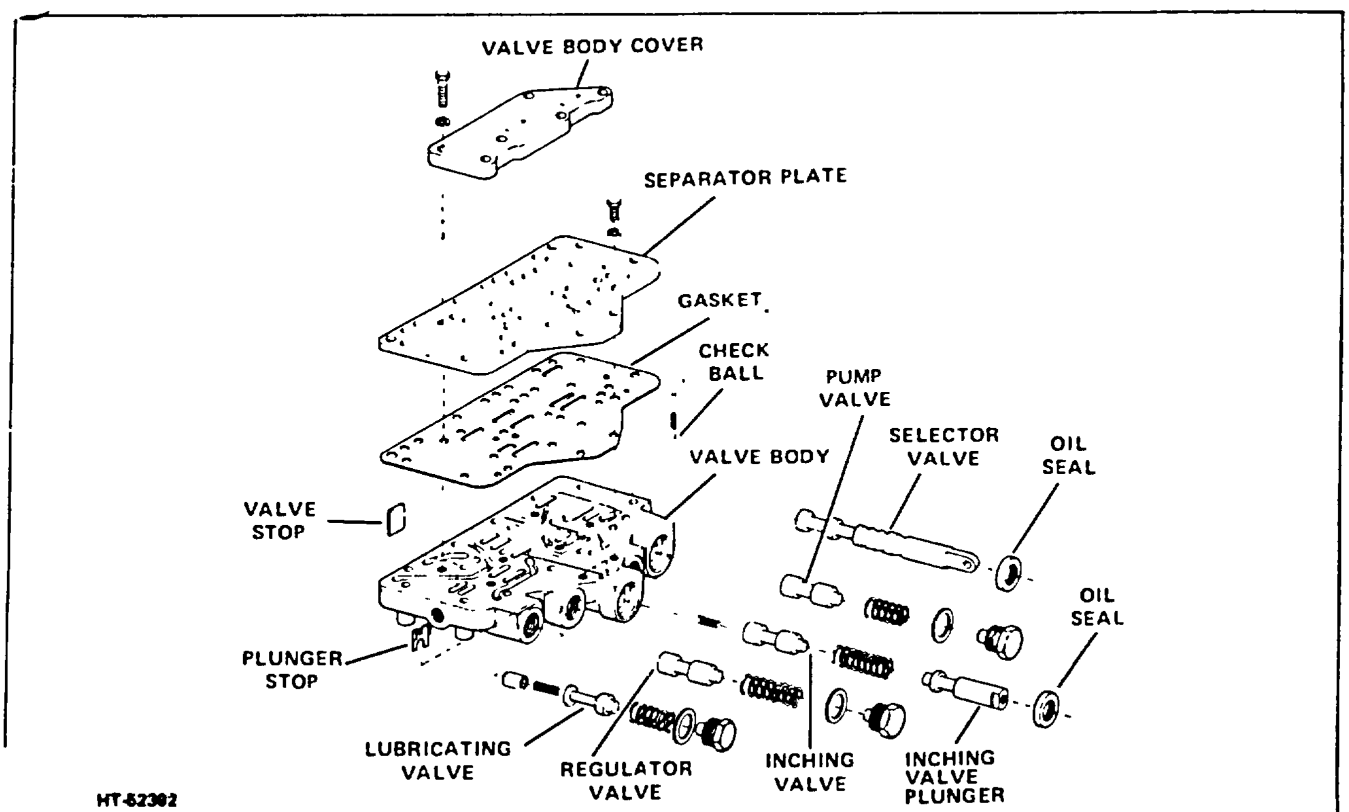


Figure 17. Control Valve - Exploded View

after the lock-clip has been removed from the valve body.

6. Remove the inching control plunger by first removing the lock-clip and seal, then the springs and the spool from the inching control valve. Note small spring In spool.

7. Remove the cap at the regulator valve and remove the spring and spool from valve body. Remove lubricating valve.

8. Remove the cap at the dump valve, and remove the spring and spool from valve body.

9. Clean all parts with an acceptable solvent and dry with compressed air. Blow out all passages in valve body.

10. Check plungers and spools for score marks; if possible, clean up with crocus cloth. If badly scored, replace.

11. Check springs for damage. Replace, if necessary.

12. Replace all oil seals, seal rings and gaskets.

C. REASSEMBLY

1. Install dump valve spool and spring, gasket and end cap.

2. Replace regulator valve spool, spring, gasket and end cap. Install lubricating valve.

3. Install small spring in Inching control cylinder, then replace spool and large spring. Replace the Inching control plunger by pushing in against plunger, then releasing after captivating plunger with clip-lock.

4. Install the forward-reverse plunger and clip-lock.

5. Replace the forward-reverse detent ball, spring and retainer.

NOTE: Ensure that all plungers and spools operate freely and that forward-reverse, and inching control plunger retainers are installed with the angled edges facing towards the rear of the valve body.

6. Install new gasket and replace the large base plate and capscrews.

7. Install cover and capscrews.

8. Remove protective covering over exposed area of transmission, then install new gasket.

9. Replace valve control assembly on transmission housing, install capscrews and torque to 5 10 lb-ft.

CAUTION: Do not torque capscrews more than 10 lb-ft.

TOPIC 5. POWER SHIFT TRANSMISSION CHECK-OUT PROCEDURES

NOTE: The transmission oil level must be at the dipstick "FULL" level before performing the following checks. All the checks are made with the transmission oil temperature at 120 - 140°F. Temperatures below 120 - 140°F. will give a reading higher than specified for the individual check.

A. PUMP, TORQUE CONVERTER AND CLUTCH PRESSURES

1. Operate transmission until the transmission oil temperature rises to 120 - 140°F. the required transmission oil temperature can be reached in a short period of time by operating the transmission with the torque converter stalled. A metal thermometer placed in the oil level dipstick hole can be used to measure the oil temperature.

2. Raise the front of the lift truck until both drive wheels clear the floor, then block into position.

3. Mount a pressure gauge (0 - 300 p.s.i) in the appropriate pressure tap port for each check. (See Figures 18 and 19).

4. Attach a tachmometer to record the engine speed (r.p.m.). All checks are to be run at the specified engine speed.

5. With the parking brake released, position the transmission in forward and accelerate engine to the specified engine speed. Drive wheel brakes must not drag.

NOTE: Check pressures at both engine speeds.

6. Check pressure gauge reading. All readings must be a steady value within the pressure range indicated for each pressure check.

Transmission Group	Engine RPM	Mainline Pressure	Converter Pressure	Forward Clutch	Reverse Clutch
With Flyball Assembly	600	80-100	70-95	70-95	70-95
	2000	130-150	90-115	95-115	95-115
Without Flyball Assembly	600	45-70	32-65	32-65	32-65
	2000	130-150	80-105	80-105	80-105

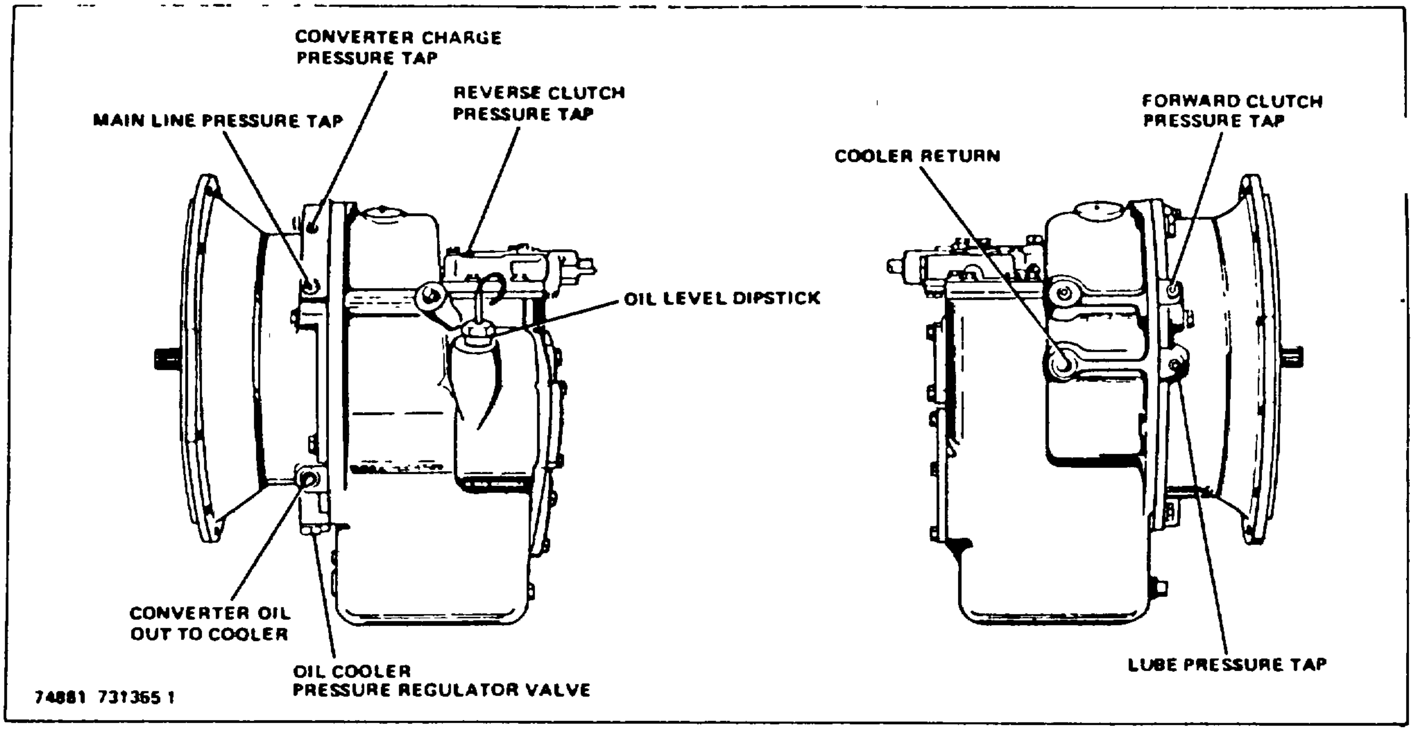


Figure 18. Pressure Tap Port Locations (One-Piece Converter Housing)

B. SEAT DUMP VALVE (OPTIONAL)

The seat dump is a safety device that will bring the truck to a positive stop whenever the operator's weight is removed from the seat. If the truck does not come to a complete stop when there is no weight on the seat deck, the seat dump should be adjusted as follows:

Hydraulic Check:

1. With the pressure gauge mounted in the clutch pressure tap port (Figure 19), operator's seat fully lowered, engine running at low idle and transmission positioned in neutral, note the pressure gauge reading: gauge should read between 100 - 120 p.s.i.

2. Remove the weight from the operator's seat to release the dump valve. Pressure gauge reading should return to zero, if the seat dump valve is fully released.

Mechanical Adjustment:

1. With engine Idling and in neutral, raise

the hinged seat deck.

NOTE: Be certain seat dump spring is compressed enough to force adjusting tube about 1" upward. Force jam nut against top of adjusting nut to lock the spring in compressed position.

2. Loosen the nut under the adjusting tube (Figure 20), so that the tube can be raised or lowered.

3. Raise or lower the adjusting tube until the top of the tube travels 15/16" in a downward stroke, measured between the bottom of the level bar at the front of the seat deck and the top of the adjusting tube, when the seat deck is depressed until it is resting on the left and right tie angles.

4. Lock the adjusting tube by forcing the nut against the bottom of the tube.

5. Check adjustment by lowering the seat, sitting on it, and putting the truck in FORWARD. With the truck moving very slowly forward, stand up. The truck should stop. If it does not, repeat steps 1 through 4, again making sure spring is compressed.

C. INCHING PEDAL

The inching pedal, operated by the left foot, allows slow creeping maneuvers with full engine speed available for lifting purposes. The more the inching pedal is depressed, the slower will be the truck movement. Full depression of the inching pedal will result in a full stop condition.

If the truck does not come to a full stop when the inching pedal is down, or if the truck does not move smoothly forward with the pedal released, the inching pedal assembly must be adjusted.

NOTE: Check inching pedal adjustment after every 500 hours of operation. Normal wear to the service brake will make adjustment necessary.

Hydraulic Check:

1. Mount a pressure gauge in the clutch pressure tap port and attach a tachometer to record the engine speed. Transmission oil temperature must be at 120 140°F.

2. Block the front of the lift truck until the drive wheels clear the floor.

3. Position the transmission in FORWARD and accelerate the engine speed slowly to 2000 rpm. Observe the pressure gauge reading.

4. With foot pressure, fully depress the inching pedal to the toe plate; the drive wheels should come to a rolling stop. When the inching pedal is fully depressed, the pressure gauge reading should fall to zero. Brake pressure must not be applied until the clutch pressure falls to zero.

5. Repeat steps 1 through 4 with the transmission in reverse.

Mechanical Adjustment:

1. Remove the toe plate and the floor plate.

CAUTION: Be sure inching plunger is completely bottomed before making any adjustments. Be sure the inching pedal stop prevents the inching plunger from piercing the back of the control valve.

2. Adjust the return spring anchor assembly so that the return spring is between 11"11-1/4" on cushion tire trucks or 11-1/4"-11-3/4" on pneumatic trucks. If the toe plate touches the return spring, the return spring anchor assembly may be moved one bolt down the transmission housing.

3. With the return spring at the proper length, adjust the inching pedal stop so that the plunger spring is compressed to 3/32" to 1/8".

4. With the brake pedal against the brake pedal stop, set adjustment screw to

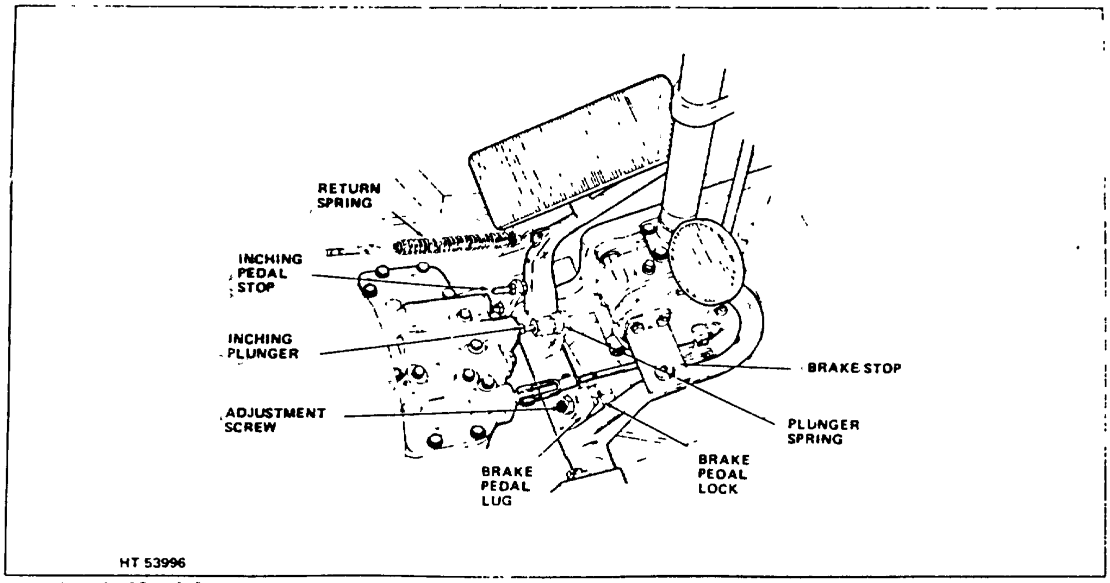


Figure 21. Typical Inching Pedal Assembly (Typical)

allow about a 1/4" gap between the brake pedal lug and the brake pedal lock.

5. To check the adjustments, raise the drive wheels off the floor, and with the engine at high idle, shift 'into FORWARD OR REVERSE. The inching pedal plunger should not move forward. If it does, repeat steps 3 and 4.

CAUTION: Before proceeding further, ensure. that shifting lever has been set at the NEUTRAL position.

6. To check the transmission output, return the drive wheels to the floor, lock the emergency brake, return the throttle to low idle, and put in gear. Engine should approach a stall condition.

7. Return shifting lever to the NEUTRAL condition again, and turn ignition switch OFF.

8. Replace the toe plate and floor plate.

TOPIC 6. SHIFTING MECHANISM

The shifting mechanism, located on the steering column shaft, is made up of many parts (Figure 22), the primary purpose of which is to provide a simple means of selecting the desired direction of travel.

There are three positive, detented positions associated with the shifting lever; forward, neutral and reverse. The shifting lever is connected to the control valve assembly on the transmission through a coupled shifting rod and associated linkage. Depending on the position of the shifting lever, the control valve will respond by causing the transmission oil to actuate the forward and reverse pistons in the clutch pack assembly.

NOTE: The engine cannot be started unless the FORWARD-REVERSE lever is in its NEUTRAL position due to a safety switch integral to the shifting mechanism.

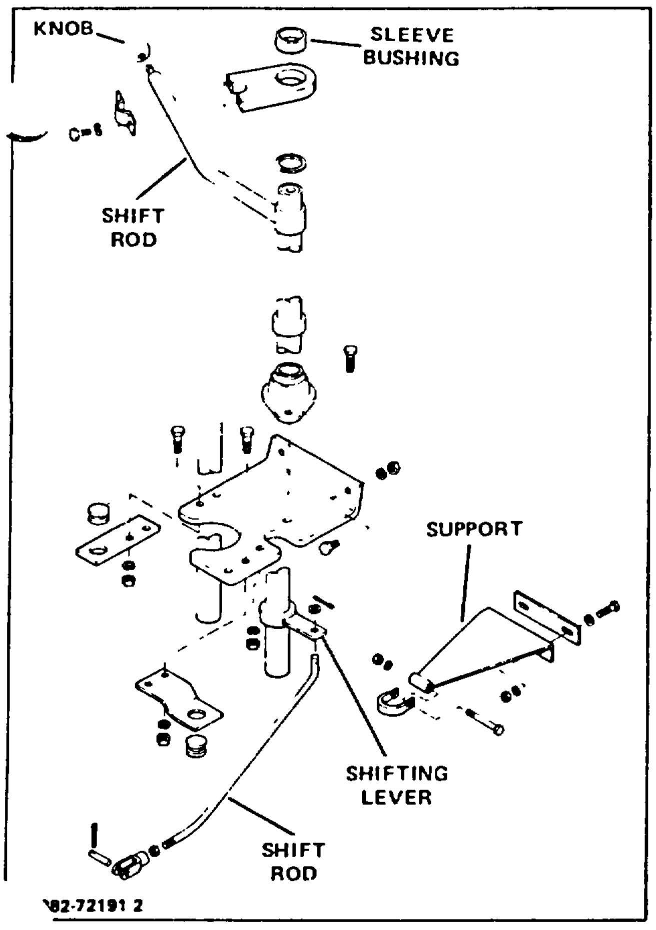


Figure 22. Forward-Reverse Lever Assembly

A. REMOVAL

The following procedure is recommended for proper disassembly of the shifting control:

1. Remove floor and toe plates.

2. Disconnect shifting rod yoke from transmission shifting shaft (Figure 23).

3. Remove the rear cover.

4. Remove the cotter pin and disconnect the shifting rod. Remove the shift lever assembly from the shift control assembly.

5. Loosen collar setscrew on shift control lever; then remove shift lever, collar and washer.

6. Loosen capscrews and lockwashers securing upper column bracket and remove bracket and clamp.

7. Remove the capscrews and lockwashers which secure assembly to lower mounting bracket.

8. Loosen capscrew and remove clamp and, ensuring that all attachments have been disconnected, remove shift control assembly from truck.

9. Inspect all mechanical parts for wear or damage and replace or replace as is necessary.

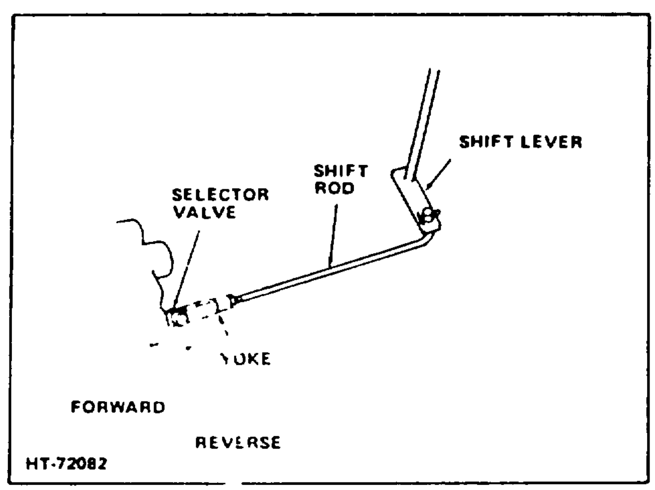


Figure 23. Shift-Selector Assembly

C. INSTALLATION

1. Carefully install the shift control assembly in its relative mounting position and attach and secure retaining clamp to upper mounting bracket.

2. Install lockwashers and capscrews which secure assembly to lower mounting bracket Then install upper column clamp along with securing capscrews and lockwashers to upper column bracket.

3. Replace shift control lever, washer and collar as removed. Tighten setscrew after properly positioned. Replace lever assembly at bottom of the shift control assembly. Tighten setscrew.

4. Connect rod to shifting lever and replace cotter pin.

5. Connect shifting rod yoke to shifting shaft on transmission.

6. Ensure that all mechanical connections have been made and that all connections are properly secured.

CAUTION: Place shifting lever in neutral position and ensure that brake pedal is slightly depressed until it is determined, with certainty that transmission is, in fact, in the neutral position.

7. Start the lift truck engine.

8. Operate the shift control lever to check alignment of the installation. If the shifting mechanism is difficult to operate, stop the engine.

9. Alternately loosen and tighten the assembly mounting capscrews in order to allow the parts to assume their proper alignment and to relieve the binding.

NOTE: Check the shift rod control linkage length on the forward-reverse rod. Adjust as Is necessary to ensure smooth operation and proper engagement.

10. When smooth shifting is assured, replace rear cover, floor and toe plates.

E. ADJUSTMENT - SHIFT SELECTOR

If the truck does not shift into reverse, neutral and forward, smoothly and completely, the shift-selector assembly should be adjusted according to the following procedure:

1. With engine off, remove toe and floor plates.

2. Using the shift selector on the steering column, shift into into neutral.

3. Detach the shift rod from the shift lever by removing cotter pin, but leave shift rod connected to selector valve. (See Figure 23).

4. Work selector valve and attached shift rod back and forth to determine center, or neutral, position.

5. Holding center position, reattach shifting rod to shifting lever. To align rod with shift lever, move the nut that is against the yoke and turn yoke. Tighten nut after alignment is made. Secure rod with cotter pin.

CAUTION: Be sure threaded end of shift rod does not protrude through yoke and come out on other side of yoke. If it does. selector valve movement will be restricted.

D. SAFETY MICROSWITCH

To prevent starting the engine with the transmission in gear a safety microswitch is mounted in the transmission control valve. When the transmission is in neutral the switch is closed allowing the starter circuit to function. No adjustment of the switch is required.

TOPIC 7. OIL COOLER

An oil cooler is installed in the Power-shift transmission system to control the temperature of the oil being delivered to the clutch pack. The cooler unit is located in the bottom tank of the radiator. If oil appears in engine coolant, it indicates a leak has developed in oil cooler. Cooler must be repaired or replaced immediately. (See Figure 27).

NOTE: Refer to COOLING SYSTEM for RADIATOR REMOVAL, REPAIR and REPLACEMENT.

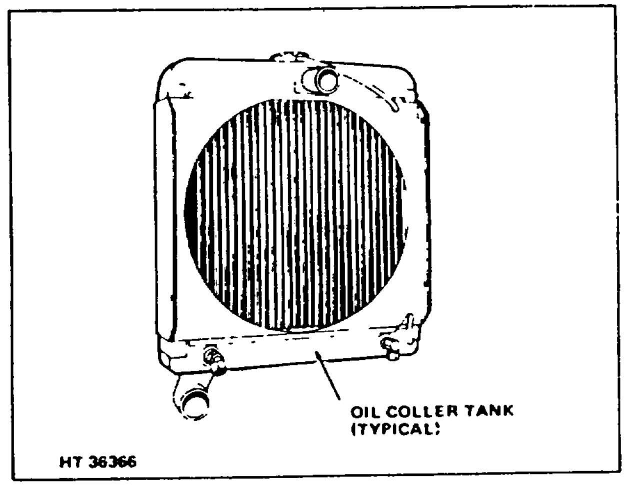


Figure 27. Oil Cooler Location

TOPIC 8. OIL FILTER

A. DESCRIPTION

A transmission oil filter is installed as standard equipment in all Power-Shift transmissions. The purpose of the filter is to eliminate harmful contaminants from the transmission oil and to increase its service life. The filter is Installed in the return line between the oil cooler and the transmission. The filter is the throw-away, replaceable type and it is recommended that it be changed every 200 hours. Changing the filter at the prescribed interval will help to keep the transmission oil free of harmful contaminants.

B. SERVICE

1. Operate the transmission until the oil temperature reaches the normal operating point. (About 10 - 15 minutes).

2. Gain access to the oil filter by removing the side panel.

3. Using an oil filter removing tool, unscrew the filter (refer to Figure 28) and discard.

4. Clean all oil and sediment from the filter base. Be sure all traces of lint are removed if a rag is used to clean parts.

5. Apply a light coat of oil to the rubber gasket on the filter. Screw replacement filter onto filter base and hand tighten only.

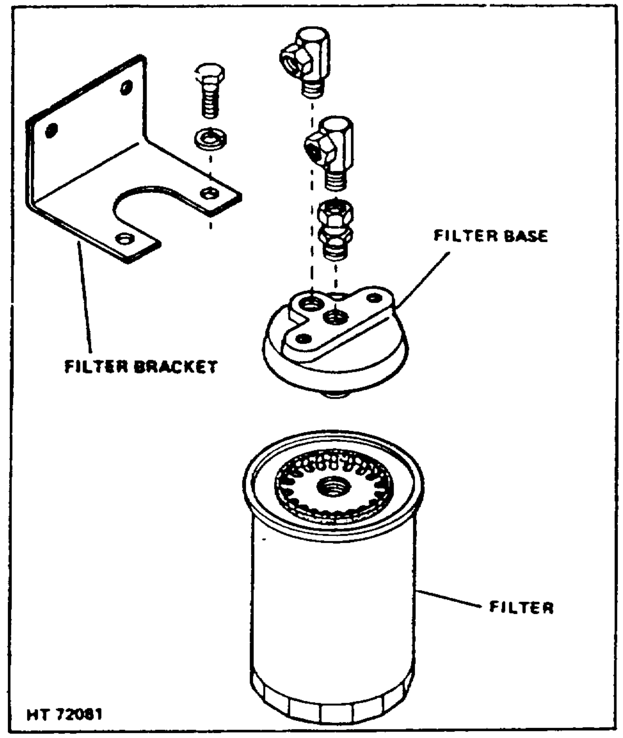


Figure 28. Throw-Away Type Filter (Typical)

CAUTION: Do not use the removing tool to replace the oil filter.

6. If oil has been drained, replace with an oil type "A" or suffix "A" to the recommended capacity.

7. Start the engine, set the parking brake, and run for about 5 minutes. With engine running and transmission in neutral (N), check the transmission oil level with the dipstick.

CAUTION: Be sure the parking brake is set.

8. If oil level is below the FULL mark, add transmission oil (Type "A" or Suffix "A") until oil reaches FULL level on oil dipstick, (about one quart for oil filter).

CAUTION: Do not overfill the transmission. Overfilling can cause damage to the transmission seals.

9. After filling transmission with oil, check for oil leakage around the gasket area and hoses. Correct any leaks found.

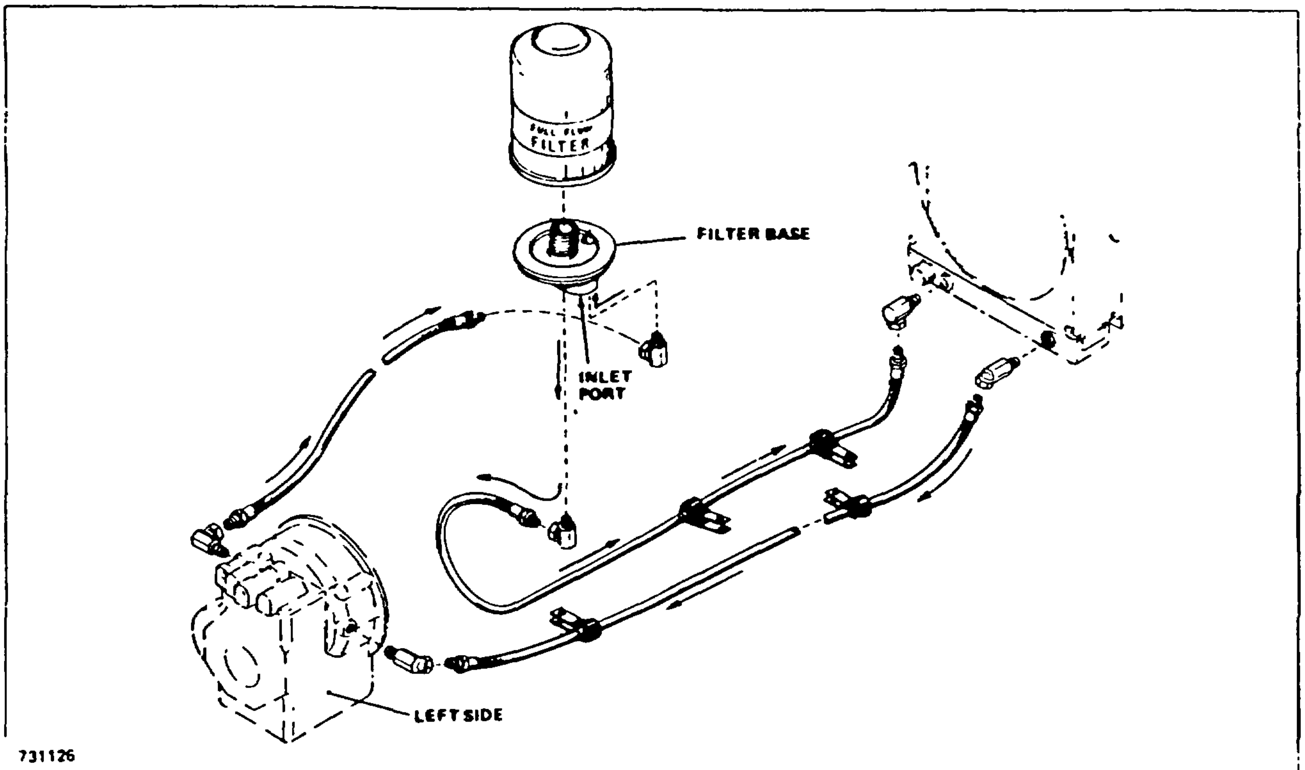


Figure 30. Oil Filter and Circuit

TOPIC 1. UNIVERSAL JOINT

A. GENERAL

The purpose of the universal joint assembly is to transfer the transmission output power to the drive wheels of the truck. The universal joint assembly is the heavy duty Industrial type which consists of a drive shaft or center plate, two cross assemblies, a transmission output flange, and the necessary hardware.

Very little service is required for the universal joint assembly, other than periodic lubrication of the cross assembly bearings. Also, it is recommended that the torque of capscrews be checked every 100 hours of operation. The mounting capscrews that secure the cross assemblies to the drive shaft or center plate, and the joint attaching capscrews must be tightened to specified torque of 25-30 lb-ft DRY THREADS, or 20-24 lb-ft LUBRICATED THREADS.

B. REMOVAL

1. Raise and securely block the lift truck to gain access to the universal joint assembly.
2. At the transmission end of the assembly, remove the capscrews that attach the cross assembly to the output flange.
3. At the differential end of the assembly, remove the capscrews that attach the cross assembly to the differential carrier flange.
4. Remove the entire universal joint assembly from the lift truck.
5. Remove the output flange from the transmission.

C. DISASSEMBLY - INSPECTION

1. Remove the mounting capscrews and remove the cross assemblies from the drive shaft or the center plate (depending upon the length of the universal joint assembly).

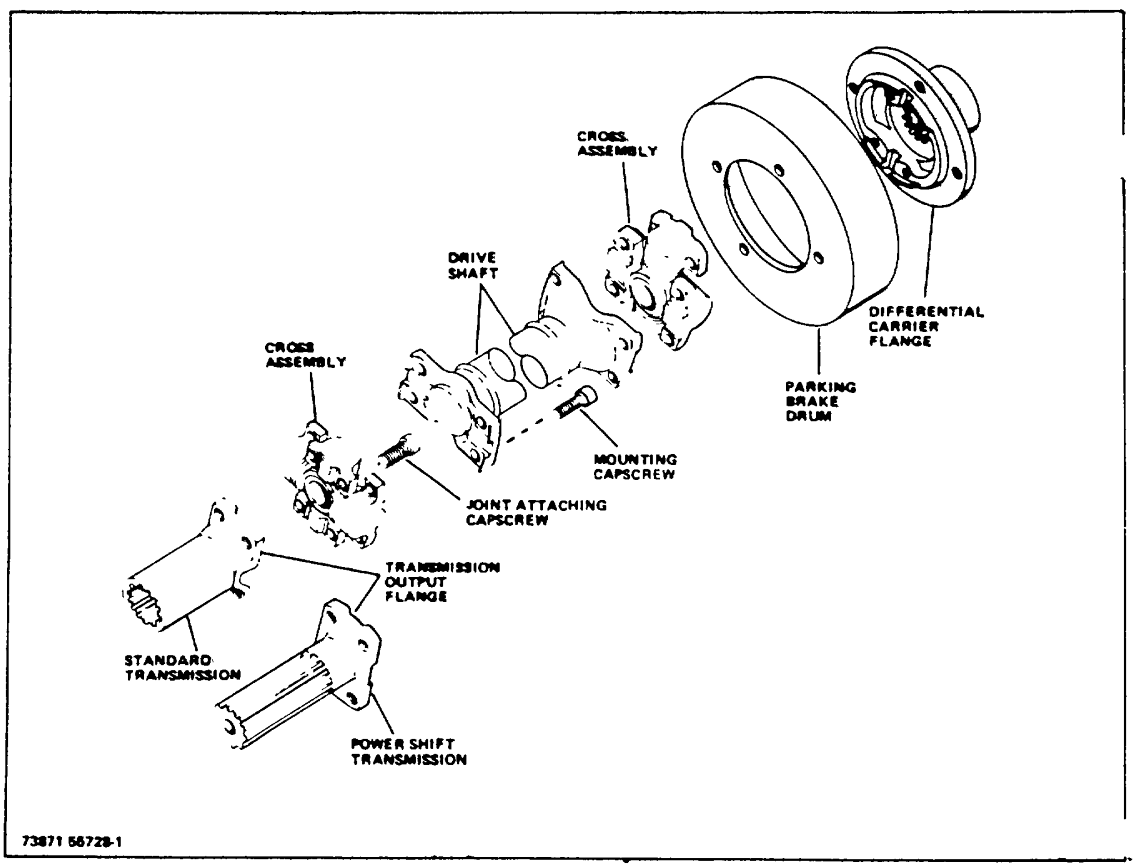


Figure 1-1. Universal Joint Assembly (Typical)

2. To disassemble the cross assembly, break the connecting strap which holds the bearings on the cross assembly. These straps need not be replaced.

3. Inspect the bearings and bearing surfaces for evidence of extreme wear or damage. Replace the cross assembly if any parts are worn or damaged.

4. Pack the bearings thoroughly with a high melting point wheel bearing or universal joint grease. Make certain the grease fully covers all bearing surfaces.

5. Inspect the output flange splines for wear or damage; replace if necessary.

D. REASSEMBLY

Reassemble the cross assemblies to the drive shaft (Fig 1-1).

Install the mounting capscrews and tighten them to a torque of 25-30 lb-ft DRY THREADS, or 20-24 lb-ft LUBRICATED THREADS.

E. INSTALLATION

1. Position output flange on transmission shaft or in the transmission internally splined output drive.

2. Position the differential end of the universal joint so the holes in the cross assembly align with the holes in

the differential carrier flange. Insert capscrews and tighten them to specified torque of 25-30 lb-ft CRY THREADS, or 20-24 lb-ft LUBRICATED THREADS.

3. Position transmission end of universal joint so holes in cross assembly align with holes in output flange. Insert capscrews and tighten them to specified torque of 25-30 lb-ft DRY THREADS, or 20-24 lb-ft LUBRICATED THREADS.

NOTE: Make certain ALL CAPSCREWS are tightened to SPECIFIED TORQUE.

4. Remove blocks supporting the lift truck and lower the truck to the floor.

TOPIC 1. DRIVE AXLE

A. GENERAL

The A-C planetary drive axle assembly consists of the axle housing, differential carrier assembly, the axle shafts, planetary gear carriers and ring gears. The service brakes are located within each of the two drive wheel hubs. The parking brake is located on the differential carrier assembly.

The first stage of gear reduction occurs at the differential carrier input pinion and the spiral bevel ring gear. The final reduction occurs at the drive ends of the axle shafts, which mesh with the planetary ring gears within the drive wheel.

The purpose of the drive axle unit is to accept and transmit the driving torque from the drive shaft coupling to the drive wheels of the lift truck, thus moving the truck in a forward or reverse direction, and is accomplished as follows.

The input differential carrier pinion is driven by the transmission output drive shaft and, in turn, is connected to and drives the differential ring gear. The spider gear cluster, within the differential case, meshes with the floating axle shaft pinion gears, thereby transferring the driving torque to the axle shafts. Final reduction is accomplished through the planetary carrier which is driven by the opposite ends of the axle shafts; the planetary gears are driven by the floating axle shaft drive gears. Because the outer periphery of the planetary gears meshes with the stationary ring gear, any rotation of the axle shaft will turn the planetary gears, which will turn within the stationary planetary ring, thereby rotating the drive wheels.

The planetary carrier, planetary ring gear and the drive end of the axle shaft are enclosed within the sealed end of the drive wheel hub, which also serves as a self-contained, lubricating oil reservoir.

B. DRIVE UNIT SERVICE

After each 100 hours of operation, check the oil level in the drive axle housing. Remove the oil filler plug (Fig 1-1) from the front of the drive axle housing. With the lift truck in a level position, the oil level should be up to the bottom of the opening. If necessary, add specified lubricant through the level opening but do not overfill. Then install oil filler plug securely.

NOTE: Previous drive axle units are equipped with a 1/2" standard pipe thread oil filler plug and drain plug.

Current drive axle units are equipped with an oil filler plug and a drain plug which have a .750"-16 2B straight thread.

After each 100 hours of operation, check differential breather to make certain it is clean and open. Remove breather (Fig 1-1 or 1-3) from the top of the drive axle housing. Wash it in a suitable cleaning solvent and dry it with clean compressed air to make certain it is not clogged. Install breather and tighten securely.

After each operating interval of 1000 hours, change the oil in the drive axle housing. Ambient temperature conditions will dictate what grade of gear lube is to be used.

C. REMOVAL

The entire drive unit can be removed as an assembly, if so desired. It is necessary to remove the mast assembly in order to remove the drive unit.

1. After the mast has been removed, disconnect the main hydraulic brake line at the tee fitting located on the differential carrier housing. Plug or cap all openings immediately.
2. Disconnect the parking brake cable at the parking brake end.
3. Disconnect the universal joint at the carrier drive flange.
4. Disconnect all lines or wires still attached to drive axle housing that would interfere with drive unit removal.
5. Attach a suitable chain hoist to the front plate of the vehicle and pull snug to take weight of truck off the drive axle unit and block in position.
6. Place transmission jack or suitable device under drive unit. Raise jack enough to support drive unit. Remove upper mounting bolts and washers that secure drive axle housing to frame. Remove lower mounting bolts and washers that secure the cap supports and remove

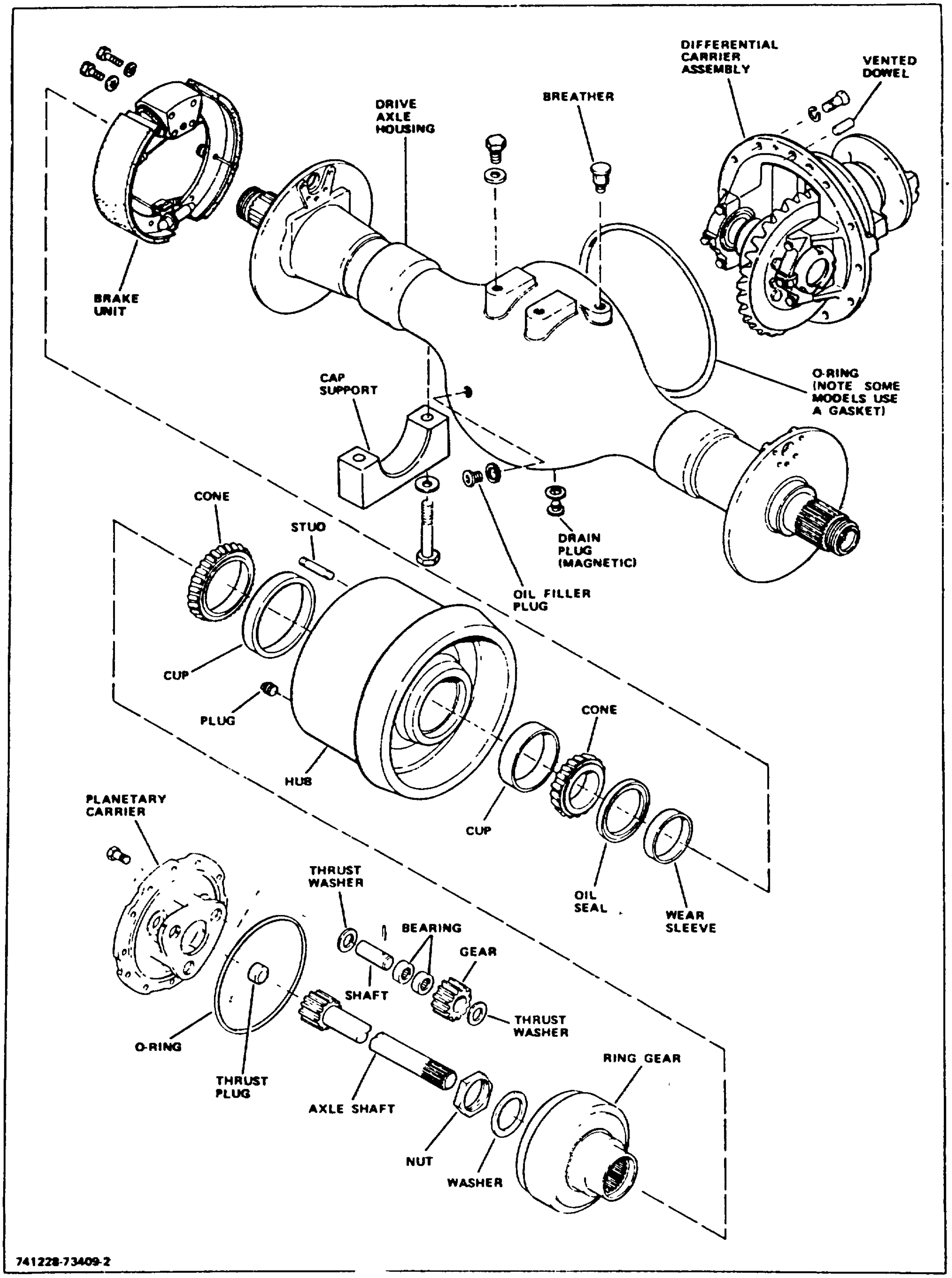


Figure 1-1. A-C Planetary Drive Axle Components (Front View)

the cap supports. Remove alignment washers from top of drive axle mounting pads.

7. Raise vehicle and carefully remove the drive unit.

D. INSTALLATION

1. To install drive unit, carefully raise the truck frame high enough with a suitable hoist to position the drive unit under the front end of the truck at the relative mounting position.

2. With drive unit in position, carefully lower truck frame until it is supported on drive unit.

3. Use the same alignment washers which were removed during the removal procedure; install alignment washers (Fig 1-2) between the drive axle top center mount and the frame. (Refer to following NOTE.)

NOTE: Washers (shims) are used between the drive axle top center mount and lift truck frame for alignment purposes. After the drive axle unit is installed, the mounting face of the differential carrier drive flange should be parallel, within one degree, to the mounting face of the transmission output flange. A protractor with a bubble level can be used to check the degree of alignment of the mounting face of each flange. Use alignment washers as required. Washers are available in .250", .187", and .125" thicknesses. Use alignment washers of the same thickness under the frame at each upper mounting location.

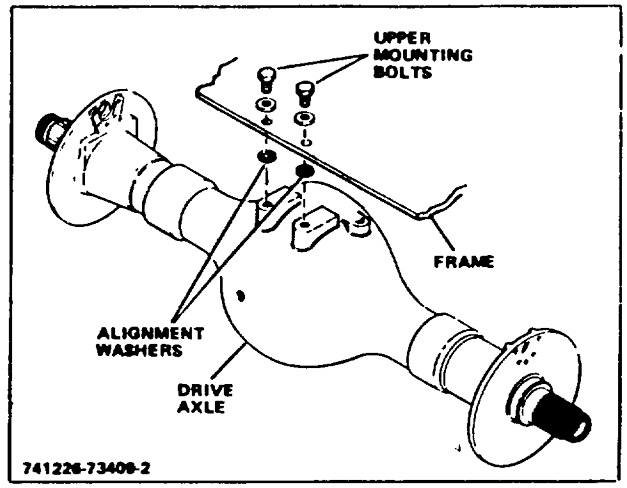


Figure 1-2. Installing Alignment Washers

4. Install washers and upper mounting bolts; install cap supports, washers, and lower mounting bolts. Tighten upper mounting bolts to a torque of 200 lb-ft. Tighten lower mounting bolts to a torque of 400 lb-ft.

5. Connect universal joint to carrier flange and transmission output flange.

6. Connect parking brake cable.

7. Connect brake line and bleed hydraulic brake system.

8. Remove hoist from frame and use it for mast installation. Install mast assembly and forks.

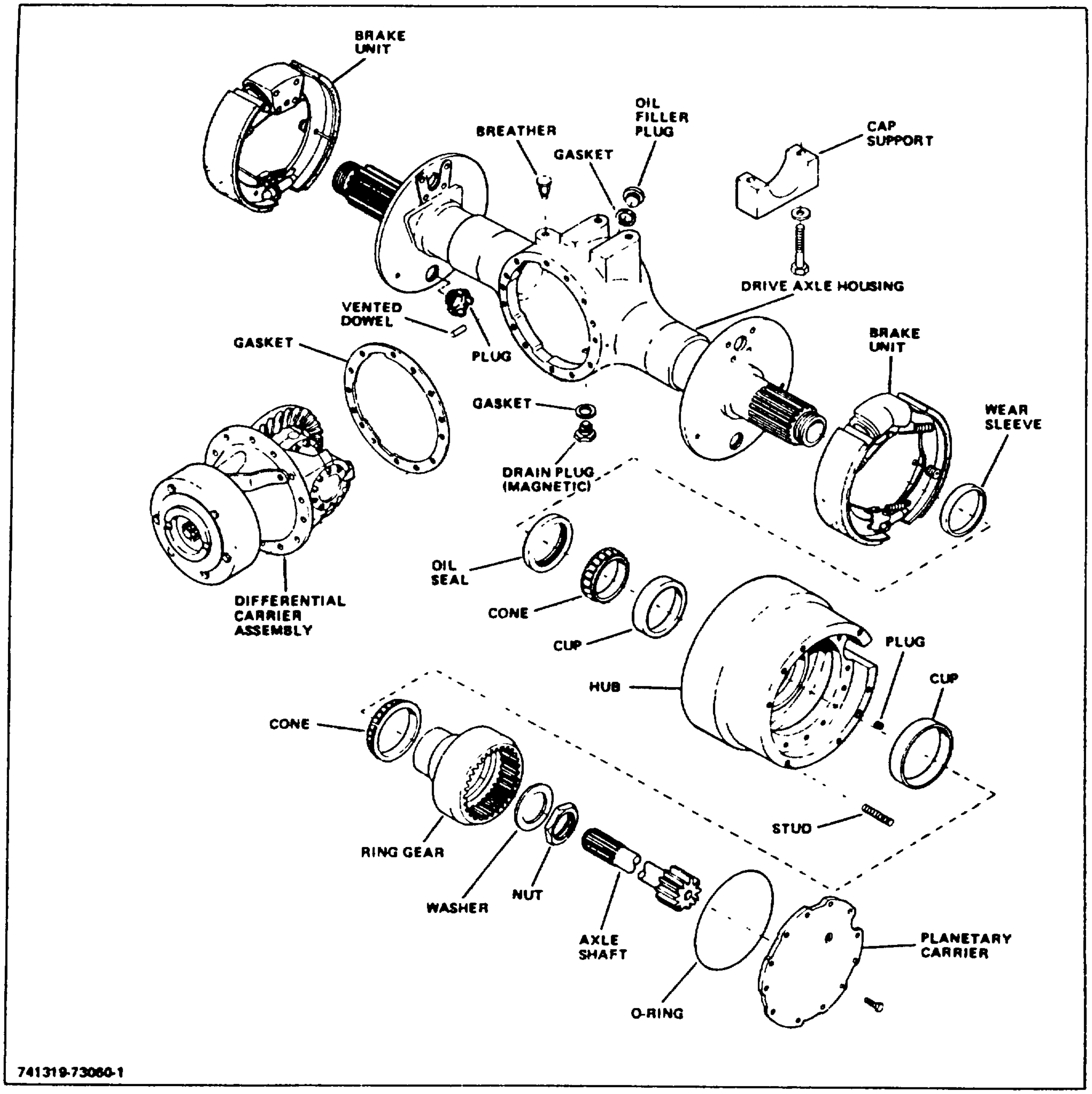


Figure 1-3. A-C Planetary Drive Axle Components
(Rear View)

TOPIC 3. DIFFERENTIAL CARRIER ASSEMBLY

A. REMOVAL

1. Raise and carefully block front end of lift truck. Also block steer wheels to prevent lift truck from rolling.
2. Rotate drive wheel so drain plugs in drive wheel hubs are at the lowest position. Remove oil filler plug from front of drive axle housing. Remove drain plugs from drive wheel hubs and drain plug from bottom of drive axle housing; allow oil to drain.
3. After oil has drained, install drain plug in bottom of drive axle housing.
4. Remove the twelve (12) planetary carrier mounting bolts and carefully pull the planetary carrier straight out of the wheel hub to remove.

NOTE: When carrier is difficult to remove, insert two (2) of mounting bolts just removed, into the threaded bolt holes on carrier housing perimeter and turn bolts inward to assist in prying carrier housing off.

5. Use the same procedure on opposite drive wheel to remove planetary carrier.
6. Pull the floating axle shaft straight out of the axle housing and place to one side, out of the work area. Repeat this procedure on the opposite axle shaft.
7. Disconnect brake lines and bracket from housing to allow clearance for removal of differential carrier assembly. Plug or cap all openings immediately.
8. Disconnect cable yoke from parking brake unit. Remove clamp that secures parking brake cable to cable anchor on differential carrier assembly.
9. Disconnect universal joint from the differential carrier drive flange.
10. Remove place bolts that secure differential carrier assembly to the drive axle housing; remove carrier assembly and place it on a suitable workbench.
11. Remove gasket from drive axle housing.
12. Mark differential case halves (Fig 3-1), bearing caps, and differential housing. Then remove bolts, washers, and adjusting nut locks; remove place bolts and bearing caps from differential carrier.
13. Remove the differential assembly (Fig 3-2) along with the bearing cones, cups, and adjusting nuts from the differential carrier.

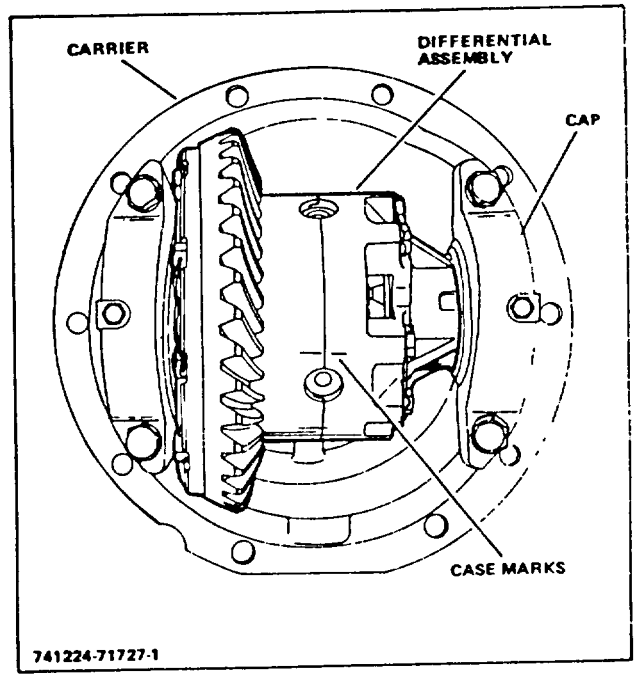


Figure 3-1. Differential Carrier Assembly - Front View

B. DISASSEMBLY

1. Pinion Removal

   a. Remove the capscrews and washers that secure parking brake drum to the drive flange; remove the parking brake drum.
   b. Remove nut (Fig 3-3),washer, and drive flange from splined end of pinion.
   c. Remove place bolts that secure parking brake unit to differential carrier housing; remove the parking brake unit.
   d. Place carrier housing on an arbor press and press pinion from housing. Front bearing and shims will remain on pinion; remove spacer and preload shims. (Retain shims in good condition.)
   e. Remove oil seal from end of carrier housing. After oil seal is removed, remove rear bearing cone from housing. Whenever oil seal is removed, it should be replaced with a new one.
   f. To remove bearing cups from carrier

housing, use a brass drift and tap out with a hammer.

g. If pinion front bearing must be replaced, remove with suitable puller.

h. Inspect bearings, cups, pinion, and drive flange for damage and excessive wear. Replace where necessary.

NOTE: Pinion and ring gear can only be replaced as a set.

2. Differential Disassembly

a. Remove bearings with suitable bearing puller when necessary.

b. Remove capscrews holding case halves together. Note aligning marks on case halves (Fig 3-1).

c. Remove plain case, spider (Fig 3-4), gears, and washers.

d. Inspect the differential case halves for breaks or wear. Replace as required.

NOTE: The case halves are a matched set and must be replaced as such.

e. Inspect differential pinion and thrust washers, gears, and spider assembly for evidence of wear or damage. Replace as required.

f. Inspect the case flange for nicks. These must be removed with a flat file prior to reassembly.

3. Ring Gear Removal

a. Remove special capscrews that secure ring gear to flange.

b. Ring gear is pinned in place. Carefully pry ring gear off case flange.

c. Inspect all parts for wear or damage and replace where necessary.

NOTE: The ring gear and pinion are a matched set and both must be replaced when one is worn or damaged.

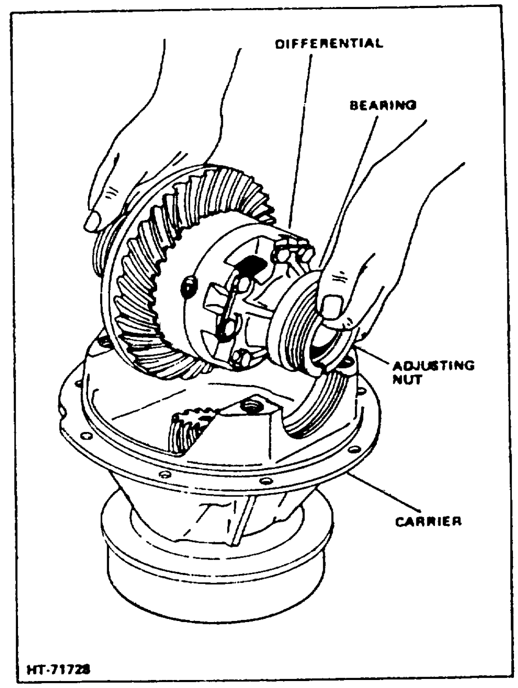


Figure 3-2. Removing Differential from Carrier

C. MEASURING PINION HEIGHT

In order to measure for the proper amount of shims to be used between the pinion gear and the front bearing cone, use a tool equivalent to the one illustrated in Figure 3-5 and proceed as follows:

1. Slide front bearing cone on tool shaft without shims. Place tool with bearing cone in differential carrier and seat cone in front cup. If bearing cup was removed, make certain new bearing cup is firmly seated before tool and cone are inserted.
2. Measure and record OD of differential case (not ring gear pilot). Measurement should be 5.297" to 5.302" (nominal 5.300").
3. Install differential assembly in position on differential carrier housing.
4. Measure and record the distance between the OD of the differential case and the face of the tool.

NOTE: With the tool installed in place of the pinion gear and without any pinion locating shims, dimension "A" as shown in Figure 3-6 would be .618". However, if an exact pinion was installed with .035" thickness of pinion locating shims installed, dimension "A" would be .583".

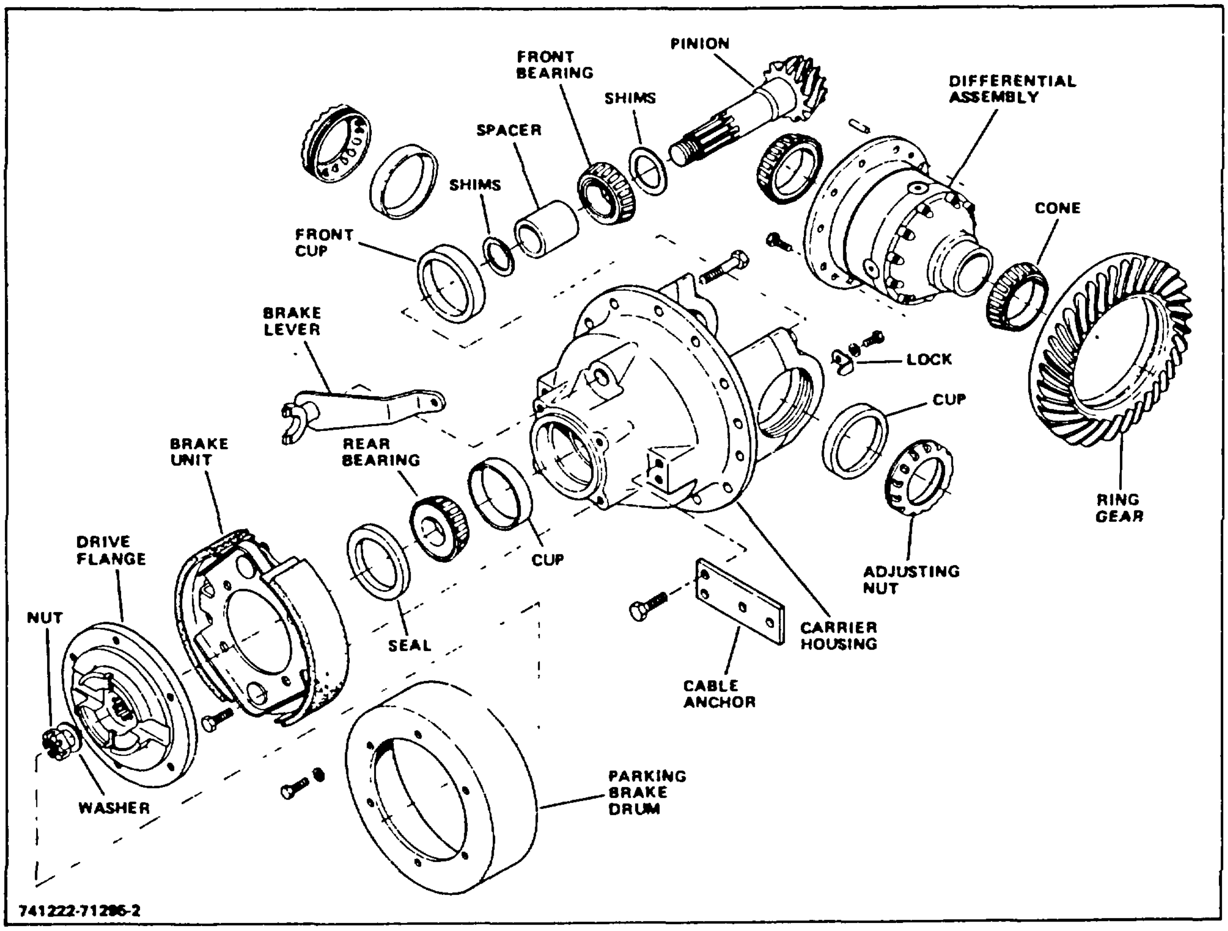


Figure 3-3. Differential Carrier Assembly Components

5. Add 1/2 of the differential case diameter to the dimension taken in step 4. Subtract 3.233" from the total to get the amount of shims required to locate a pinion etched with 3.233". Refer to following example:

2.650"	(1/2 diff. case 00)
<u>+ .618</u>"	(step 4)
3.268"	Total
<u>-3.233</u>"	(best running position)
.035"	shims required to locate and exact pinion (no manufacturing tolerance)

NOTE: The theoretical setting distance is 3.233" for an exact pinion. This distance is measured from the centerline of the differential case to the face of the pinion gear. The best running position for a pinion can vary from the theoretical setting distance, and the dimension is etched on the face of the pinion gear. Refer to following steps 6 and 7 for examples with pinions which are etched with a dimension other than the theoretical setting distance.

6. When the pinion is etched 3.238", .005" has been added to the theoretical setting distance; therefore, the amount of shim required is as follows:

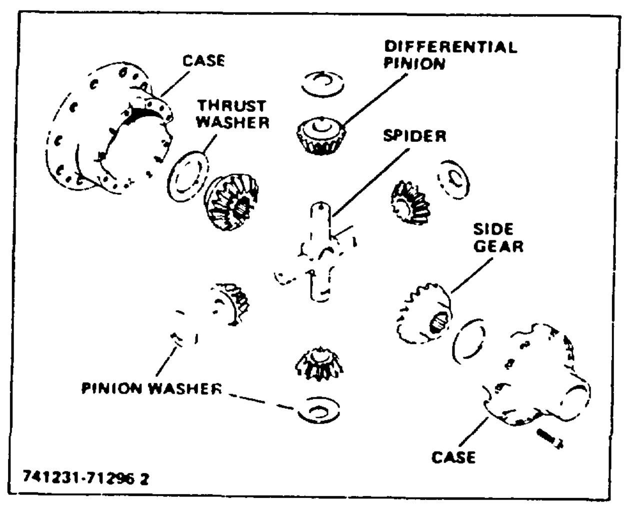


Figure 3-4. Differential Assembly

2.650"	(1/2 diff. case OD)
+ .618"	(step 4)
3.268"	Total
-3.238"	(best running position)
.030"	shims required

7. When the pinion is etched 3.228", .005" has been subtracted from the theoretical setting distance. To determine the amount of shims required is as follows:

2.650"	(1/2 diff. case OD)
+ .618"	(step 4)
3.268"	Total
-3.228"	(best running position)
.040"	shims required

NOTE: The dimensions used in preceding steps 5, 6, and 7 were for the purpose of examples. When measuring for shims, use 1/2 of the differential case diameter as actually measured, use the exact measured distance between the OD of the differential case and the face of the measuring tool, and use the dimension etched on the face of the pinion gear (best running position).

8. Remove differential assembly from differential carrier housing. Remove tool and front bearing cone from carrier housing.
9. Install proper shim pack and then install front bearing cone on pinion shaft. Shim pack should be compressed while measuring with a micrometer. Make certain shim stock is clean and free of burrs.

D. MEASURING PINION BEARING PRELOAD

1. Press front and rear bearing cups into differential carrier. Be sure they are firmly seated.
2. Install proper shim pack and front bearing cone on pinion shaft, then install pinion shaft in carrier housing.
3. Slide spacer (Fig 3-7) on pinion shaft with correct end of spacer (beveled ID) towards pinion gear.

NOTE: Spacer is used to separate the front and rear bearing cones.

4. Install preload shims. (As a starting point, use same amount of shims which were removed during the disassembly procedure. After preload is determined, more shims may have to be added.) Install rear bearing cone, drive flange, washer, and nut.

NOTE: If oil seal is installed in housing, lubricate lip of seal with engine oil before flange is installed. Seal drag will add approximately 5 lb-in. to preload reading.

5. Draw nut up tight enough to eliminate any end play in pinion shaft, approximately 150 lb-ft. (Shims must be used between spacer and rear bearing to obtain preload on pinion bearing.)
6. Measure the pinion bearing preload with a torque wrench and refer to following preload chart. Torque reading must be made with a reliable torque wrench that will clearly indicate pounds per inch. Use a torque wrench with a zero to 100 lb-in. range. (See Figure 3-8.)

Correct pinion bearing preload is 15-25 lb-in.

If preload in lb-in. is:	Install additional shim to pinion spacer:
40	.001"
50	.002"
60	.003"
70	.004"
80	.004"
90	.005"
100	.006"

7. After proper amount of shims for correct pinion preload has been determined, remove nut, washer, flange, pinion, spacer, and rear bearing cone from housing. Proper shim pack must be installed between spacer and rear bearing cone.

E. REASSEMBLY

1. Ring Gear Installation

   a. To install ring gear, align ring gear holes with groove pin holes in flange and Install groove pins.
   b. Install special capscrews and draw ring gear in place, tighten capscrews to a torque of 80 lb-ft. (Clean threads on capscrew and apply thread sealant to capscrew before installing.)

2. Differential Reassembly

   a. Place thrust washer in bottom of flanged case. Install side gear, spider, pinion gears, pinion washers and opposite side gear with thrust washer.
   b. Install plain case.

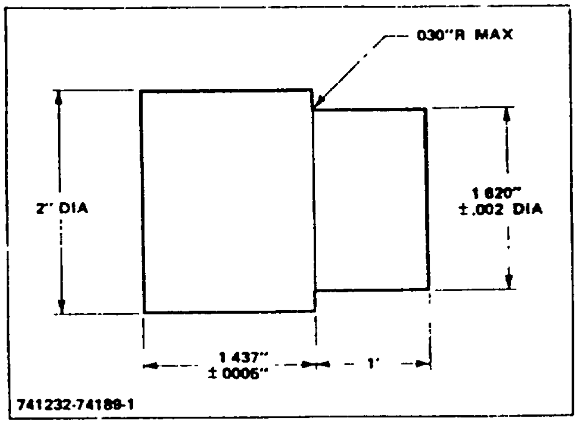


Figure 3-5. Tool for Measuring Shims

NOTE: Make sure case matching marks are aligned.

c. Install capscrews and tighten to a torque of 50 lb-ft.

d. Install bearings, if removal was necessary.

3. Pinion and Differential Installation

a. Press front and rear bearing cups in pinion gear housing. Make certain they are firmly seated.

b. Install proper shim pack and front bearing cone on pinion shaft. (For shim pack information, refer to preceding Paragraph C, MEASURING PINION HEIGHT.) Make certain shims are clean and free of burrs.

c. Install pinion shaft (with shims and bearing) in carrier housing.

d. Slide spacer on pinion shaft with correct end of spacer (beveled ID) towards pinion gear. Install proper shim pack and rear bearing cone. (For preload shim pack information, refer to preceding Paragraph D, MEASURING PINION BEARING PRELOAD.) Make certain shims are clean and free of burrs. Shim pack should be compressed while measuring with a micrometer.

e. Press rear bearing cone on pinion shaft; install new oil seal in end of housing.

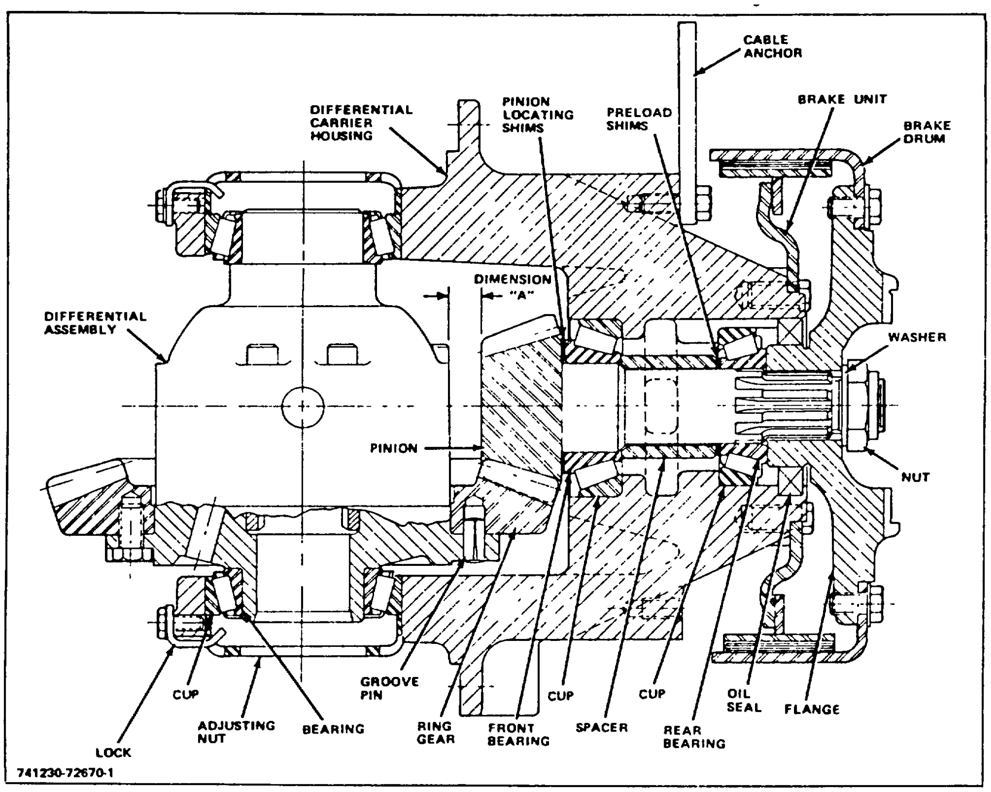


Figure 3-6. Differential Carrier Assembly

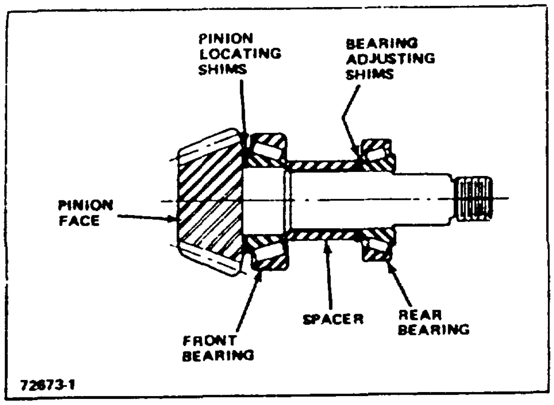


Figure 3-7. Pinion Bearing Spacer

f. Install parking brake unit to pinion gear housing; tighten place bolts to 55 lb-ft torque.

g. Lubricate lip of oil seal with SAE 20 engine oil. Install drive flange, washer, and nut to splined end of pinion shaft. Tighten nut to 200 lb-ft torque.

h. Install parking brake drum to drive flange with washers and capscrews; tighten capscrews to 45 lb-ft torque.

i. Place the differential assembly, with the proper side bearings and cups, into bores of differential carrier. Exercise care not to install them on top of the threads. Move the ring gear toward the pinion until all the backlash is taken up.

j. Install the two bearings caps to the differential carrier with washers and place bolts. Clean the threads and apply thread sealant to the place bolts before installation. Tighten place bolts securely. (Tighten place to 45 lb-ft torque after backlash is adjusted.)

NOTE: The correct bearing cap must be installed on the correct side of the housing as marked during disassembly.

k. Install the side-bearing adjusting nuts into the threads taking care not to crossthread them.

l. Tighten both adjusting nuts until they contact the side-bearing cups.

m. Loosen the right-hand adjusting nut (the one opposite the ring gear), until the ring gear and differential case assembly are loose in the bearings. This should require two or three revolutions.

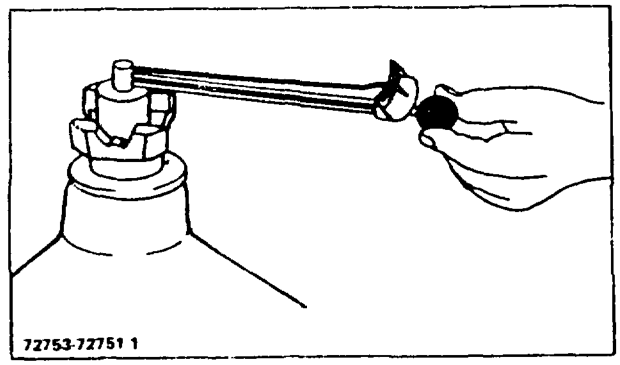


Figure 3-8. Measuring Bearing Preload

n. Tighten the left-hand adjusting nut (the one next to the ring gear) against the bearing cup until all backlash between the ring and pinion gear has been eliminated, then back off three or four notches.

o. Tighten the right-hand nut until the bearing race starts to turn, indicating preload is being exerted on the bearings.

p. Continue to turn the right-hand nut one or two notches more.

WARNING: Under no circumstances should two notches be exceeded.

q. Wrap a cord around the differential case and attach a spring scale to the loose end. Start pulling gradually on the scale and note the effort required to rotate case. Scale reading should be 4.7 to 6.6 pounds. (Proper preload for differential side bearings is 25-35 lb-in)

r. Adjust backlash between ring gear and pinion. (Refer to following Paragraph F, BACKLASH ADJUSTMENT.)

F. BACKLASH ADJUSTMENT

To adjust for the backlash between the ring and pinion gear teeth, the adjusting nuts must be turned in sequence. If the right-hand nut is tightened two notches, then the left-hand nut must be loosened two notches. This routine is continued until the proper backlash is obtained.

Use a dial indicator and check ring gear for backlash.

1. Install a dial indicator (Fig 3-9) to the differential housing.
2. Move ring gear by hand in clockwise direction until all play or movement is eliminated between ring gear and pinion gear.

3. Position stem of dial indicator against the side (face flank) of ring gear tooth.
4. Move ring gear by hand in opposite direction and read backlash shown on dial indicator. Specified backlash between ring gear and pinion gear is etched on the ring gear and on the face of the matching pinion gear. The backlash must never be less than .006" or more than .009". If the variation in backlash around the circumference of the ring gear exceeds .003", the ring gear or the case has excessive run-out-and must be corrected before continuing.
5. Check backlash at four places on ring gear approximately 90° apart.

NOTE: Check all four places on ring gear before adjustment of backlash is attempted.

6. If adjustment is required, use a spanner wrench or drift to turn adjusting nut one notch at a time and perform one of the following:
   a. To increase amount of backlash, remove locks from top of caps; loosen adjusting nut in the side of carrier housing which is nearest to the ring gear and tighten the opposite one.
   b. To decrease amount of backlash, remove locks from top of caps; loosen adjusting nut in the side of carrier housing which is farthest from the ring gear and tighten the nut nearest to the ring gear.

CAUTION: When backlash is adjusted, turn each adjusting nut exactly the same distance so proper bearing preload is maintained.

7. Align and install adjusting nut locks with washers and place holts. (Clean the threads and apply thread sealant to the place bolts before installation.) Tighten the place bolts to 13 lb-ft torque.

G. INSTALLATION

1. Install new gasket on drive axle housing.
2. Position differential carrier assembly on dowel and install it to the drive axle housing with washers and place bolts. Tighten place bolts to 50 lb-ft torque.

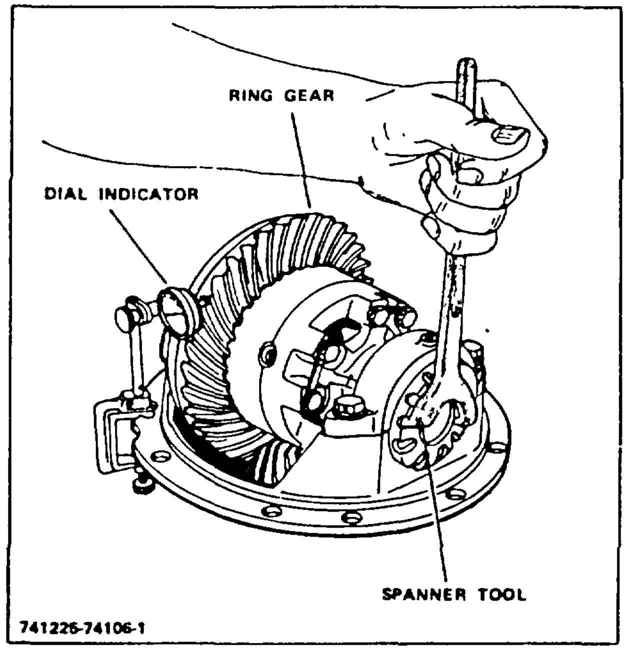


Figure 3-9. Checking Backlash

3. Connect universal joint to differential carrier drive flange. Tighten joint attaching capscrews to a torque of 25-30 lb-ft DRY THREADS, or 20-24 lb-ft LUBRICATED THREADS.
4. Connect cable yoke to parking brake unit. Install clamp and secure parking brake cable to cable anchor.
5. Connect brake lines and bracket which were removed to allow additional clearance for removal of the differential carrier assembly.
6. Install the axle shaft in the axle housing and be certain that the spline end of shaft is fully inserted in differential side gear.
7. Repeat step 6 for opposite axle shaft.
8. Install planetary carrier assembly along with axle shaft thrust plug and lubricated O-ring into the wheel hub, and install the carrier mounting bolts. Tighten mounting bolts to 56 lb-ft torque.
9. Rotate drive wheel until the oil level arrow, located on the planetary carrier, is horizontal to the floor.
10. Fill drive axle housing, at filler plug opening, with specified gear oil until oil runs out of oil level holes in drive wheel hubs. Refer to the following for approximate capacities:

ACP 60 .... 22 pints

11. Install drain plugs in drive wheel hubs and install oil filler plug securely.

12. Remove the supporting blocks and carefully lower the lift truck to the floor.

TOPIC 4. SERVICE BRAKES

A. GENERAL

The service brakes are of the "Duo-Servo" design principle. This design makes use of the momentum of the truck to assist the braking system in bringing the truck to a stop. (Refer to Figure 4-1.) In the "Du-Servo" brake system, there is only one anchor pin and it is located near the hydraulic wheel cylinder. An adjusting screw assembly and tension spring connects the bottom ends of the two brake shoes.

The wheel cylinder assembly (Fig 4-3) is bolted to a flat support plate and the cylinder serves as an anchor for the brake shoes. The upper end of each shoe web bears against a piston insert, which in turn, bears against the wheel cylinder. The lower end of each shoe web engages an adjusting screw assembly which acts as a strut to transmit the force from the primary (front) shoe, to the secondary shoe. A return spring is assembled between each shoe web and the head of the wheel cylinder bolt. The springs hold the upper ends of the shoes against the piston inserts when the brake is released, and prevents the brake shoe linings from dragging against the drums.

The lower end of the web of the primary brake shoe engages a slot in the end of the pivot nut and the end of the web of the secondary brake shoe engages a slot in the end of the adjuster screw socket. The pivot nut and the socket, therefore, cannot rotate. The adjusting screw is threaded into the pivot nut and is free to rotate in the socket.

The adjusting screw and nut have either a right or a left hand thread. The thread type depends upon whether the brake assembly is on the right or left side of the lift truck, and also depends upon which side of the shoe web the adjuster lever is located.

The lower ends of the shoes are held against the adjusting screw assembly by the automatic adjuster spring. The automatic adjuster feature of the brake consists of the automatic adjuster spring, adjuster lever, upper and lower links, and a toggle lever. The adjuster lever pivots on the secondary shoe web and engages the teeth of the adjusting screw starwheel. The adjuster lever also is attached to the adjuster spring and the lower adjuster link. The links are assembled to the toggle lever which pivots on a pin pressed into the web of the secondary shoe. The toggle lever is retained on the pin by a flat washer and a cotter pin. The upper end of the upper link is hooked to the wheel cylinder bolt.

Each shoe is held to the support plate by a hold down pin and spring arrangement as shown

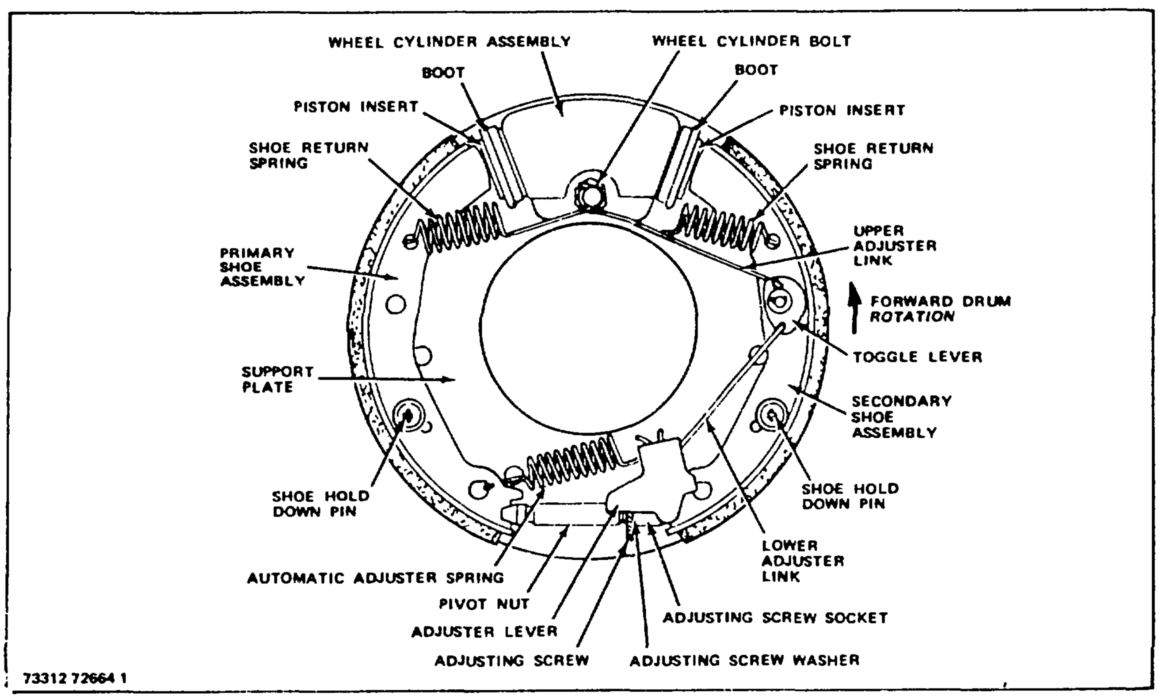


Figure 4-1. Brake Assembly - Left Side

in Figure 4-1. The-hold down pin is assembled through an elongated hole in the shoe web. A shoe hold down spring is-compressed between inner and outer washer-type cups, and the-outer cup is engaged under the swaged end of the pin. The compressed spring keeps the shoe rim in contact with the support plate, which serves as a guiding surface for the shoe. Clearance is provided between the pin and the inner cup, and between the pin and the shoe web. This allows freedom of movement of the shoe on the support plate.

The wheel cylinder body contains two machine bores of equal diameter. The cylinders are connected by drilled passages to a bleed port and fluid inlet port located at the back side of the support plate. Each cylinder bore contains a piston, rubber hydraulic cup, and a spring assembled as shown in Figure 4-3. A piston insert is pressed into the center of each piston. The insert transfers the piston force to the brake shoe and also applies the shoe anchor load to the cylinder body which is bolted to the support plate. A rubber boot attached to both the cylinder body and the piston insert, keeps dirt and water out of the cylinder.

The cylinder body casting is attached to the support plate with four mounting bolts and the casting transmits the anchor load to the support plate. Shakeproof washers are used on the cylinder mounting bolts to prevent the bolts from loosening. The heads of the inner two mounting bolts are flush with the support plate surface to prevent brake mounting interference.

B. BRAKE SHOE INSPECTION AND REPLACEMENT

After each 500 hours of operation, inspect wheel cylinders for leaks and check brake shoes to determine the amount lining remaining on the shoes. When the lining has worn down to less than 1/8" thickness, the shoe and lining assemblies should be replaced.

CAUTION: Do not operate the lift truck after lining has worn down to under 1/16" thickness.

1. Drive Wheel Removal
   a. Raise front end of unit and place adequate service jacks and/or blocks under drive axle housing.
   b. Rotate drive wheels so drain plugs in drive wheel hubs are at the lowest position. Remove oil filler plug from front of drive axle housing. Remove drain plugs from drive wheel hubs and drain plug from bottom of drive axle housing; allow oil to drain.
   c. After oil has drained, install drain plug in bottom of drive axle housing.
   d. Remove the twelve (12) planetary carrier mounting bolts and carefully pull the planetary carrier straight out of wheel hub to remove.

NOTE: When carrier is difficult to remove, insert two (2) of mounting bolts just removed into the threaded bolt holes on carrier housing perimeter and turn bolts inward to assist in prying carrier housing off.

   e. Pull floating axle shaft straight out of axle housing and place to the side, out of the work area.
   f. Using extreme care because of the total assembly weight involved (tires and wheel hub unit), loosen and remove the large axle nut and washer while supporting wheel assembly.

WARNING: Be certain that the axle housing is properly blocked prior to wheel unit removal.

   g. Using a steady, strong pull, remove the entire wheel hub and tire assembly. The ring gear, the outer and inner wheel bearings, and the shaft seal will all pull off as part of the assembly.

NOTE: One suggestion to aid in removal is to place a large greased sheet of heavy paper under the tire unit to be removed, and when ready, slide tire assembly off across the slick paper surface.

2. Cleaning and Inspection

   Brush dirt and lining dust from the drum and the brake support plate.

   When the shoe guide area of the support plate is rusty, use steel wood or fine emery cloth to clean this surface.

   Inspect the wheel cylinder ends of the shoes for bent webs. Replace shoes when webs are distorted. Check all springs for fatigue cracks. Inspect the automatic adjuster lever, the toggle lever, and the upper and lower links for excessive wear. Check adjusting screw for sheared threads or broken teeth on the starwheel. Replace any defective components.

3. Wheel Cylinder Inspection
When Inspection of the wheel cylinder reveals a hydraulic fluid leak around the dust boots, pull back the boots and check for brake fluid behind the pistons. When there is evidence of fluid leakage, the wheel cylinder should be replaced.

4. Brake Shoe Removal
   a. Pull the adjuster lever toward lower end of the secondary shoe and unhook the lever from the web of the secondary shoe. Pull adjuster spring toward toggle lever sufficiently to unhook the lower links from the toggle lever. Remove adjuster lever and spring.
   b. Separate the brake shoes and remove the adjuster screw assembly. Mark adjusting screw parts and the adjuster lever so that they will be reassembled to the same brake in the same manner as they were removed.
   c. Unhook the shoe return springs and the upper link from the wheel cylinder bolt. Remove the springs from the shoes. Remove the cotter pin and separate the washer and toggle lever from the secondary shoe. Do not remove the toggle lever pin from the shoe.
   d. Press down on outer cup of the shoe hold down parts. On back side of support plate, hold head of hold down pin to prevent pin from turning. Rotate outer cup 90 degrees and remove cups and hold down spring. Remove shoes and hold down pins from the support plate.

5. Brake Shoe Installation
   a. Attach the secondary shoe to the support plate using the shoe hold down parts.
   b. Turn adjusting screw into pivot nut and assemble socket to end of adjusting screw.
   c. Place adjusting screw assembly in position between the bottom ends of the primary and secondary shoes. The slot of the pivot nut engages the web of the primary shoe, and the slot in the socket engages the web of the secondary shoe. Assemble the primary shoe to the support plate using the shoe hold down parts.
   d. Attach the secondary shoe return spring into the web of the secondary shoe and hook the spring to the wheel cylinder bolt.
   e. Attach the upper and lower adjuster links to the toggle lever. Put the upper link hook in position on the wheel cylinder bolt and place the toggle lever on the pivot pin. Assemble the flat washer and cotter pin to the toggle lever pin. Spread the ends of the cotter pin.
   f. Assemble the automatic adjuster spring to the web of the primary shoe, attach the automatic adjuster lever to the small adjuster spring hook, and connect the adjuster lever to the lower adjuster link.
   g. Pull the adjuster lever toward the lower end of the secondary shoe and hook lever in the hole in web of the secondary shoe.
   h. Attach the primary shoe return spring into the web of the primary shoe and hook the spring to the wheel cylinder bolt.

NOTE: When the parts are properly assembled (for proper wheel cylinder boot clearance), the hooks on the shoe return springs and upper adjuster link should point toward the wheel cylinder body.

6. Drive Wheel Installation
   a. Before installing the drive wheel assembly, apply a light film of grease to the following:
      (1) On support plate where shoe rim rests (6 places).
      (2) On end of each shoe web where web contacts cylinder piston insert.
      (3) On shoe web surface at point where web contacts the hold down cup.
      (4) On adjusting screw threads and at socket end of adjusting screw assembly.
      (5) On the toggle lever pivot pin where pin contacts toggle lever.

NOTE: To check for proper operation of automatic adjuster, carefully insert a screwdriver between end of shoe and wheel cylinder on brake backing plate; raise and lower the secondary shoe where its web contacts cylinder piston insert to simulate adjustment.

b. Center the brake shoes using the outside diameter of the support plate as a guide. Adjust the shoe ring diameter (measured across shoes at horizontal centerline) to approximately .030" less than the brake drum inside diameter. Adjust shoes by turning the adjusting screw IN or OUT of the pivot nut as required.

c. Install the shaft seal (Fig 4-2) on the axle wear sleeve with the exposed, protruding lip on I.D. of seal facing towards differential housing.

NOTE: The seal is pre-coated with bore tight sealer. Seal is the enclosed type to prevent spring from popping out during installation or operation.

d. Carefully inspect the inner roller bearing assembly for evidence of scratches, flats, or excessive wear. Replace if necessary. Install roller bearing on axle shaft and ensure that narrow end of taper faces out, toward planetary carrier end of axle shaft.

e. Carefully inspect the inner and outer wheel hub bearing cups. If there is any evidence of excessive wear or flat spots, then replace bearing cups. Position the wheel hub and tire assembly next to the axle shaft mounting location, and be sure that truck is blocked to proper height for hub unit installation.

f. Using a steady and straight pushing motion, install hub and tire assembly on axle shaft.

CAUTION: Take care to ensure that wheel hub is properly seated on the shaft seal and inner roller bearing.

g. Inspect the outer roller bearing assembly for evidence of excessive wear or flats. Replace if necessary. Install outer roller bearing assembly on the planetary ring gear housing, with roller bearing narrow taper facing inward, toward the differential housing.

h. Install the planetary ring gear assembly within wheel hub, ensuring that the outer roller bearing on ring gear seats properly in bearing cup. Install large retaining washer and nut, and torque nut to 300-325 lb-ft. Use special socket with chamfer (Part No. 4908103-7) to tighten nut.

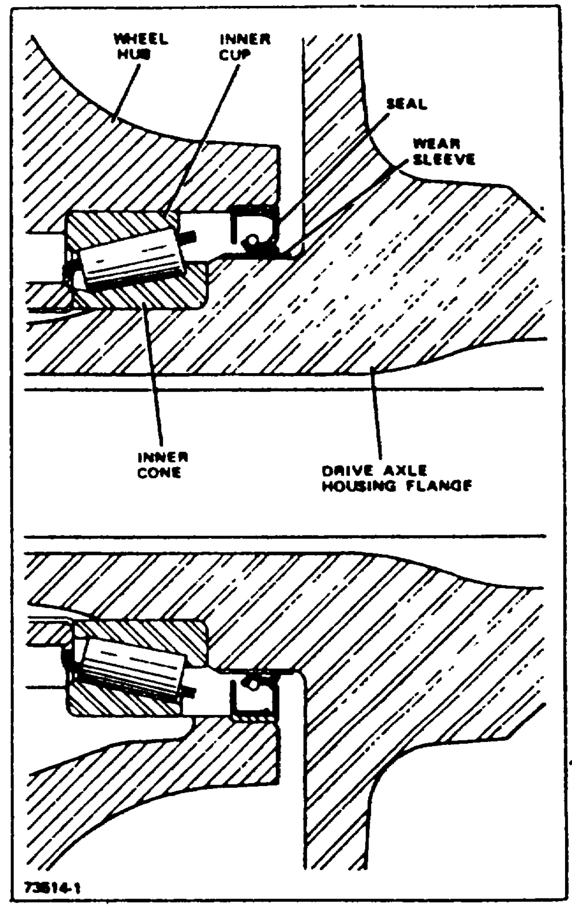


Figure 4-2. Oil Seal Installation

While tightening nut with torque wrench, simultaneously rotate wheel six times in each direction. Wheel should turn freely.

Check end play with a dial indicator. Range for end play is .0000" to .0075". If ZERO end play is obtained, wheel should turn freely and without any drag (.001" to .002" preload on bearing will not harm bearing).

i. Install the axle shaft in axle housing and be certain that spline end of shaft is fully inserted in differential side gear.

j. Install planetary carrier assembly along with axle shaft thrust plug and lubricated O-ring into the wheel hub, and install the carrier mounting bolts. Tighten mounting bolts to 56 lb-ft torque.

k. Rotate drive wheel until the oil

level arrow, located on the planetary carrier, is horizontal to the floor. Install drain plug in bottom of drive axle housing.

l. Fill drive axle housing, at filler plug opening, with specified gear oil until oil runs out of oil level holes in drive wheel hubs. Refer to the following for approximate capacities:

ACC 100 C	16 pints
ACC 100-120	16 pints
ACP 60-70-80	22 pints
ACP 100-120-140	37 pints

m. Install drain plugs in drive wheel hubs and install oil filler plug securely.

n. Carefully lower the truck and remove service jacks and/or blocks.

C. SERVICE BRAKE ADJUSTMENT

If brake pedal travel is excessive, this is due to brake shoes not being properly adjusted (brake shoe lining should be .020" from drum). A series of reverse stops will automatically adjust the brakes. When brakes are grossly underadjusted they can be adjusted by turning the adjusting screw starwheel.

1. Use a spoon type adjusting tool (access through lower slot on backside of brake backing plate) and turn adjusting screw starwheel to obtain .020" clearance between each brake shoe and drum (total clearance of .040").

NOTE: Check clearance by inserting .020" feeler gauge between brake shoe and drum at rear of support plate, along wheel hub diameter.

D. WHEEL CYLINDER

1. Removal

a. Remove the drive wheel to gain access to the wheel cylinder. (Refer to Drive Wheel Removal in preceding Paragraph B, BRAKE SHOE INSPECTION AND REPLACEMENT.)

b. Remove hydraulic brake line fitting(s) from wheel cylinder. Plug all openings to prevent entrance of foreign material.

c. Remove capscrews and lockwashers that secure wheel cylinder to backing plate; remove wheel cylinder.

2. Installation

a. Position and secure wheel cylinder to backing plate with lockwashers and capscrews.

b. Remove plugs and connect hydraulic brake line fitting(s) to wheel cylinder securely.

c. Install the drive wheel. (Refer to Drive Wheel Installation in preceding Paragraph B, BRAKE SHOE INSPECTION AND REPLACEMENT.)

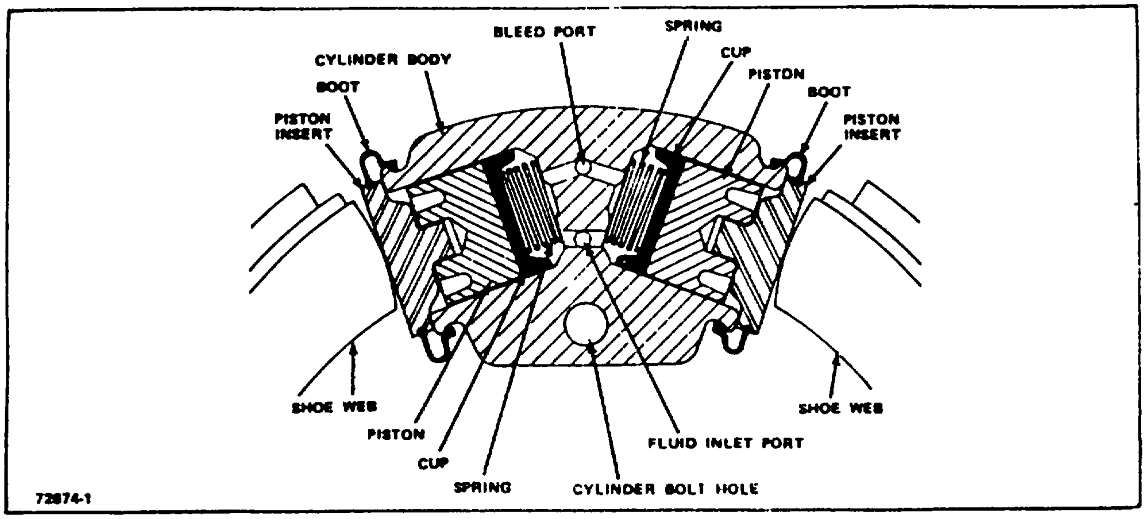


Figure 4-3. Wheel Cylinder (Sectional View)

E. BRAKE SYSTEM BLEEDING

Whenever the wheel cylinders are replaced, the hydraulic brake system must be bled to remove any air that may have entered the brake lines.

1. Fill master cylinder with clean specified brake fluid.

CAUTION: Due to importance of fluid used in brake system, use only premium quality, heavy duty brake fluid with an extreme heat-cold range that conforms to SAE specification J1703d.

2. Bleed the wheel cylinder furthest from the master cylinder first (right side of unit).

NOTE: Normally, the bleed screw is located at the back of each drive axle flange. However, some models of lift trucks are equipped with a central bleeding system. This system utilizes a junction block located near the top of the drive axle housing. The junction block is equipped with two bleed screws, one for each wheel cylinder. If unit is equipped with a central bleeding system, see Figure 4-5.

3. Have an assistant apply the brake pedal to apply pressure to the brake fluid and

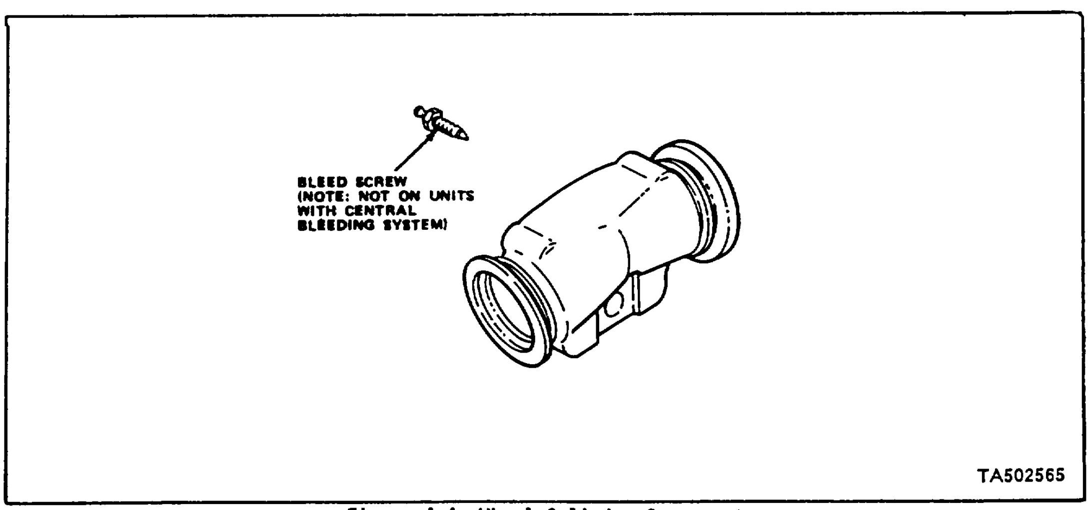


Figure 4-4. Wheel Cylinder Components

TOPIC 2. MASTER CYLINDER

A. DESCRIPTION

Brake cylinder and fluid reservoir are combined in one casting and are joined by intake and by-pass ports located in the cylinder wall. Internal parts are removed or installed at push rod end. Stop plate holding internal parts is retained by a lock-wire clipped into cylinder bore. Cylinder piston is operated through a push rod connected to the brake pedal. The push rod and cylinder opening is enclosed with a rubber boot

It is considered impractical to thoroughly clean the cylinder and fluid reservoir mounted in the truck. For this reason follow instructions below.

B. REMOVAL

1. Remove floor plate
2. Disconnect brake hydraulic line attached to master cylinder.
3. Remove clevis pin securing push rod to brake pedal assembly
4. Remove capscrews holding master cylinder to inside of frame and remove cylinder.

Cylinder castings may be cleaned with usual cleaning methods but must be finish cleaned with denatured alcohol or brake fluid to remove all traces of solvent.

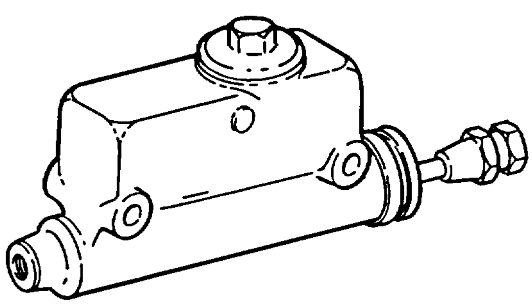


Figure 7. Master Cylinder Assembly

C. INSTALLATION

1. Replace master cylinder in its relative mounting location and install securing capscrews
2. Attach brake pedal push rod to cylinder and secure with clevis pin previously removed.
3. Connect brake hydraulic line to cylinder.
4. Refer to LUBRICATION CHART and fill cylinder with proper high grade hydraulic brake fluid.
5. Bleed brake system as outlined under appropriate heading, this Section.
6. Replace floor and toe plate.

D. PEDAL LINKAGE

If pedal linkage does not provide proper clearance or lash between master cylinder piston and linkage with brakes released, piston cannot return to full off position. Brakes will drag after several applications if bypass port is blocked. Refer to Figure 8 and proceed as follows:

1. Loosen locknut at master cylinder.
2. Adjust linkage to provide 1/2" of free play measured at brake pedal. More free play will reduce usable stroke of master cylinder piston.
3. Tighten locknut.

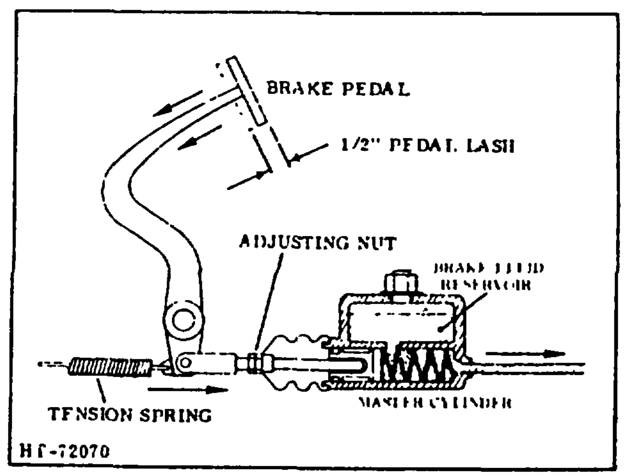


Figure 8. Adjusting Pedal Lash

TOPIC 3. PARKING BRAKE

A. GENERAL

A dual-shoe mechanical brake, mounted on the differential pinion housing, is used as a parking brake. The brake mechanism requires no lubrication except at the time of reassembly. However, the hand lever and linkage should be lubricated every 50 hours of truck operation.

B. PARKING BRAKE ADJUSTMENT

Each 500 hours of operation, check the parking brake and adjust the hand lever if necessary. To compensate for parking brake lining wear, the tension on the hand lever can be increased by adjusting the knob on top of the lever.

1. Set the hand lever in fully disengaged position.
2. Loosen setscrew that locks adjusting knob in position.
3. Turn adjusting knob clockwise one or two turns; then verify adjustment by engaging the brake. Lever should now pull harder to engage brake.
4. Repeat Step 3, if additional tension is required. After adjustment is completed, turn setscrew in to lock adjusting knob.

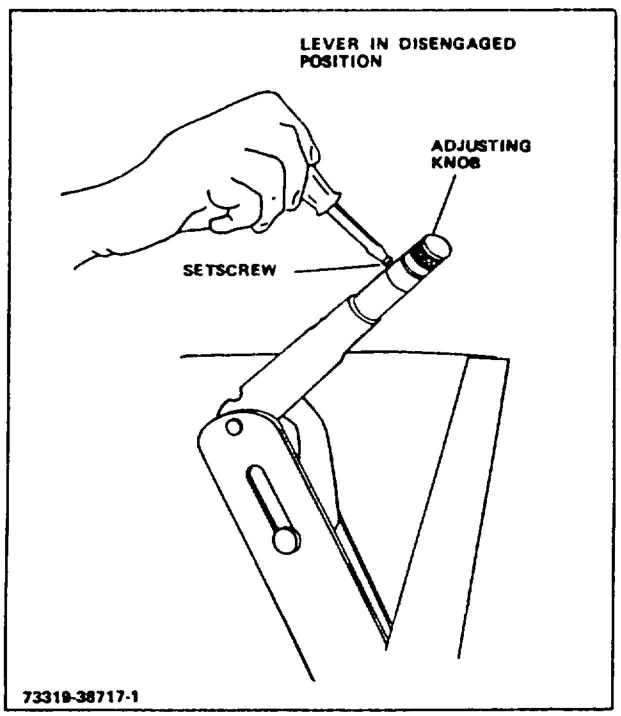


Figure 3-1. Parking Brake Adjustment

C. BRAKE SHOE ADJUSTMENT

If the adjusting knob on the parking brake lever will no longer provide correct brake adjustment and sufficient brake lining is still available, further adjustment is made at the lower brake cable yoke.

1. Remove adjusting knob setscrew from parking brake lever and back off knob four or five turns. Brake must be in OFF or DISENGAGED position during adjustment.
2. Remove the floor plate.
3. Remove yoke pin from yoke and loosen yoke locknut (Fig 3-2).
4. Turn yoke clockwise to shorten length of cable. Generally three or four turns will be sufficient.
5. Install yoke on brake lever and check adjustment by engaging hand brake lever. If necessary, make further adjustment to yoke to make certain brake shoes do not drag when disengaged.
6. After satisfactory adjustment is made, tighten yoke locknut; install yoke, yoke pin and cotter pin. Install setscrew in adjusting knob of parking brake lever.

D. BRAKE SHOE REPLACEMENT

When excessive adjustment is needed on parking

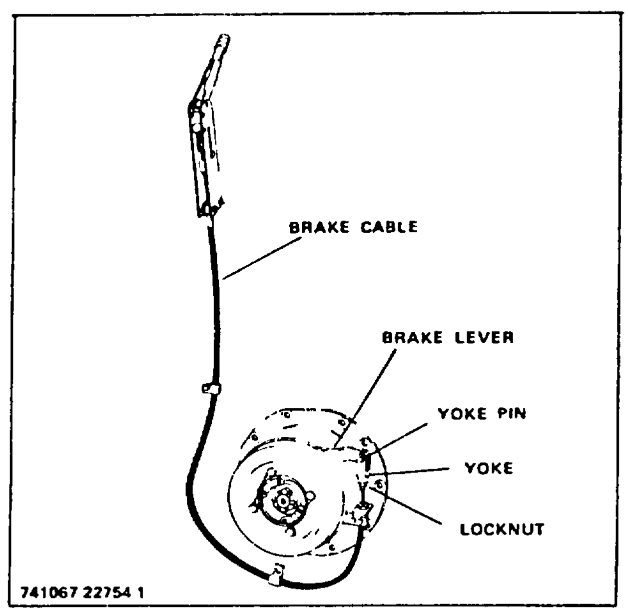


Figure 3-2. Adjustment at Brake Shoes

brake linkage, or when parking brake becomes ineffective in holding truck securely, the brake shoes should be checked, and if necessary, replaced.

1. Removal and Disassembly

   a. Place blocks in front and behind one of the lift truck wheels.
   b. Remove the floor plate.
   c. Remove the yoke pin that secures the brake cable yoke to the parking brake lever (Fig 3-2); remove the yoke from the lever.
   d. Remove the universal joint from the drive flange.
   e. Remove the capscrews and washers that secure the brake drum to the drive flange; remove the parking brake drum.
   f. Remove return springs, anchor spring, and brake shoes from brake support plate (Fig 3-3); remove brake lever.
   g. Remove place bolts that secure brake support plate to pinion gear housing; remove the brake support plate.

2. Inspection

   a. Check brake support plate for wear or distortion.
   b. Check brake lining for wear or grease saturation.
   c. Check brake shoes for worn lever contact areas.
   d. Check brake drum for cracks, scoring, or other damage.
   e. Replace worn or damaged parts. Always replace shoe return springs and anchor spring during reassembly.

3. Reassembly and Installation

   During reassembly, apply a light coat of grease to the brake lever, brake support plate, and brake shoe wear points. Also fill cavity with grease where the brake lever pivots in the pinion gear housing. Avoid excessive lubricant and be careful not to get grease on the brake lining.

   a. Install brake support plate to pinion gear housing; tighten place bolts to 55 lb-ft torque.
   b. Position brake shoes and brake lever on brake support plate; install anchor spring and return springs.
   c. Install brake drum to drive flange with washers and capscrews; tighten capscrews

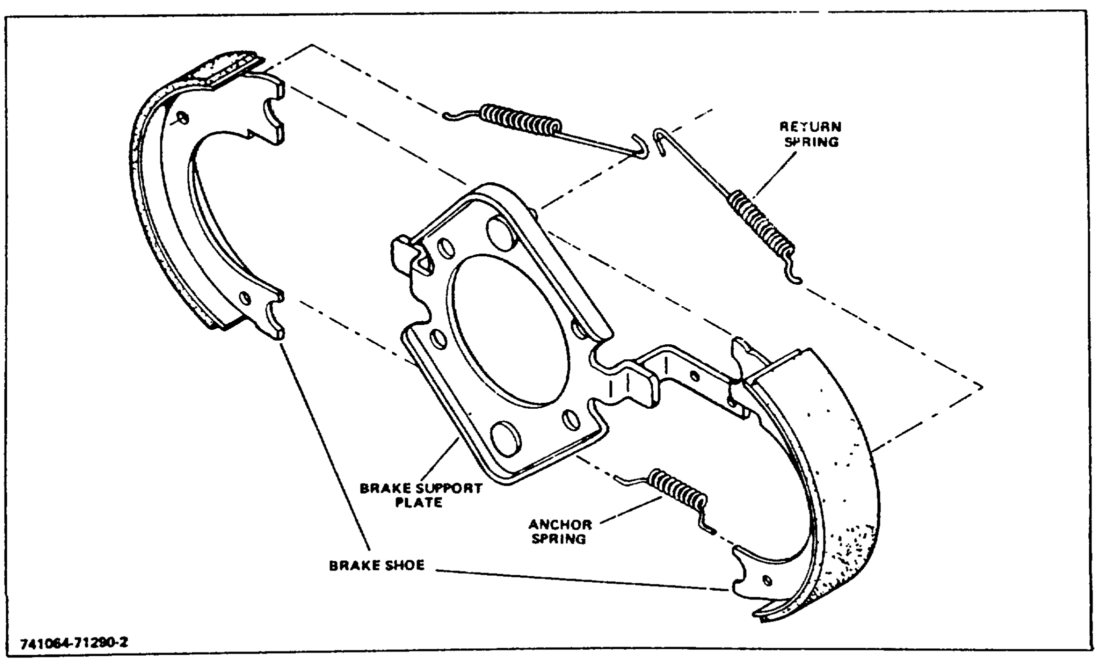


Figure 3-3. Parking Brake Components

to 45 lb-ft torque.

d. Install the universal joint to the drive flange; tighten joint attaching capscrews to 25-30 lb-ft torque (dry threads).

e. Connect yoke to parking brake lever; install yoke pin and cotter pin.

f. Check operation of parking brake; adjust if necessary.

g. Install the floor plate and remove blocks which were used to hold lift truck stationary.

TOPIC 5. BLEEDING THE BRAKE SYSTEM

F. BRAKE SYSTEM BLEEDING

Whenever the wheel cylinders are replaced, the hydraulic brake system must be bled to remove any air that may have entered the brake lines. To bleed the system, the following basic procedure should be used:

1. Fill the master cylinder reservoir with clean brake fluid. Bleed the brake assembly furthest from the master cylinder first.

2. Have an assistant apply the brake pedal to apply pressure to the brake fluid and open the bleed screw (located at back of support plate) to allow the air to escape from the wheel cylinder. Close the bleed screw while foot pressure is still on the brake pedal. After the bleed screw Is closed, allow the pedal to return to its released position.

3. Repeat step 2 as many times as required until the brake fluid is free of air bubbles and then tighten the bleed screw before allowing the pedal to return to its released position.

4. Bleed the remaining wheel cylinder in the identical manner as outlined in steps 2 and 3.

5. Fill the master cylinder reservoir to approximately 1/2" from the filler port opening.

G. BRAKE SYSTEM CHECK-OUT PROCEDURE

1. Apply the brake pedal and hold pressure in the brake system. Check for any evidence of fluid leakage if pedal gradually goes to the floor.

2. Operate the vehicle to determine if the brakes operate to stop the vehicle evenly and quickly from a slow speed.

3. If the pedal travel is excessive, this may be due to the brake shoes not being adjusted out to the drums properly (shoes should be .020" to drum, total of .040" per assembly). A series of reverse stops will automatically adjust brakes. (Adjust starwheel if grossly underadjusted.)

MEMO

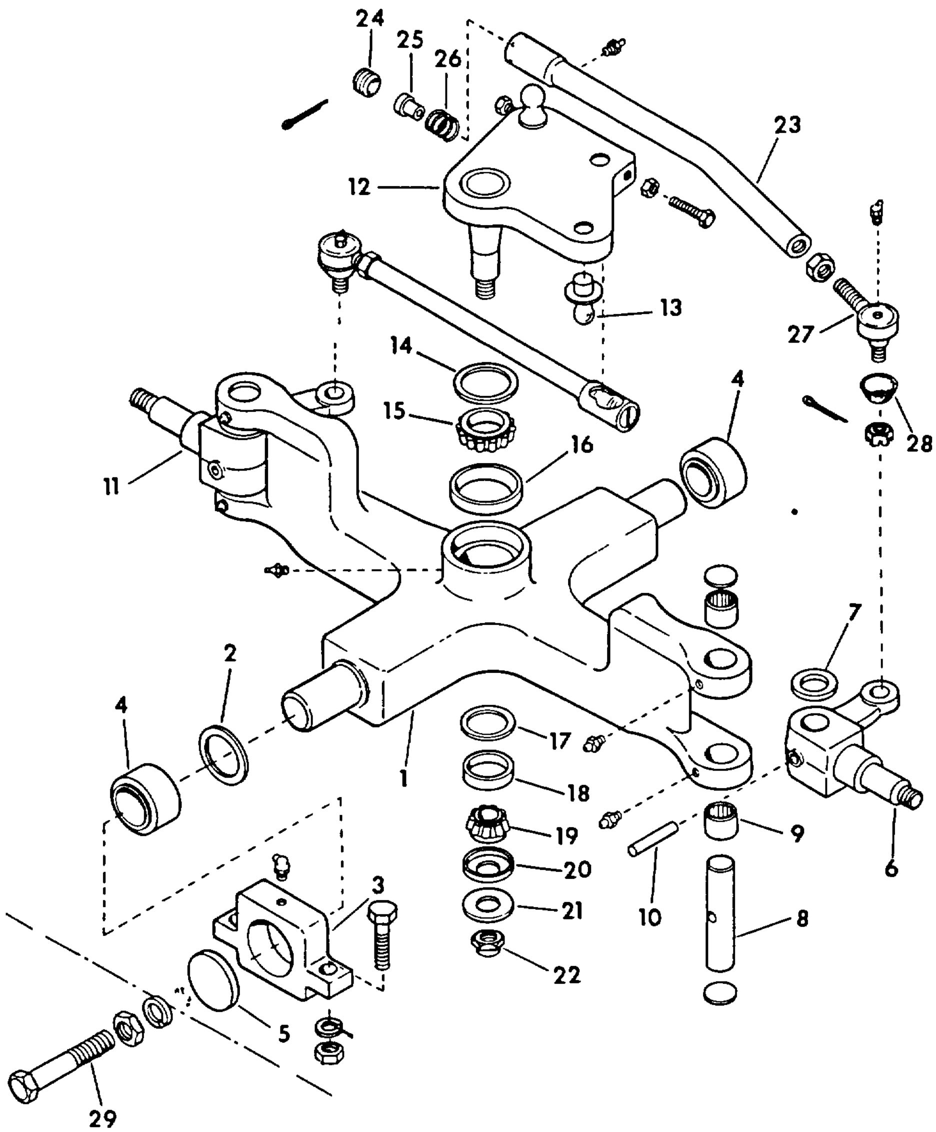
TOPIC 1. STEER AXLE

A. AXLE REMOVAL

1. Raise the rear of the truck with an adequate hoist or jack until the steer wheels clear the floor. Place service jacks under both sides of the frame.

⚠WARNING

Do not place the service jacks under the counterweight. Be certain that the service jacks are properly positioned under the frame.



1	AXLE ASSY STEER	11	SPINDLE RH	21	WASHER
2	WASHER (ACC20/30)	12	ARM ASSY PIVOT	22	NUT
3	HOUSING AXLE MTG	13	STUD BALL	23	ROD TIE
4	BUSHING-HOUSING	14	SEAL UPPER	24	PLUG ADJUSTING
5	SPACER	15	CONE-UPPER	25	SEAT BALL
6	SPINDLE LH	16	CUP UPPER	26	SPRING
7	BEARING THRUST	17	RING RETAINING	27	SOCKET BALL
8	PIN KIT KING	18	CUP LOWER	28	COVER
9	BEARING NEEDLE	19	CONE LOWER	29	CAPSCREW ADJ
10	PIN SPRING	20	SEAL LOWER		

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Figure 1-1. Steer Axle Assembly (ACC/ACP 20-30)

2. Lower the truck onto the service jacks and remove the hoist or jack.

3. Remove the tire and wheel assemblies, and the wheel bearings, as outlined in the POWER STEERING MAINTENANCE MANUAL, TOPIC 1, paragraph D, step 2-a.
4. Disconnect the drag link from the pivot arm by loosening the adjusting plug in the end of the socket unit. Lift the socket unit from the ball stud on the pivot arm
5. Place a jack under the steer axle assembly. Raise the jack high enough to take the weight off the axle mounting capscrews.
6. Loosen the jam nut and back off the adjusting capscrew at the front pivot of the axle to free the solid spacer. Remove the spacer.
7. Remove the nuts, lockwashers, and capscrews securing the axle mounting housing to the frame.
8. Secure the axle to the jack, lower the jack and remove the axle from the truck.

B. DISASSEMBLY

1. Refer to TABLE 1 for the Figure Number pertaining to specific truck model axle assemblies.

TABLE 1. STEER AXLE CONFIGURATION

MODEL	STUD LOCATION	PIVOT ARM SEAL	TRUNNION WASHER	FIGURE NUMBER
ACP 20/30	Pivot Arm	Yes	No	1-1
ACC 20/30	Pivot Arm	Yes	Yes	1-1
ACP 40/50	Axle	No	No	1-2
ACC 35/55	Axle	Yes	No	1-2
ACP 60/80	Axle	No	No	1-3
ACC 60/80	Pivot Arm	No	No	1-4
ACC 100	Axle	No	No	1-5
ACC 120	Axle	No	No	1-5

2. Remove the axle mounting housing from the steer axle pivot pin.
3. Remove the cotter pins and adjusting plugs from the tie rods. Separate the tie rods from the pivot arm. Remove ball seats and springs from the tie rods.
4. Remove the cotter pins and nuts from the ball sockets. Separate the ball sockets from the spindles. Loosen the jam nut and remove the ball sockets from the tie rods. Record the number of turns required to remove the ball socket.
5. Remove the expansion plugs from the king pin bores. Drive the spring pins from the king pins and remove the king pins from the spindles. Separate the spindles from the axle and remove the needle bearings.
6. Straighten the indentation in the lower pivot arm retaining nut. Remove the retaining nut, washer, lower seal (ACC 20-55; ACP 20-30), and lower cone. Remove the pivot arm assembly. Remove the upper seal (ACC 20/55; ACP 20-30), and the upper cone.
7. Using a brass drift, remove the upper cup. Remove the lower retaining ring. Using a brass drift, remove the lower cup.

C. INSPECTION
1. Clean all parts with mineral spirits or other suitable solvent. Thoroughly dry all parts.

CAUTION
Do not dry bearing cones with compressed air.

2. Inspect all parts for wear, scoring, cracks, abnormal bending, or other damage. Repair or replace as necessary.

D. SPINDLE INSTALLATION

1. Install the king pin needle bearings in the steer axle flush with the casting surface (Fig 1-6).

NOTE: The lubrication holes in the bearings must be aligned with the lubrication holes in the axle assembly.

2. Position the spindle and upper thrust washer on the steer axle and insert the king pin.

NOTE: Align the spring pin hole in the king pin with the hole in the spindle as the king pin is installed.

3. Install the spring pin securing the king pin and spindle.

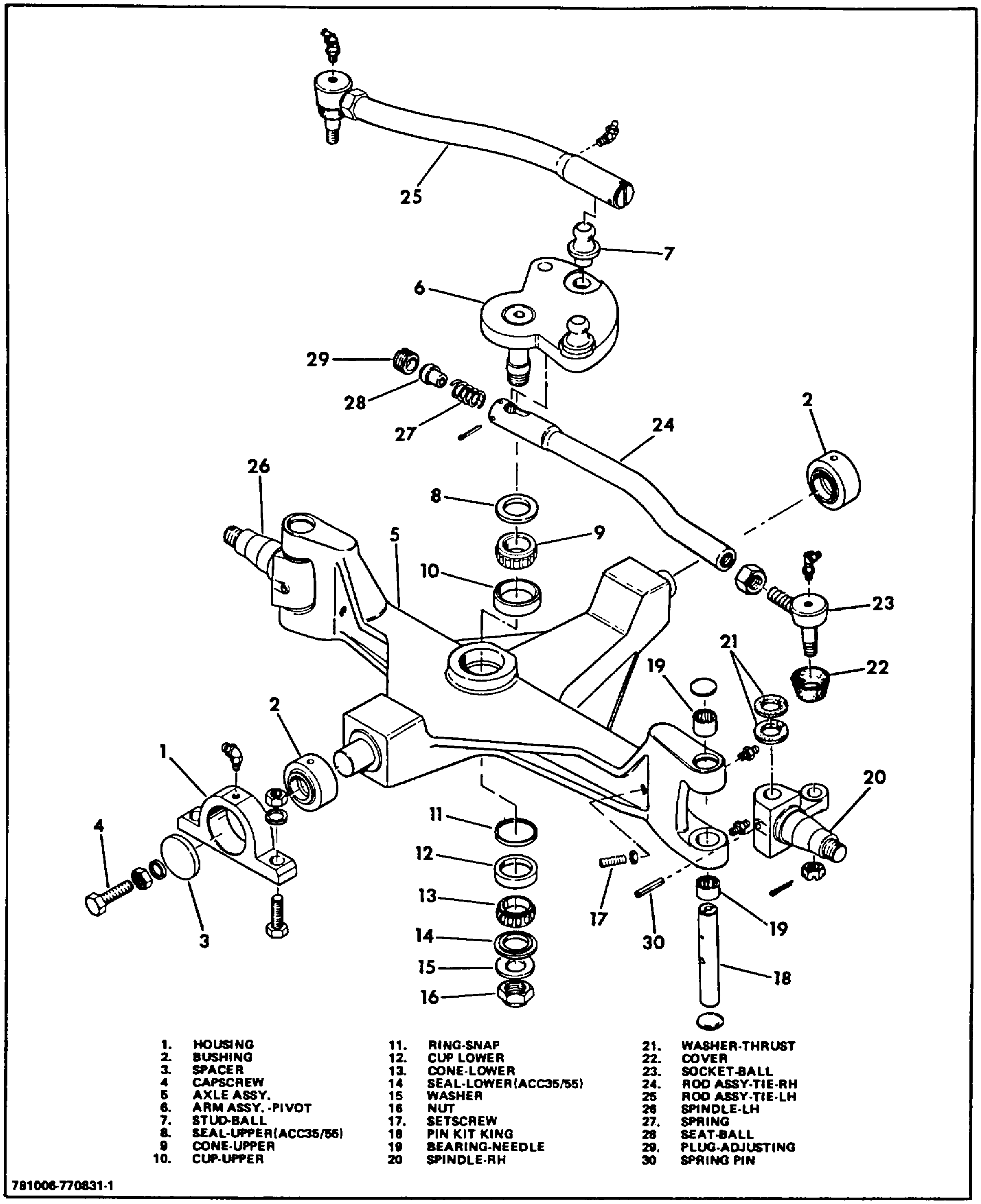


Figure 1-2. Steer Axle Assembly (ACP 40-50/ACC 35-55)

4. Install the upper and lower expansion plugs. See Topic 1, Section C, of the MAINTENANCE MANUAL for proper procedures.

E. PIVOT ARM INSTALLATION

1. Clean the pivot pin, bearing seats, and

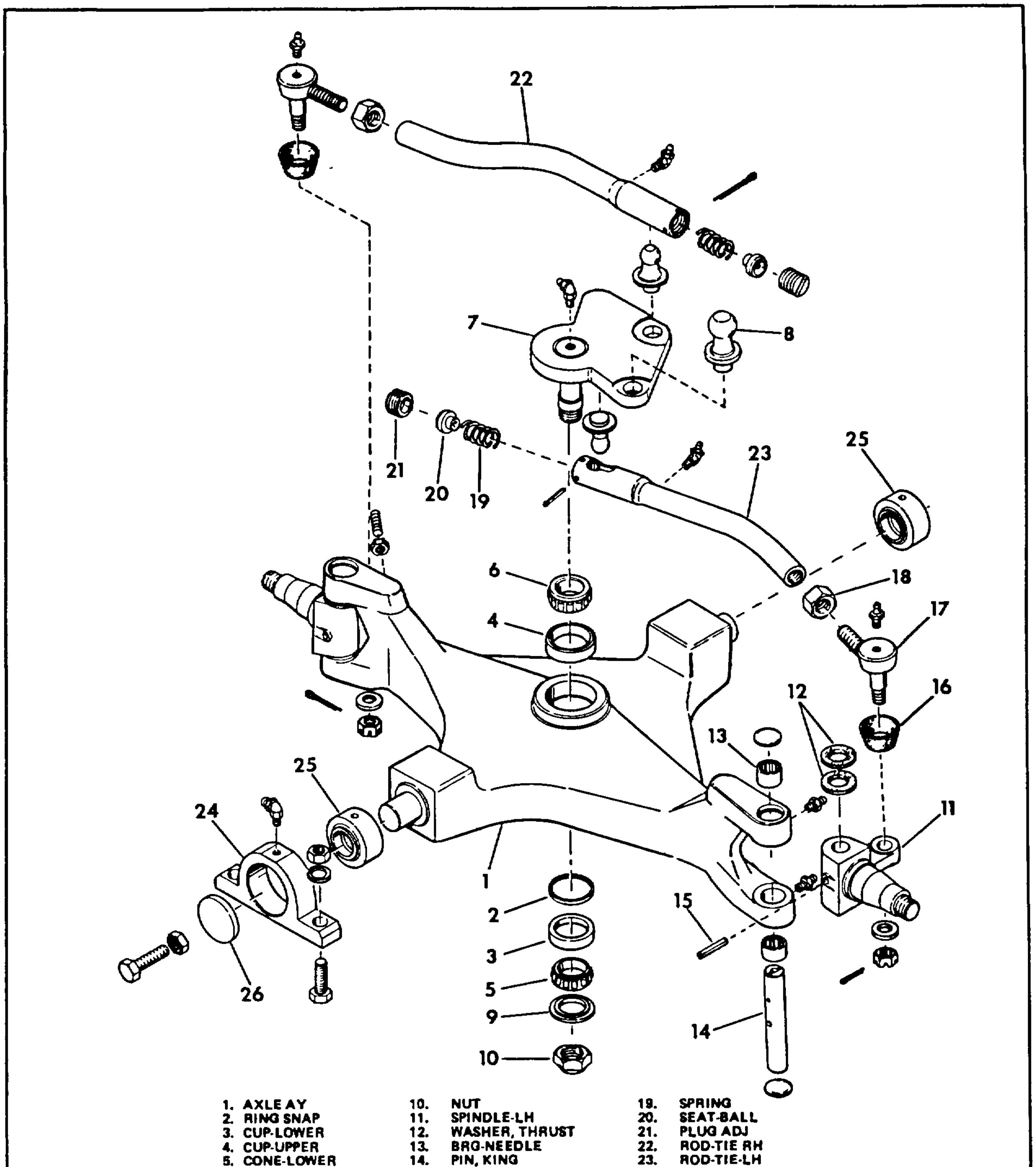
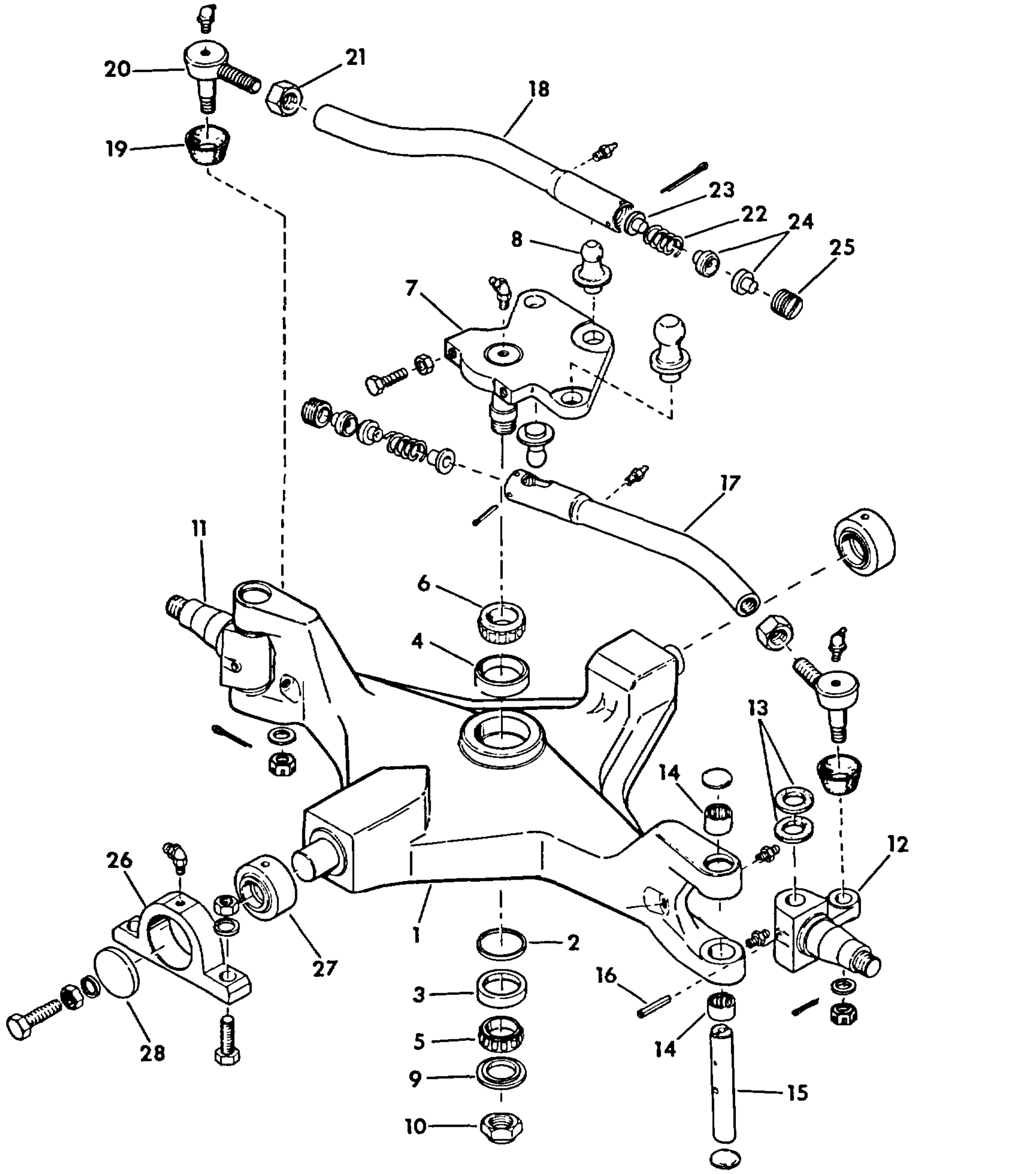


Figure 1-3. Steer Axle Assembly (ACP 60-80)

axle bore (Fig 1-7).

2. Install the retaining ring and bearing

cups, making certain the cups are squarely seated.



1.	AXLE AY	11	SPINDLE-RH	21	NUT
2.	RING SNAP	12	SPINDLE LH	22	SPRING
3	CUP LOWER	13	WASHER, THRUST	23	PLUG SAFETY
4.	CUP UPPER	14	BEARING-NEEDLE	24	SEAT BALL
5.	CONE-LOWER	15	KING PIN	25	PLUG ADJ
6.	CONE-UPPER	16	PIN, SPRING	26	HOUSING AXLE MTG
7.	ARM AY -PIVOT	17.	ROD TIE LH	27.	BUSHING
8.	STUD, BALL	18	ROD TIE-RH	28	SPACER-FRONT
9	WASHER PLAIN	19	COVER		
10	NUT	20	SOCKET BALL		

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Figure 1-4. Steer Axle Assembly (ACC 60-80)

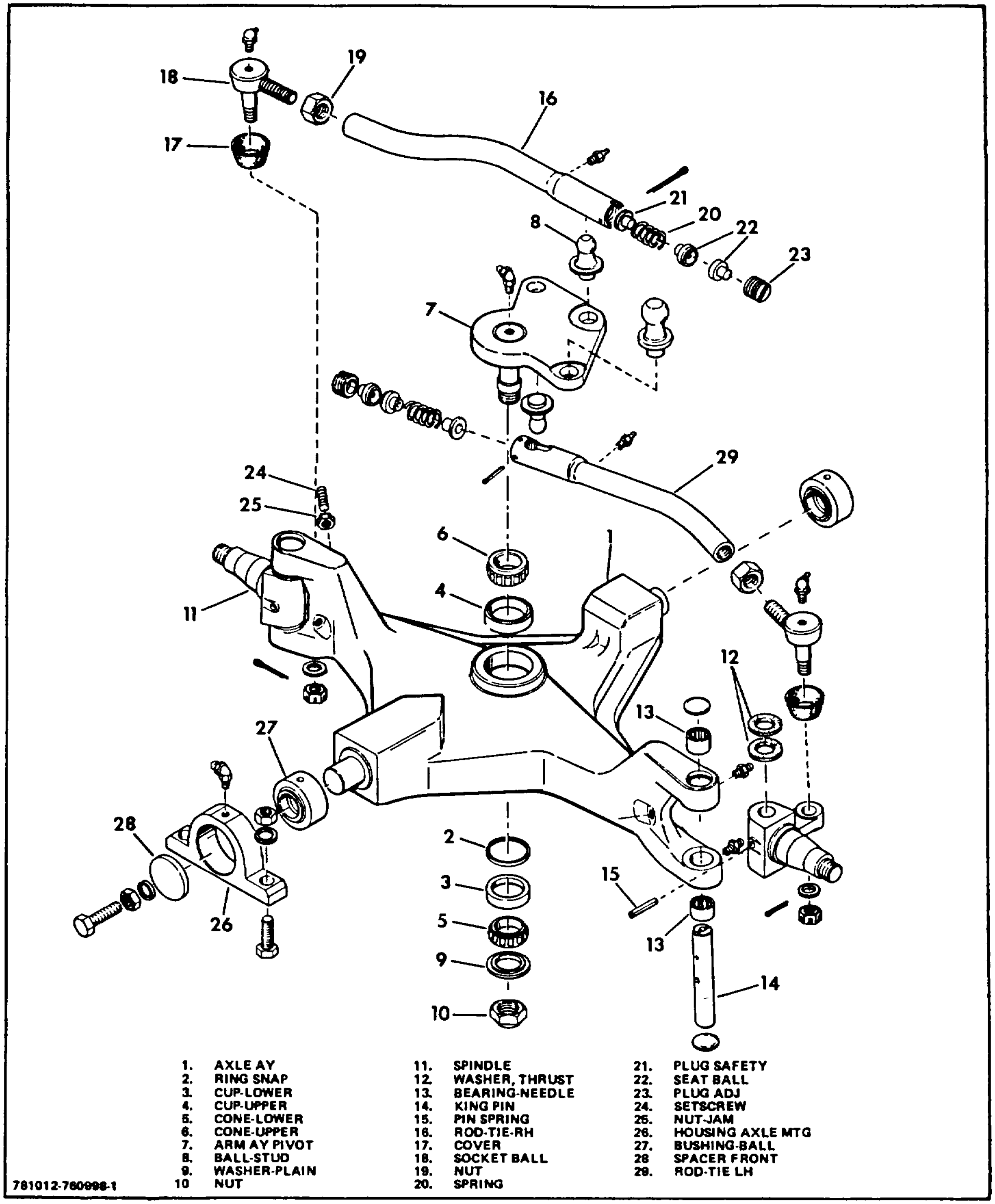

Figure 1-5. Steer Axle Assembly (ACC 100-120)

3. Seat the upper seal on the pivot arm (ACC 20-55; ACP 20-30). Fill the seal with specified grease.

4. Lubricate the upper and lower bearing cones with National Lubricant and Grease Institute (N.L.G.I.) Heavy Duty Grade 2

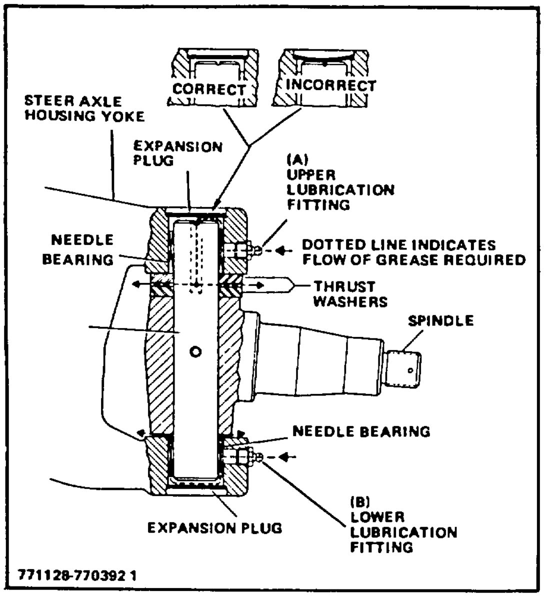

Figure 1-6. King Pin Installation

(HD-2) sodium base grease. The grease must be waterproof and heat resistant. Apply the grease with an applicator designed to force the lubricant into the roller bearings.

5. Press the upper bearing cone on the pivot arm.
6. Install the pivot arm into the axle assembly. Install the lower bearing cone.
7. Fill the lower seal with specified grease (ACC 20-55; ACP 20-30) and position on the pivot arm.
8. Install the washer and start the retaining nut on the pivot arm.
9. Tighten the retaining nut with a torque wrench and note the torque reading as the lower bearing cone starts to seat. As the bearing cone seats, an increase in torque will be noted. Continue tightening until the torque measured is 15-25 lb-ft (20 to 33 N-m) greater than the initial torque reading.
10. Measure the rotational bearing torque as follows:

> **NOTE: The tie rods must not be connected to the pivot arm assembly when rotational torque is checked.**

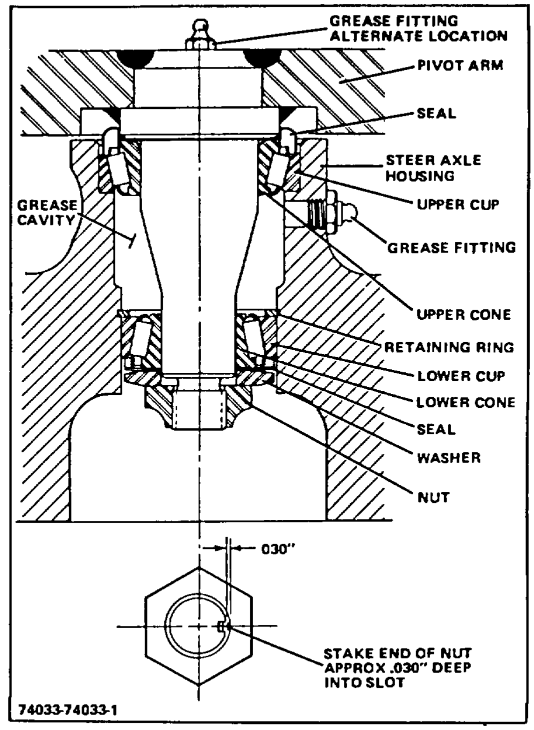

Figure 1-7. Pivot Arm Installation

a. Rotate the pivot arm assembly back and forth several times and take a rolling torque reading. It should require 15-25 lb-in (1.5-3 N•m) of torque to rotate the pivot arm in either direction.
b. If the rolling torque measured is less than 15 lb-in (1.5 N•m), tighten the retaining nut an additional 5 lb-ft (6.5 N•m) of torque and repeat step 0-a.
c. If the rolling torque measured is greater than 25 lb-in (3 N•m), back the retaining nut off one full turn. Stroke the end of the pivot arm pin with a soft mallet to unseat the bearings and repeat steps 9 and 10-a.

11. After the proper rotational bearing torque is obtained, stake the end of the retaining nut .030" (.762 mm) as shown in Figure 1-7.

F. TIE ROD INSTALLATION

1. Install the ball sockets on the tie rods, turning the ball socket in the same number of turns as was recorded at removal.
2. Install the springs, ball seats, and adjusting plugs in the pivot arm end of the tie rods.

3. Install the tie rods on the pivot arm ball studs, turning the adjusting plugs until the ball seats are snug, on the pivot arm ball studs. Install the cotter pins.

4. Perform the tie rod adjustments outlined in the POWER STEERING MAINTENANCE MANUAL, TOPIC 2, paragraph A.

G. AXLE INSTALLATION:

1. Completely lubricate the axle assembly as outlined in the POWER STEERING MAINTENANCE MANUAL, TOPIC 1, paragraph C.

2. Adjust the toe in; and spindle or pivot arm stops. Refer to TOPIC 2, Sections A and B for detailed procedures.

3. Install the bushings, front housing, and spacer on the axle assembly.

NOTE: Make certain that the bushing and housing grease holes are aligned (Figs 1.1 thru 1.5).

4. Position the axle assembly, on a jack under the truck. Make certain that the axle is secured to the jack and raise the axle,, position the rear pivot in the frame weldment,. and secure the front housing, with capscrews, lockwashers, and nuts. Tighten the nuts securely enough to hold the housing in position but allow for axle position adjustment.

5. Push the axle assembly, against the rear frame member. Tighten the adjusting, capscrew, against the front spacer to, 8-12, lb-ft (11 to 16 N•m) of torque.

6. Hold the adjusting capscrew, and, tighten the jam nut to 80-100 lb-ft (108-136 N•m) of torque.

7. Tighten the housing mounting capscrews and nuts to 75-95 lb-ft (102-1291N•m) of torque.

8. Lubricate the axle housing bushings with, specified grease.

9. Lower the jack used to lift the axle and remove it from under the' truck.

10. Install the socket unit from the power steer cylinder on the ball stud: on the pivot arm. Tighten the adjusting plug until the ball seats are snug and install the cotter pin.

11. Adjust. the-steer cylinder as outlined in TOPIC 3 of the HYDRAULIC MAINTENANCE MANUAL.

12. Install the wheel. bearings and the tire and wheel assemblies as outlined in the POWER STEERING MAINTENANCE MANUAL,, TOPIC 1, paragraph D, step 2-6.

13. Raise the rear of the truck with an adequate hoist or jack until the truck is off the service jacks.

14. Remove the service jacks and lower the truck to the floor. Remove the jack or hoist.

TOPIC 2. POWER STEERING CYLINDER

A. CYLINDER AND LINKAGE REMOVAL

1. Raise the rear of the truck with an adequate hoist or jack until the steer wheels clear the floor. Place service jacks under both sides of the frame.

> **WARNING**
>
> **Do not place the service jacks under the counterweight. Be certain that the service jacks are properly positioned under the frame.**

2. Lower the truck onto the service jacks and remove the hoist or jacks.
3. Remove the left wheel and tire assembly, and the wheel bearings as outlined in the POWER STEERING MAINTENANCE MANUAL, TOPIC 1, paragraph D, step 2-a.
4. Disconnect the drag link from the pivot arm by loosening the adjusting plug in the end of the socket unit. Lift the socket unit from the ball stud on the pivot arm.
5. Place a drain pan under the steering cylinder parts. Tag the hoses for identification and remove from the cylinder. Plug or cap all openings to prevent entry of contaminants into the hydraulic system.
6. Remove the cotter pin, washer, and anchor pin that secures the steering cylinder to the cylinder anchor.

B. DISASSEMBLY

1. Loosen the jam nuts (Fig 2-1), or jam nuts and clamp (ACC 60-120, Fig 2-2).
2. Remove the socket unit from the rod, counting and recording the number of turns required.
3. Remove the jam nuts from the rod.
4. Remove the spacer from the rod, counting and recording the number of turns required.
5. To disassemble fixed piston cylinders (Fig 2-3), proceed as follows:

   a. Remove the gland nut from the tube assembly.

> **NOTE: All seals, bearings, and wipers should be replaced with an appropriate seal kit for the cylinder installed in each model truck.**

   b. Remove the wiper ring, packing, nylon pellet, O-ring, and backup ring from the gland nut.

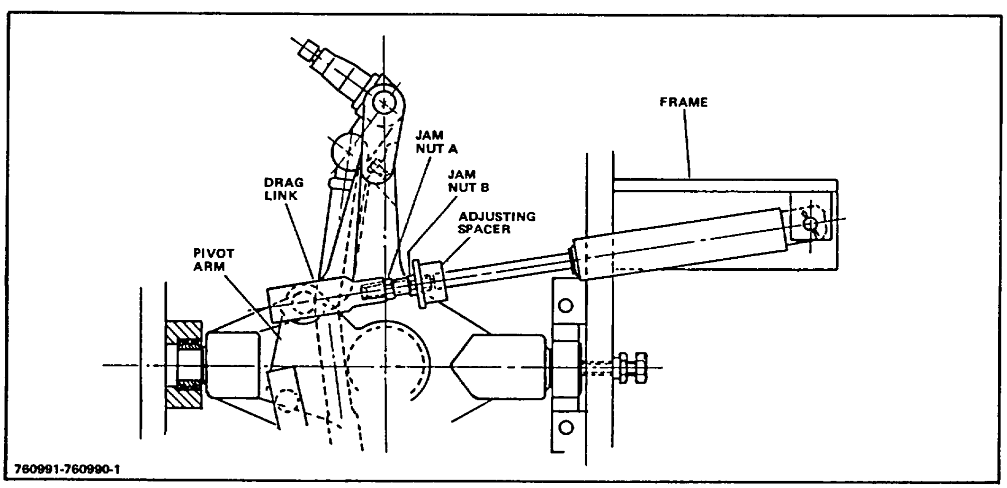

Figure 2-1. Drag Link Assembly

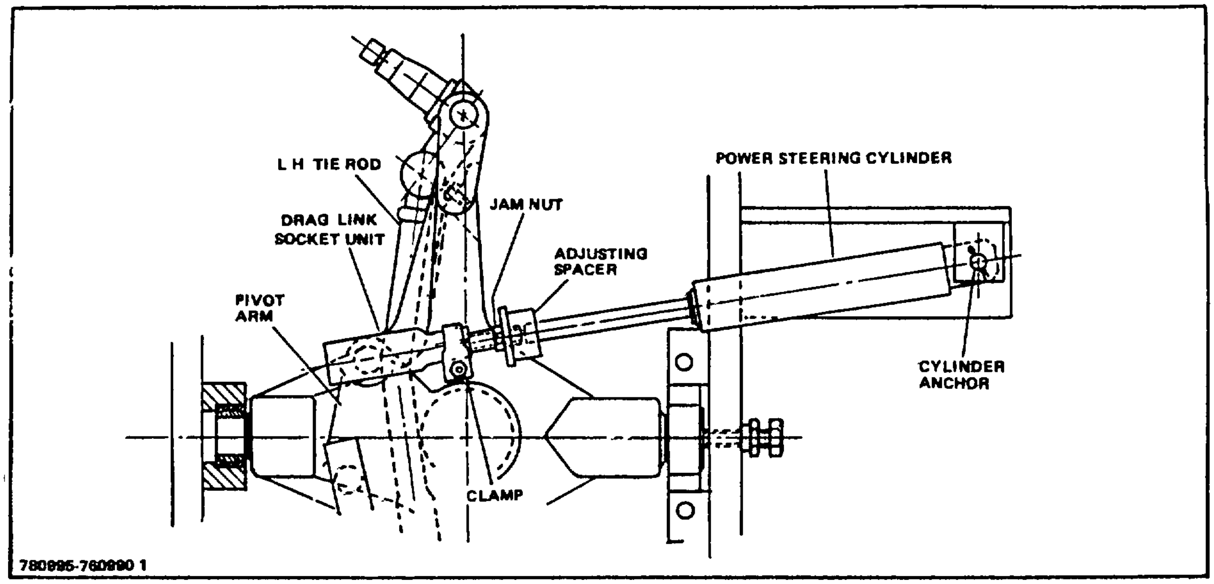

Figure 2-2. Drag Link Assembly (ACC 60-120)

c. Remove the plunger assembly from the tube assembly.
d. Remove the bearing and T-ring from the head of the plunger assembly.

6. To disassemble removable piston cylinders (Fig 2-4), proceed as follows:
   a. Remove the outer retaining ring, spacer, and inner retaining ring from the cylinder assembly. Remove the head from the tube assembly.
   b. Remove the 0-rings, back up washer and wiper from the head.
   c. Remove the rod and piston assembly from the tube assembly.
   d. Remove the seal from the piston.
   e. Remove the piston from the rod and remove the rod 0-ring.

C. INSPECTION AND REPAIR

1. Clean all metal parts in a suitable solvent.

2. Inspect the tube bore, piston, rod, and head or gland nut for excessive wear, scoring, burrs, or other damage. Repair or replace any parts which are worn or damaged.

3. Replace all seals, bearings, 0-rings, wipers, and packing.

D. ASSEMBLY

1. To assemble a fixed piston cylinder (Fig 2-3), proceed as follows:
   a. Insert the rod and piston assembly, with the bearing and T-ring installed into the tube assembly.
   b. Place thin shim stock over the rod threads to protect the seals and install the gland nut with the O-ring, backup ring, packing, nylon pellet, and wiper in place.

CAUTION

Exercise extreme care when installing seals, 0-rings,, and packing that they are not damaged or twisted.

   c. Tighten the gland nut until it is flush with the tube assembly.

2. To assemble a removable piston cylinder assembly (Fig 2-4), proceed as follows:
   a. Cover the rod threads at the piston end of the rod with thin shim stock and install the rod seal
   b. Install the piston seal and assemble the piston to the rod. Install the jam nut, and tighten to 50 lb-ft (68 N•m) of torque.
   c. Insert the rod and piston assembly

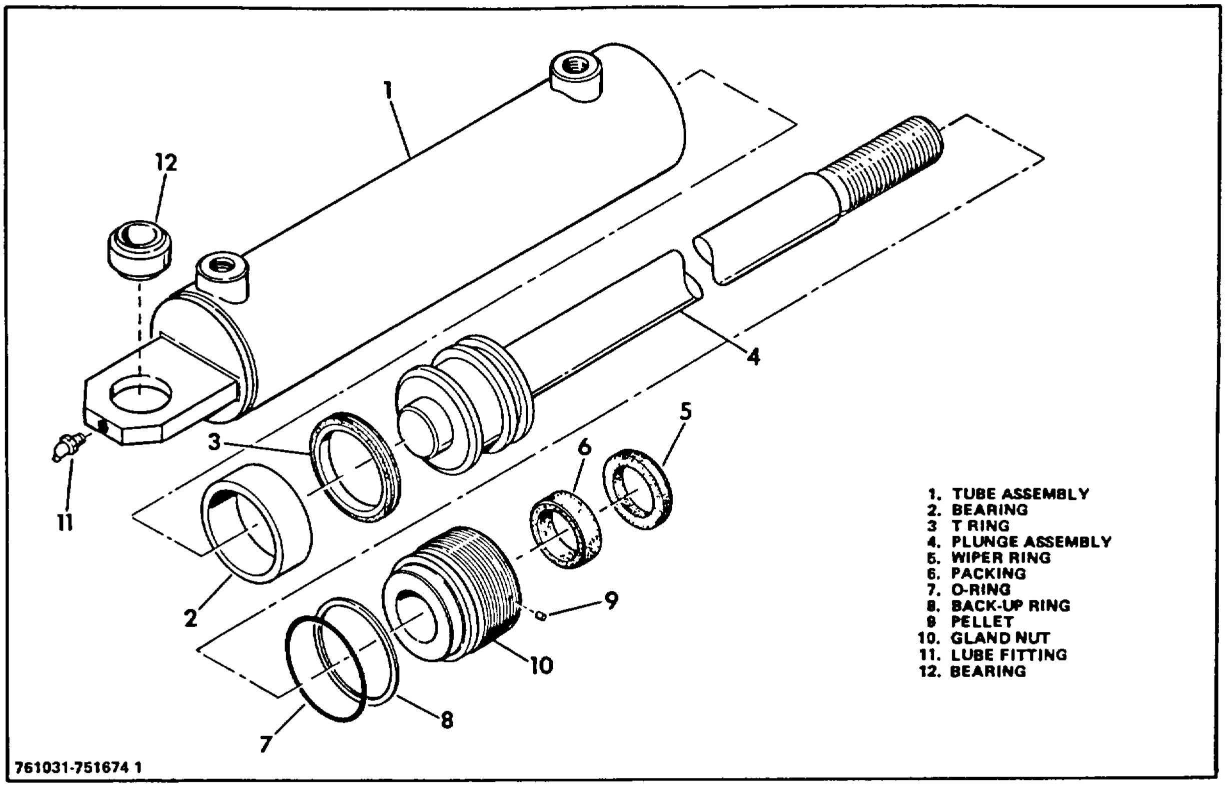

Figure 2-3. Power Steer Cylinder Assembly (Fixed Piston)

into the tube assembly.

d. Install the O-rings, backup washer, and wiper on the head.

> ⚠ **CAUTION**
> **Exercise extreme care when installing seals, O-rings, and packing that they are not twisted or damaged.**

e. Cover the rod threads with thin shim stock to protect the seals and install the head in the tube assembly. Secure the head with the inner retaining ring, spacer, and outer retaining ring.

3. Install the spacer on the rod, turning it the same number of turns as was required for removal.
4. Install the jam nuts on the rod.
5. Install the socket unit on the rod, turning it the same number of turns was required for removal.
6. Tighten the jam nuts to 150-170 lb-ft (203-230 N•m) of torque.

E. SOCKET UNIT

1. Remove the adjusting plug, ball seat, spring and safety plug. Inspect for excessive wear or damage. Replace worn parts as necessary (Fig 2-5).
2. Install the safety plug, spring, ball seat and adjusting plug.

F. CYLINDER AND LINKAGE INSTALLATION

1. Position the cylinder anchor end at the truck anchor point. Install the anchor pin and washer. Secure the anchor pin with the cotter pin (Fig 2-1, 2-2).
2. Position the socket unit on the pivot arm ball stud. Tighten the adjusting plug until the socket unit is secure. Install the cotter pin.
3. Remove the caps and plugs from the cylinder parts and the hose fittings. Install the hoses to their proper port and tighten the fittings securely.
4. Install the left wheel bearings and wheel and tire assembly as outlined in the POWER STEERING MAINTENANCE MANUAL, TOPIC 1, paragraph D, step 2-b.

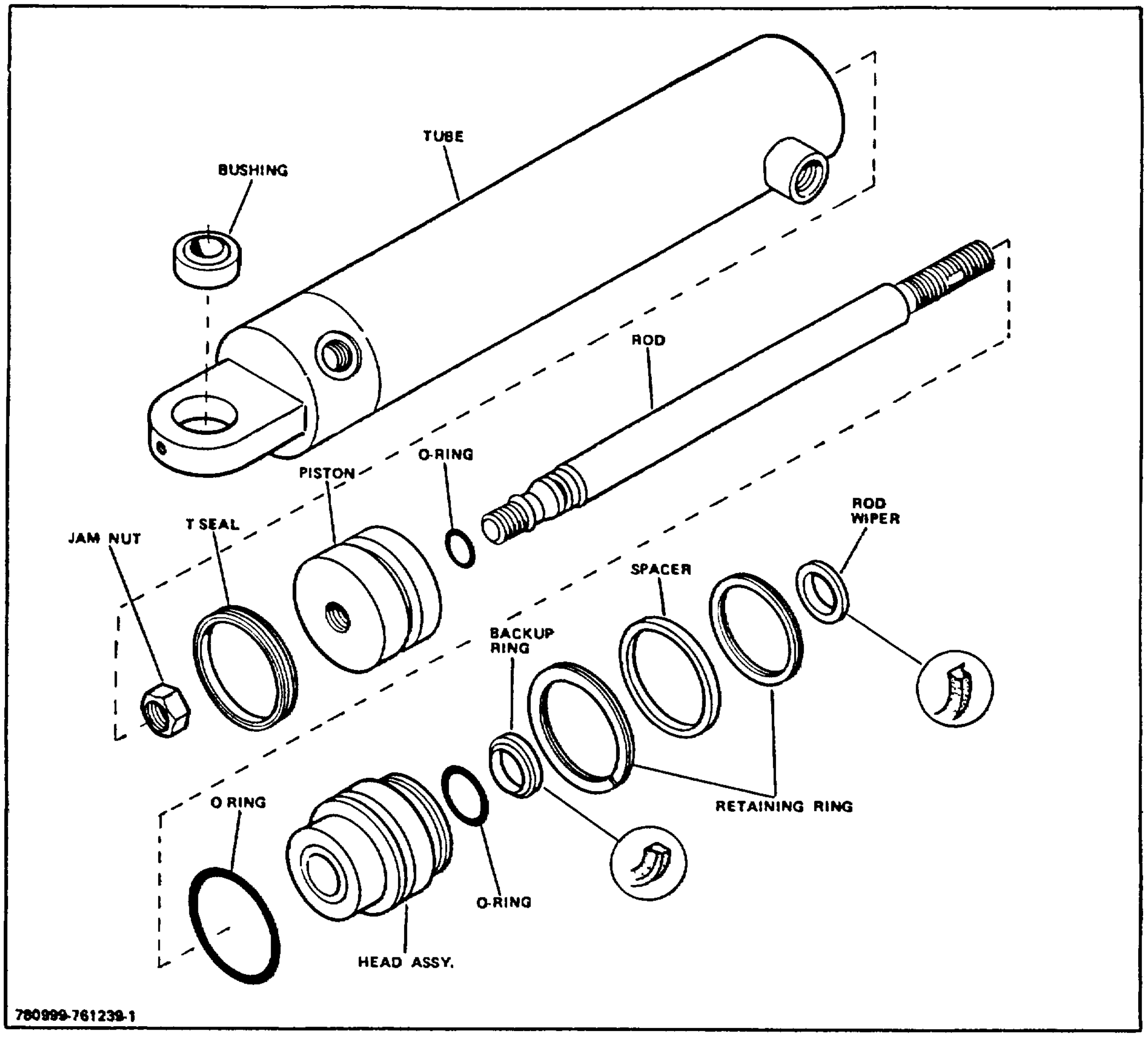

Figure 2-4. Power Steer Cylinder Assembly (Removable Piston)

5. Raise the rear of the truck with an adequate hoist or jack until the truck is off the service jacks.
6. Remove the service jacks and lower the truck to the floor.
7. Remove the jack or hoist. Operate the steering system to make sure the hose connections were made properly.

G. ADJUSTMENT

Refer to the POWER STEERING MAINTENANCE MANUAL, TOPICS 2 and 3 for complete adjustment procedures.

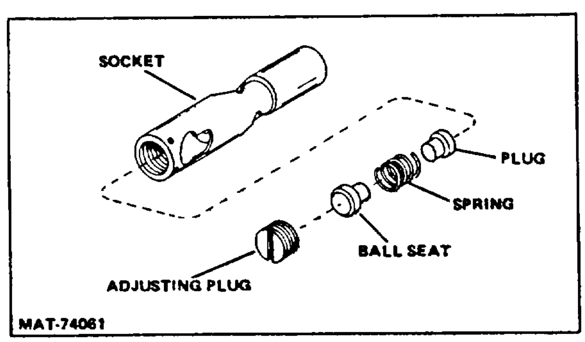

Figure 2-5. Socket Unit

TOPIC 3. POWER STEER UNIT

A. TROUBLESHOOTING

Troubleshooting procedures for the truck power steer system are divided into two sections; the truck steering system, and the power steer control unit. It is advised that the more obvious problems in the steering system be checked first, before the control unit is repaired or replaced.

1. STEERING SYSTEM

TROUBLE	PROBABLE CAUSE	REMEDY
Hard steering	Low oil.	Fill hydraulic oil reservoir to proper level.
	Hydraulic pump worn.	Repair or replace pump.
	Faulty priority valve (in hydraulic pump).	Repair or replace priority valve.
	Line leakage.	Inspect and replace lines. Tighten loose fittings.
	Bent linkage.	Replace bent parts.
	Improper wheel alignment.	Align wheels.
	Lack of lubrication.	Lubricate steering system.
	Leakage in steer cylinder.	Repair or replace steer cylinder.
	Low oil pressure.	Contaminants in relief valve. Remove and clean the valve.
	Faulty bearings on steer axle.	Replace steer axle bearings.
	Air in system.	Tighten fittings; system is self-bleeding.
Loose steering.	Wheels out of alignment.	Align wheels.
	Loose linkage.	Tighten or replace linkage.
	Worn king pins.	Replace king pins.
	Wheel bearings loose or worn.	Adjust or replace bearings.
	Air in system.	Tighten fittings; system is self-bleeding.

TROUBLE	PROBABLE CAUSE	REMEDY
Low hydraulic oil pressure.	Worn hydraulic pump.	Repair or replace pump.
	Faulty priority valve (in hydraulic pump).	Repair or replace priority valve.
	External leakage.	Tighten or replace fittings, hoses, or seals.
	Internal leakage.	Replace seals in cylinders.
	Contaminants in relief valves.	Remove and clean valve.

2. POWER STEERING CONTROL UNIT

TROUBLE	PROBABLE CAUSE	REMEDY
No response when steering wheel is turned	Dirt in system.	Drain, flush, and refill with specified oil.
	Oil level is low.	Fill reservoir to proper level.
	Faulty priority valve (in hydraulic pump).	Repair or replace priority valve.
	Relief valve stuck open.	Repair or replace relief valve.
	Hydraulic pump failure.	Repair or replace pump.
	Clogged hose or line.	Inspect and clear or replace hose or line.
	Broken column shaft.	Replace column shaft.
	Sleeve and spool locked.	Repair or replace control unit.
	Broken centering springs.	Repair or replace control unit.
Slow steering.	Dirt in system.	Drain, flush, and refill with specified oil.
	Sleeve or spool worn.	Repair or replace control unit.
	Worn orbit gear.	Repair or replace control unit.
Wrong response to steering wheel.	Lines connected to wrong ports.	Connect lines to proper ports.
	Orbit gear misaligned.	Repair or replace control unit.

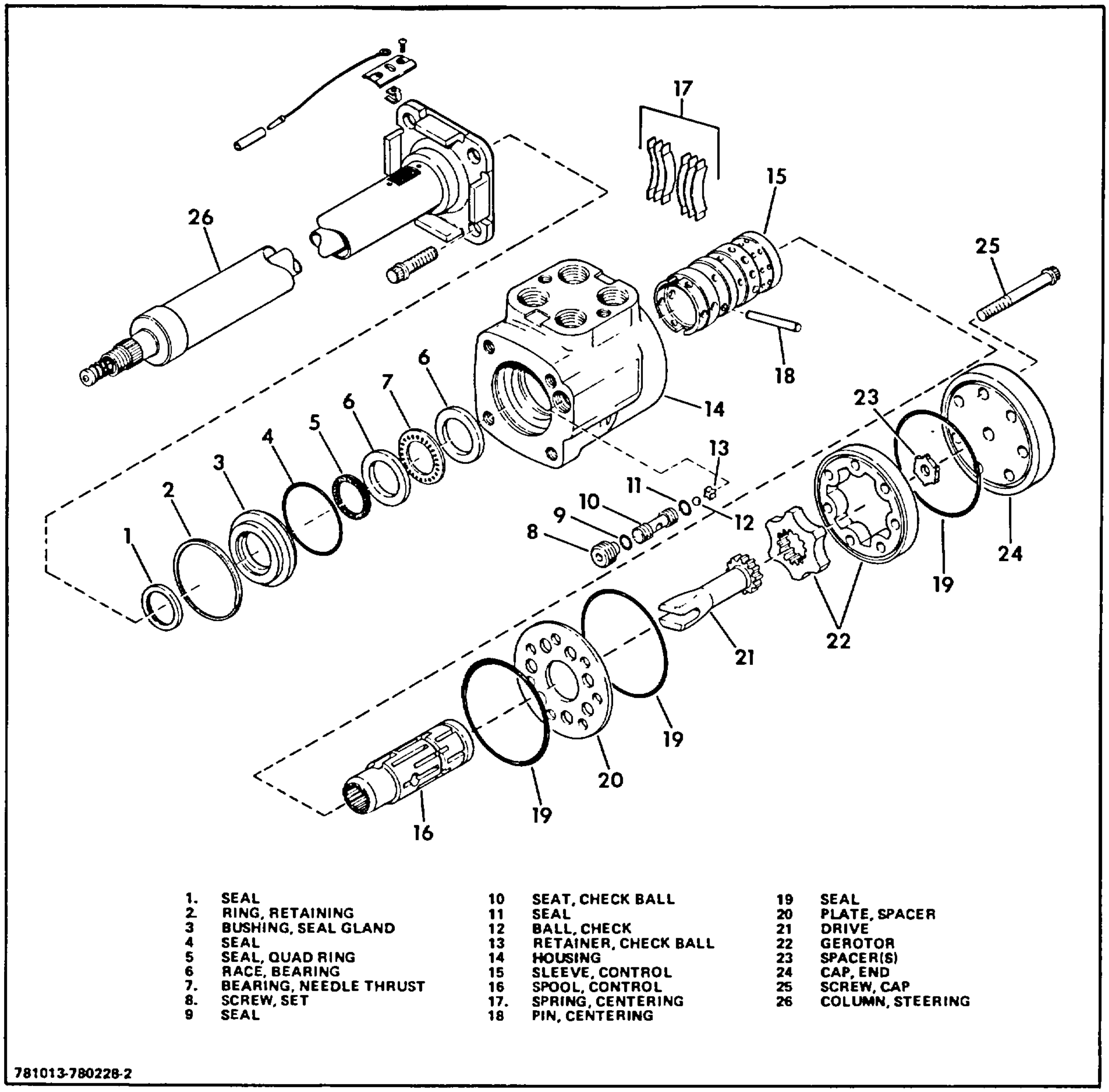

Figure 3-1. Power Steer Control Assembly

B. DISASSEMBLY

1. Remove the steering column and power steer control unit from the truck as outlined in the POWER STEERING MAINTENANCE MANUAL, TOPIC 4, paragraph B.

2. Remove the 12-point capscrews securing the steering column to the control unit. Remove the steering column (Fig 3-1).

NOTE: Mark the capscrew holes so that the ports will be located in the proper direction when the control unit and steering column are assembled.

3. Install the power steer control unit in a vise, splined input end down. Remove the 12-point capscrews.

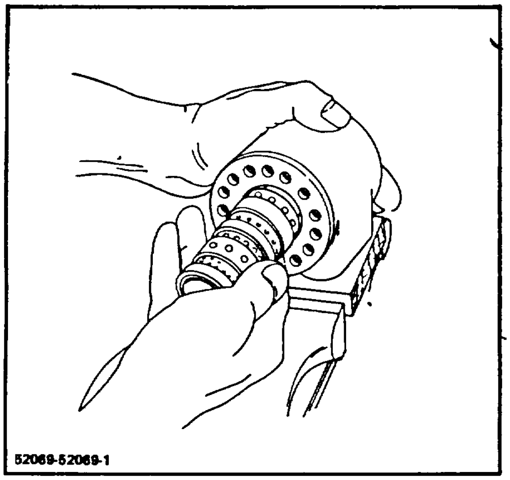

Figure 3-2. Removing Spool-Sleeve Assembly

4. Remove the three-section meter end assembly (Items 19 through 24, Fig 3-1) as a unit.

5. Place a clean wooden block across the vise throat to support the spool and sleeve assembly. Secure the control unit in the vise with the splined input end up.

6. Remove the retaining ring (2) and the seal gland bushing (3).

7. Remove the control unit from the vise and place the port face of the housing on a flat surface. Remove the spool and sleeve assembly from the housing (Fig 3-2).

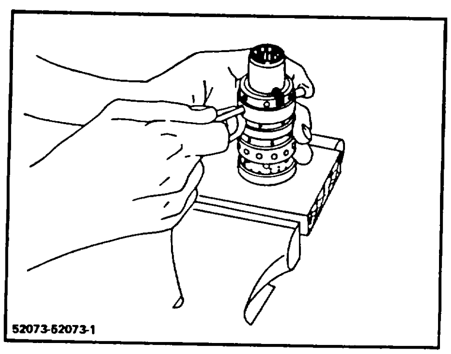

Figure 3-3. Loosening Spool Assembly

CAUTION
Use extreme care when removing the spool sleeve assembly. The components are closely fitted and must be rotated slightly as they are separated.

8. Remove the needle bearing (7) and the races (6) from the control spool.

9. Hold the spool-sleeve assembly and push the centering pin (18) from the assembly (Fig 3-3).

10. Push the inside lower edge of the spool so that the spool moves towards the splined end (Fig 3-4). Carefully remove the spool from the sleeve.

11. Remove the centering spring set from the spool.

12. Remove the check valve set screw (8). Bend a slight hook in the end of a length of wire and insert it through the check ball seat (10). Hook and remove the check ball seat. Remove the check ball (12) and check ball retainer (13).

C. INSPECTION

1. Carefully clean each part with a suitable solvent and allow to air dry. The parts should be set to dry on clean paper towels.

2. Inspect the surfaces of all moving parts for scoring or other damage. Slightly scored parts can be refinished by hand rubbing with 600-grit abrasive paper. Smooth burnished areas are normal. Do not attempt to refinish these areas, or mistake them for excessive wear.

3. Replace any parts found to be defective or badly worn.

NOTE: All seals must be replaced when the control unit is reassembled.

4. Place a sheet of 600-grit abrasive paper on a piece of plate glass, or a similar smooth flat surface.
5. Clean the ends of the meter section star gear by stroking it across the abrasive paper. This will also remove any excessively sharp grit which would scratch other meter section components.
6. Lightly clean both sides of the gerotor (22), the spacer plate (20), the 14 hole end of the unit housing, and the

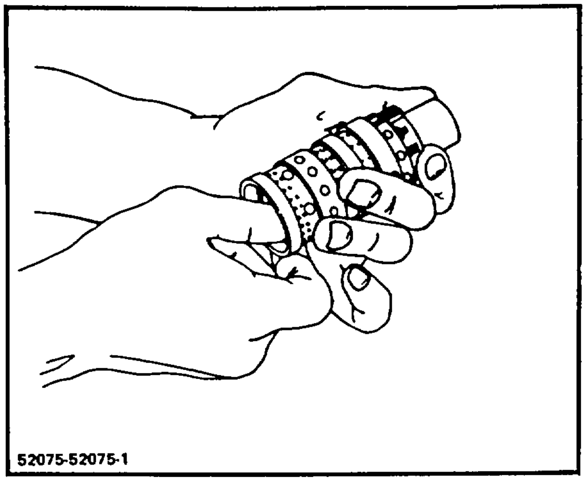

Figure 3-4. Removing Spool From Sleeve

end cap.

NOTE: Stroke each surface across the abrasive several times and inspect the parts. Any small bright areas indicate a burr which must be removed.

7. Clean all polished parts with a suitable solvent and dry with compressed air.

D. ASSEMBLY

1. Lubricate all parts with clean hydraulic oil

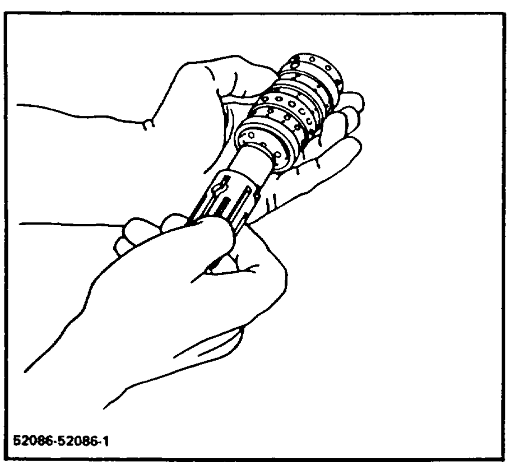

Figure 3-5. Spool Installation

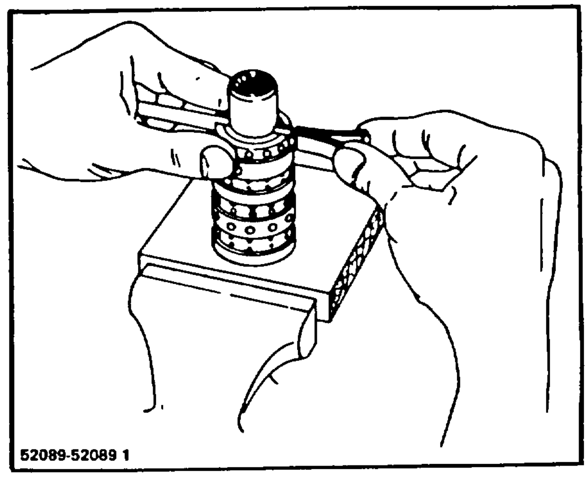

Figure 3-6. Installation Centering Spring Set

2. Carefully install the spool in the sleeve (Fig 3-5). Be sure that the spring slots of both parts are at the same end. Rotate the spool while sliding the parts together.

CAUTION

The spool must rotate freely in the sleeve with finger tip force applied at the splined end.

3. With the spring slots of the spool and sleeve in line, stand the parts on end (Fig 3-6) and insert the spring installation tool (Char-Lynn P/N 600057) through the slots in both parts.

NOTE: The spring installation tool may be obtained from:

Char-Lynn
15151 Highway 5
Eden Prairie, Minnesota 55343

4. Position 3 pairs of centering springs (or 2 sets of 3 each) on the bench so that the extended edge is down and the arched center section is together. Position one end of the entire spring set into the spring installation tool.

5. Compress the extended end of the centering spring set and push it into the spool-sleeve assembly, withdrawing the installation tool at the same time.

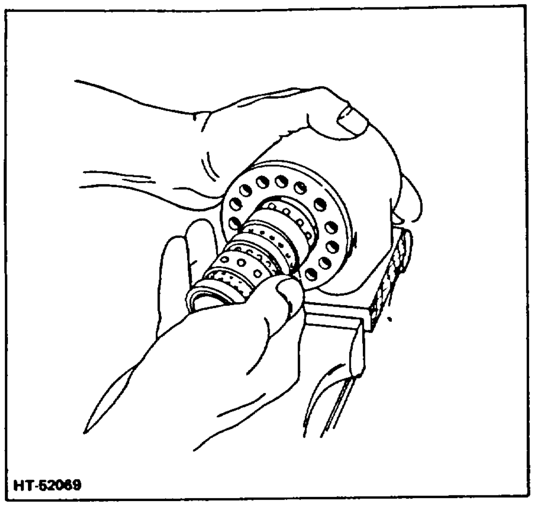

Figure 3-7. Installing Spool Assembly

NOTE: Be certain that the spring set is centered in the spool-sleeve assembly.

6. Install the cross pin through the spool-sleeve assembly. Push the cross pin in until it is flush or slightly below the sleeve surface at both ends.

7. Place the housing on a solid surface with the port face down. Install the spool-sleeve assembly with the splined end of the spool entering the 14-hole end of the housing first (Fig 3-7). Push the spool-sleeve assembly into the housing with a rotating motion.

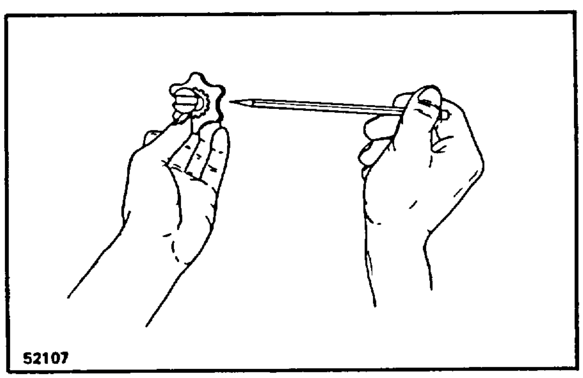

Figure 3-8. Alignment of Drive Slot

CAUTION
Exercise extreme care when installing the spool-sleeve assembly so that the parts do not cock out of position.

NOTE: The spool-sleeve assembly should be installed in the housing bore until it is flush with the end of the housing. Do not install the spool-sleeve assembly beyond this point as the cross pin may drop into the discharge groove in the housing.

8. Check the spool-sleeve assembly for free rotation with finger-tip force applied at the splined end.
9. Hold the parts in this position and place the 14-hole end of the housing on a wooden block placed in the vise throat. Clamp the housing lightly across the port face.
10. Install the rear bearing race (Item 6, Fig 3-1), the needle bearing (7), and the front race (6).
11. Install new seals (5, 4, 1) on the seal gland bushing (3). Install the seal gland bushing over the end of the spool.
12. Install the retaining ring (2) in the control unit housing.
13. Reposition the housing in the vise with the 14-hole end of the housing up. Be certain that the spool-sleeve assembly is flush or slightly below the surface of the housing.

NOTE: Wipe the upper surface of the housing clean with the palm of your hand or with your thumb. Clean each part of the flat surfaces in the same way as they are assembled.

14. Install the seal (19) in the housing and position the spacer plate (20) so that the bolt holes in the plate are aligned with the tapped holes in the housing.

15. Install the seal (19) on the gerotor (22) and position the gerotor so that the bolt holes are aligned with the tapped holes in the housing.

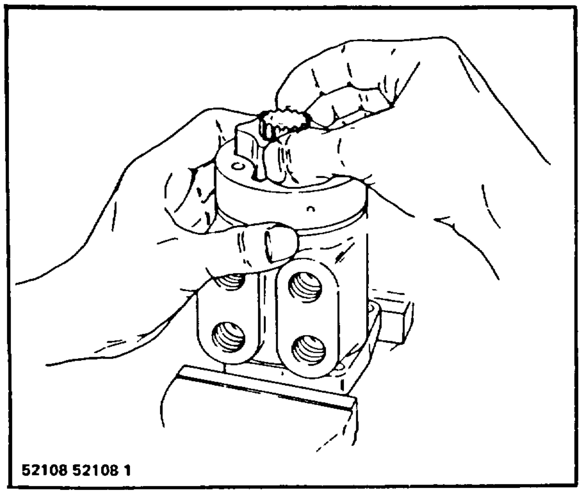

Figure 3-9. Installing Meter Gear Star

16. Install the splined end of the drive (21) into the meter gear star so that the slot at the control end of the drive is aligned with the valleys between the meter gear teeth (Fig 3-8).

CAUTION

Alignment of the cross slot in the drive with the valleys between the teeth of the meter gear star determines the proper valve timing of the unit. There are 12 teeth on the spline end of the drive and 6 on the star. Alignment will be correct in 6 positions and wrong in 6 positions. Should the drive slip from the meter gear star during reassembly of the control unit, properly reposition the drive.

17. Hold the spacer plate and gerotor in position on the housing while the drive and meter gear star assembly are being installed.

18. Note the direction of the cross pin in the spool-sleeve assembly and install the cross slot end of the drive to mesh with the cross pin (Fig 3-9).

19. Place the spacer (23) in position at the end of the meter gear star. If the spacer does not fit flush with the gear surface, the drive has not properly engaged the cross pin in the spool-sleeve assembly. Realign the drive if necessary.

20. After the drive and spacer are properly installed, place the seal (19) in the end cap (24) and position the end cap, with the boltholes aligned, on the control unit. Install 2 capscrews, finger tight, to maintain alignment.

21. Install the remaining 12-point capscrews and tighten all capscrews gradually and evenly to 150 lb-in (68 N-m) of torque.

22. Install the check valve as follows:

    a. Install the check ball retainer (13) and the check ball (12).
    b. Install new seals (11, 9) on the check ball seat (10) and install the check ball seat.
    c. Install the check valve set screw (8) and tighten to 100 lb-in (11 N•m) of torque. The face of the set screw should be flush with, or below, the surface of the housing face.

23. Install the steering column by rotating the shaft to engage the splines in the control unit while bringing the surfaces into contact.

24. Rotate the steering column until the capscrew marks are aligned. Install the capscrews and tighten to 280 lb-in (32 N•m) of torque.

25. Install the steering column and power steer control unit in the truck as out-lined in the POWER STEERING MAINTENANCE MANUAL, TOPIC 4, paragraph C.

E. POWER STEERING PRESSURE ADJUSTMENT

Refer to the appropriate hydraulic pump in the HYDRAULIC SYSTEM REPAIR MANUAL.

MEMO

TOPIC 3. STEER WHEEL.

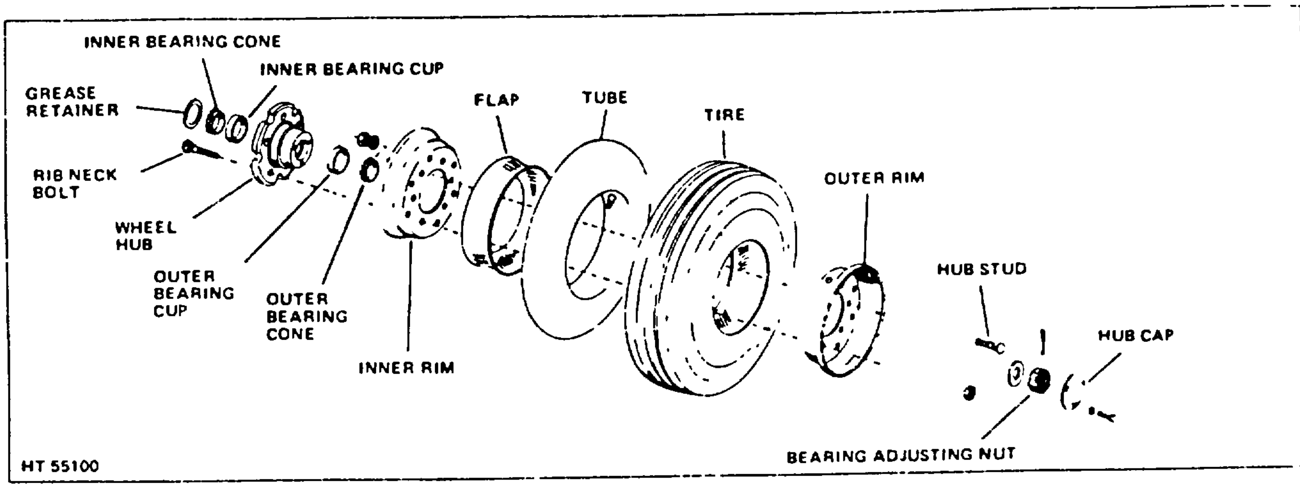

Figure 12. Steer Wheel Assembly (Pneumatic Fire)

A. REMOVAL (PNEUMATIC TIRE)

1. Ensure drive wheels are securely blocked and set parking brake to prevent truck from rolling.

2. Remove the nuts and lockwashers attaching the rims to the bolts in the wheel hub. (See Figure 12.)

3. Pull the tire and rim assembly from the hub.

B. SERVICE - TIRE AND TUBE REPAIR

If a tire is excessively worn or badly damaged, replace it as follows:

> **CAUTION: Ensure tube has been completely deflated prior to separating rims.**

1. Completely deflate the tube assembly. Remove valve core from tube.

2. To remove the steer wheel tire, tube and flap, remove the (6) six bolts, nuts and lockwashers (inside the inner rim) and separate the inner and outer rims. (See Figure 12.)

> **CAUTION: A safety tire rack, cage or equivalent protection should be provided and used when Inflating, mounting, or dismounting tires installed on split rims, or rims equipped with locking rings or similar devices.**

3. Replace or repair the detective tire, tube or flap and reassemble In reverse order of removal by placing tube in tire, then inserting flap, place inner and outer rims in tire and secure nuts, bolts and lockwashers.

4. insert valve core and inflate tube to specified pressure.

For good performance and long life, the correct Lire pressure must always be maintained in pneumatic tires. Under-inflation will cause damage to tire cords and may allow the tires to slip on the rims, tearing out the inner tube v valve stem. Over-inflation will result in excessive slippage, causing rapid tread wear. (See Figure 13.)

Air pressure should be checked every day with an accurate tire gauge having one pound graduations. Do not allow tire pressures to drop below the recommended rating Always be sure that the valve stem caps are in place and turned tight by hand.

Never use pliers to tighten valve stem, caps. The caps prevent loss of air by keeping out any water or dirt which could otherwise enter the valve core and cause damage.

C. TIRE PRESSURE

Maximum recommended pressures for pneumatic tires are as follows:

5.00 x 8" x 6 ply .... 80 psi
6.00 x 9" x 10 ply. .... 100 psi
6.50 x 10" x 10 ply .... 100 psi
7.50 x 10" x 10 ply .... 85 psi
7.50 x 10" x 12 ply .... 100 psi
7.00 x 12" x 6 ply .... 95 psi
7.00 x 12" x 12 ply .... 100 psi
7.00 x 15" x 6 ply .... 70 psi
7.00 x 15" x 12 ply .... 100 psi
7.50 x 15" x 10 ply .... 95 psi
8.25 x 15" x 12 ply .... 100 psi

D. INSTALLATION (PNEUMATIC TIRE)

1. Install tire and rim assembly on hub.

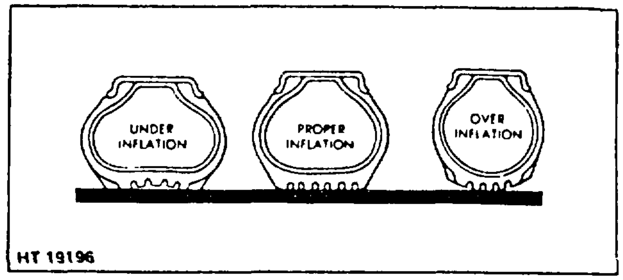

Figure 13. Tire Inflation

2. Secure tire and rim assembly with nuts and lockwashers.

3. Remove blocks, lower truck and release handbrake.

MEMO

TOPIC 1. HYDRAULIC PUMP

A. DESCRIPTION

The hydraulic pump is a gear type unit, driven directly from the engine. With this type of installation, the pump Is always driven at engine speed.

The hydraulic pump consists of a housing, a combination end plate and mounting flange, gears, seals, bushings and capscrews. The housing also contains bores for the priority flow control valve, and the priority flow relief valve.

The relief valve pressure setting can be adjusted by turning the setscrew, located in the end of relief assembly, in or out. Turning the setscrew IN increases the spring pressure on the cone to increase the relief pressure setting, while turning the setscrew OUT will decrease the relief pressure.

When the hydraulic pump must be removed for replacement or repair, the following procedure is recommended:

B. REMOVAL

1. Remove radiator grille and components necessary to gain access to hydraulic pump.

NOTE On truck applications %here the hydraulic oil reservoir is below the supply line connection at the pump, it will not be necessary to drain the reservoir. Check reservoir to see If oil level is above or below the pump. If it is above the pump, oil will flow out of the supply (suction) line, when It is removed from the pump.

2. Disconnect hoses from fittings on hydraulic pump, and cap hoses to prevent contamination.

3. Remove capscrews and lockwashers attaching pump bracket to the engine and remove pump assembly.

4. Place the hydraulic pump assembly in a suitable work area for service.

C. DISASSEMBLY

1. Thoroughly clean outside of pump.

2. Remove capscrews which attach mounting flange to pump body. Remove flange.

3. Remove all accessible "0" rings and backup rings.

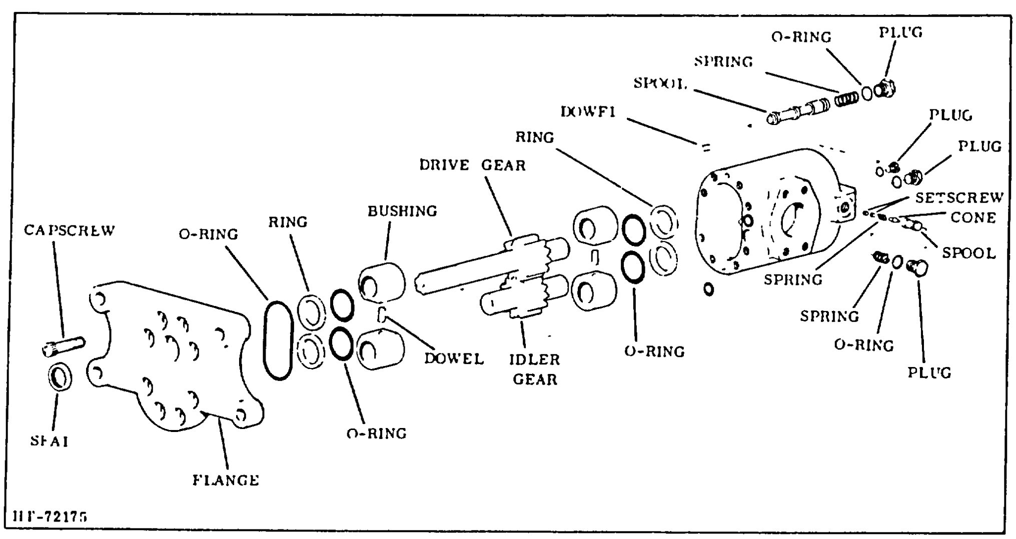

Figure 3. Hydraulic Pump

4. Turn pump over, holding one band over the front bushings stick, tap and let them slide out, if bushings stick, tap body on a piece of wood to prevent marring mating surfaces. Place bushings on clean rag to prevent damaging surfaces.

NOTE: If the front bushings are excessively tight and difficult to remove, it indicates operations with duty oil.

5. Set pump body face-up and remove drive shaft and idler shaft.
6. Invert pump body and allow rear set of bushings to slide out. See Step 4.
7. Remove the relief port plug and remove the relief valve components, laying them out in their order of removal.
8. Remove plug from rear of body and take out steering spool and spring.
9. Wash parts in solvent, blow dry with compressed air and inspect for damage.

D. Inspection

1. Check bushing bores near the front of the housing, using a 2'' inside micrometer. If bores measure over 1.770, discard the pump body. This indicates pump has been subjected to excessive pressures, and the system should be checked to determine the cause.
2. Measure depth of grooves cut by the gears. If deeper than .005'', it results in reduced flow of hydraulic oil. The gear track should be darker color than the rest of the body. If it has a sandpaper like texture, and a light gray or silvery color (when dry), it indicates pump has been running on dirty or foamy oil. Flush hydraulic system before installing clean oil, and if pump body is to be refused, bone thoroughly, use fine sandpaper to remove any burrs left inside the bores.
3. Inspect the shaft seals in the end plate, and if they can be reused. Place a straightedge across the machined surface that faces the pump body. If the flange is bowed, do not reuse.

NOTE: Bowing of flange is caused by excessive pressures, and the cause should be determined before reinstalling the pump.

Looking at the plate from the pump side measure the top left and lower right mounting holes. If the holes are lager than .441 diameter, replace the flange. This indicates pump has been running with mounting boas loose. If flange is to be reused, bone same as body face.

4. Handle pump gears carefully when inspecting to prevent burring the teeth with resultant damage to be bushings. If the length of the gear is less than 1.320 or if gear O.D is less than 1.754, the gear must be replaced. Check gear teeth ends and remove any burrs with small, time hone. If journal surfaces are blackened and can be scratched with a penknife, they have lost their case hardening ands must be replaced
5. When inspecting the bushings, they must be handled very carefully to prevent damage, as this makes them difficult to assemble and reduces their sealing effectiveness. The bore of the bushing, which will be worn slightly oval, must not measure under 1.055. Minor cuts or scratches can be removed by honing in a circular motion with an extra fine stone. Be sure sharp edge between face of bushing and the O.D. is not broken. Erosion on the face of the bushing near the rectangular land and in the lube oil slot indicates dirt in the system.
6. Wash valve spool and dry with compressed air. It should slide freely in and out of its bore in the body. Check diameter of all lands and replace spool if any are less than .748. Check the balance and flow orifices and clear with a fine wire, if plugged.
7. Check valve spool spring to see that it is not bent or deformed. Replace if length is less than 3-1/2''
8. Inspect the relief valve plunger for wear and erosion and replace, if damaged.
9. If relief valve spring is bent or deformed, replace it.. Replace if length is less than 0.80

E. REASSEMBLY

Before reassembling pump, lay out all parts in a sequence in which they were removed and make sure all parts are perfectly clean.

1. Place pump face up and install the two body dowels, tapping them in place with a plastic hammer. Coat body bores with oil.

2. Place the bushing ''O'' rings and the back-up rings on the shoulder at the rear bushings, Hold in place with grease, if necessary. Place the bushing dowel in the holes.

in the flat side of the bushings and holding the bushings together, carefully align them and slide them, "O" ring side down, into the bores. Coat faces and bores of the bushings with light oil,

CAUTION: Do not tap or force bushings into bores. They should slide to the bottom by hand force.

Be sure bushings bottom in housing and that back-up rings do not fall off.

3. Turn pump body so priority valve bore is to the left, then place drive gear (long shaft) in top bore and idler gear (short shaft) in lower bore. Coat journals and gear faces lightly with oil.

4. Place bushing dowel between the two front bushings. Hold bushings together, and insert face down into the pump bores.

CAUTION: Do not force bushings in. They will slide in smoothly if properly aligned.

Place the bushing "O" ring and then the back-up rings on the bushing shoulders.

5. Place the two drain "O" rings in the two small recesses in the face of the body on the inlet side of the pump and place the body "O" ring in its recess around the bushings.

6. Place the priority valve spring in the valve spool, coat the spool with oil, and install it (spring end last) into the valve bore.

7. Install plug in spool bore.

8. To replace seals in the end plate, first press in the oil seal with the lip pointed in, then press in the air seal with the lip pointed out. Install the end plate on the pump, taking care not to damage the seals on the shaft. Before sliding end plate all the way down, check to see that all "O" rings and back-up rings are still In place.

9. Tighten capscrews firmly. Turn shaft of pump to see If it has some drag, but can still be turned by hand.

10. Install the relief valve components in the same position from which they were removed in the relief valve bore. Tighten plug until it bottoms.

F. INSTALLATION

NOTE: If the splines of the original coupling are worn, replace coupling.

1. Install the pump and the mounting bracket onto the front of the engine. Reconnect the hydraulic lines to the hydraulic pump.

2. Check the hydraulic oil reservoir to be sure the oil level is correct. Run pump for one minute at no load, idle speed, to allow the system to fill. Check for any pressure or air leaks in the system at this time. After one minute of running, shut engine off and recheck oil level in reservoir. If low, fill to proper level as indicated by Full mark on oil level dipstick.

NOTE: If severe foaming is observed, it indicates a suction leak or Improper oil, and must be corrected.

3. Set the main hydraulic relief pressure (adjustable valve located in control valve assembly) to 1950 $\pm$ 50 p.s.i.

4. Install a pressure gauge (2000 p.s.i.) in the pressure side of the steering circuit. With the hydraulic pump operating at full speed, turn the steer wheels to their limit. The opening pressure should be set at 1100 p.s.i. by adjusting the pump relief valve setscrew IN or OUT.

5. Always start the hydraulic pump under no load conditions to prolong pump life. Refer to SPECIFICATIONS of LUBRICANTS for proper oil to use.

6. Install the radiator grille and components which were removed to gain access to the pump.

TOPIC 7. CONTROL VALVE

A. REMOVAL

The following procedure is recommended for proper control valve removal:

1. Make sure lift is collapsed and that mast is tilted all the way forward.
2. Disconnect control lever linkage if necessary to gain access for control valve removal. (On some new model trucks, the handles, linkage, and mounting bracket can all be removed along with the control valve.)
3. Disconnect and cap all hydraulic lines.

> **NOTE: Properly tag all lines so that they will be reconnected to their proper ports.**

4. Remove the mounting capscrews and control valve.
5. Clean outside of valve with a solvent and dry with compressed air.
6. Remove all fittings and place control valve in a suitable work area.

B. DISASSEMBLY

1. Before disassembling, it is suggested that each valve section be cleaned and marked numerically to avoid incorrect reassembly (Refer to Figure 8).

2. Remove the three tie rod nuts from the right end section using a 9/16" thin wall socket.
3. Remove the valve sections by sliding them from the tie rods.

> **NOTE: If valve sections are to be added or removed, use the proper length tie rod. Refer to the parts manual for your truck to obtain the correct rod part number. Use assembly nuts with all tie rods. A total of six tie rod nuts are required. Use no lockwashers.**

4. Clean 0 Ring counter bores, and ground surfaces of each section thoroughly.

C. INSPECTION

1. Clean each metal part in a suitable solvent and dry thoroughly. Inspect housings for physical damage, such as cracks, etc. Carefully inspect plunger bores for scores, cracks, and other damage. Plunger bores can be reconditioned with a fine hone.
2 Examine each section's mating surfaces. Surfaces must he free of burrs and pits. Should mating surfaces require resurfacing, remove burrs or pits by lapping sections with fine lapping compound. Reclean and dry all Parts before assembly.
3. Replace all damaged or excessively worn parts. Install new seals contained in repair kit when control valve is completely disassembled.
4. Before assembling control valve parts, lubricate each part with clean hydraulic oil.

D. ASSEMBLY

1. Replace O Rings in each valve section.
2. Replace valve sections on tie rods in the same order in which they were removed. All O Ring counter bores should be to the left, when facing the "A" port end of the valve. Use care in replacing valve sections to avoid dislodging O Rings from counterbores.
3. When all valve sections are positioned on the tie rods, replace rod nuts and tighten evenly to 20 lb ft torque. If rod nuts are not torqued properly, valve spools may bind and stick, or valve section seals may extrude.

E. REPLACING SPOOL SEALS

1. Remove the bonnet assembly parts from the back of the valve, and keep parts in the order of disassembly.
2. Remove all parts connected to the spool on the front of the valve, including the complete handle bracket assembly.

> **NOTE: Do not remove the spool as the seals can be replaced externally. Prevent spool from moving or turning by inserting a screwdriver through the clevis slot, or running a rod through the pin hole, and using it as a handle. Do not hold the spool with a wrench as this will destroy the finish.**

3. Remove the retainer plate, retainer plate washer, back-up washer, and spool seal. Clean counterbores thoroughly.
4. Oil new seals lightly. Slide over valve spool and Insert in counterbore.

spool and assemble the levers, fulcrum rod and "E" washers.

F. INSTALLATION

1. Ensure that all fittings have been replaced and properly tightened.
2. Place control valve assembly in its relative mounting location and insert the attaching capscrews.
3. Uncap and connect the hydraulic lines as marked.
4. Reconnect the lever linkages if disconnected.
5. After complete reassembly has been assured, run the hydraulic system (i.e., operate the control, lift control, tilt control and any auxiliary functions associated with the hydraulics) for about 5 minutes to eliminate any air present in system. The internal construction of the hydraulic reservoir will "bleed-off" any trapped air in the hydraulic oil as it flows through the reservoir. Recheck the hydraulic oil level (reservoir) after operating the hydraulic system and refill, if necessary.

G. ADJUSTMENT

1. Linkage

   Improperly adjusted or out of adjustment linkage can result in binding or bending of the control valve linkage.

   Ensure that tilt and lift control levers and associated linkage travels freely and smoothly forward and backward movement of each lever and that the control valve plungers respond accordingly. Adjust, bend, repair or replace as necessary.

   Be certain that pivot points or other mating surfaces are free of accumulated sludge and remain lightly lubricated to function smoothly.

2. Relief Valve Adjustment Whenever the control valve or hydraulic pump has been repaired or replaced, check the relief valve and adjust to open at specified pressure. Check and adjust the relief valve (Fig 7) located in the lift section of the control valve as follows:

a. Gain access to the control valve; actual location varies between truck models.
b. Some adapters have a plug in them where a pressure gauge can be installed. If unit is not equipped with this type adapter, disconnect the hydraulic tube at the inlet part of the control valve.
c. Install a tee fitting on the end of the hydraulic tube and connect the tee fitting to the adapter in the inlet port
d. Install a pressure gauge with a 0 to 3000 psi range in the tee.
e. Place shift lever in neutral position, turn key switch ON and start engine.
f. Pull the tilt lever back to retract the lift cylinders and hold lever in this position.
g. While holding lever, observe the needle on the pressure gauge. When pressure reading of 1950 psi is attained, the needle will stop, Indicating relief valve opening.
h. If the relief valve opens below or above 1950 $\pm$ 50 psi, it must be adjusted as follows:

(1) Turn key switch OFF.
(2) When pressure gauge reads zero, remove relief valve plug.
(3) Check relief valve assembly and valve spring for damage. Replace defective parts.
(4) Install valve assembly with spring, 0 Ring, and plug.
(5) Repeat Steps e through g.

i. Turn key switch OFF.

j. Remove pressure gauge and tee; then install hydraulic tube to control valve fitting.

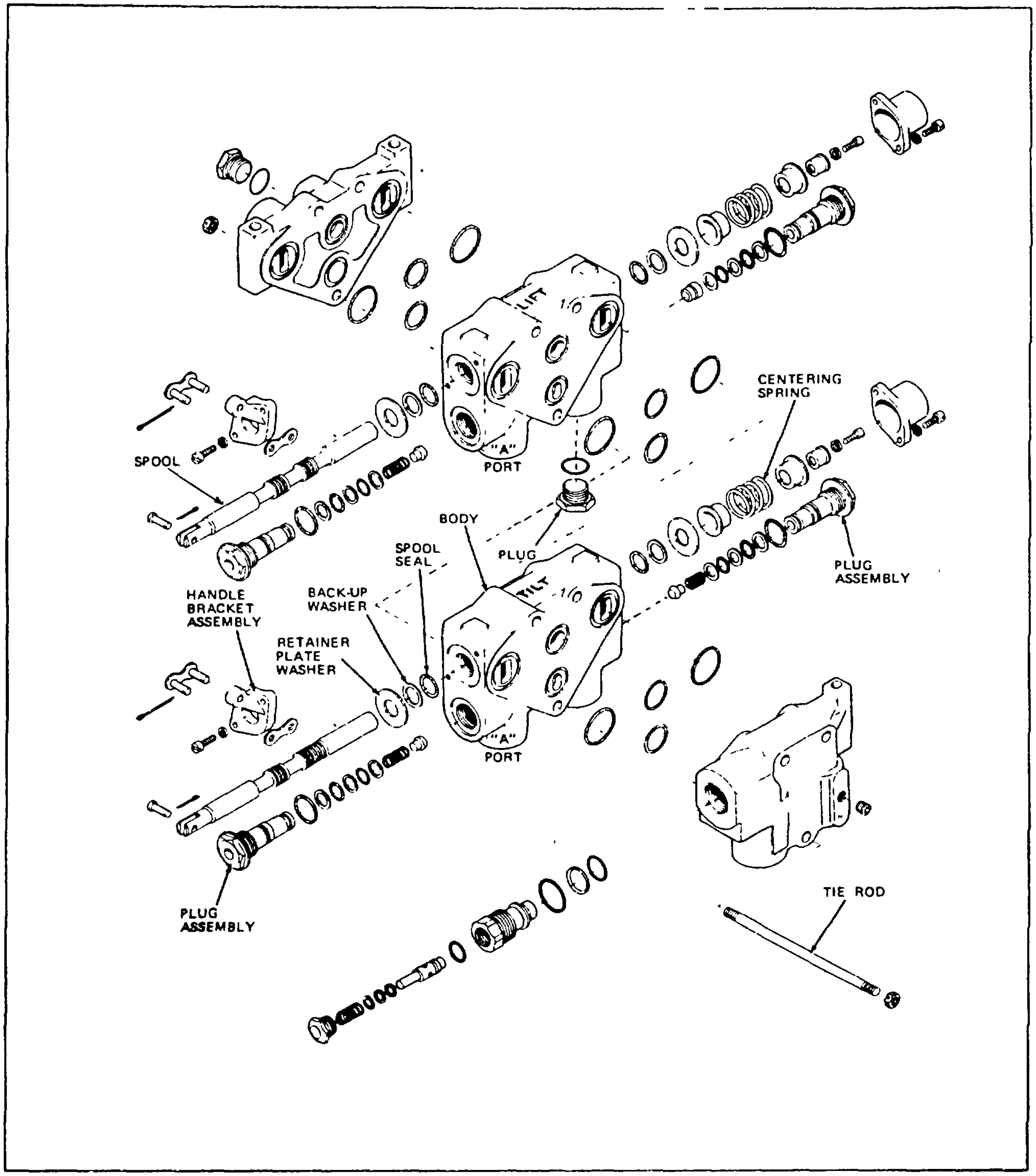

Figure 8. Control Valve

5. Reassemble and replace all parts connected to the spool on the front of the valve.
6. Replace the bonnet assembly parts on the back of the valve.

F. INSTALLATION

1. Ensure that all fittings have been replaced and properly tightened.
2. Place control valve assembly in its relative mounting location and insert the attaching capscrews.
3. Uncap and connect the hydraulic lines as marked.

4. Reconnect the lever linkages if disconnected.

5. After complete reassembly has been assured, run the hydraulic system (i.e., operate the lift control, tilt control and any auxiliary functions associated with the hydraulics) for about 5 minutes to eliminate any air present in system. The internal construction of the hydraulic reservoir will "bleed-off" any trapped air in the hydraulic oil as it flows through the reservoir. Recheck the hydraulic oil level (reservoir) after operating the hydraulic system and refill, if necessary.

G. ADJUSTMENT

1. Linkage

Improperly adjusted or out of adjustment linkage can result in binding or bending of the control valve linkage.

Ensure that tilt and lift control levers and associated linkage travels freely and smoothly through forward and backward movement of each lever and that the control valve plungers respond accordingly. Adjust, bend, repair or replace as is necessary. Be certain that pivot points or other mating surfaces are free of accumulated sludge and remain lightly lubricated to function smoothly.

2 Relief Valve Adjustment

Whenever the control valve or hydraulic pump has been repaired or replaced, check the relief valve and adjust to open at specified pressure. Check and adjust the relief valve (Fig 9) located' in the inlet section of the control valve as follows:

a. Gain access to the control valve; actual location varies between truck models.

b. Install a pressure gauge with a 0 to 3000 psi range in the pressure gauge port of the inlet section.

c. Place shift lever in neutral position, turn key switch ON and start engine.

d. Pull the tilt lever back to retract the tilt cylinders and hold lever in this position.

e. While holding lever, observe the needle on the pressure gauge. When pressure reading of 1950 psi is attained, the needle will stop, indicating relief Salve opening.

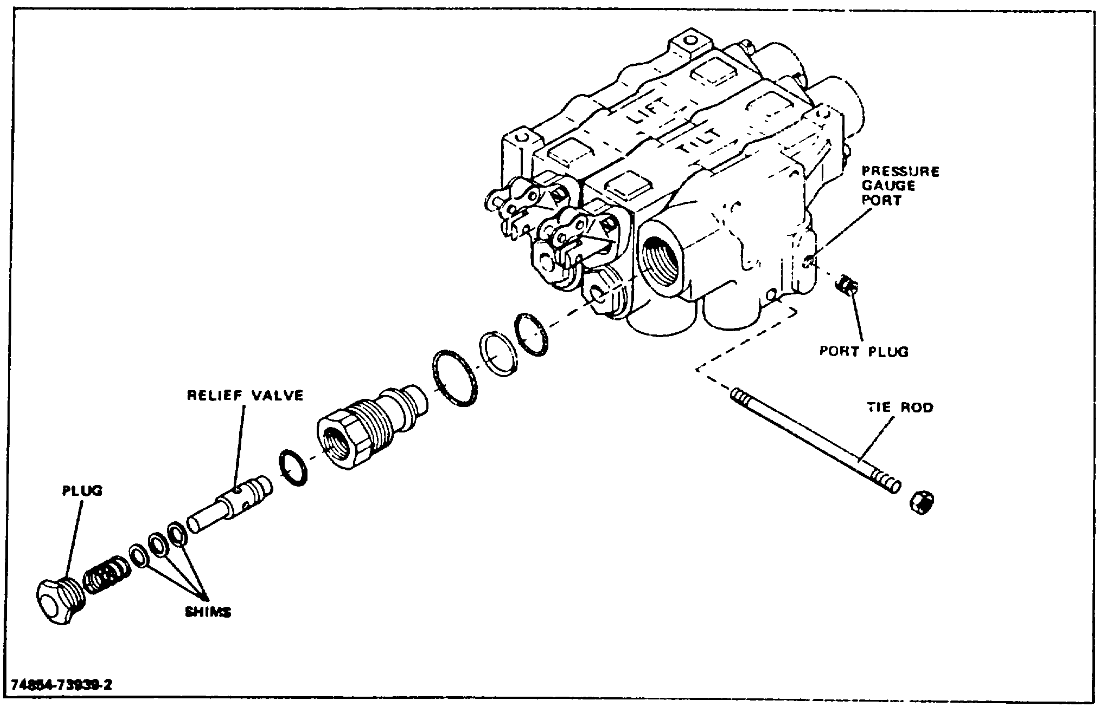

Figure 9. Relief Valve

MEMO

TOPIC 4. TILT CYLINDER

A. DESCRIPTION

The action of the tilt cylinder is a straight line motion. Any misalignment between the cylinder and the piston will cause binding, rapid wear of packing and the packing gland, rapid wear of piston rod and packing, and will tend to break the weld on the cylinder case.

The welded section is designed to hold hydraulic pressure and should not be called upon to sustain any bending action due to misalignment.

To remove the tilt cylinder for replacement or repair, the following procedure is recommended:

B. REMOVAL

The tilt cylinders are mounted under the toe plate and floor plate. To remove tilt cylinders the following procedure is recommended:

1. Set hand brake. Operate tilt cylinder lever and put mast in forward position. Turn ignition switch to OFF position. Secure mast In position with a chain hoist.

2. Remove cotter pin and yoke pin.

> **CAUTION: Protect tilt cylinder rod from truck frame and handling mishaps.**

3. Remove toe plate and floor plate.

4. Disconnect hydraulic lines at tilt cylinder.

5. Remove capscrew and pin retainer (Figure 6).

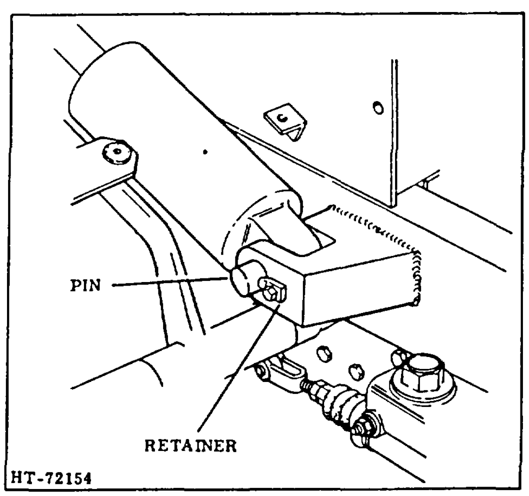

Figure 6. Tilt Cylinder Anchor Pin

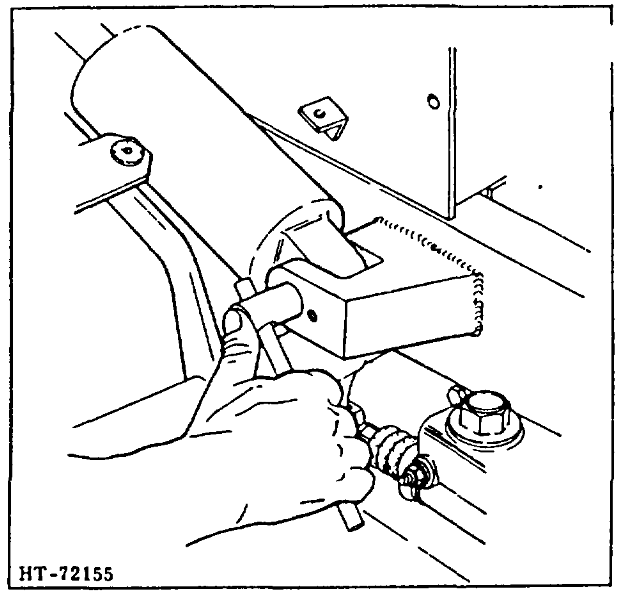

Figure 7. Tilt Cylinder Pin Removal

6. Insert drift pin (Figure 7) in hole provided for it in tilt cylinder mounting pin, and remove pin. The tilt cylinder may then be lifted from location.

C. TILT CYLINDER DISASSEMBLY

1. With tilt cylinder firmly secured In bench vise, loosen capscrew on yoke and remove yoke from plunger rod. Record number of turns required to remove yoke.

2. Remove packing gland and pry out packing and wiper. Also remove "0" ring, back-up ring, and nylon pellets.

3. When replacing "O" ring, and back-up ring, lubricate with hydraulic oil and do not over-stretch when sliding over edge of packing gland.

4. When replacing plunger packing seal, remove items in Steps 1 and 2 in this paragraph, and then withdraw complete piston and plunger assembly from cylinder tube.

5. Remove spacers from plunger rod. An "O" ring Is installed in the end spacer only.

> **CAUTION: Do not attempt to remove piston from plunger rod. They do not separate.**

6. Remove bearing and packing from piston.

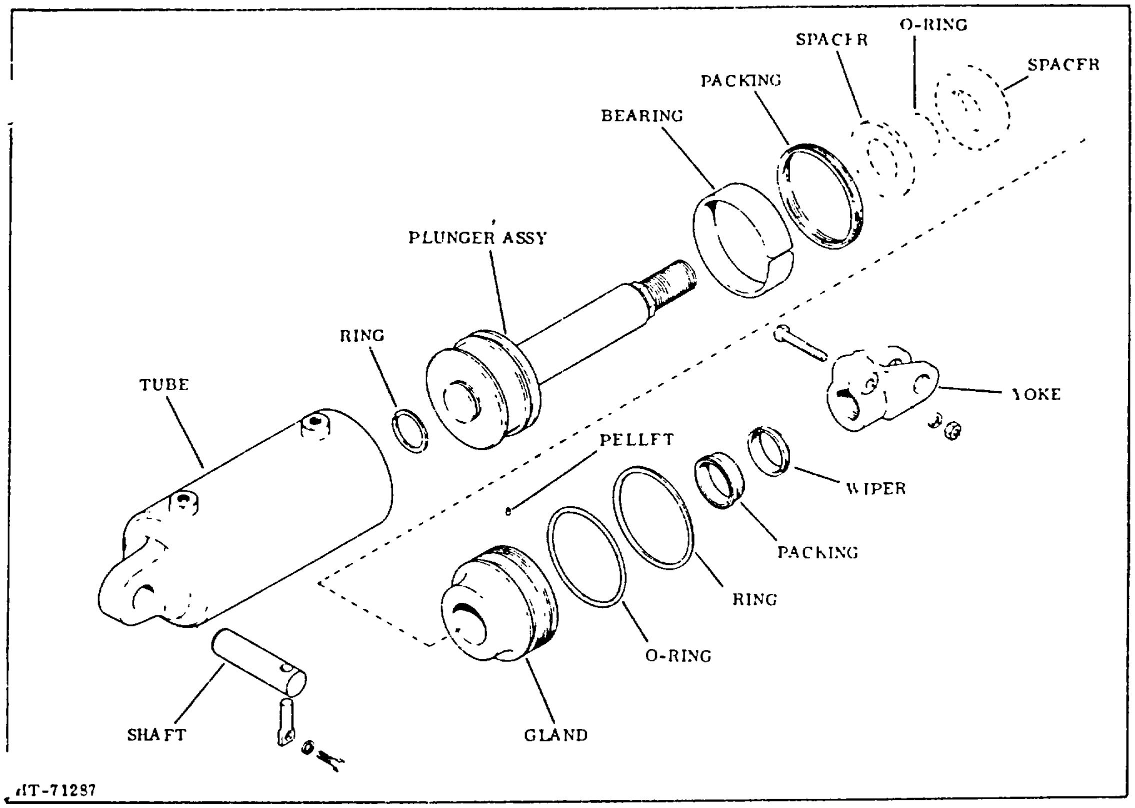

Figure 8. Tilt Cylinder Components

7. Thoroughly check cylinder bore for score marks or nicks. These cause damage to piston packing cups.

D. TILT CYLINDER REPAIR

1. When packing starts to wear, renew it, otherwise parts of the packing will contaminate the oil and work into the pump or valve, thus causing damage, or malfunction.

2. Do not disassemble the unit any more than is required to replace the fault packing.

3. Use only approved packing. Never make substitutions.

4. Before installing, inspect for nicks, cuts or flaws. Do not install If any of these faults are present.

5. All metal surfaces on which packing slides should be very smooth. If surfaces are scored or nicked, replace the parts or resurface them.

6. Soak packing in hydraulic oil before installing.

7. Sharp tools or instruments should not be used when installing packing.

8. When installing seal rings do not stretch them more than absolutely necessary.

9. Fit packing evenly and snugly without using undue force.

10. When packing must be installed over threads or sharp edges, use shim stock to protect packing.

    a. "O" rings should be pushed over sharp edges with care. They can be easily cut.
    b. Usually no adjustment is required upon installation, make certain that "O" rings are not twisted.
    c. Check to see that the ring is of correct size to give a "squeeze" in the installed position.

11. Do everything possible to keep all hydraulic parts as clean as possible. Keep dirt and fine metal particles from packing and plungers. Such material can quickly damage packing and score plungers.

E. TILT CYLINDER REASSEMBLY

Reverse disassembly procedure when installing new parts.

1. Install new packing and bearing on piston.

2. Install spacers on plunger rod. Be sure that outer spacer has an "O" ring in groove.

3. Install piston and plunger assembly in cylinder tube.

4. Install new nylon pellets, "O" ring, back-up ring, packing and wiper on packing gland.

5. Install packing gland on plunger assembly and cylinder tube. Gland must be flush with outer edge of cylinder tube.

6. Install yoke on plunger rod same number of turns as when removed. Tighten capscrew on yoke.

F. INSTALLATION

1. Place the tilt cylinder in the mounting bracket lining up holes and insert mounting pin.

2. Install pin retainer and capscrew.

3. Install hydraulic lines, making sure connections are tight. Check for leakage before installing toe and floor plate.

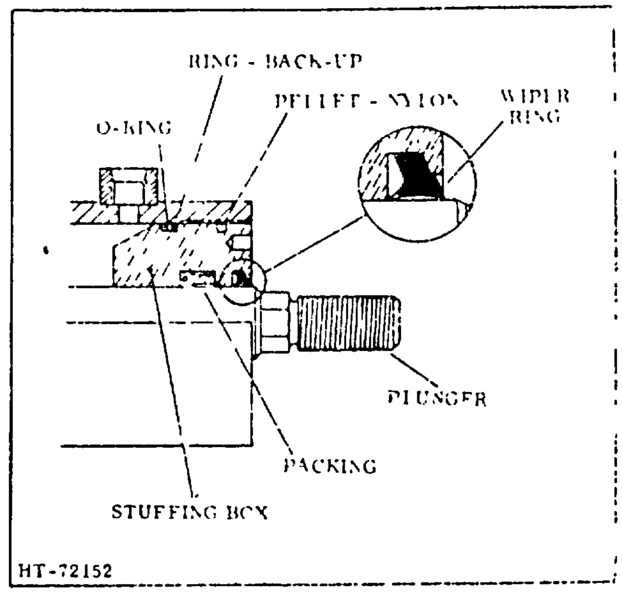

Figure 9. Tilt Cylinder Assembly

4. Install yoke pin at back of mast. install cotter pin.

5. Check tilt cylinders to make sure they bottom simultaneously.

TOPIC 1. MAST - CANTED BEARING TYPE

A. DESCRIPTION

The TRI-MAX mast is a three section (upright) mast assembly. Three upright structural assemblies, nested together, comprise the unit; an outer mast, intermediate mast, and an inner mast. Each upright consists of a structural steel frame, with mounting blocks and brackets welded to it to support the cylinders, chains, and bearings. The intermediate and inner masts

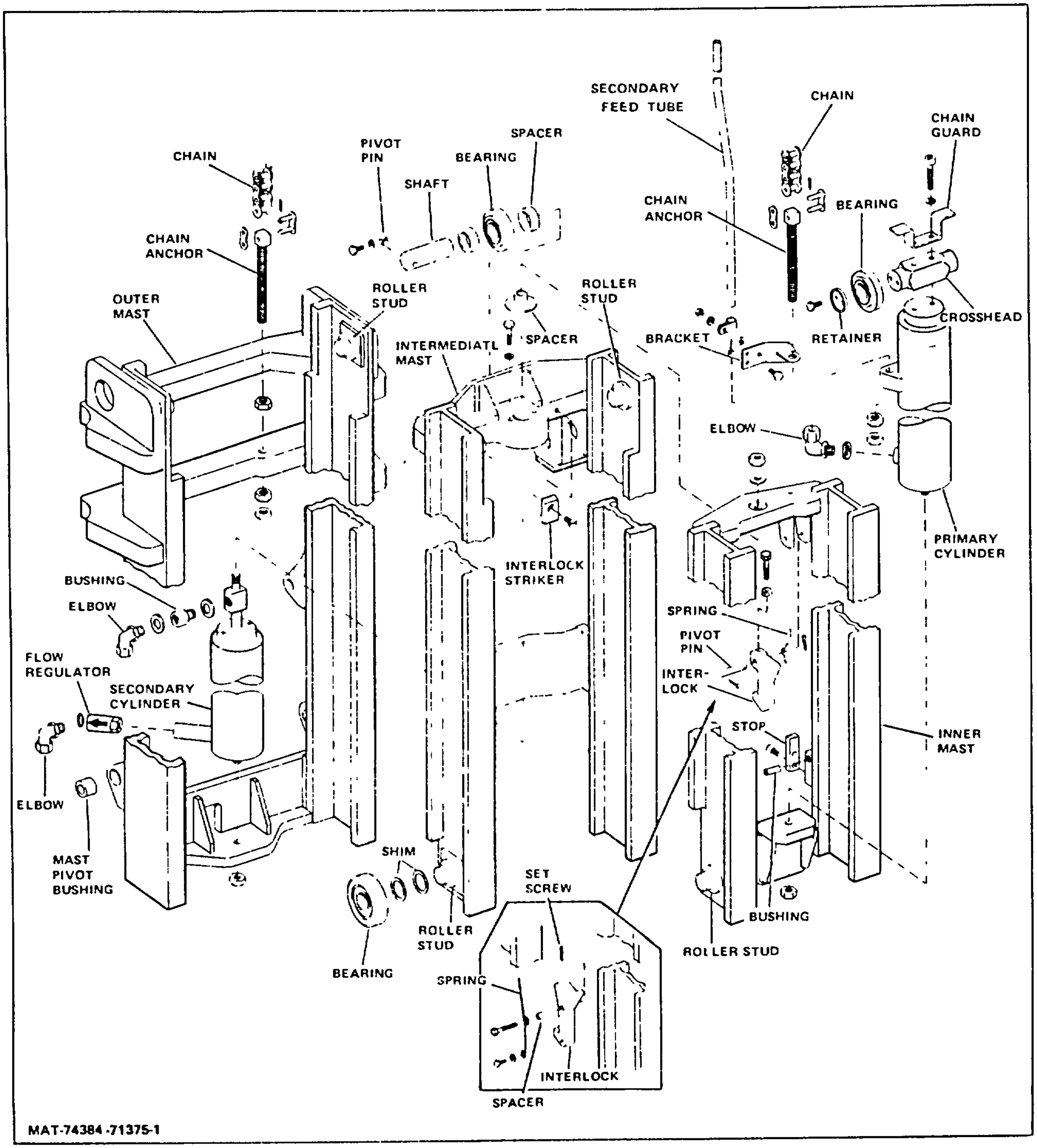

Figure 3. Mast (60-70-80 Series)

ride on adjustable roller bearings enabling them to telescope up and down smoothly, and with a minimum of friction or drag. Alignment of the mast channels is accomplished by adjusting the roller bearings.

B. REMOVAL

CAUTION: Fully retract or lower lift cylinders.

1. Remove carriage (Refer to appropriate Topic in CARRIAGE REPAIR MODULE.
2. With mast fully lowered, attach a sling from an overhead hoist to the mast lift eyes to secure entire mast assembly during removal.

CAUTION: Be certain overhead hoist is rated to safely support entire mast assembly weight.

3. Disconnect tilt cylinder from outer mast.
4. Disconnect hydraulic hoses from lift cylinders.

NOTE: Cap or plug all hydraulic openings to prevent contamination by foreign particles.

5. (PIVOT PIN TYPE) Remove lockwires, capscrews, and lockwashers (Figure 2) which retain mast pivot pins to mast assembly. Raise overhead hoist high enough to relieve pressure on the pivot pins and remove pins. Use hoist to lay mast on suitable supports.

D. DISASSEMBLY (6,000 to 12,000 lb.)

1. Remove the nut and washer which secure the secondary cylinder feeder tube to the top of the inner mast.

2. Remove primary cylinder (refer to TOPIC 3, LIFT CYLINDERS).

3. Remove the inner mast stops, and interlock assembly from the inner mast. Remove interlock striker from intermediate mast. Disconnect chains at inner mast and outer mast chain anchors. Carefully slide inner mast out of top of intermediate mast.

4. Remove flow regulator and fittings from secondary cylinder.

5. Remove secondary cylinder (refer to TOPIC 3, LIFT CYLINDERS).

6. Carefully slide intermediate mast, with chains, out of top of outer mast. Remove chains from mast.

7. Remove bearings and shims from studs on all three mast uprights.

E. INSPECTION

1. Clean all parts with an acceptable solvent.

2. Carefully inspect all parts for evidence of wear or damage, and replace any worn or badly damaged parts.

3. In the event of any bearing failure where the inner race has been fractured, check the respective roller stud for nicks. Small nicks may be removed with a fine grit emery cloth or a honing stone. Replace any stud that has been too severely damaged (refer to TOPIC 7, WELDING REPAIR PROCEDURE).

4. It is recommended that whenever a stud or bearing that is mounted with a capscrew is replaced, the capscrew must also be replaced and torqued to 245 lb. ft.

5. Repair cracks and minor breaks by welding if practicable.

F. ADJUSTMENT

1. Outer Mast Assembly. Use an adjustable inside spanning tool and check the rear inside of the outer mast upright to find narrowest distance between uprights (Figure 5). Lock tool in this position. Set an adjustable outside spanning tool to match inside spanning tool. Lock tool in this position (Figure 6).

2. Intermediate Mast Assembly. Install bearings on studs located at bottom of intermediate mast assembly. Use an outside spanning tool as set in Step 1 above and span bearings at maximum camber point where bearings contact outer mast uprights. Shim bearings, if required, to obtain maximum .015 inch clearance between bearings and outside spanning tool. Divide shims as equally as possible between bearings. Shims are available in 0.015 and 0.040 inch thicknesses.

NOTE: If odd shim is required, place odd shims on same side of all mast sections and carriage so mast will be in balance.

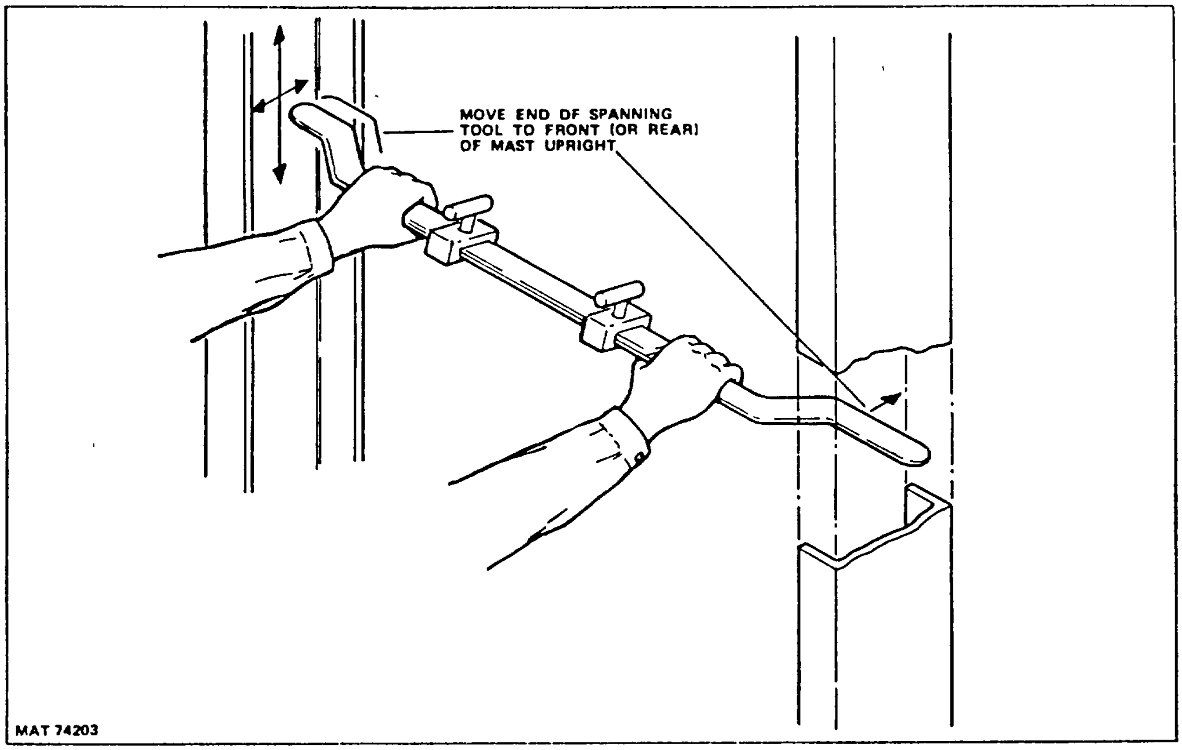

Figure 5. Spanning Outer Mast Uprights

3. Outer Mast Assembly Top Bearing. Use outside spanning tool and find widest point in outside width of web on intermediate mast assembly. Install bearings on studs at top inside of outer mast. Use inside spanning tool to span bearings at maximum camber point where bearings contact outer mast upright. Check clearance between outer and inner spanning tools. Measure clearance accurately and install shims to provide proper clearance. Install shims as equally as possible under both bearings to provide maximum .015 inch clearance.

4. Inner and Intermediate Mast Bearings. Perform Steps 2 and 3 to adjust upper bearings on inside of intermediate mast and lower bearings on inner mast.

NOTE: Add the same thickness of shims to each side so the mast uprights remain centered. Insert enough shims behind the upper and lower bearings to eliminate excessive side play; however, if too many shims are added, the mast uprights will bind.

5. After assembly raise and lower the mast and carriage several times to check for free movement throughout the entire range of travel.

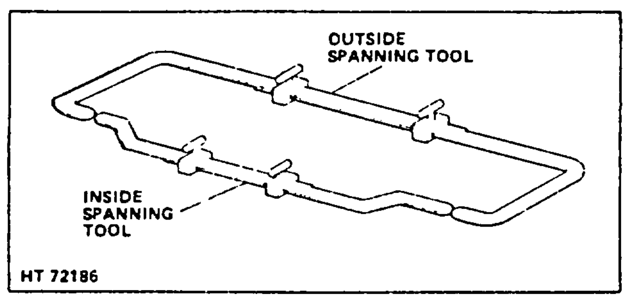

Figure 6. Setting Outside Spanning Tool

H. REASSEMBLY (6,000 - 12,000 lb.)

NOTE: Ensure that all roller bearings have been replaced and shimmed as necessary.

1. Carefully slide the intermediate mast into the outer mast.

2. Carefully install secondary cylinder (refer to TOPIC 3, LIFT CYLINDERS).

3. Carefully slide inner mast into top of intermediate mast. Install chains over chain rollers on intermediate mast and connect to chain anchors on outer and inner masts.

4. Refer to Figures 3, 4 (as applicable), and reinstall interlock assembly and stop to inner mast.

5. Install primary cylinder (refer to TOPIC 3. LIFT CYLINDERS).

6. Install secondary feeder tube, including clamp, washers and nut.

NOTE: Refer to following PARAGRAPH J, LIFT CHAIN ADJUSTMENT.

NOTE: Refer to following PARAGRAPH L, LUBRICATION, and lubricate mast uprights.

I. INSTALLATION

1. Using a properly rated hoist, maneuver mast assembly to its relative mounting position on front of lift truck.

2. (PIVOT PIN TYPE) Use a drift pin to align mounting holes on mast and lift truck frame. Insert pivot pins and reinstall retaining capscrews and lockwashers, then tighten securely. Reinstall lockwires.

3. (HOOK TYPE) Reinstall pivot caps and bearings, capscrews, and lockwashers. Tighten to 210-230 lb ft.

4. Connect and properly secure the tilt cylinders.

5. Reinstall hydraulic hoses (including flow regulator and fittings).

6. Reinstall carriage. (Refer to appropriate Topic in CARRIAGE REPAIR MODULE).

7. Lubricate all web surfaces at the mast uprights with specified lubricant.

8. Refer to following paragraph and adjust lift chains.

J. LIFT CHAIN ADJUSTMENT

When it becomes apparent that the carriage is not level, that the lift chains are loose, or the forks (or attachments) are higher than .25" to .50" off of ground, then the lift chains require adjustment.

1. Position mast assembly so it is vertical. Ensure that the inner mast and the lift cylinders are in the fully lowered position.

NOTE: All cluster cylinders are adjusted with the SINGLE cylinder in the fully extended position.

2. Loosen chain anchor locknuts (Figure 7).

3. Chain tension is adjusted by increasing or decreasing chain lengths with the adjusting nuts. Alternately tighten or loosen the chain on one side and then on the opposite side until the chains are snug with no slack, and carriage forks (or attachments) are no higher than .25" to .50" off of ground.

4. Make certain that the carriage chain tension is equal and that the carriage is level. Also ensure that secondary chain tension is equal. Adjust as to step 3 above.

5. After adjustment is completed tighten locknuts securely, and make certain anchors were not turned.

K. CHAIN LUBRICATION SERVICE

Approximately every 00 hours operation, remove the lift chains and clean them in an oil-solvent solution (50% SAE 30 non-detergent engine oil, and 50% suitable cleaning solvent). Soak chains in oil-solvent solution for about four (4) hours, agitating them several times during the soaking period. Remove chains from solution and wipe off all oil-solvent solution. Inspect chains for wear or broken or cracked links. Replace entire chain if any links are broken or cracked. Install the chains. Then use a 1" paint brush and lubricate both sides of chain with SAE-20 engine oil. Wipe off excess oil with a clean cloth. Refer to preceeding PARAGRAPH J, and adjust lift chains.

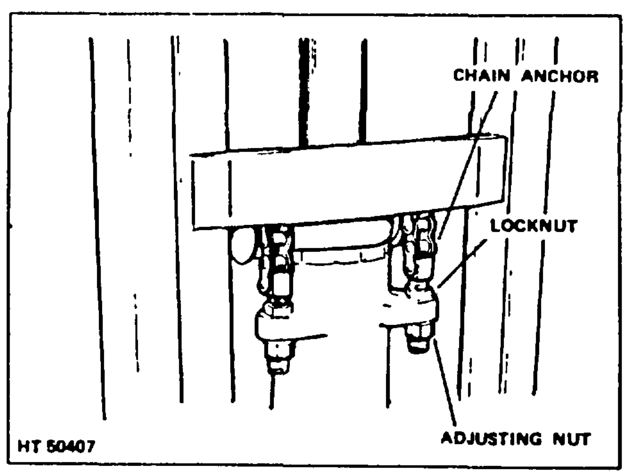

Figure 7. Chain Adjustment (on cylinder)

B. REMOVAL - PRIMARY/SECONDARY (6,000 - 14,000 lb.)

NOTE: Cylinders must be in fully collapsed position for removal.

1. Remove carriage (refer to appropriate Topic in CARRIAGE REPAIR MODULE).

2. Disconnect the lift chain anchors and chains from the primary cylinder. Remove the nut which secures the primary cylinder to the inner mast and carefully remove cylinder, with crosshead and bearings from the mast. Disconnect feed tube and fittings from top of secondary cylinder.

NOTE: Cap or plug all hydraulic openings to prevent entry of foreign particles.

3. Remove the capscrews and lockwashers that secure secondary cylinder to the inner mast top support.

4. Remove nut and washer that secure the secondary cylinder to the bottom of the outer mast.

5. Using an acceptable hoist carefully remove the secondary cylinder from the intermediate and the outer mast.

NOTE: Refer to the appropriate following topics to disassemble and repair the lift cylinders.

CAUTION: Prior to lift cylinder installation, make sure that all hoses and fittings are clean and there is no foreign matter in the cylinder- inlet port.

D. INSTALLATION (6,000 - 14,000 lb.)

CAUTION: Prior to lift cylinder installation, make sure that all hoses and fittings are clean and that there is no foreign matter in the cylinder inlet port. Always handle cylinders in fully retracted position to avoid scratching ram surface.

1. Using a properly rated hoist, carefully install the secondary cylinder within the intermediate and the outer masts; install nut and washer which secure cylinder to bottom of outer mast, and capscrew and washer at top of Intermediate mast.

2. Install flow regulator and fittings.

3. Using a properly rated hoist, install the primary lift cylinder, with crosshead and bearings within the inner mast. Install retaining nut at bottom of inner mast. Install lift chain anchors to primary cylinder and reconnect lift chains.

4. Reinstall hydraulic hoses. Connect secondary cylinder feeder tube at top of inner mast; replace clamp, nut, and washer previously removed.

NOTE: Refer to LIFT CHAIN ADJUSTMENT, TOPIC 1, prior to operational use of lift truck.

5. Reinstall carriage (refer to appropriate Topic in CARRIAGE REPAIR MODULE).

NOTE: Refer to LIFT CYLINDER BLEED SERVICE, PARAGRAPH C, this topic.

E. LIFT CYLINDER BLEED SERVICE

It is generally good practice to bleed lift cylinders after repair or when erratic cylinder operation is noticed. It is suggested to bleed the lift cylinders in the morning before a days use, after sitting all night. This allows small air bubbles to surface, and provides for better bleeding.

1. Raise mast until forks (or attachments) are approximately 3 ft. off of ground.

2. Open bleed screw(s) until a stream of pure hydraulic oil comes out.

NOTE: Be sure that the oil being emitted is free of any bubbles that may only be seen under close inspection. Leave bleed screw(s) open until a PURE stream of HYDRAULIC OIL is emitted.

3. Close bleed screw(s).

4. Check hydraulic oil level. Fill, if required, with specified oil.

5. Raise and lower mast to check for leaks, and repair as necessary.

TOPIC 5. LIFT CYLINDER - 60-70 80 SERIES

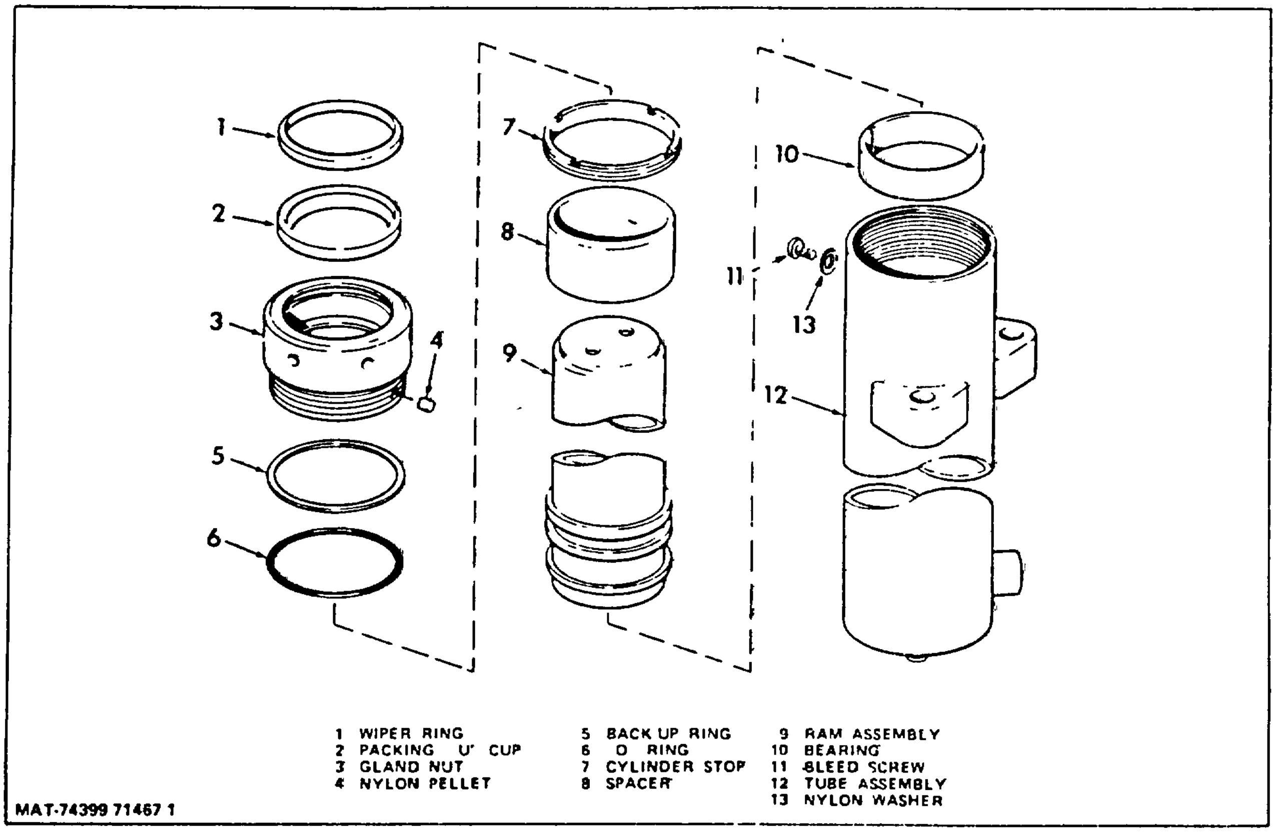

Figure 10. Primary Cylinder Exploded View

A. DISASSEMBLY/INSPECTION (PRIMARY CYLINDER)

1. Refer to TOPIC 3 and remove cylinder.

2. Using a spanner wrench remove gland nut.

3. Remove wiper ring, packing, pellets, "0" ring and back-up ring from gland nut.

4. Remove cylinder stop from tube assembly.

5. Remove ram from tube. Remove spacer and bearing from ram.

CAUTION: Always use care when handling the ram assembly so that it will not be nicked or damaged.

6. Clean all metal parts in an approved solvent. Inspect parts for wear or damage.

7. Carefully remove any nicks or scratches with crocus cloth or honing stone; replace all unserviceable parts.

8. Examine wipers and packing for scores, folded edges, or worn or torn sections.

NOTE: Always replace all packing sets, "0" rings, back-up rings, and wiper rings, regardless of their condition. Be certain tube is clean and free of foreign matter.

B. REASSEMBLY (PRIMARY CYLINDER)

1. Refer to Figure 10 and install packing and wiper ring to inside of gland nut. Install back-up ring, "0" ring, and nylon pellets to outside of gland nut. Set preassembled gland nut off to side.

2. Install bearing and spacer to ram. Ensure that ram and tube assembly are free of any foreign matter and insert ram into tube.

3. Install cylinder stop.

4. Install gland nut to tube and tighten securely.

5. Refer to TOPIC 3 and reinstall lift cylinder.

C. DISASSEMBLY/INSPECTION (SECONDARY CYLINDER)

1. Refer to TOPIC 3 and remove cylinder.

2. Remove the feed tube by pulling it from the cylinder; handle feed tube carefully, to ensure against nicking or scratching. Remove the gland nut (12) from cylinder tube with a spanner wrench and remove the "0" ring, backup ring, packing, wiper ring, and nylon pellets from the gland nut.

3. Remove the stop ring from cylinder tube. Remove ram assembly from cylinder tube.

CAUTION: Always use care when handling the ram assembly so it will not be nicked or damaged.

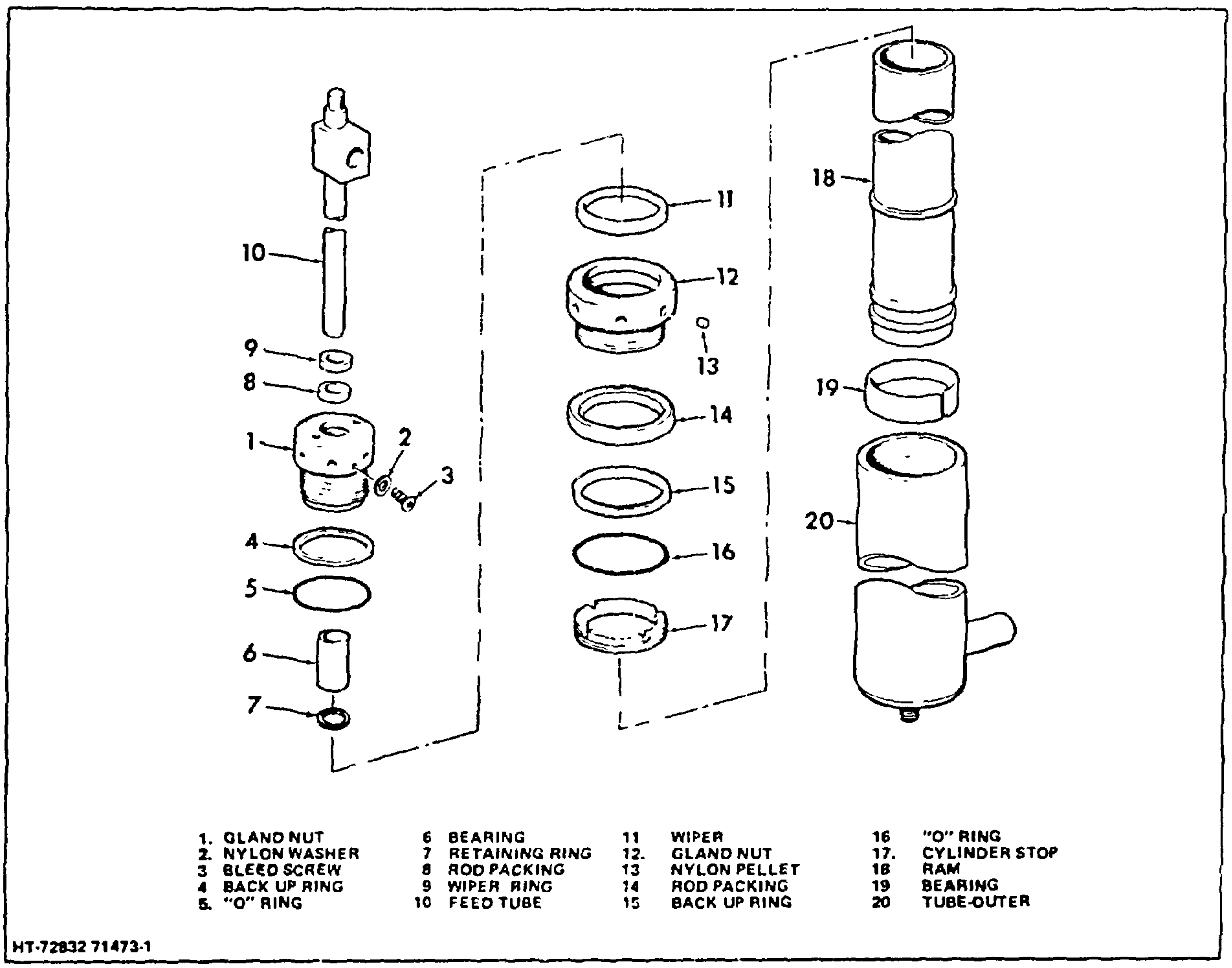

Figure 11. Secondary Cylinder - Exploded View

4. Remove the feed tube gland nut (1) from the ram (if necessary, insert a rod through the 3/8" dia. holes at base of ram to hold it during removal).

5. Remove retaining ring which secures feed tube bearing to inside of gland nut and remove bearing. Remove wiper ring, packing, "0" ring, and back up ring from gland nut.

6. Remove bearing from ram.

7. Clean all metal parts in an acceptable solvent. Inspect parts for wear or damage.

8. Replace all unserviceable parts.

NOTE: Always replace all packing sets, "0" rings, back-up rings and wiper rings regardless of their condition. Be certain shell is free of foreign matter.

D. REASSEMBLY (SECONDARY CYLINDER)

1. Refer to Figure 11 and preassemble feed tube gland nut (1) by installing packing, wiper ring, back-up ring, "0" ring, and bearing and retaining ring.

2. Preassemble gland nut (12) by installing wiper ring, packing, back-up ring, "0" ring, and nylon pellets.

3. Install bearing on base of ram, then install gland nut (1) to ram, and tighten securely with a spanner wrench.

4. Install stop ring within cylinder tube; tighten securely.

5. Insert ram into cylinder tube. Install gland nut (12) to tube and tighten securely with spanner wrench.

6. Insert feed tube within gland nut (1).

7. Refer to TOPIC 3 and reinstall cylinder.

TOPIC 4. CARRIAGES

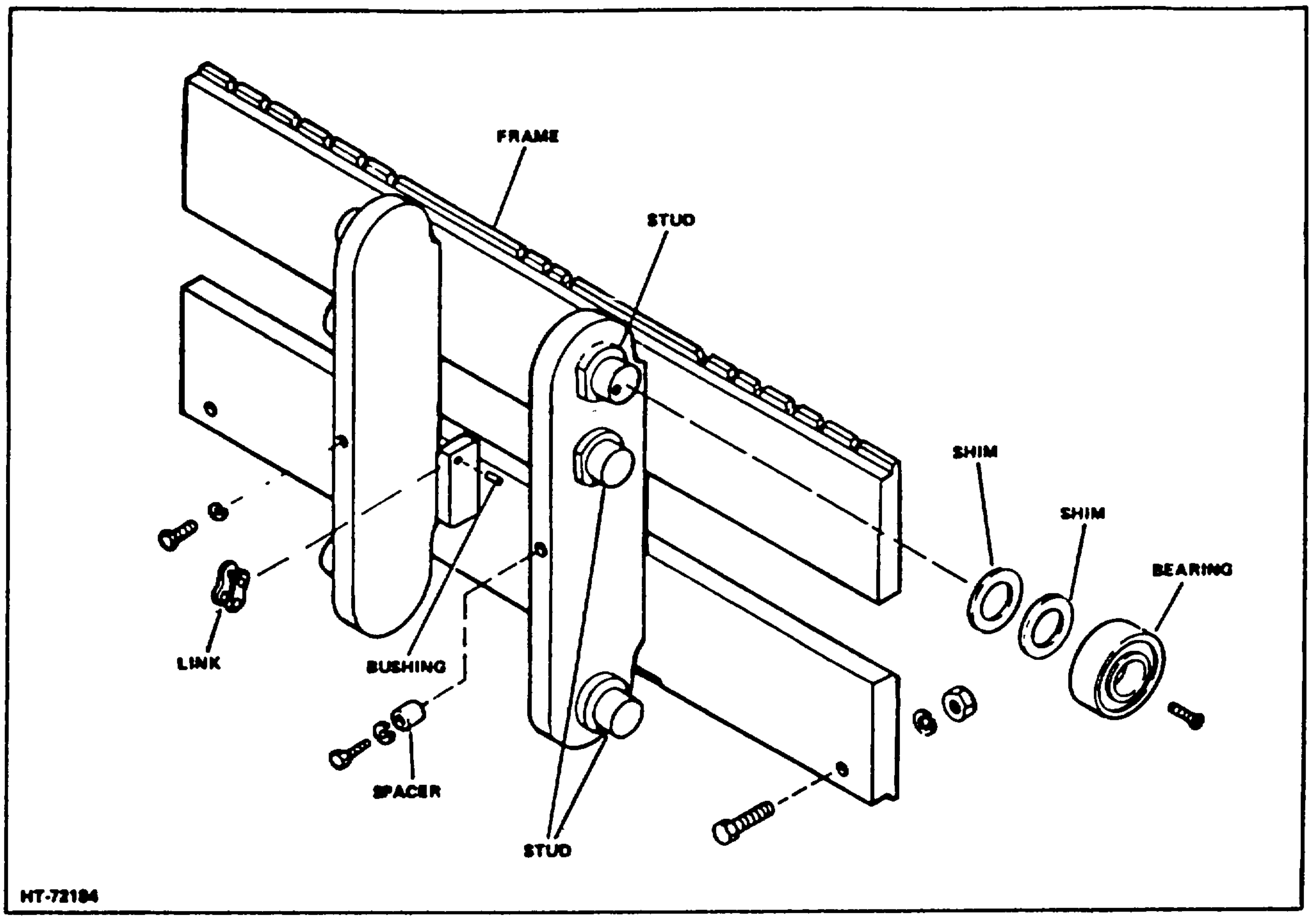

Figure 1. Hook Type Carriage Assembly (Typical)

A. CARRIAGE REMOVAL

> **NOTE: If backrest is used, simply attach properly rated hoist to top of backrest assembly, remove capscrews which attach backrest to carriage assembly and lift backrest free of carriage.**

1. Remove carriage forks (or attachments) (Refer to TOPIC 5, FORKS).

2. Remove carriage stop capscrews (or stop if applicable).

3. Attach a suitable hoist to the carriage to relieve tension on lift chains, then remove the lift chain anchor pins (or connecting link, if applicable), and disconnect chains from carriage.

> **CAUTION: Be certain overhead hoist is rated to safely support carriage assembly weight.**

4. Ensure that no attachments secure the carriage to the mast assembly, then carefully raise the carriage out of the top of the inner mast.

B. CARRIAGE INSTALLATION

1. Using a suitable hoist, lift carriage into its relative mounting position (at top of inner mast) and slowly lower it into the inner mast uprights.

2. Reinstall carriage stop capscrews (or stop, if applicable).

3. Reinstall lift chain anchor pins (or connecting link, if applicable) and reinstall lift chains. Then disconnect hoist.

4. Reinstall forks (or attachments) (Refer to TOPIC 5, FORKS).

TOPIC 5. FORKS

A. DESCRIPTION

Basically, there are two types of lift forks; the shaft style which pivots on a horizontal support shaft, and the more commonly used hook style fork (Figure 1), which hooks into notches along the top edge of the fork carriage. The standard or hook type fork will be discussed here. Any differences will be noted in shaft type removal and installation.

The forks should always be adjusted on the carriage to obtain the optimum balance in proportion to the width of the anticipated loads.

A fork lock (Figure 2) is installed in the top of each of the hook type forks to hold it in position in one of the notches along the top bar of the carriage. To change the fork location, pull up on the lock and move fork to the left or right. Allow fork lock to seat in the notch nearest to location chosen.

The forks can be easily removed from the carriage by releasing the locks and aligning each fork with the wide removal slot (see Figure 2), at the bottom of the fork carriage. (Refer to following REMOVAL procedures for detailed instructions.)

> **CAUTION: Naturally, the weight of each fork depends upon its size. Therefore, exercise caution while fork is being removed from the carriage to avoid injury to personnel and to prevent damage to the equipment.**

B. REMOVAL

1. Place support block under lower portion (bottom flat) of fork.

2. Drive securing roll pin, (or remove retaining plate, if applicable), from horizontal support shaft in carriage frame, then carefully drive support shaft far enough to side to allow freeing of fork.

C. SERVICE

1. Inspect hook fork and locking mechanism for any evidence of wear or damage.

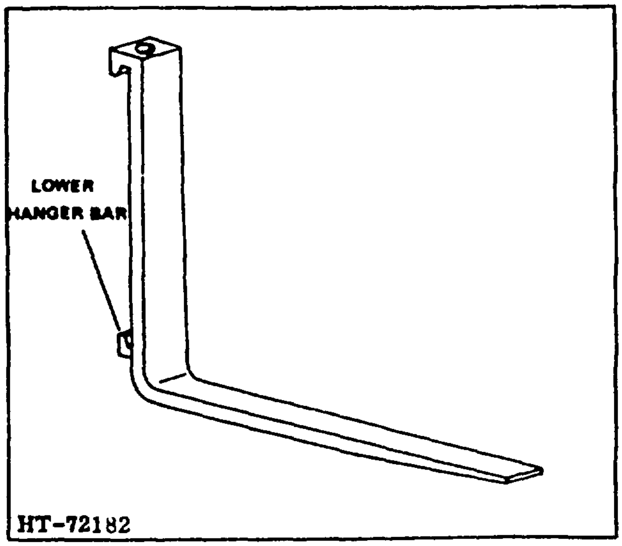

Figure 1. Hook Type Fork

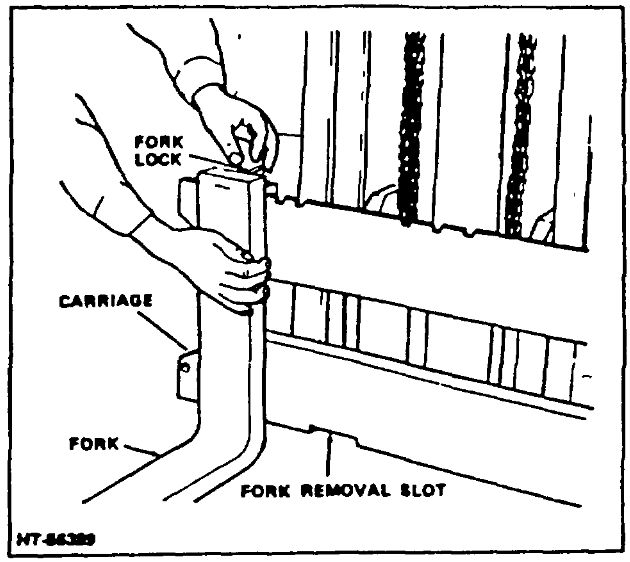

Figure 2. Fork Adjustment and Removal

2. If locking mechanism is worn or damaged, remove and replace it as a unit.

3. If fork is defective, then replace with same type and capacity rated fork.

D. INSTALLATION

(Hook Type)

1. Carefully lift fork up onto upper carriage mounting slot, then slowly lower until back of fork rests against carriage face and bottom of fork hook passes through lower carriage cutout.

2. Release the fork lock pin and slide fork left or right until properly positioned for anticipated load clearance/balance requirements.

TOPIC 6. WELDING REPAIR PROCEDURE

For various applications in the mast assembly, specially treated metals are used. Care must be taken when these metals are repaired or replaced by welding. Figures 15 and 16 Illustrate the manner in which the welding is to be performed.

Prepare welding surface by removing all foreign material such as rust, scale, grease, etc. Any part that may be damaged by heat should be removed before welding.

After welding is completed, remove all slag, weld spatter and excessive weld material.

A. REPAIR WELDING MAST ROLLER STUDS

Process...Shielded Metal Arc
Equipment...Manual
Settings:
- Current.. A.C.
- Amps 275/325
- Volts 31/33

Base Metals . ...(1) AC 1035-P1
(2) AC 86-L-20-H (roller stud)
Plate Thickness Range. ....3/8" - 1"
Electrode:
- Type .... Stick
- Class ....E 7018 (hydrogen free)
- Size .... 3/16"
- Flux ....Electrode Covering

Weld Type and Size ....1/4" Fillet
Number of Passes 1
Position..Horizontal
Preheat ....400°F
Interpass..250°F
Postheat..None

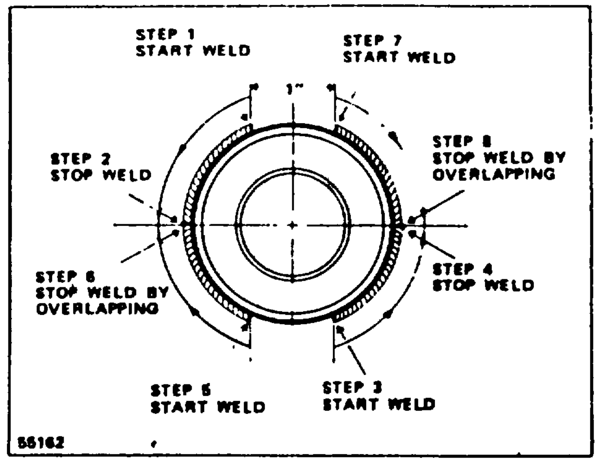

Figure 6 . Roller Stud Welding Procedure

B. INSPECTION

1. Finished weld to be magnafluxed for defects.
2. The weld defect shall be explored by removing material with a pencil grinder in 0.010" 0.020" deep passes (length to depth ratio of 4:1). Visually inspect for defect after each pass and magnaflux to confirm disappearance.

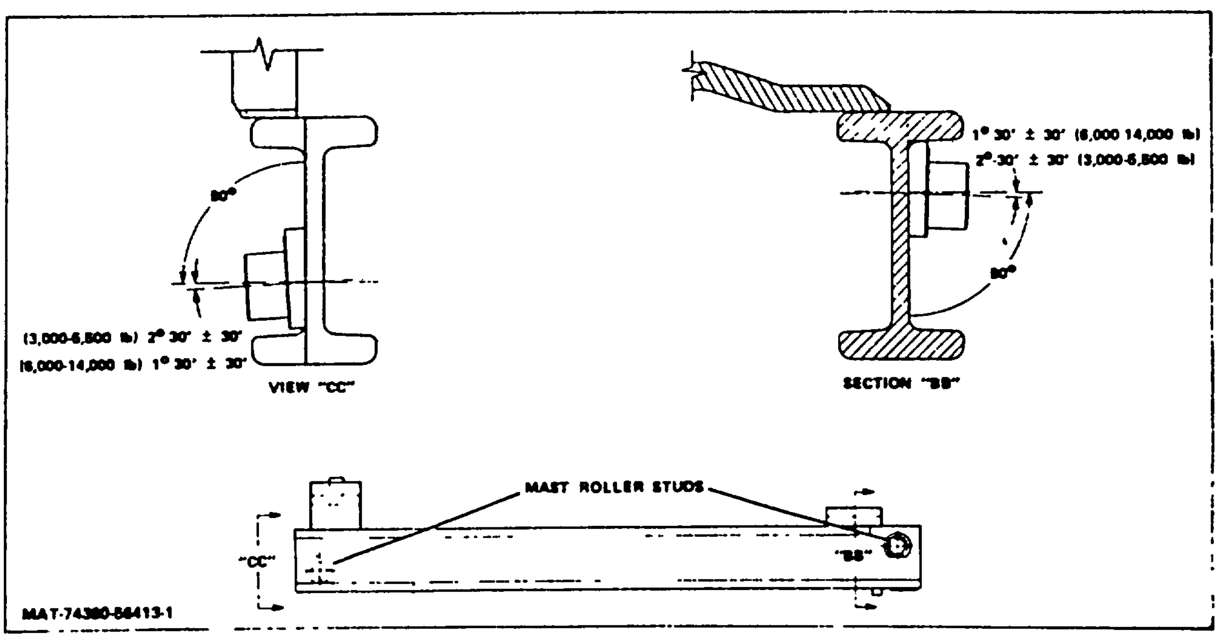

Figure 7. Mast Roller Stud Location (Canted Roll Type)

PARTS LIST

BASE UNIT INDEX

NUMERICAL INDEX

The following numerical index lists all Allis-Chalmers 4 million series part numbers found in the parts list and their page numbers.

Supplier information is listed In the form of the Federal Manufacturer's Code number and that manufacturer's part number.

The following is a list of the Federal Manufacturer's Code numbers that appear in the index along with their names and addresses.

CODE	NAME AND ADDRESS
00624	Aeroquip Corp Aircraft Division Jackson Plant 300 So. East Ave. Jackson, MI. 49203
00779	Amp. Inc P. O. Box 3608 Harrisburg, Pa. 17105
01943	Moeller Mfg. Co. Inc. P. O. Box 1318 Greenville, Ms. 38701
02397	North American Rockwell Corp. Brake Division Ashtabula, Ohio
02660	Amphenol Corp Broadview, Ill.
02978	Continental Motors Corp. Military Division Muskegon, Mi.
07200	Michigan Precision Molded, Inc. Walled Lake. Mi.
07988	Ambac Industries Inc. Fluid Power Systems Division 661 Glenn Ave. Wheeling, Ill. 60090
08162	Bower Roller Bearing Division of Federal - Mogul Corp. 3040 Hart Detroit, MI. 48214
11314	National Seal Division of Federal - Mogul Corp 11634 Patton Road Downey, Ca. 90241
11671	Tyrone Hydraulics Inc. P. O. Box 511 Corinth, Ms. 38834
15605	Cutler-Hammer, Inc. 4201 No. 27th St. Milwaukee, Wis. 53216
16764	Delco-Remy Division of General Motors Corp 2401 Columbus Ave. Anderson, In. 46011
18265	Donaldson Co Inc 1400 West 94th St. Minneapolis, Mn. 55431
19728	Prestolite Co the Division of Eltra Corp. P. O. Box 931 511 Hamilton St. Toledo, Ohio 43601
20984	Arron Safety Device Co Route 113 Georgetown, De 19947
21003	Sparton Mfg. Co Highway 50 West Flora, III 62839
22031	Air Way Mfg Co. 586 No. Main at US 27 Olivet, MI 49076
23040	Ford Marketing Corp. Autolite-Ford Parts Division P. O. Box 3000 Livonia, MI 48151
24455	General Electric Co. Lamp Division of Consumer Products Group Nela Park Cleveland, Ohio
27995	Warner-Motive Division of Borg- Warner Corp. Auburn Plant P. O. Box 351 Warner Road Auburn, In. 46706
30321	Automation Industries Inc. Materials Evaluation Group Division 51 6106 Rookin St. Houston, Tx. 77036
30327	Imperial Division Imperial-Eastman Group I-T-E Imperial Corp. 6300 West Howard St. Chicago, Ill 60648

CODE	NAME AND ADDRESS
30612	Allis-Chalmers Mfg. Co. Material Handling Division 21800 So. Cicero Ave. Matteson, Ill. 60443
32705	Vickers Mobile Division of Vickers Division of Sperry Rand Corp. Troy, Mi. 48084
33544	Kickhaefer Mercury 157 Western Ave. Cedarburg, Wis. 53012
36540	Lisle Corp. 805 E. Main Clarinda, Ia. 51632
49234	Protectoseal Co. 1920 So. Western Chicago, Ill. 60608
50022	McCord Heat Transfer Division 2850 West Grand Blvd. Detroit, Mi. 48202
52676	S. K F. Industries Inc. Front St. and Erie Ave. Philadelphia, Pa. 19132
57733	Stewart-Warner Corp. 1826 Diversey Parkway Chicago, Ill. 60614
59730	Thomas and Betts Co. The 36 Butler St. Elizabeth, N. J. 07207
60038	Timken Roller Bearing Co. 1835 Dueber Ave. SW Canton, Ohio 44706
60380	Torrington Co. The Subsidiary of Ingersoll-Rand Corp. 59 Field St. Torrington, Ct. 06790
63477	Wagner Electric Corp. Wagner Division 6400 Plymouth Ave. St. Louis, Mo. 63133
66295	Wittek Mfg. Co. 4309 West 24th Chicago, III. 60623
67049	Young Radiator Co. 709 Marquette St. Racine, Wis. 53403
70026	Chicago Fittings Corp. 18th Ave. at 21st St. Broadview, Ill. 60153

CODE	NAME AND ADDRESS
70040	A C Spark Plug Division of General Motors Corp. 1300 No. Dort Hgwy Flint, Mi. 48556
70434	Anchor Coupling Co. Inc. Church and Fouth St. Libertyvllle, Ill. 60048
70485	Atlantic India Rubber Works, Inc. 571 No. Polk St. Chicago, 111. 60607
71400	Bussman Mfg. Division of McGraw-Edison Co. 2536 West University St. St. Louis, Mo. 63017
72210	Columbus Auto Parts Co. Hudson St. at North Freeway Columbus, Ohio 43211
72530	Deluxe Products Corp. 1201 Michigan Blvd. Racine, Wis. 53402
72625	Amsted Industries Inc. Diamond Chain Co. Division 402 Kentucky Ave. Indianapolis, In. 46225
72962	Elastic Stop Nut Division of Amerace ESNA Corp. 2330 Vouxhall Road Union, N.J. 07083
73134	Helm Universal Division The of North American Rockwell Corp. 60 Round Hill Rd. Fairfield, Ct. 06430
73370	Fram Corp. 105 Pawtucket Ave. Providence, R. I. 02916
73740	Ross Gear Division TRW Inc. Lebanon Plant P. O. Box 298 Lebanon, Tx. 37087
73842	Goodyear Tire and Rubber Co. 1144 E. Market Akron, Ohio 44316
74400	Hobbs Division Stewart- Warner Corp. Yale Blvd. and Ash St. Springfield, Ill. 62705
74465	Hoof Products Co. 6543 So. Laramic Chicago, Ill. 60638

CODE	NAME AND ADDRESS
75272	Kickhaefer Mfg. Co 1964 Wisconsin Ave. Grafton, Wis. 53024
75677	Lincoln Mtg. Co 2621 Flitcher St. Chicago, Ill. 60618
75958	Borg and Beck Division Borg Warner Corp 12501 Chrysler Freeway Detroit, MI. 48212
76005	Lord Manufacturing Co. Division of Lord Corp 1635 West 12th St Erie, Pa. 16512
76110	Maremont Corp 168 No. Michigan Ave. Chicago, Ill. 60601
76680	National Seal Division of Federal-Mogul Corp Broadway and National Redwood City, Ca. 94062
76700	Nelson Muffler Corp P. O. Box 308 Staughton, Wis. 53589
76871	Ohio Nut and Bolt Co. Division of Fastener Industries Inc. 33 First St. Berea, Ohio 44017
77060	Packard Electric Division of General Motors Corp 408 Dana St. NE Warren, Ohio 44481
77200	Pesco Division Borg-Warner Corp 24700 No Miles Rd Bedford, Ohio 44104
77260	Pierce Governor Co. Inc. P O Box 2000 Upland, In. 44481
77640	Ross Gear Division TRW Inc Lafayette Plant Lafayette, In. 47902
77890	Service Products Corp 201 So Rural St Indianapolis, In. 46201
77915	Sheller-Globe Corp. Steering Wheel Division So. Bridge St Portland, In 47371

CODE	NAME AND ADDRESS
78480	Tillotson Mfg. Co. 761-69 Berdan Ave Toledo, Ohio 43612
78553	Tinnerman Products Inc 8700 Brookpark Rd Cleveland, Ohio 44129
79136	Waldes Kohinoor Inc. 47-16 Austel Place Long Island City, N.Y. 11101
79410	Warner Gear Division Borg Warner Corp 1106 E Seymour St Muncie, In. 47305
79470	Weatherhead Co The 300 E 131 St Cleveland, Ohio 44108
80201	Chicago Rawhide Mfg Co 1301 Elston Ave. Chicago, Ill 60622
80756	Ramsey Corp Manchester-Weidman St. Louis, Mo. 63108
80813	Dimco Gray Co 207 E Sixth St Dayton, Ohio 45402
80900	Eaton Corp Spring Division 9771 French Rd. Detroit, MI. 48213
81300	Dayco Corp 333 W 1st Dayton, Ohio 45402
82465	Mac Lean Fogg Lock Nut Co 1000 Allanson Rd Mundelein, Ill. 60060
82807	Milwaukee Resistor Co 700 Virginia Milwaukee, Wis. 53204
86850	Champion Spark Plug Co. 1006 Fisher Bldg. Detroit, MI. 48202
8794	Triangle Mfg Co 720 Division St Oshkosh, Wis. 54901
90763	United-Carr Inc. 4258 No Cicero Chicago, Ill. 60640

CODE	NAME AND ADDRESS
91561	Bruning Co. P. O. Box 81247 Lincoln, Nb. 68501
92563	Mc Fill Mfg. Co. Inc. Bearings Division 907 Lagayette Valparaiso, In. 46383
92850	Anchor Industries Inc. 1725 London Rd. Cleveland, Ohio 44112
92863	Marvel Engineering Co. 7227 No. Hamlin Ave. Chicago, Ill. 60645
92867	Orscheln Brake Lever Mfg. Co. 1177 No. Morley Moberly, Mo. 65270
93608	Standard Pressed Steel Co. National Machine Products Division Utica Plant 44225 Utica Rd. Utica, Mi. 48087
93784	Husco Division of Koehring Co. Pewaukee Rd. P. O. Box 257 Waukesha, Wis. 53187
96151	Char Lynn Co. 15151 Highway 5 Eden Prairie, Mn. 55343

CODE	NAME AND ADDRESS
95878	American Petroleum Institute 1271 Ave. of Americas New York, N.Y. 10020
95879	Alemite Instrument Division of Stewart-Warner Corp. 1826 Diversey Parkway Chicago, Ill. 60614
96152	Marvel-Schebler Division of Borg-Warner Corp. 2195 So. Elwin Rd. Dicatur, Ill. 62525
96867	Bushings Inc. 4358 Coolidge Hwy. P. O. Box 189 Royal Oak, Mi. 48068
96906	Military Standards Logistic Services, DSA
97286	North American Rockwell Corp. Commercial Products Group North American Rockwell Bldg. Pittsburgh, Pa. 15222
97577	Mechanics Division of Borg-Warner Corp. Memphis Plant P. O. Box 8366 1248 Warford St. Memphis, Tx. 38108

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4254658-0	77	79410	B109A
	77	79410	B109A
4254666-3	81	79410	T11-107
4254667-1	77	79410	T11-110
4254697-8	81	79410	T11-108
4254736-4	93	60038	02877
4254846-1	68	02660	31184
	68	02660	236
4254864-4	75	30612	
4254902-2	93	30612	
4254976-6	68	93608	400D113
	68	93608	400D113
4254984-0	125	60038	26884
4254986-5	125	80201	504960
4255041-8	117	82465	296FH43816
4255060-8	165	82465	3/8-16-1
4255183-8	49	79136	X5133-31
4255195-2	68	30612	
	186	30612	

PART NO.	VENDOR PAGE	VENDOR CODE	PART NO.
4255355-2	47	59730	TY24M
	63	59730	TY24M
	68	59730	TY24M
	69	59730	TY24M
	71	59730	TY24M
	85	59730	TY24M
4255401-4	49	79136	X5133-37
4255431-1	69	30612	
4255470-9	83	60380	B3216
4255491-5	149	30612	
4255521-9	63	00779	321235
4255538-3	173	75272	CC1213
4255570-6	69	77060	2977517
	69	30612	
4255646-4	125	30612	
4255819-7	113	60038	2729
4255820-5	113	60038	2789
4255821-3	113	60038	LM29710
4255S22-1	113	60038	LN29700L
4255823-9	113	21634	6284
4335601-3	167	30612	
4365450-8	1	74400	M4006
4408658-5	65	74400	236
4408660-1	1	30612	
	69	05970	RC363
4507415-0	109	30612	
	109	30612	
4511898-1	87	77260	4070-3
4512207-4	19	73370	235114
4512341-1	19	73370	106089
4515665-0	59	16764	1115065
4701705-8	173	72625	C3470
	173	72625	C3470
	178	72625	C3470
	183	75625	C3470
4703438-4	91	30612	
4704052-2	117	30612	
4704828-5	68	30612	
4704830-1	115	30612	
4705279-0	65	71400	AGC10
	65	71400	AGC10
4707331-7	87	91821	350GP
4707401-8	109	30612	
4707650-0	79	79410	A5512X12
4708A16-7	101	63477	FC1243
4708362-1	65	71400	4522
4708603-8	85	70434	6MA4UFS
4708605-3	85	70434	4MA4UFSX
4709816-5	115	77915	601
4710162-1	33	30612	
4710442-7	33	92850	218
4711590-2	33	30612	
4711943-3	97	08129	37
4712841-8	141	30612	
4712890-5	97	30612	
4714907-5	186	30612	
4715032-1	68	30612	
4715055-2	186	00624	60W6FJD
	186	00624	60W6FJD
	186	00624	60W6FJD
	187	00624	60W6FJD

PART NO.	VENDOR PAGE	VENDOR CODE	PART NO.
	187	00624	60W6FJD
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4715712-8	173	30612	
4716090-8	49	30612	
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	131	30612	
4716091-6	131	30612	
471R022-9	125	30612	
4718482-5	167	30612	
4719978-1	173	30612	
4719981-5	173	30612	
4720549-7	115	70485	1303
4721573-6	67	16764	1116781
4722511-5	109	926R7	6110042-775
4724666-5	68	77060	278
4724667-3	68	02660	236
	68	00779	31884
	69	02660	236
4724728-3	63	30612	
4724733-3	63	15605	7118K2
4726629-1	69	63477	FC 7715
4726660-6	97	30612	
4727452-9	63	30612	
4730551-1	37	78480	0W449
	41	78480	0W449
4734887-5	69	30612	
4735714-0	37	57733	72030
4735718-1	49	30612	
4736044-1	69	77060	277
4737517-5	125	73809	D191-4
4737639-7	68	30612	
	68	30612	
4742113-6	167	30612	
4745363-4	87	78643	DS108
4746222-1	71	30612	
4746438-3	65	16764	1907215
4747622-1	125	30612	
4749382-0	37	49234	1273-10
4749988-4	37	30612	
4750039-2	159	30612	
4750202-6	109	92867	81-000111
	109	92867	81-000111
4750203-4	109	30612	
4750421-2	85	30612	
4751032-6	75	30612	
4751644-8	91	30612	
4752002-8	75	30612	
4752075-4	91	30612	
	93	30612	
4755380-5	75	71000	XF12K56
4755381-3	75	75958	F7X90
4755785-5	35	76005	J8006
4757268-0	186	30612	
4757678-0	37	77060	1878788
	68	77060	5286201
4757912-3	63	71400	AGC20
4758882-7	97	30612	
4760149-7	9	70040	1513462
4760327-9	31	70434	6M-4UFS
4761032-4	75	75958	F7W09
4761270-0	49	73134	RC6-148

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4763183-3	101	30612	
4763868-9	173	30612	
4765162-5	105	63477	FC23800A
4765182-3	125	30612	
4765514-7	49	92850	3316S
4765753-1	117	30612	
4766398-4	173	30617	
4766588-0	63	30612	
4767130-0	59	30612	
	63	30612	
	63	30612	
	69	30612	
4769239-7	85	30612	
4769321-3	31	30612	
4770449-9	69	20984	127STR12
4771148-6	73	30612	
4771179-1	73	30612	
4771623-8	89	76260	18592J
4771651-9	97	30612	
4772127-9	69	30612	
	101	30612	
	109	30612	
4773420-7	47	30612	
4774104-6	99	30612	
4774640-9	49	30612	
4774924-7	97	30612	
4774925-4	97	30612	
4774988-2	91	73842	ST69
4774994-0	141	30612	
4775866-9	68	74400	M2389
4775867-7	68	80813	95
4775868-5	68	30612	
4775869-3	68	30612	
4775899-0	67	30612	
4777000-3	143	93784	4499-3
	143	93784	4499-3
4781446-2	68	72210	S5896
4784720-7	101	30612	
4785070-6	115	73740	33050
4786323-8	115	77640	453077A1
4786324-6	115	77640	029037
4786325-3	115	77640	401081
4786326-1	115	77640	029031
4786327-9	115	77640	450029
4786329-5	119	96151	32390A1
4786330-3	119	96151	401082
4786331-1	119	96151	29039
4786677-7	93	30612	
4787707-1	1	30612	
4791361-1	65	30612	
4791435-3	67	30612	
4793751-1	47	78940	1B19
4794303-0	186	30612	
	187	30612	
4798004-0	69	30612	
4799393-6	125	30612	
4801154-8	71	30612	
4801304-9	71	30612	
48028052L	93	30612	
4803166-0	87	30612	
4803175-1	87	30612	

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
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4803665-1	173	45014	1SF6785-40
	173	45014	1S6785-40
4804565-2	47	18265	RBX00-2220
4804768-2	181	30612	
4804777-3	181	30612	
4804779-9	181	30612	
4806197-2	125	30612	
4806199-8	97	30612	
4806357-2	137	30612	
4806763-1	113	60038	17FS28X3
4806771-4	113	30612	
4806772-2	113	30612	
4806773-0	113	30612	
4806774-8	113	30612	
4806775-5	113	30612	
4807680-6	181	30612	
4807682-2	113	30612	
4807776-2	125	30612	
4807778-8	125	30612	
4809521-0	183	30612	
4809523-6	183	91561	6707-068
	185	30612	
	185	91561	
4810048-1	47	30612	
4810196-8	186	30612	
	186	30612	
4810223-0	186	30612	
	187	30612	
4810228-9	187	30612	
4810270-1	186	30612	
	187	30612	
4811115-7	85	70434	4MA4UFS
4811214-8	129	30612	
4811940-8	173	22031	6410-17-12
4812705-4	121	30612	
4813781-4	187	30612	
4814108-9	123	73680	17149-1117
	141	73680	17149-1117
4814109-7	123	30612	
	141	30612	
4814133-7	123	96779	TP032
	141	96779	TP032
4814134-5	123	30612	
	141	30612	
4814364-8	1	02978	5654782
4816384-4	69	30612	
4816684-7	173	70026	R944-12
4816749-8	123	30612	
	141	30612	
4818260-4	65	70040	6462577
4818261-2	65	70040	6431382
4818262-0	65	70040	6489590
4818263-8	65	70040	6473718
4818457-7	141	30612	
4818829-6	131	30612	
4819117-5	91	30612	
4819144-9	91	30612	
4819206-6	99	30612	
4819210-2	95	30612	
4819211-6	19	30612	

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4819451-8	93	30612	
4819453-4	93	30612	
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4819455-9	93	30612	
4819456-7	93	30612	
4819457-5	93	30612	
4819458-3	93	30612	
4819459-1	93	30612	
4819491-4	65	57733	356
4819871-7	161	30612	
4819980-6	93	30612	
4819981-4	93	30612	
4819982-2	93	30612	
4819983-0	93	30612	
4819984-8	93	30612	
4819985-5	93	30612	
4819986-3	93	30612	
4819989-7	93	81596	410614SSR
4819990-5	91	30612	
4819991-3	91	79150	62675SL
4819992-1	99	30612	
4819993-9	93	30612	
	99	30612	
4819995-4	93	30612	
4819996-7	91	14892	324583
	105	14892	324583
4819997-0	91	14892	324584
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4819998-8	93	30612	
4820063-8	91	30612	
4820067-9	91	30612	
4820068-7	99	30612	
4820070-3	91	30612	
4820073-7	99	60399	WJ162112
4820347-6	177	30612	
4820462-2	173	30612	
4820490-3	177	30612	
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4820522-3	176	30612	
4820527-2	176	30612	
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4820530-6	173	30612	
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	183	30612	

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	178	76062	309-SZZ-4
4820659-4	183	76062	309-SZZ-4
4820677-5	91	30612	
4820830-0	175	30612	
4820863-1	91	30612	
4820895-3	173	30612	
4821837-4	93	30612	
4821904-2	173	79410	PS278822-5
4821912-5	173	30612	
4821913-3	173	30612	
4822141-0	91	30612	
4822142-8	93	30612	
4827148-5	91	30612	
4822149-3	93	30612	
4822178-2	133	30612	
4822716-9	109	30612	
4822760-7	141	30612	
4822811-8	183	30612	
4822814-2	183	30612	
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4824293-7	85	30612	
4824664-9	101	92850	3032
4824824-9	183	30612	
4824917-1	183	30612	
4824971-7	101	14892	2225110
4824971-8	103	14892	2225110
4826029-3	165	30612	
4826095-4	33	76700	T12429
4826247-1	129	30612	
4826249-7	129	30612	
4826276-0	167	30612	
4826512-8	173	30612	
4826522-7	173	30612	
4826532-6	175	30612	
4827208-2	177	73680	17149-1162
4827374-2	173	30612	
	173	30612	
4827392-4	141	30612	
4827468-2	176	30612	
	177	30612	
4827731-3	91	30612	
4827856-8	175	30612	
4827858-4	178	30612	
4827915-2	93	30612	
4827968-1	115	30612	
4828179-4	175	30612	
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4828474-9	161	30612	
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4829298-1	89	30612	
4829337-7	141	30612	

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
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4829348-4	107	14892	2225314
4829349-2	107	14892	2225319
4829357-5	105	14892	323729
4829358-3	105	14892	323730
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4830173-3	67	21003	C8388
4830537-9	65	30612	
4831699-6	173	30612	
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4834702-3	133	30612	
4835378-3	137	72530	DX1603Z
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4835721-4	186	30612	
4835723-0	186	30612	
4935725-5	186	30612	
4835726-3	187	30612	
4835727-1	187	30612	
4835728-9	187	30612	
4835732-1	187	30612	
4835735-4	187	30612	
4835736-2	187	00624	6QW6FJD
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4835739-6	187	30612	
4836780-9	91	30612	
4836781-7	91	30612	
4836849-2	186	30612	
4836851-8	186	30612	
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4836855-9	187	30612	
4838269-1	93	30612	
4838679-1	111	30612	
4839089-2	93	30612	
4839229-1	129	30612	
4839229-4	131	30612	
4839231-0	113	30612	
4840041-0	93	30612	
4840052-7	91	30612	
4840053-5	91	30612	
4840790-2	115	80755	TL1-1-8
4841556-6	113	30612	
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4843526-7	131	30612	
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4844327-9	113	30612	
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4845163-7	101	30612	
4845678-4	37	30612	
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PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
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4847837-4	37	30612	
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4848483-6	63	30612	
4848486-9	51	16764	1961291
4848884-5	37	30612	
4848885-2	37	02978	X01698
4851340-2	178	30612	
4854017-3	89	30612	
4854028-0	91	30612	
4854029-8	91	02951	289-1
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4855211-1	129	30612	
4855593-2	129	30612	
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4855690-6	59	82807	12M40-50
4856441-3	75	79410	10-01-000-042
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4856615-2	27	81300	5-9308
4856618-6	51	30612	
4856852-1	47	78940	A11426
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4857249-9	87	30612	
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4857829-8	123	30612	
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4857898-3	35	30612	
4858103-7	59	02978	F400M293
4858123-5	33	30612	
4858124-3	33	30612	
4858126-8	33	30612	
4858128-4	27	30612	
4858134-2	37	30612	
4858142-5	159	30612	
4858144-1	159	30612	
4858160-7	117	30612	
4858161-5	115	30612	
4858166-4	59	19728	1BT6701D
	61	19728	1BT6701D
4858174-8	163	30612	
4858197-9	31	24161	4283-10
4858198-7	31	24161	4283-13
4858680-4	59	30612	
4858682-0	35	02978	F24508157
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4858691-1	143	30612	
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4858914-7	131	30612	
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4859845-2	131	30612	
4859849-4	85	30612	
4860293-4	65	74400	1500
4860448-2	65	30612	
4860529-9	165	30612	
4860679-2	73	30612	
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4860728-7	143	02249	3704
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4860752-7	115	30612	
4860756-8	47	30612	
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4861845-8	131	30612	
4861997-7	37	30612	
4862067-8	131	30612	
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4862079-3	151	30612	
4862472-0	59	30612	
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4863249-1	151	30612	
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4863263-2	165	30612	
4863265-7	151	30612	
4863395-2	177	73680	79X287
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4864085-8	49	30612	
4864274-8	65	30612	
4864615-2	65	30612	
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4867999-7	165	30612	
4868008-6	49	30612	
4868103-5	49	30612	
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4868120-9	153	30612	
4868125-8	49	30612	
4868199-3	155	30612	

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4873406-5	121	30612	
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4876533-3	65	16764	1115836
4876696-8	55	16764	1109053
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4877516-7	181	30612	
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4877801-3	137	30612	
4877808-8	151	30612	
4877814-6	31	30612	
4878220-5	33	30612	
4878221-3	33	30612	
4878421-9	85	81321	6683907
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4905793-8	77	79410	AT12G106
4905843-1	173	70026	MR-375-12
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4905883-7	83	79410	AT12-16A
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	107	14892	2231475
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4906136-9	105	14892	314606
4906137-7	105	14892	49798
4906139-3	105	14892	3201221
4906140-1	105	14892	3201222
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4906147-6	105	14892	373614
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4906149-2	105	14892	323617
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4906151-8	105	14892	323616
4906152-6	105	14892	323685
4906153-4	105	14892	323686
4906154-2	107	14892	616435
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4908391-8	145	02249	1820-001
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4908392-6	145	02249	1857-001

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4909055-8	37	74465	730A
4909056-6	37	74465	H732H
4909057-4	37	74465	H732D
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4909111-9	61	19728	P90-392
4909112-7	61	19728	IBT1035
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4910078-7	15	02978	X18387
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4912047-0	43	29092	8R538
4912048-8	43	29092	8R539
4912049-6	43	29092	8R540
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4912051-2	43	29092	8R956

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4912056-3	43	29092	17R31
4912057-9	43	29092	18R80AS
4912058-7	43	29092	19R146
4912059-5	43	29092	21R355-25
4912060-3	43	29092	22R40-66
4912061-7	43	29092	25R166A
4912062-9	43	29092	25R167A
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4912068-6	43	29092	38R108
4912069-4	43	29092	38R110
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4912071-0	43	29092	38R452
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4912073-8	45	29092	49R456A
4912074-4	45	29092	63R469
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4912076-0	45	29092	49R149
4912077-7	45	29092	37R135
4912078-5	45	29097	8R1098
4912079-3	45	29092	29R339
4912096-7	45	29092	85G3311
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4912303-7	127	30612	
4912304-5	127	72210	S13342D
4917305-2	127	72210	S13274D
4917306-0	177	72210	S862T
4912307-8	127	72210	S13336D
4912314-4	57	16764	1114458
4912557-3	139	92863	265000C2500-2
4912558-6	139	92863	25000-3
4912559-4	139	92863	909420-20
4912560-2	139	92863	265162-16DC
4912561-0	139	92863	265000-15
4912566-9	139	92863	265000-1
4912629-5	135	64294	151-25042
4912630-3	135	64794	152-37751-107
4912638-6	53	16764	1876470
4912656-8	135	64294	151-43451
4912657-6	135	64294	151-4500
4912658-4	135	64294	29630-130
4912659-2	135	64294	151-43112-3
4912660-0	135	64294	151-44095
4912661-8	135	64294	152-37752-43
4912662-6	135	64294	151-48371-1
4912664-2	135	64294	151-48390-1
4912666-7	135	64294	29547-7

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
4912668-3	135	64294	29602-202
4912669-1	135	64294	152-4117-9
4912671-7	135	64294	152-38330-46
4912740-0	53	16764	1891055
4912741-8	53	16764	1876873
4912937-3	119	96151	5389-10
4912938-0	119	96151	5663-4
4912939-8	119	96151	6901-3
4912940-6	119	96151	370
4912941-4	119	96151	15048
4912942-2	119	96151	5796
4912964-5	119	30612	
4913069-3	135	64294	151-37842-4
4913070-1	135	64294	151-37752-24
4913071-9	135	64294	151-46366-1
4916954-1	25	02978	X18067
4980048-5	89	76260	BK3786J
4981104-5	41	78480	3W355
4981105-2	41	78480	0W352
4981106-0	41	78480	06096
4981107-8	41	78480	06137
4981108-6	41	78480	0W462
4981109-4	41	78480	0W446
4981110-2	41	78480	0W432
4981978-2	113	72210	S1679
4481979-0	113	72210	S2137
4981981-6	113	72210	S4034
4987583-4	77	79410	T11-8
4987585-9	77	79410	T12-7
4987586-7	77	79410	T12-146
4987587-5	79	79410	AT12-10
4987588-3	79	79410	T12-35
4987589-1	79	79410	4717C
4987590-9	79	79410	T11-147
4987593-3	77	79410	T12-7
	77	79410	T12-7
4987595-8	77	79410	T11-116
4987596-6	79	79410	T12-150
4987597-4	79	79410	T12-149
4987600-6	77	79410	4806F
4987603-0	83	79410	4622C
4987606-3	83	79410	4806E
4987609-7	83	79410	4823B
4987611-3	83	79410	T11-97
4987630-3	81	79410	T11-244
4987631-1	81	79410	T11-247
4987634-5	81	79410	4868A
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4987644-4	79	79410	AT11-195
4987673-3	81	79410	T11-223
4987702-0	77	79410	4824
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4987703-8	79	79410	4743B
4987758-2	113	72210	S130003
4988062-8	81	79410	T11-215
4991217-3	37	49234	01273-10-36
4991740-4	79	79410	4863A
4991741-2	79	79410	4868B
4991747-9	81	79410	T11-288A

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
4992358-4	113	72210	S14953
4992361-8	113	72210	D16095
4993479-7	89	76260	114-4110
	89	76260	114-4110
4994900-1	119	96151	15
4994901-9	119	96151	370
4994903-5	119	96151	843
4994906-A	119	96151	857
4994907-6	119	96151	859
4994908-4	119	96151	20599
4994910-0	119	96151	21124
4994912-6	119	96151	14092
4994913-4	119	96151	21146
4994915-9	119	96151	5029
4994916-7	119	96151	5244
4995371-4	119	96151	5245
4995372-2	119	96151	844
4995378-9	119	96151	21149
4995379-7	119	96151	21151
4995380-5	119	96151	21173
4995381-3	119	96151	21142
4995382-1	119	96151	21144
4995383-9	119	96151	21141
4995592-5	77	79410	48060
4995594-1	77	79410	T11-17A
4995595-8	77	79410	T11-6B
4995626-1	77	79410	4745F
4995627-9	77	79410	8210AF6
4996438-0	83	79410	4737Y
	83	79410	4737Y
4997175-7	57	16764	1932197
4997176-5	57	16764	1958679
4997180-7	57	16764	1928021
4997181-5	57	16764	1928022
4997568-3	47	78940	250A13
4997587-3	79	79410	T11-33
	79	79410	T11-33
4998179-9	57	16764	455106
4998258-0	119	96151	5414
4998320-8	119	96151	5415
4998673-0	83	79410	940911
4998682-1	185	91561	50059-012
4998849-6	57	16764	1928023
4998851-7	57	16764	1951567
4999280-3	83	79410	AT11-67A
4999347-5	181	30612	
4999354-6	79	79410	T11-98
4999355-3	79	79410	T11-99
4999539-2	83	79410	T12-48
	83	79410	T12-48
4999636-6	185	91561	39004-301
4999638-2	185	91561	39003-103
4999650-7	185	91561	6707-068TA
4999651-5	185	91561	6707-072-1229
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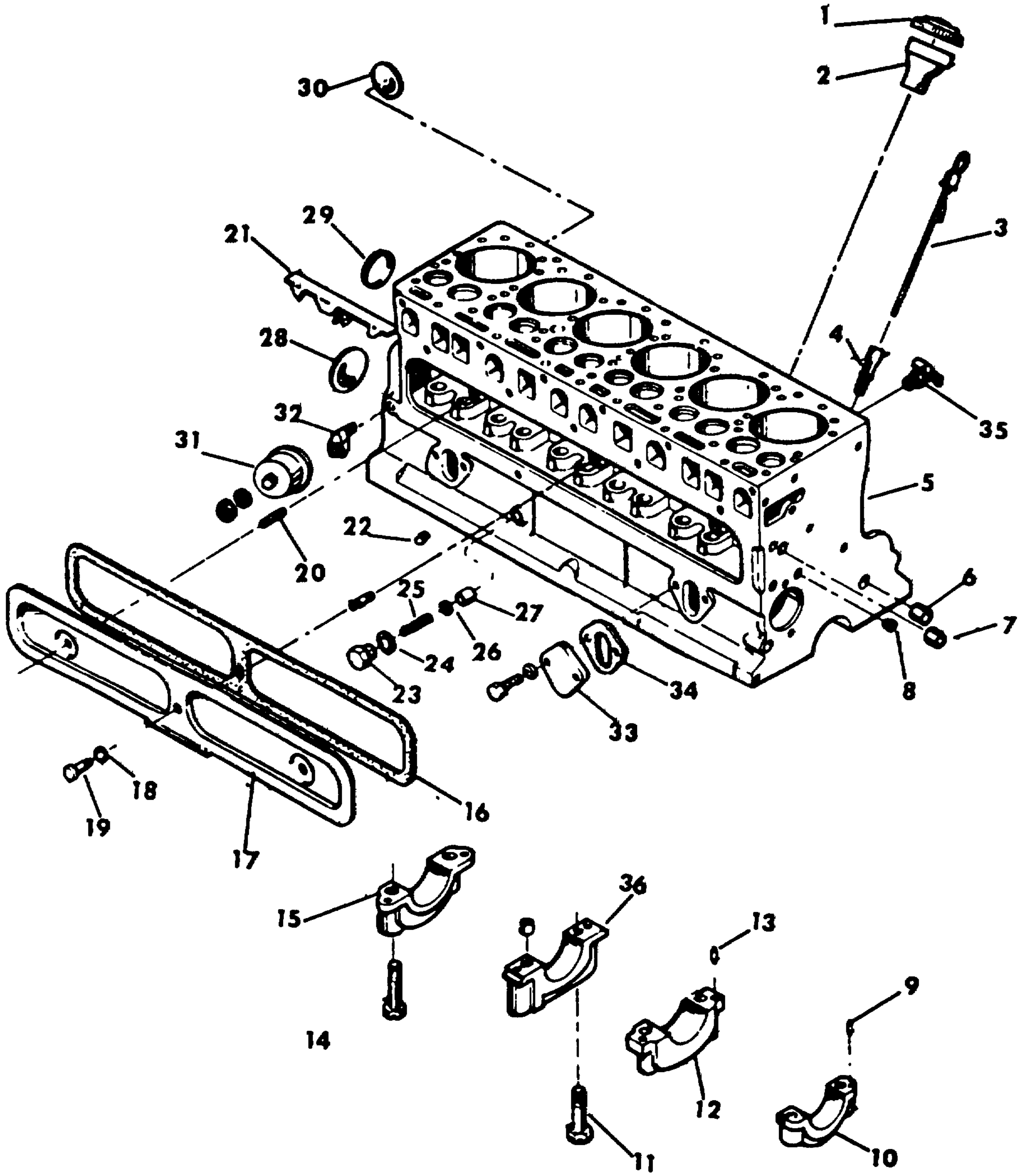
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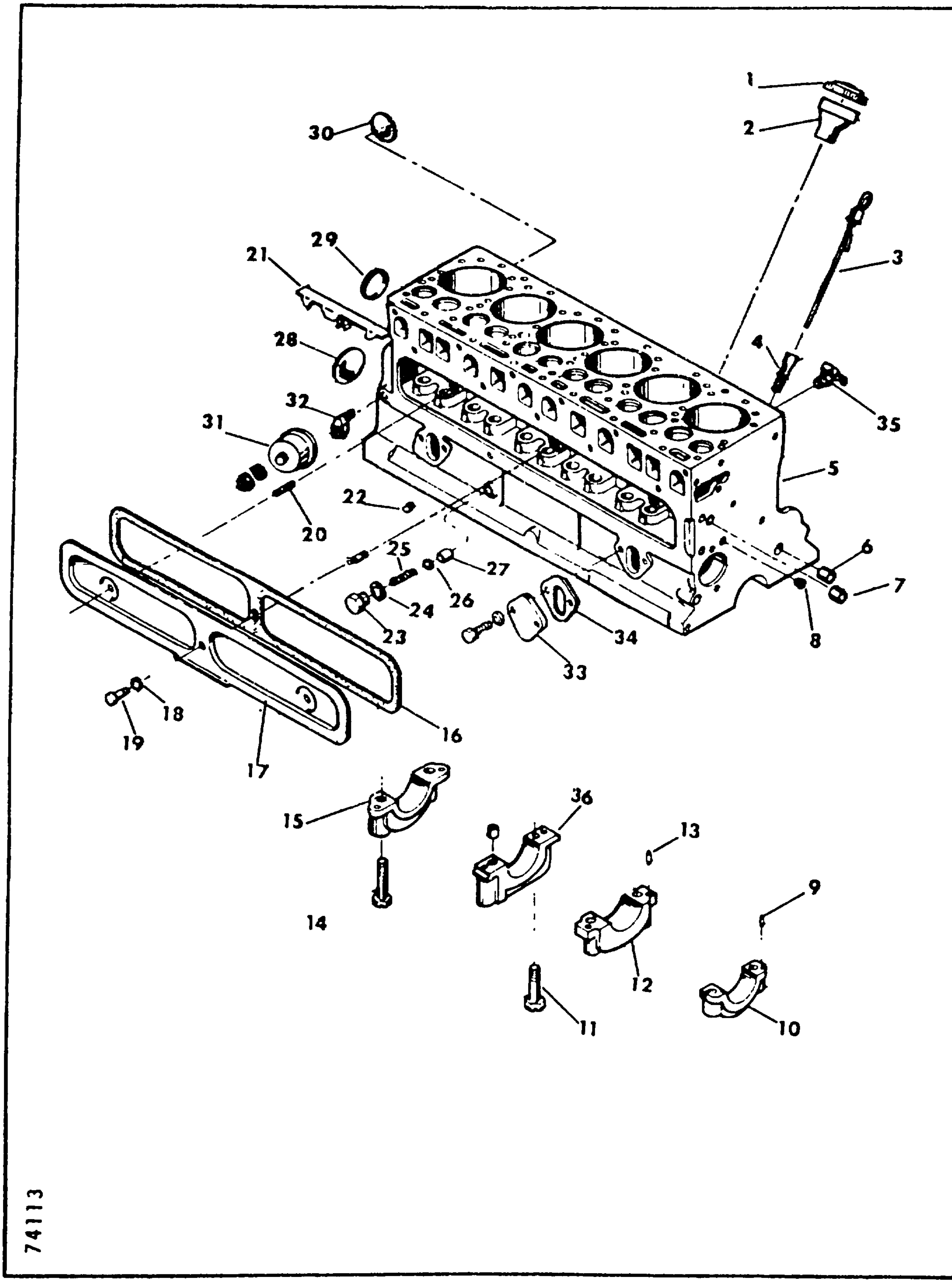
CYLINDER BLOCK

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4908517-8	CAP OIL FILLER	1	
2	4910050-6	OIL FILLER-CRANKCASE	1	
3	4908613-5	ROD-OIL GAUGE	1	
4	4908701-8	SUPPORT-ROD	1	
5	4910023-3	BLOCK ASSY-SHORT	1	SEE NOTE A
	4910024-1	ENGINE ASSY-SERVICE	1	SEE NOTE B
6				
7				
8	4908560-8	PLUG	2	
9	4908536-8	DOWEL	2	
10	4908618-4	CAP-FRONT BEARING	1	
11	4908640-8	BOLT-PLACE-.50" -13 X 2.5"	2	
12	4910037-3	CAP-CENTER BEARING	1	
13	4908507-9	DOWEL	5	
14	4908537-6	BOLT-PLACE	6	
15	4910039-9	CAP-REAR BEARING	1	
16	4910034-0	* GASKET-COVER	1	
17	4910020-9	COVER-VALVE CHAMBER	1	
18	4908780-2	* GASKET-COPPER	3	
19	4908580-6	NUT	3	
20	4910070-4	STUD-.25” -20 X 1.38"	2	
21	4908612-7	BAFFLE-REAR	2	
	4910035-7	BAFFLE-FRONT	1	
22	4908539-2	PLUG-SOCKET-.13"	1	
23	4908524-4	PLUG-RELIEF VALVE	1	
24	4908525-1	GASKET-COPPER	1	
25	4908526-9	SPRING-RELIEF VALVE	1	
26	4908578-0	WASHER-PLAIN-.25"	*	USE AS REQUIRED
27	4908519-4	PLUNGER-RELIEF VALVE	1	
28	0910014-0	PLUG-EXPANSION-.5" PT	1	
29	4910067-0	PLUG-EXPANSION-1.12"	9	
30				
31	4814364-8	SENDER-OIL PRESSURE	1	
	0917365-9	LOCKWASHER-#10	1	
	0917415-2	NUT-#10 -32	1	
32	0917032-5	ADAPTOR- .12"	1	
	4365450-8	SWITCH	1	
	4787707-1	WIRE ASSY	1	
	0918960-6	TEE--PIPE	1	
	4408660-1	TERMINAL	1	

74113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CYLINDER BLOCK (CONTINUED)

ITEM	PART NO.		DESCRIPTION	QTY.
32	0920655-8		ELBOW-45°	1
	4908595-4		STUD	2
33	4908506-1		COVE-FUEL PUMP HOLE	2
	0921332-3		CAPSCREW	4
	4908594-7		WASHER	4
34	4908627-5	*	GASKET	2
35	0914453-6		COCK-DRAIN- .12 PT	1
36	4910038-1		CAP-BEARING-INTERMEDIATE REAR	1
	4910081-1		DOWEL	1
	4910069-6		STUD	1
	0920787-9		CAPSCREW	1
	0914383-5		CAPSCREW	2
	4908594-7		WASHER	1

* INCLUDED IN KIT 4910064-7

NOTE A SHORT BLOCK ASSY INCLUDES: CYLINDER BLOCK CONNECTING RODS -CAMSHAFT -BUSHINGS -BEARING CAPS -VALVE TRAIN-TAPPETS-CAMSHAFT-MAIN AND ROD BEARINGS-CRANKSHAFT-PISTONS-PISTON PINS -PISTON RINGS-FRONT END PLATE-THRUST PLATE-CAM GEAR-CRANKSHAFT GEAR-OIL GAUGE ROD SUPPORT -OIL GAUGE ROD-HOLE COVER, FUEL PUMP-OIL GUARD, REAR BEARING AND SERVICE GASKET SET.

NOTE B SERVICE ENGINE ASSY INCLUDES: CYLINDER AND CRANKCASE-BEARINGS-CAPS-GUIDES-INSERTS-COMPLETE VALVE MECHANISM-.SUPPORTS-PISTONS AND RINGS -CONNECTING RODS -CRANKSHAFT-CAMSHAFT-FRONT END PLATE GEARS -FILLER BLOCKS-CYLINDER HEAD-GASKETS -GEAR COVER-OIL PUMP-OIL PAN-STUDS-NUTS-SCREWS -WASHERS-PINS AND PLUGS.

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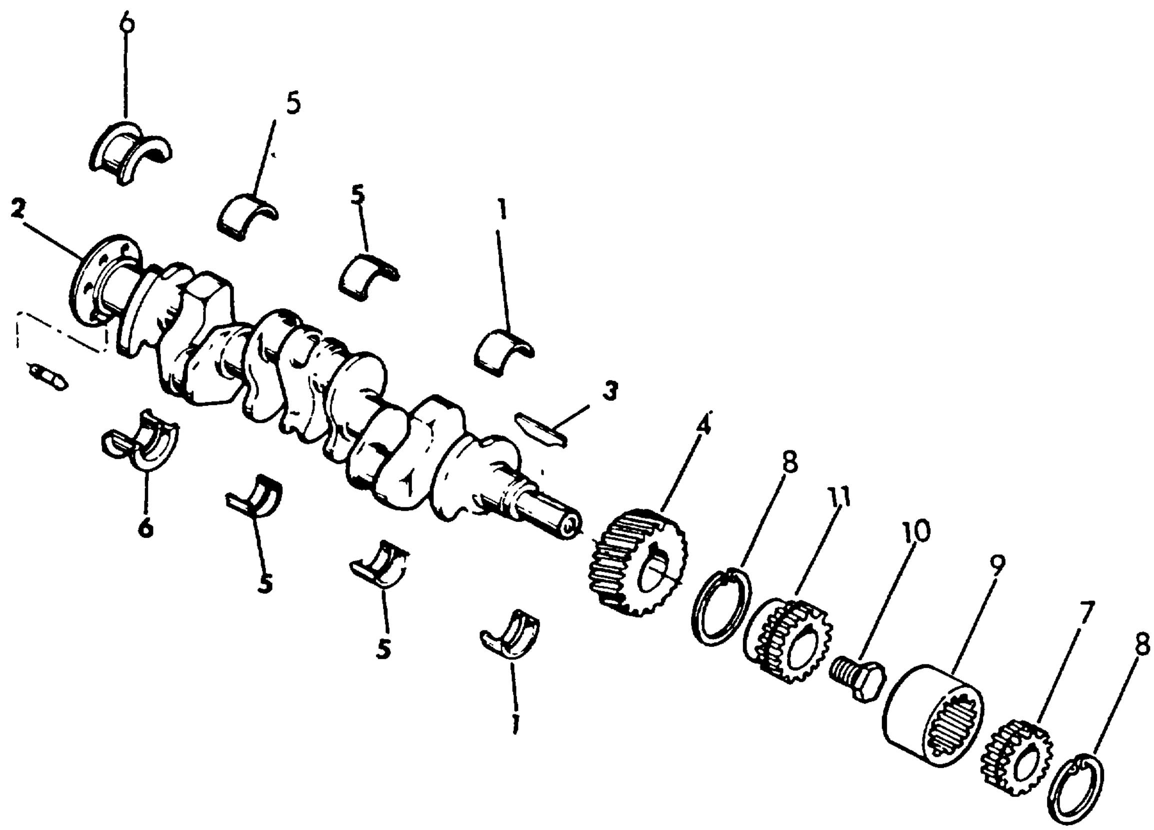
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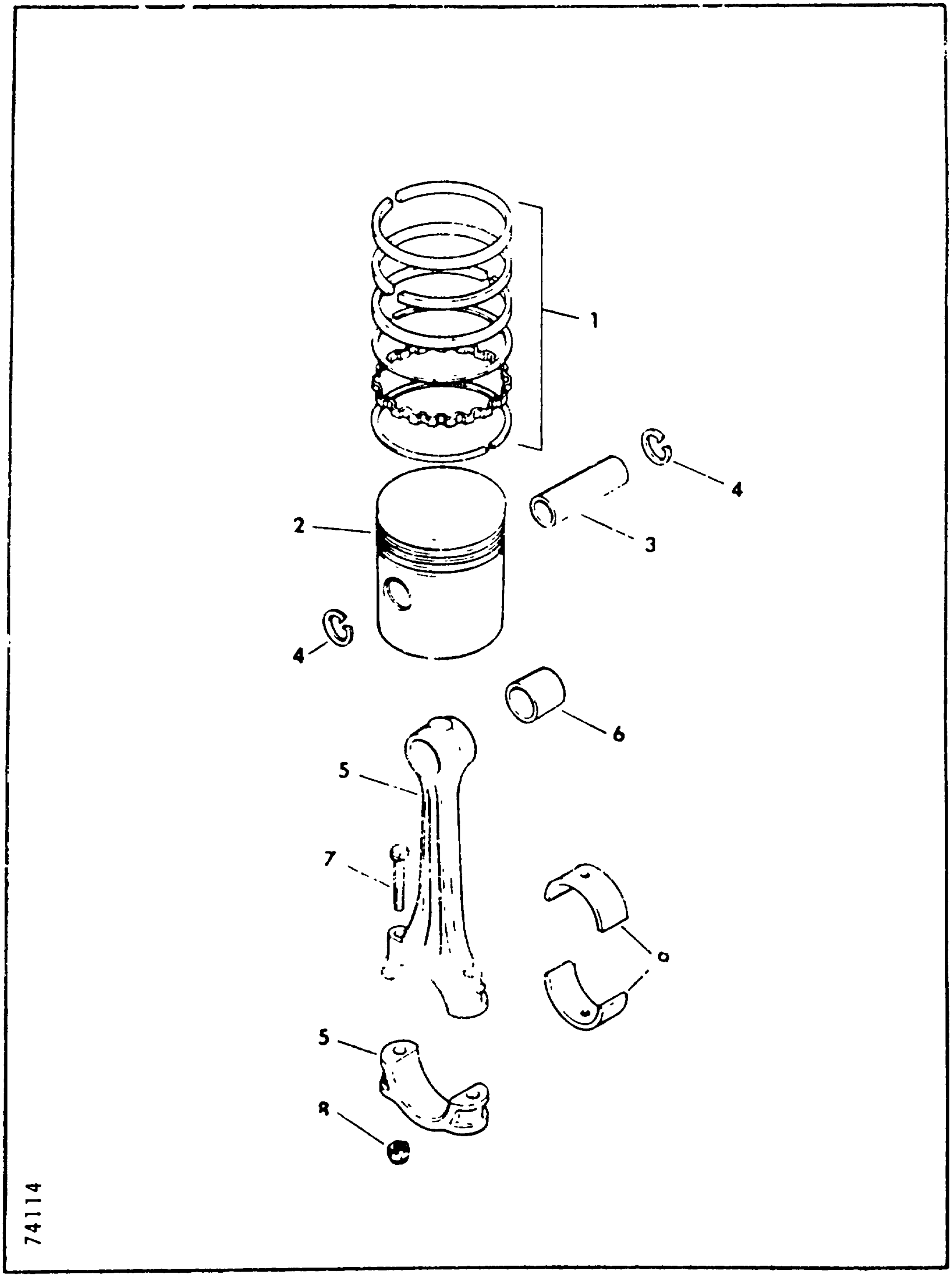
CRANKSHAFT

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4908641-6	* BEARING-FRONT MAIN-UPPER & LOWER	1	STANDARD
	4908642-4	** BEARING-FRONT MAIN-UPPER & LOWER	1	-.002"
	4908643-2	# BEARING-FRONT MAIN-UPPER & LOWER	1	- 010"
	4907644-0	##BEARING-FRONT MAIN-UPPER & LOWER	1	-.020"
	4908645-7	@BEARING-FRONT MAIN-UPPER & LOWER	1	-.030"
	4908646-5	@@BEARING-FRONT MAIN-UPPER & LOWER	1	-.040"
2	4910040-7	CRANKSHAFT	1	
3	4908563-2	KEY-CRANKSHAFT GEAR	1	
4	4910030-8	GEAR-CRANKSHAFT	1	
5	4910045-6	* BEARING-CENTER MAIN-UPPER & LOWER	2	STANDARD
6	4908647-3	* BEARING-REAR MAIN-UPPER & LOWER	1	STANDARD

* INCLUDED IN KIT 4910059-7

ITEM	PART NO.	DESCRIPTION	QTY.
7	4909770-2	GEAR HYDRAULIC PUMP	1
8	4909763-7	RETAINING RING	2
9	4909771-0	SLEEVE	1
10	4909764-5	SCREW	1
11	4909762-9	COUPLING	1

74115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PISTON & CONNECTING ROD

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4910025-8	RING SET-STANDARD	1	ENGINE SET
	4910026-6	RING SET-.020" O/S	1	
	4910027-4	RING SET-.030" O/S	1	
	4910028-2	RING SET-.040" O/S	1	
2	4912747-5	PISTON ASSY-STANDARD	6	INCL ITEMS 3 & 4
	4912774-9	PISTON ASSY-.010" O/S	6	
	4912775-6	PISTON ASSY-.020" O/S	6	
	4912776-4	PISTON ASSY-.030" O/S	6	
	4912777-2	PISTON ASSY-.040" O/S	6	
3	4908565-7	PIN-PISTON-STANDARD	6	
	4908677-0	PIN-PISTON-.003" O/S	6	
	4908678-8	PIN-PISTON-.005" O/S	6	
	4908679-6	PIN-PISTON-.010" O/S	6	
4	4912748-3	RING-RETAINING	12	
5	4909783-5	ROD ASSY-CONNECTING	6	INCL ITEMS 6-7 & 8
6	4908505-3	BUSHING	6	
7	4908564-0	BOLT-CONN ROD	12	
8	4908504-6	NUT-CONN ROD	12	
9	4909785-0	* BEARING-CONN ROD-STANDARD	6	
	4909812-2	** BEARING-CONN ROD-.010" U/S	6	
	4909813-0	# BEARING-CONN ROD-.020" U/S	6	
	4909815-5	@ BEARING-CONN ROD-.040" U/S	6	

* INCL IN KIT 4910052-2
** INCL IN KIT 4910053-0
# INCL IN KIT 4910054-8
@ INCL IN KIT 4910056-3

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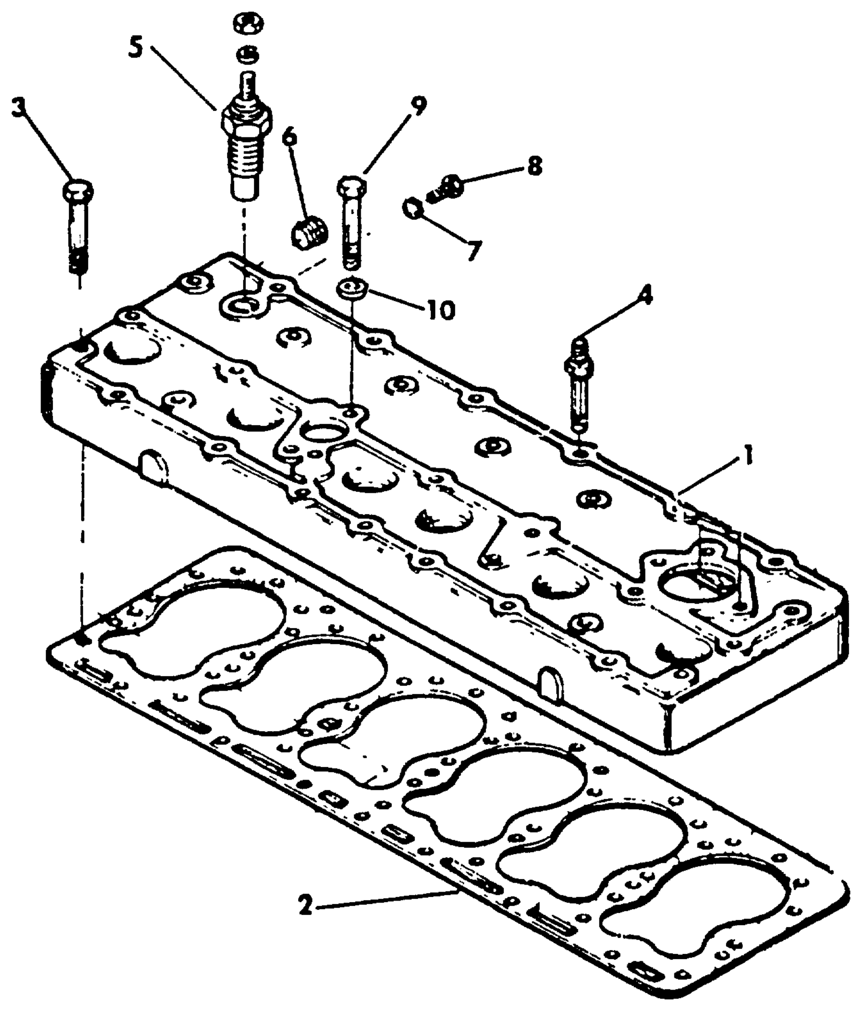

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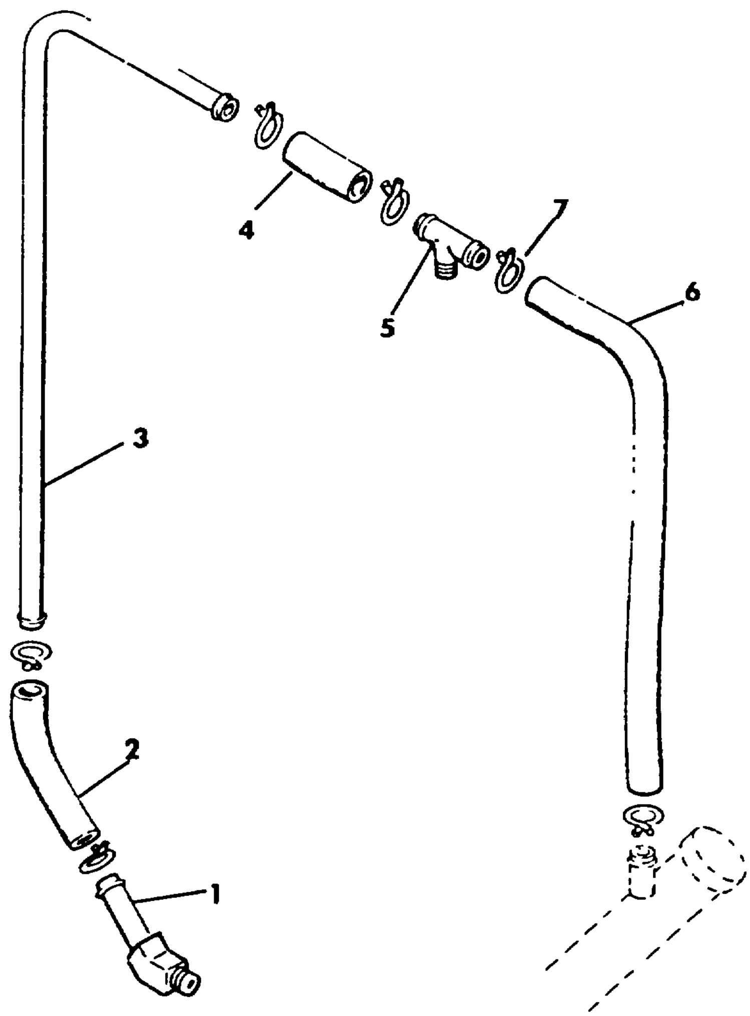
CYLINDER HEAD

ITEM	PART NO.		DESCRIPTION	QTY.
1	4910057-1		HEAD-CYLINDER	1
2	4910022-5	*	GASKET-CYLINDER HEAD	1
3	4910080-3		SCREW- .44" -14 X 2.75"	3
4	4910079-5		SCREW- .44" -14 X 2.75"	29
5	4760149-7		SENDER-WATER TEMP	1
	0917365-9		LOCKWASHER- #10	1
	0917415-2		NUT- #10 -32	1
6	4908781-0		PLUG-LEFT SIDE- .5" - 14 PT	2
7	4908594-7		WASHER-PLAIN	2
8	0920787-9		SCREW- .31" -18 X .5"	2
9	4910073-8		SCREW- .38" -16	1
10	4908593-9		WASHER-PLAIN- .38"	1
	4908595-4		STUD	1

* INCLUDED IN KIT 4910064-7

74116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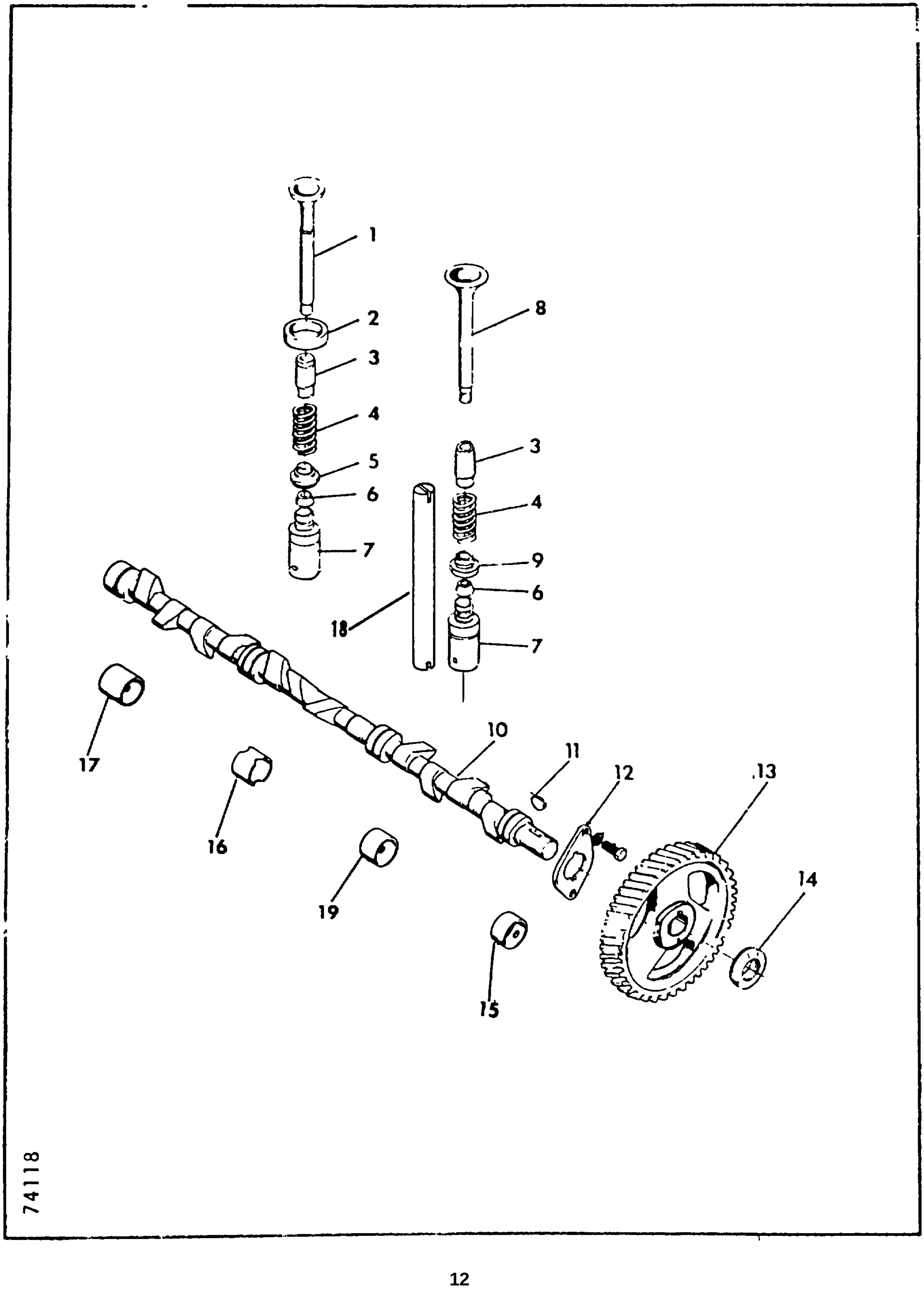
CRANKCASE VENTILATION

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4910095-1	ELBOW	1	
2	4910096-9	HOSE, RUBBER	1	
3	4910097-7	TUBE ASSEMBLY	1	
4	4910096-9	HOSE, RUBBER	1	
5	4910098-5	TEE	1	
6	4910101-7	HOSE, RUBBER	1	
7	4910099-3	CLAMP, HOSE	6	
8	4910100-9	CLAMP, HOSE	1	NOT ILLUSTRATED
	0916965-7	WASHER LOCK	1	
	0923518-5	NUT PLAIN HEX	1	

74117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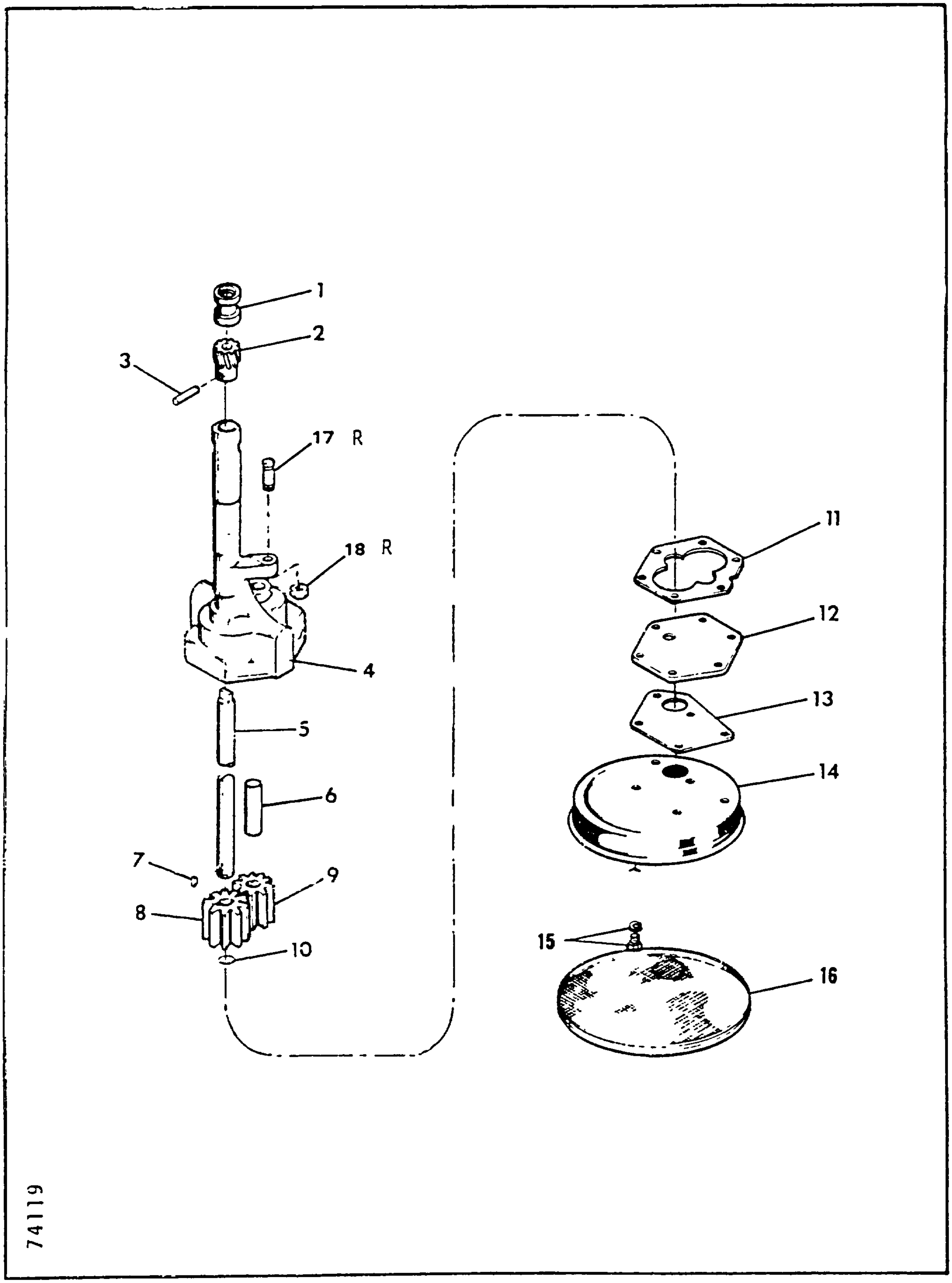
VALVE MECHANISM

ITEM	PART NO.	DESCRIPTION	QTY.
1	4908609-3	VALVE-EXHAUST	6
2	4908514-5	INSERT-VALVE SEAT-EXHAUST	6
3	4908513-7	GUIDE-VALVE STEM	12
4	4908512-9	SPRING-VALVE	12
5	4908562-4	ROTOCOIL-EXHAUST	6
6	4908574-9	LOCK-VALVE SPRING RTNR	24
	4908515-2	TAPPET-VALVE-STANDARD	12
	4908732-3	TAPPET-VALVE- .001" OS	12
	4908733-1	TAPPET-VALVE- .003" OS	12
7	4908734-9	TAPPET-VALVE- .005" OS	12
	4908735-6	TAPPET-VALVE- .010" OS	12
	4908736-4	TAPPET-VALVE- .015" OS	12
	4908737-2	TAPPET-VALVE- .020" OS	12
8	4908607-7	VALVE-INTAKE	6
9	4908575-6	RETAINER-VALVE SPRING-INTAKE	6
10	4910058-9	CAMSHAFT-STEEL	1
11	4908569-9	KEY-CAMGEAR TO CAMSHAFT	1
12	4908566-5	PLATE-CAMSHAFT THRUST	1
	0916803-0	LOCKWASHER- .31"	2
	0925205-7	CAPSCREW- .31" -18 X .63"	2
13	4910032-4	GEAR-CAMSHAFT-	1
14	4908590-5	NUT-CAMGEAR TO CAMSHAFT	1
15	4908568-1	* BUSHING-CAMSHAFT-FRONT	1
16	4908502-0	* BUSHING-CAMSHAFT-INT-REAR	1
17	4908501-2	* BUSHING-CAMSHAFT-REAR	1
18	4909828-8	SHAFT DISTRIBUTOR DRIVE	1
19	4910021-7	* BUSHING-CAMSHAFT IN-FRONT	1

* INCLUDED IN KIT 4910051-4

74118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OIL PUMP

ITEM	PART NO.		DESCRIPTION	QTY.	
R -	4909780-1		PUMP ASSY,-OIL	1	INCL ITEMS 2 THRU 16
1	4908511-1		BUSHING	1	
2	4909793-7	*	GEAR-OIL PUMP DRIVE	1	
3	4908747-1	*	PIN-DRIVE GEAR	1	
4	4908746-3		BODY-OIL PUMP	1	
5	4908510-2		SHAFT-DRIVE	1	
6	4908699-4		STUD-IDLER GEAR	1	
7	4908745-5	*	KEY	1	
8	4908742-2	*	GEAR-DRIVER	1	
9	4908741-4	*	GEAR-IDLER	1	
10	4908744-8	*	RING-RETAINER	1	
11	4908748-9	*	GASKET-COVER	1	
12	4908749-7		COVER	1	
13	4908751-3	*	GASKET-FRAME	1	
14	4908750-5		FRAME-STRAINER	1	
			NOT USED		
15	0928588-3		SCREW AND LOCKWASHER-.25"-20 X .62"	6	
16	4908712-5		SCREEN-STRAINER	1	
R 17	4908703-4		STUD	1	
R 18	4910078-7		NUT	1	
		*	INCLUDED IN KIT 4909779-3		

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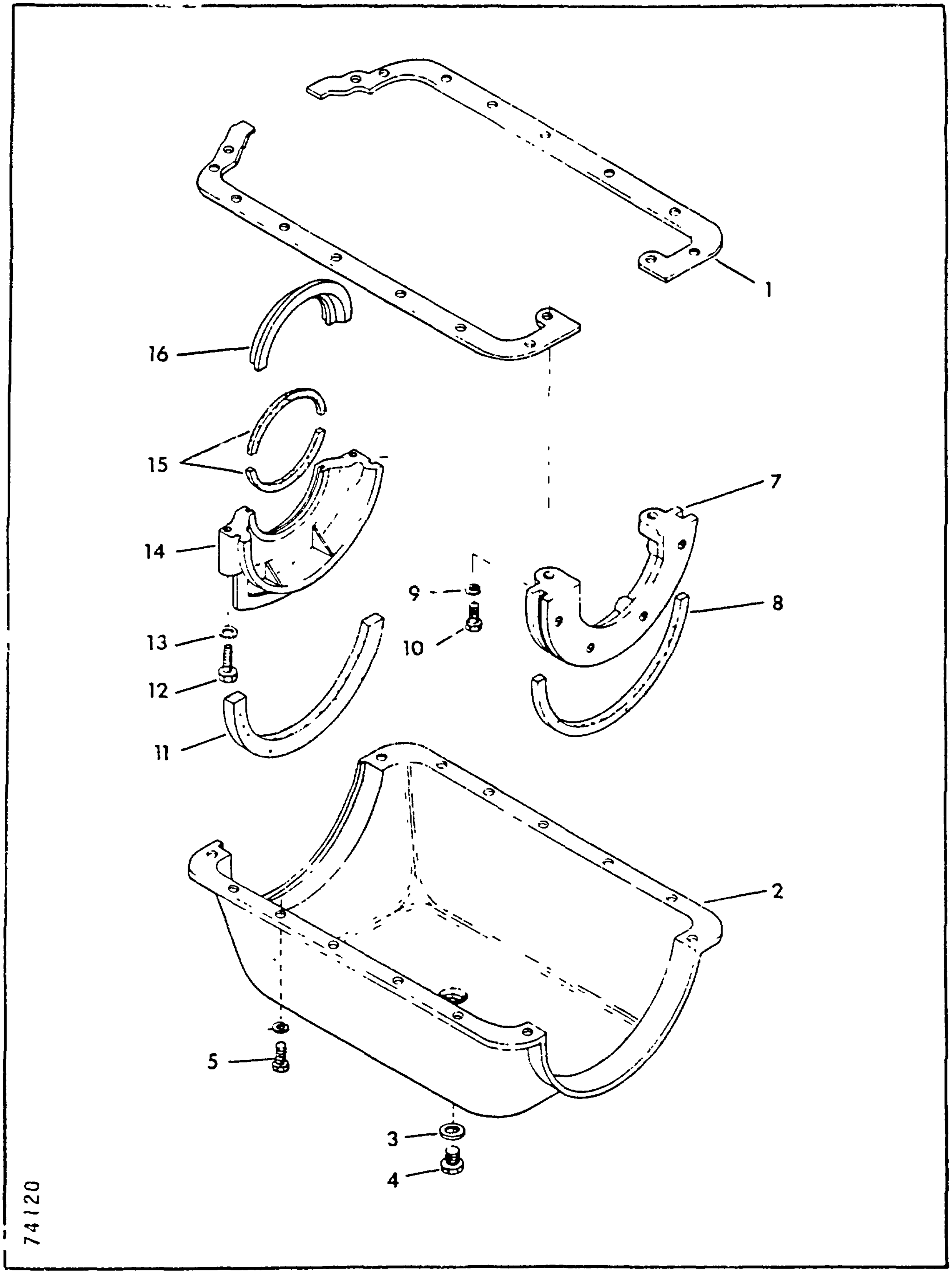
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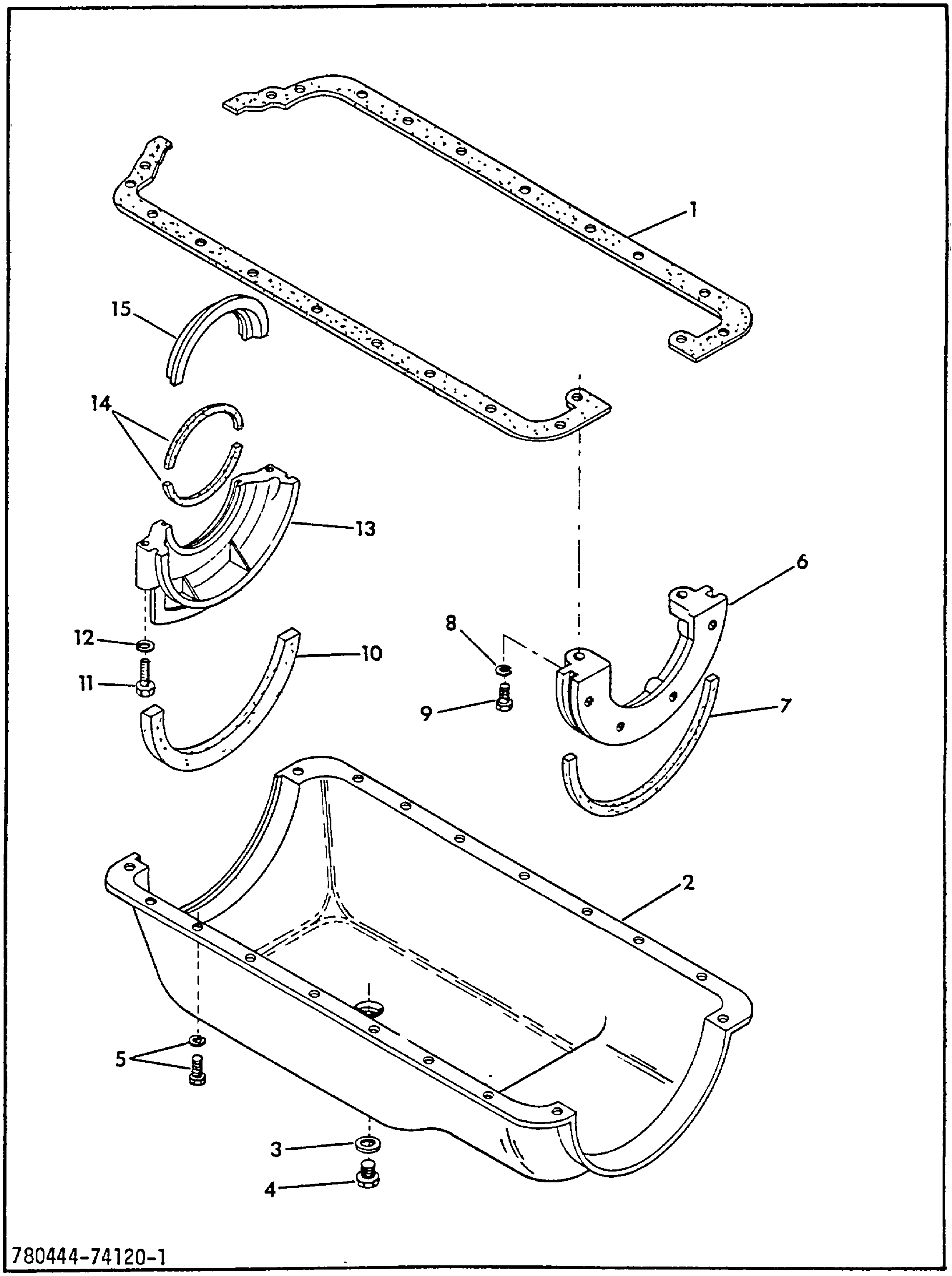
OIL PAN
PRIOR TO SERIAL NO. 106400

ITEM	PART NO.		DESCRIPTION	QTY.
1	4910036-5	*	GASKET-OIL PAN	2
2	4910094-4		PAN-OIL	1
3	4908717-4	*	WASHER-DRAIN PLUG	1
4	4908579-8		PLUG-OIL DRAIN	1
5	0923045-9		CAPSCREW W/LOCKWASHER	18
7	4908601-0		BLOCK-FILLER-FRONT	1
8	4908714-1	*	GASKET-FILLER BLOCK	1
9	0910941-4		LOCKWASHER-.31"	2
10	4908581-4		SCREW-.31"-18 X .88"	2
11	4908714-1	*	GASKET-FILLER BLOCK	1
12	4908596-2		SCREW-.31"-18 X 2.63"	2
13	0910941-4		LOCKWASHER-.31"	2
14	4908619-2		BLOCK-FILLER-REAR	1
15	4908715-8		SEAL-OIL	2
16	4908602-8		GUARD-OIL SEAL	1

* INCLUDED IN KIT 4910065-4

74120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780444-74120-1

OIL PAN
EFFECTIVE/WITH SERIAL NO. 106400

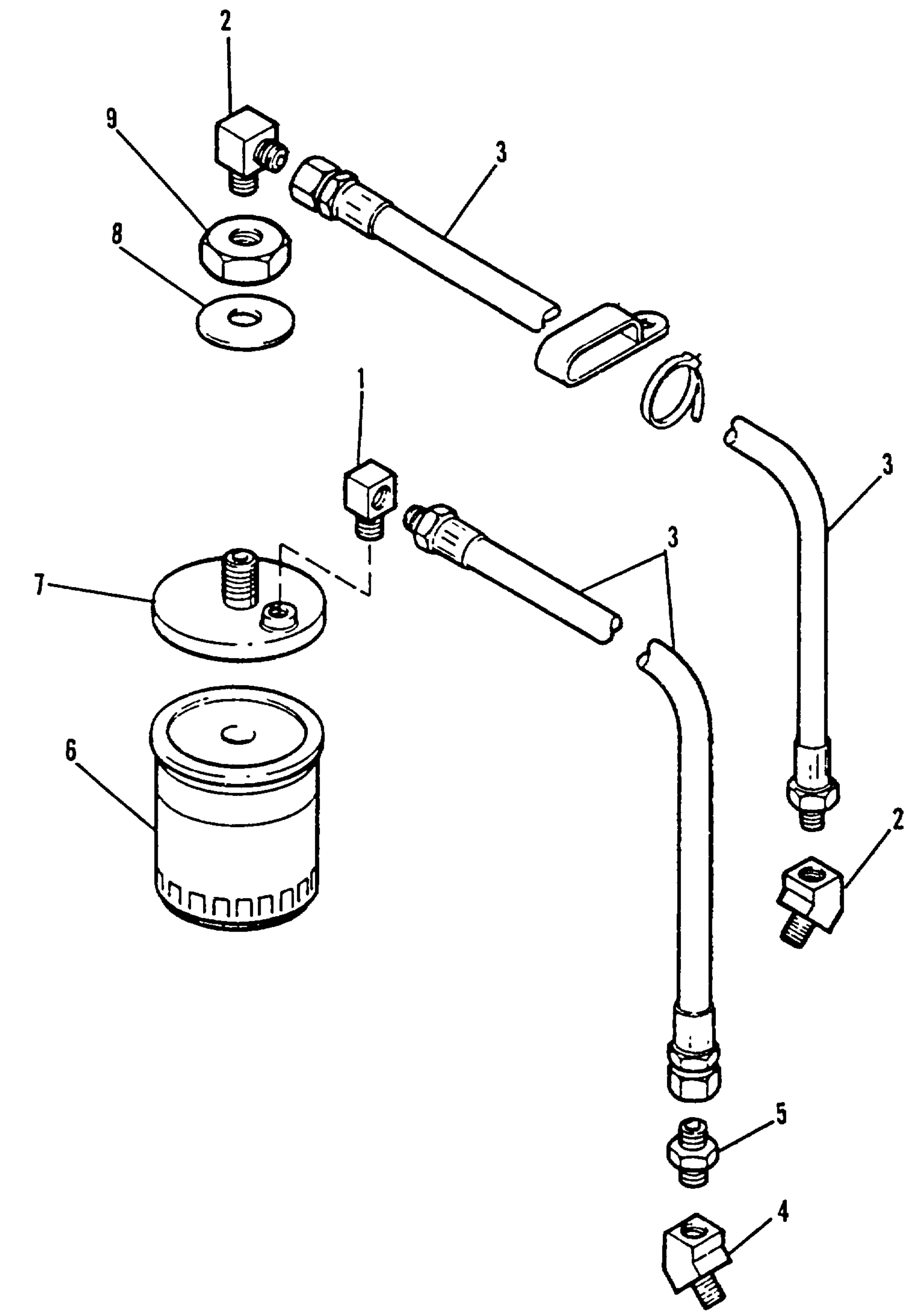
ITEM	PART NO.	DESCRIPTION	QTY.	
1	--------------	GASKET-OIL PAN	#	SEE NOTE
2	4813998-3	PAN-OIL	1	
3	4912201-3	WASHER	1	
4	4912200-5	PLUG	1	
5	0923045-9	CPSC-.31-18 X .63	18	INCL LKW
6	4914115-3	BLOCK-FLR-FRT	1	
7	*4908714-1	GASKET-FLR BLOCK	1	
8	0910941-4	LKW-.31	2	
9	4908581-4	SCREW-.31-18 X .88	2	
10	*4908714-1	GASKET-FLR-BLOCK	1	
11	4908596-2	SCREW-.31-18 X 2.63	2	
12	0910941-4	LKW-.31	2	
13	4914116-1	BLOCK-FLR-RR	1	
14	4908715-8	SEAL-OIL	2	
15	4908602-8	GUARD-OIL SEAL	1	

NOTE-FORM IN PLACE GASKET MATERIAL IS AVAILABLE IN 4.50 CC TUBES-ORDER PART NO. 4914117-9-USE AS REQUIRED

* INCL IN KIT 4914282-1

E/W-ENGINE SPEC. NOS. F245-8501 & F245-8502

780444A-74120-1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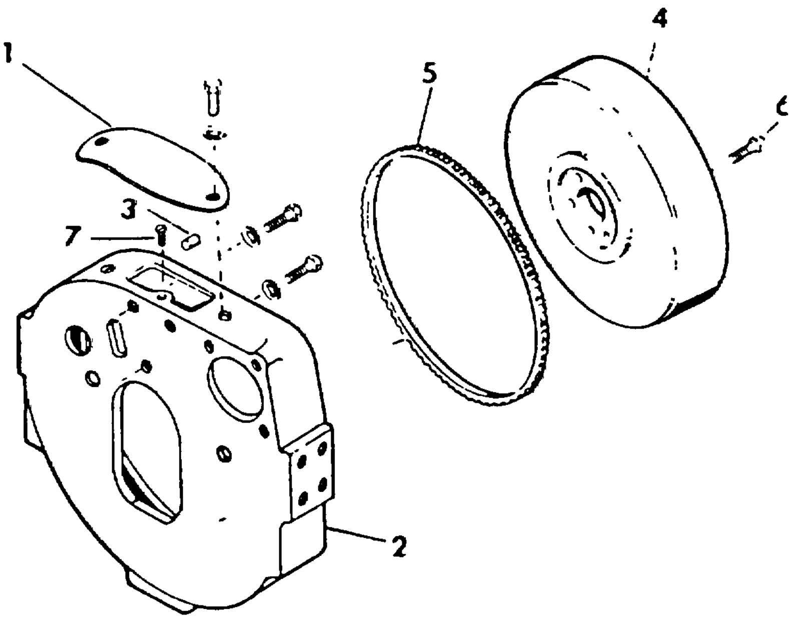
OIL FILTER

ITEM	PART NO.	DESCRIPTION	QTY.
1	0917032-5	ADAPTER	1
2	0910140-3	ELBOW	2
3	4819211-6	HOSE	2
4	0915399-0	ELBOW	1
5	0901834-2	BUSHING	1
6	4512207-4	FILTER	1
7	4512341-1	BASE	1
8	0919390-5	WASHER	1
9	0921138-4	NUT	1
10		NOT USED	
11		NOT USED	
12		NOT USED	

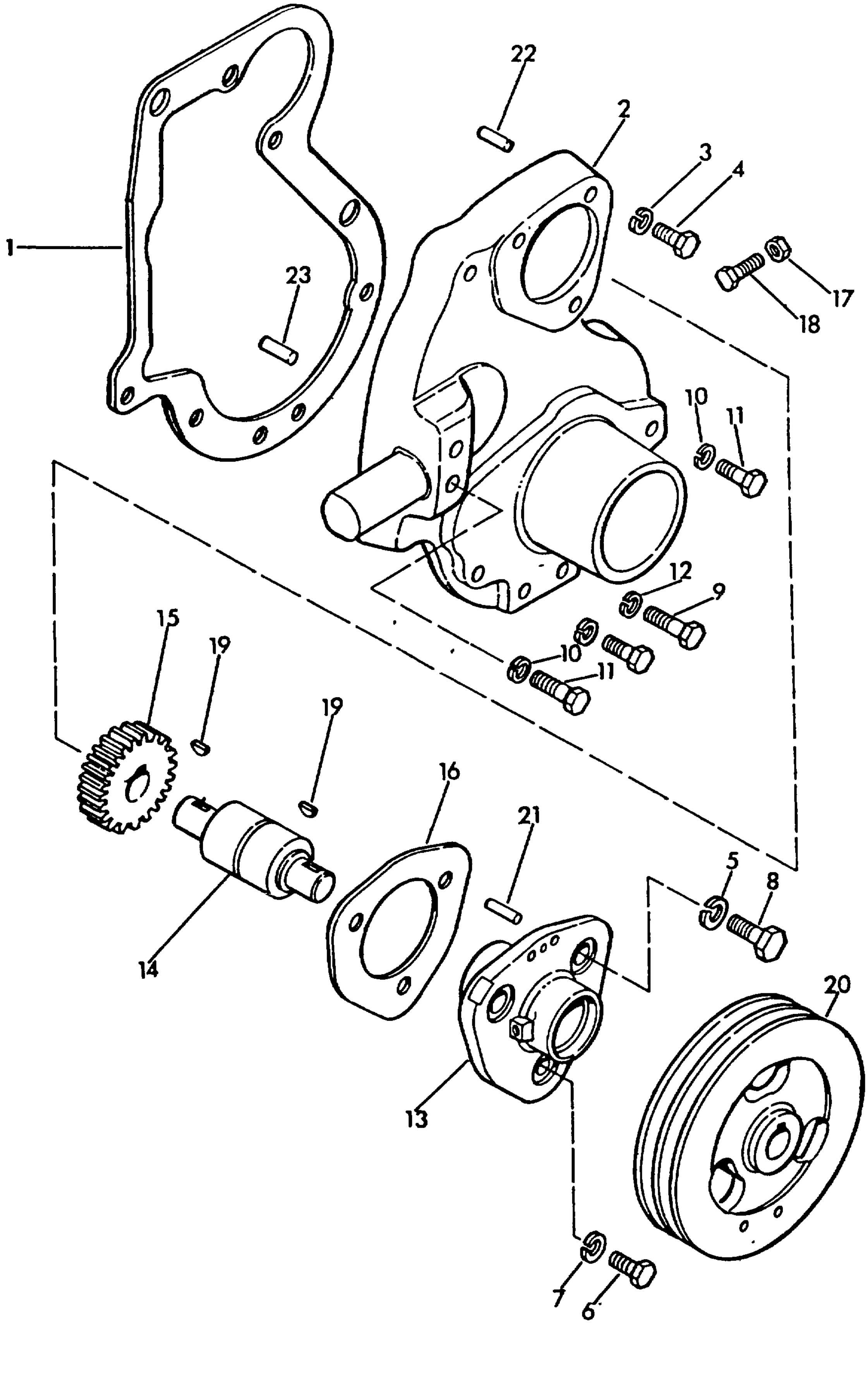


74123

FLYWHEEL AND HOUSING-P/S

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4908615-0	COVER-TIMING HOLE	1	
	0921958-5	CAPSCREW-.25" -20 X .5"	2	
	0924958-2	LOCKWASHER-.25"	2	
2	4909788-4	HOUSING-FLYWHEEL	1	
	0918199-1	LOCKWASHER-.44"	5	
	0921212-7	CAPSCREW-.44" -14 X 1.50"	2	
	0921876-9	CAPSCREW-.44" -14 X 1.25"	3	
3	4908576-4	DOWEL-RING	2	
4	4909767-8	FLYWHEEL ASSY.-P/S TRANS	1	INCLUDE ITEM 5
5	4908614-3	GEAR-RING	1	
6	4910075-3	BOLT-.38" -24 X 1.19"	6	
7	4908509-5	SCREW-TIMING POINTER - #10 -32 X .75"	1	
	4909832-0	SCREW TIMING	1	

74123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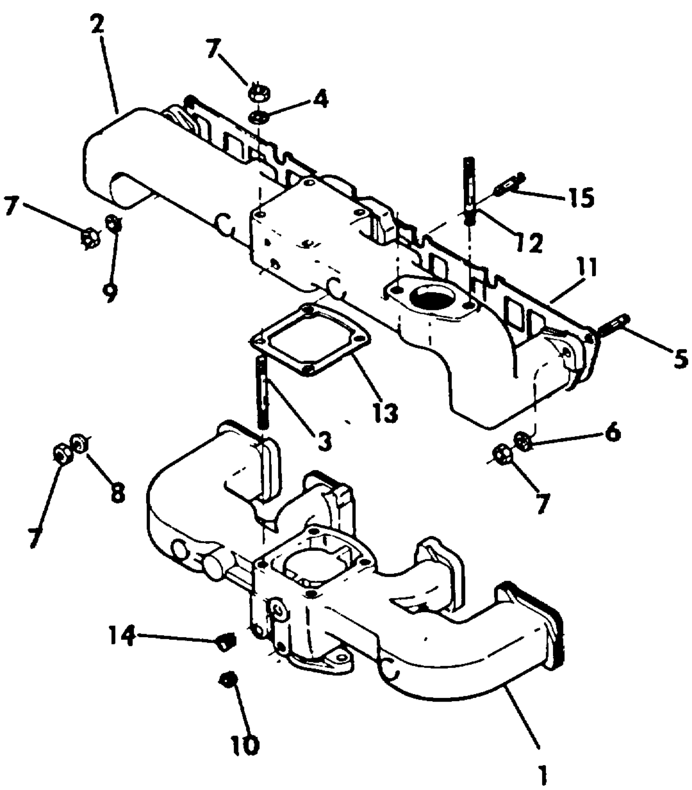
GEAR COVER

ITEM	PART NO.		DESCRIPTION	QTY.
1	4909794-2	*	GASKET COVER	1
2	4909765-2		COVER-GEAR	1
3	0918199-1		WASHER-LOCK	1
4	0924346-0		SCREW- .38" -16 X 1.25"	1
5	0916965-7		WASHER-LOCK- .38"	1
6	4909820-5		SCREW- .38" -16 X 1"	1
7	4908593-9		WASHER-PLAIN- .44"	3
8	0919953-0		SCREW- .38" -16 X 3.12"	2
9	0922130-0		SCREW- .38" -16 X 2"	2
10	0916965-7		LOCKWASHER- .38"	2
11	0921973-4		SCREW- .38" -16 X 1.25"	2
12	0916965-7		LOCKWASHER- .38"	2
13	4909771-0		ADAPTER-FAN DRIVE	1
14	4909772-8		SHAFT W/BEARING	1
15	4909764-4		GEAR-FAN DRIVE	1
16	4909774-4	*	GASKET-ADAPTER	1
17	4909823-9		NUT, WATER PUMP	1
18	4909822-1		SCREW WATER PUMP	1
19	4909827-0		KEY SHAFT	2
20	4909773-6		PULLEY FAN BELT	1
21	0918547-1		PIN SPRING	1
22	4909824-7		PIN DOWEL	1
23	4909825-4		PIN DOWEL	1
	4910074-6		CAPSCREW	2
		*	INCLUDED IN KIT 4909766-0	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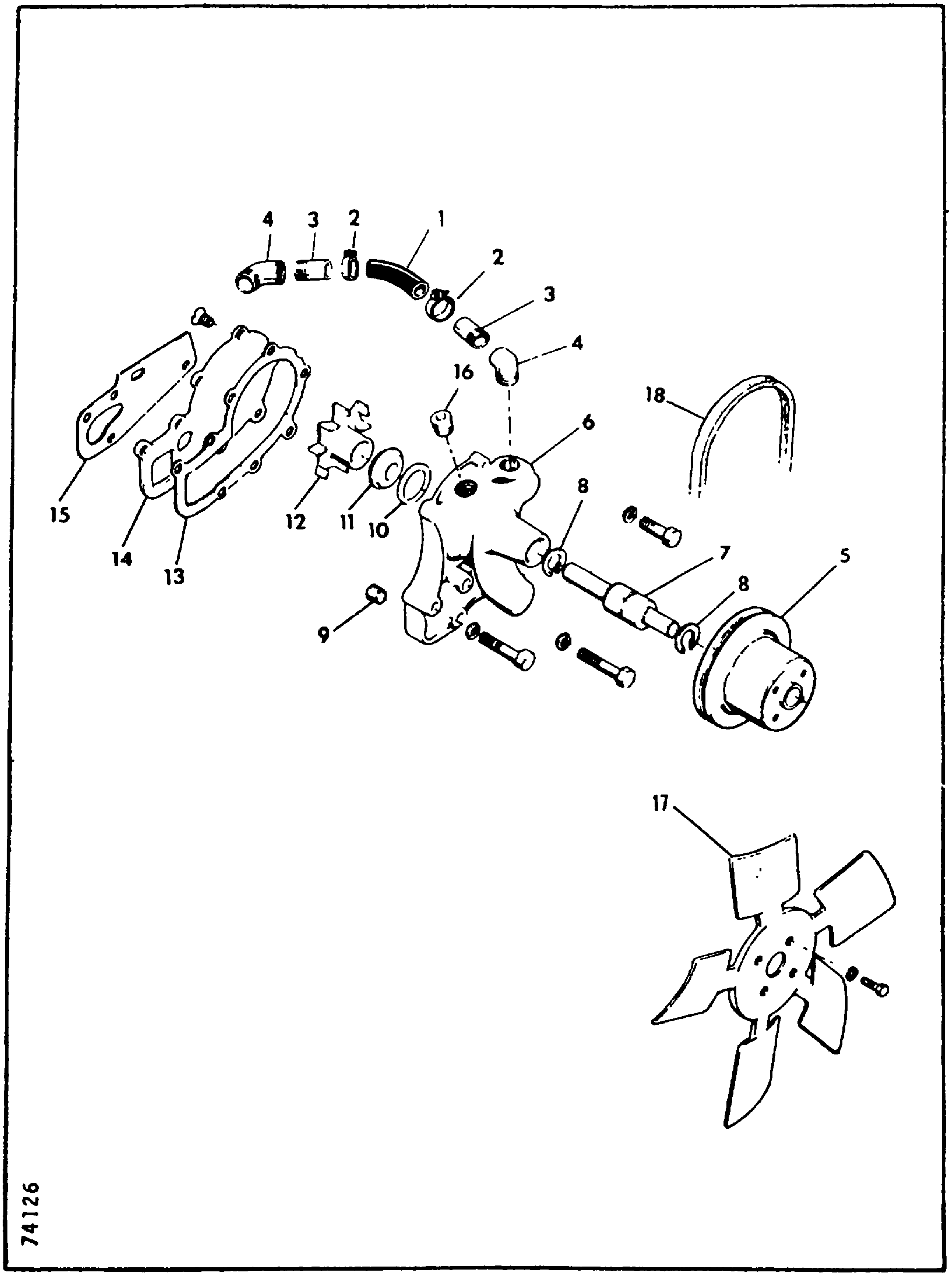
INTAKE & EXHAUST MANIFOLD

ITEM	PART NO.		DESCRIPTION	QTY.
1	F600F00529		MANIFOLD-INTAKE	1
2	F600E00527		MANIFOLD-EXHAUST	1
3	4910071-2		STUD	4
4	4908586-3		WASHER, .38"	4
5	4908518-6		STUD	10
6	4910076-1		WASHER	2
7	0916954-1		NUT- .38-16	15
8	0929362-2		WASHER	3
9	4910077-9		WASHER	6
10	4908560-8		PLUG-.25 PT	1
11	4910042-3	*	GASKET	1
12	4910072-0		STUD	2
13	4910041-5	*	GASKET	1
14	4910066-2		PLUG	1
15	4909816-3		STUD	1

* INCLUDED IN KIT 4910064-7

74125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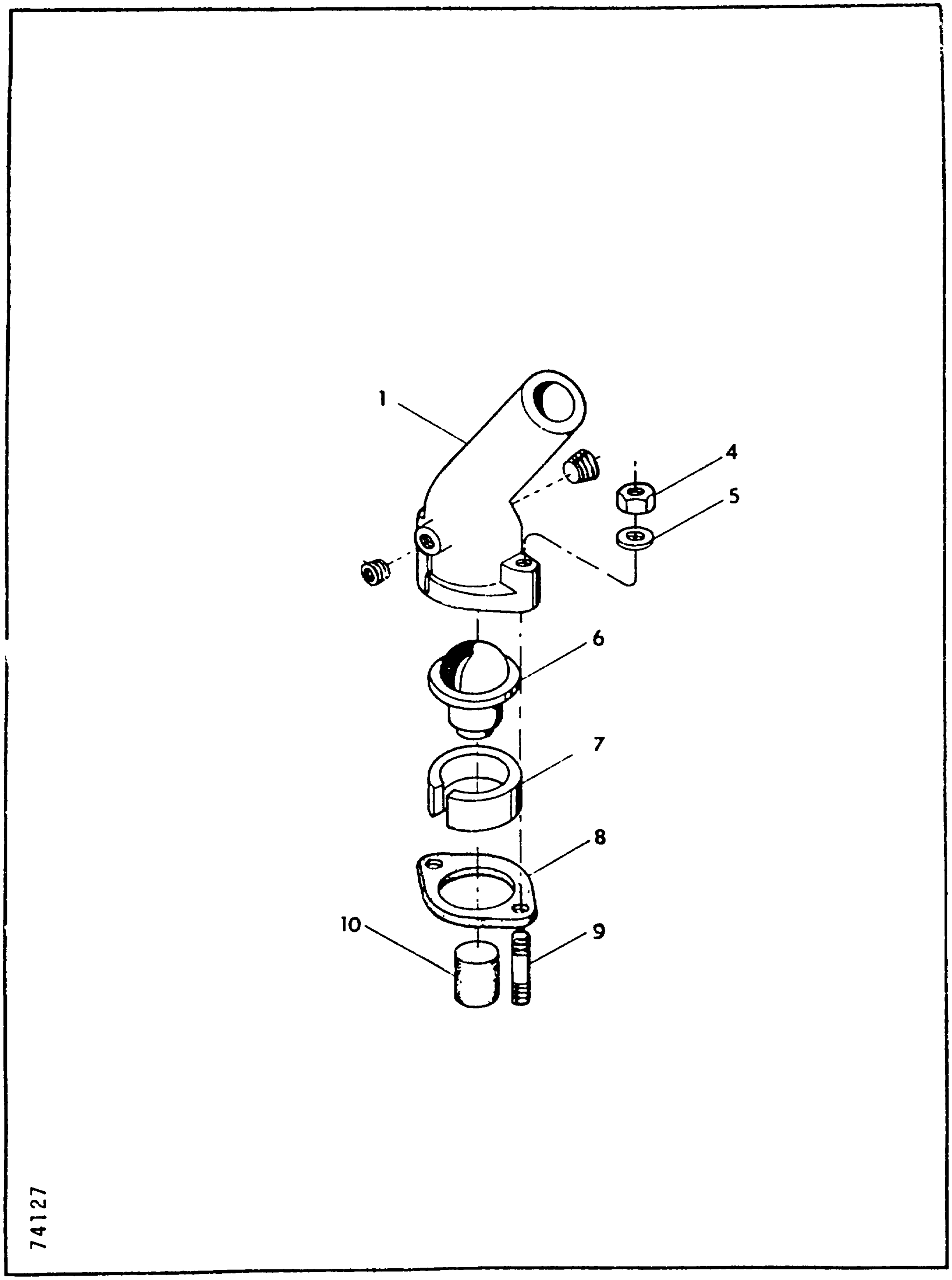
WATER PUMP AND FAN

ITEM	PART NO.	DESCRIPTION	QTY.	
-	4909776-9	PUMP ASSY -WATER	1	INCLUDE ITEMS 6 THRU 16
	0921972-6	SCREW	1	
	0929362-2	LOCKWASHER	1	
	0916272-4	SCREW	1	
	4910068-8	SCREW	1	
	0916965-7	LOCKWASHER	2	
	0921969-2	SCREW	1	
	4908593-9	WASHER-COPPER	1	
1	4909819-7	HOSE-BY-PASS	1	
2	4908532-7	CLAMP-HOSE	2	
3	4908530-1	NIPPLE	1	
4	0916735-4	ELBOW-90°-.38"	1	
5	4908617-6	PULLEY-DRIVE	1	SEE NOTE A
6	--------------	BODY-PUMP	1	ORDER ASSY
7	4908753-9	* BEARING AND SHAFT	1	
8	4908782-8	* RING-RETAINING	2	
9	4908560-8	PLUG-PIPE	1	
10	4908759-6	* GASKET-SEAL	1	
11	4908754-7	* SEAL	1	
12	4909797-5	* IMPELLER	1	
13	4908757-0	* GASKET-PLATE TO BODY	1	
14	4908756-2	PLATE-BACK	1	
15	4908755-4	* GASKET-PUMP TO CRANKCASE	1	SEE NOTE B
	4908783-6	SCREW	4	
16	4908781-0	NOT USED	1	
17	4858128-4	FAN	1	
	0915809-8	CAPSCREW- .31" -18 X .75"	4	
	0917356-8	LOCKWASHER-.31"	4	
18	4856615-2	BELT-FAN	1	

* INCLUDED IN KIT 4909778-5

NOTE A INSTALLATION INSTRUCTIONS PACKAGED WITH SERVICE PUMP MUST BE FOLLOWED WHEN ASSEMBLING PULLEY TO PUMP

NOTE B INCLUDED IN KIT 4909766-0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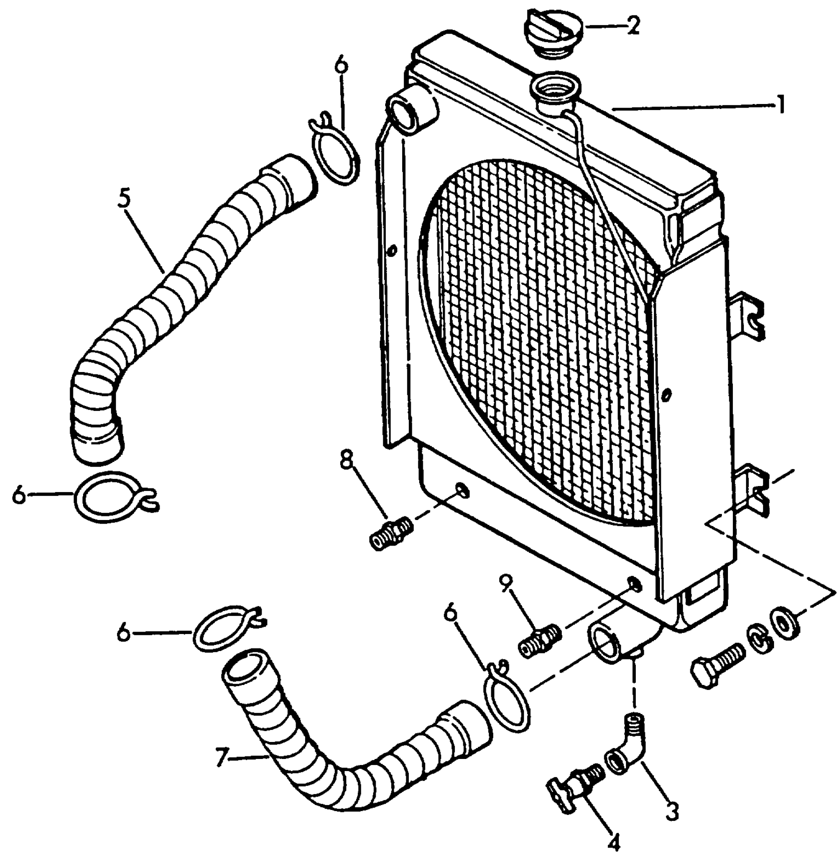
THERMOSTAT & HOUSING

ITEM	PART NO.	DESCRIPTION	QTY.
1	4909818-9	ELBOW-WATER OUTLET	1
2		NOT USED	
3		NOT USED	
4	0917372-5	NUT- .31" -18	2
5	0910941-4	LOCKWASHER- .31"	2
6	4908710-9	THERMOSTAT- 1800	1
7	4908625-9	RING-THERMOSTAT ADAPTER	1
8	4908588-9	* GASKET	1
9	4909821-3	STUD- .31" -18 X 1.75"	2
10	4908534-3	CAPSULE-COOLANT CONDITIONER	2

* INCLUDED IN KIT 4910064-7

74127



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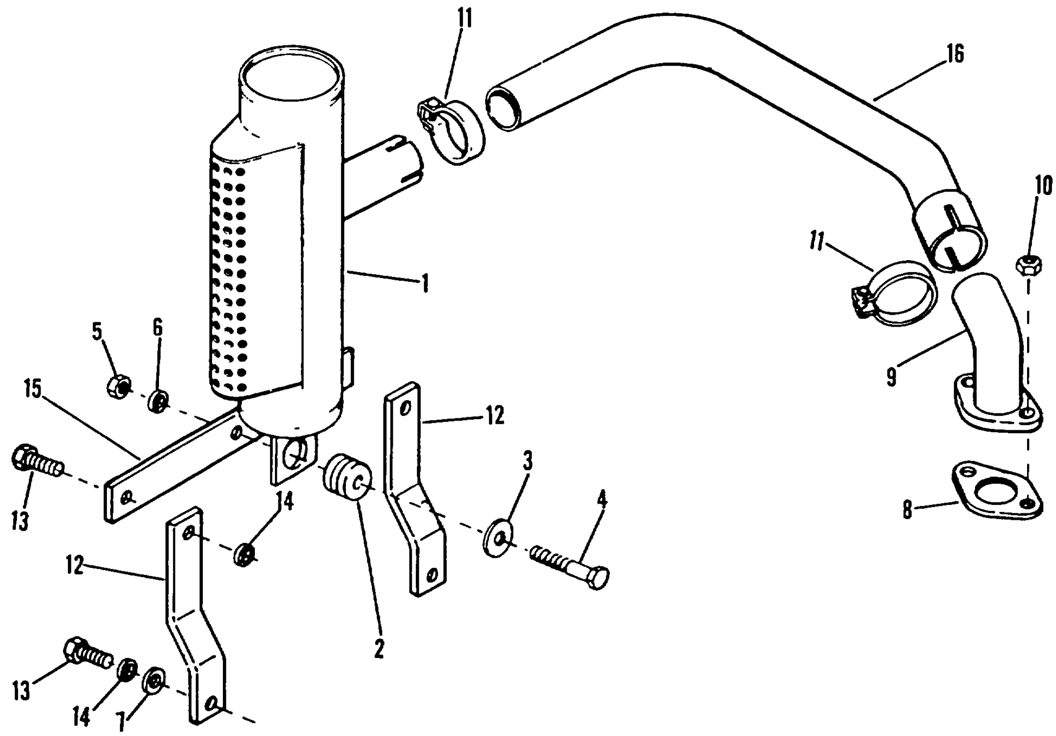
RADIATOR-POWER SHIFT

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4877814-6	RADIATOR	1	INCL ITEM 2
	0921965-0	CAPSCREW- .375-16 X .750	4	
	0916965-7	LOCKWASHER- .38"	4	
	0917378-2	WASHER- .38"	4	
	4908156-5	CAP- RADIATOR	1	7#
2				
3	0915399-0	ELBOW	1	
4	0914453-6	COCK- DRAIN-PIPE- BRASS- .12"	1	
5	4858197-9	HOSE- RADIATOR	1	
6	0922198-7	CLAMP- HOSE	4	
7	4858198-7	HOSE- RADIATOR	1	
8	0921727-4	ADAPTER	1	
9	4760327-9	ADAPTOR	1	
	4769321-3	SPACER	4	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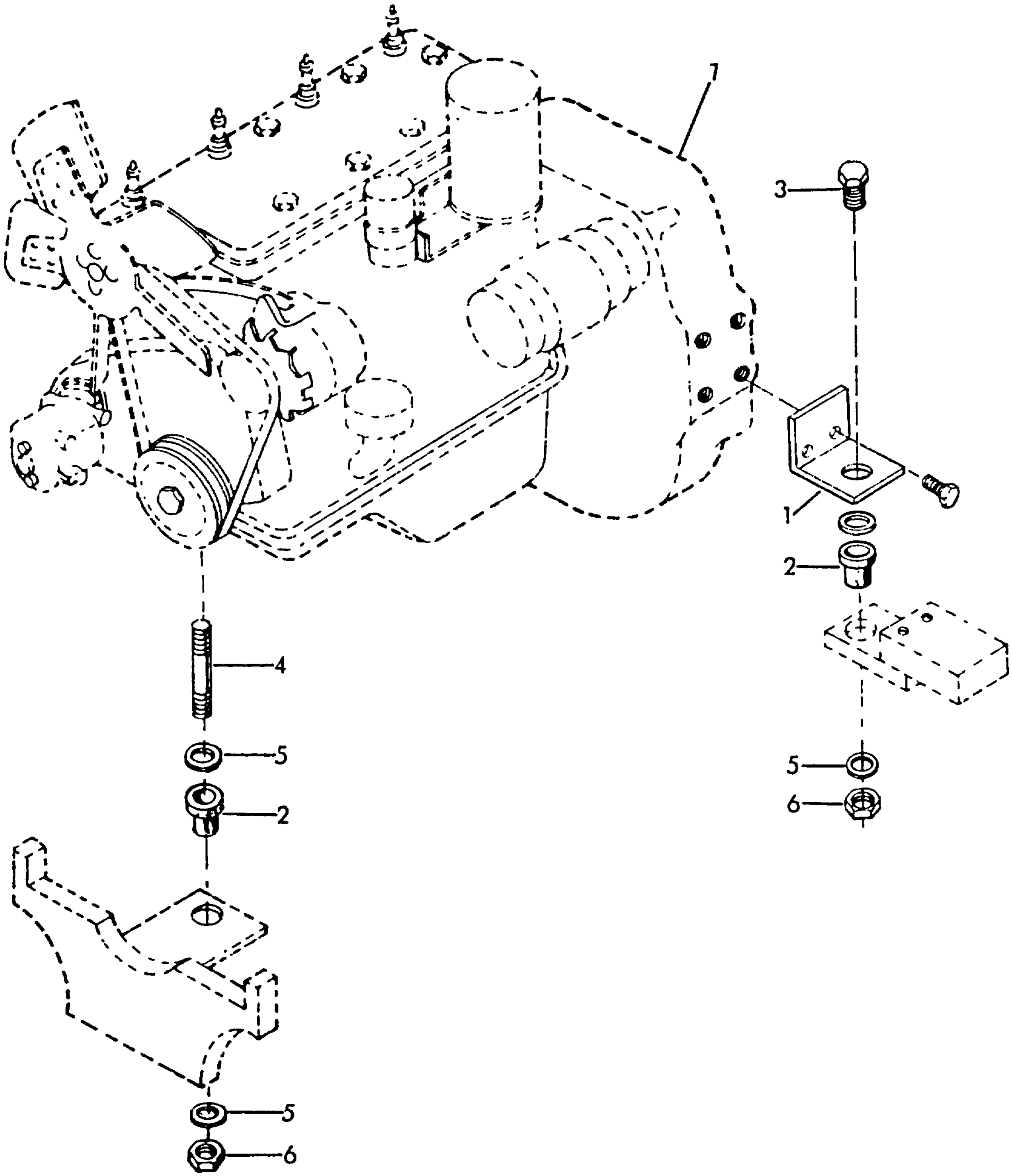
EXHAUST GROUP

ITEM	PART NO.	DESCRIPTION	QTY.
1	4826095-4	MUFFLER W/DIFUSER	1
2	4710442-7	GROMMET	1
3	4711590-2	WASHER	1
4	0921971-8	CAPSCREW .375 -16 X 1.75	1
5	0916950-9	NUT .375-16	1
6	0916965-7	LOCKWASHER	1
7	0916956-6	WASHER	2
8	4858123-5	GASKET	1
9	4858124-3	EXHAUST PIPE ASSY	1
10	0917258-6	NUT	2
11	4710162-1	CLAMP	2
12	4878221-3	STRAP	2
13	0921965-0	CAPSCREW	4
14	0916965-7	LOCKWASHER	4
15	4878220-5	SPACER	1
16	4858126-8	PIPE-EXHAUST	1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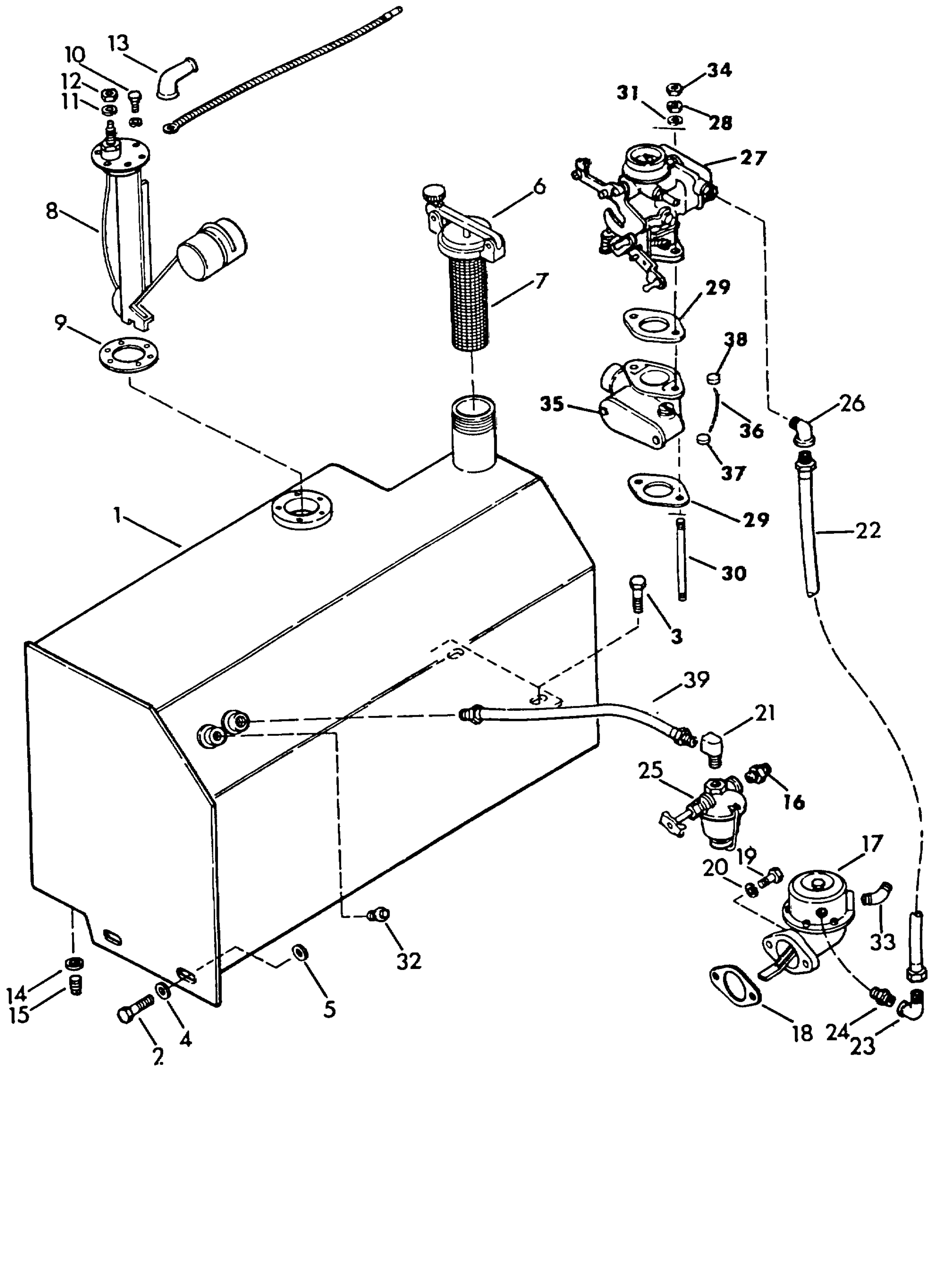
ENGINE MOUNTING

ITEM	PART NO.	DESCRIPTION	QTY.
1	4857898-3	BRACKET-ENGINE SUPPORT	2
	0923781-9	CAPSCREW- .50" -13 X 1.50	4
	0916966-5	LOCKWASHER	4
	4755785-5	MOUNT-ENGINE	3
	0920587-3	CAPSCREW- .625-11 x 3.5	2
	4857245-7	STUD	1
	0929306-9	WASHER- .688 X 2.50 X 12	7
	0923351-1	NUT-LOCK- .625-11	3
	4858682-0	ENGINE ASSEMBLY	1

74133



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FUEL SYSTEM

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4858134-2	TANK-FUEL	1	
2	0922130-0	CAPSCREW	2	
3	0921210-1	CAPSCREW	2	
4	0918266-8	WASHER	4	
5	0916965-7	LOCKWASHER	4	
	0916950-9	NUT	2	
6	4749382-0	CAP	1	
7	4991217-3	SCREEN	1	
8	4905897-7	SENDER-FUEL	1	
9	4735714-0	GASKET	1	
10	0917452-5	SCREW	5	
11	0917365-9	LOCKWASHER	6	
12	0917415-2	NUT	1	
13	4757678-0	BOOT	1	
14	4845678-4	WASHER-NYLON	1	
15	4847837-4	PLUG-DRAIN	1	
16	0920215-1	NIPPLE	1	
17	4848884-5	FUEL PUMP	1	
18	4848885-2	* GASKET	1	
19	0921332-3	CAPSCREW	2	
20	0917356-8	LOCKWASHER	2	
21	0910140-3	ELBOW	1	
22	4861997-7	FUEL LINE	1	
23	0922967-5	ELBOW	1	
24		NOT USED		
25	4730551-1	FILTER-FUEL	1	SEE PAGE 41
26		NOT USED		
27	4858903-0	CARBURETOR	1	SEE PAGE 43
28	4909055-8	NUT	1	
29	4909053-3-	GASKET	2	
30	4909054-1	STUD	2	
31	0916965-7	LOCKWASHER	2	
32	30901651-0	PLUG	1	
33	0915856-9	ADAPTER	1	
34	0916602-5	NUT	2	
35	4858902-	GOVERNOR	1	
36		WIRE LOCK	1	INCL. IN ITEM 41.
37		SEAL	1	INCL. IN ITEM 41.
38		SEAL	1	INCL. IN ITEM 41.
39	4749988-4	FUEL LINE	1	
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	4864820-8	CLAMP	1	
	0916965-7	LOCKWASHER	1	
	0916950-9	NUT	1	
	0920655-8	ELBOW	1	
41	4909981-5	KIT-SEAL	1	

* INCLUDED IN KIT 4910064-7

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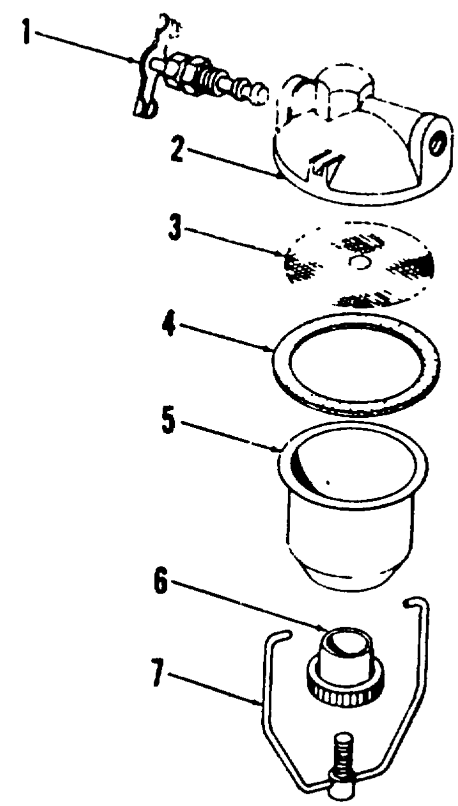
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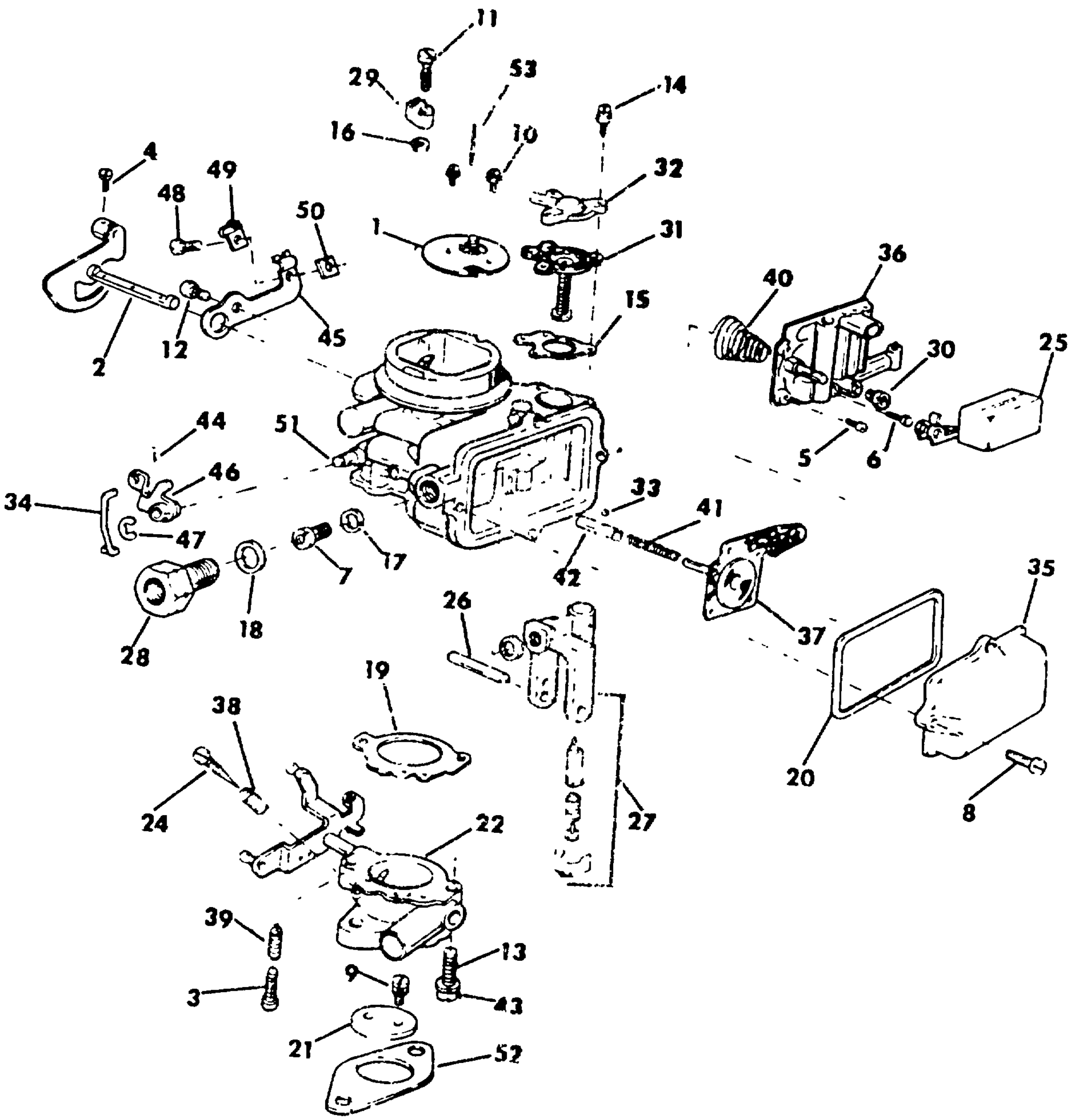
FUEL STRAINER - 4730551-1

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4981110-2	SHUT-OFF	1	
2	4981104-5	COVER	1	
3	4981105-2	SCREEN	1	
4	4981106-0	GASKET	1	
5	4981107-8	BOWL-METAL	1	
6	4981108-6	NUT-CUP	1	
7	4981109-4	WIRE ASSEMBLY-CLAMP	1	INCL STUD

18367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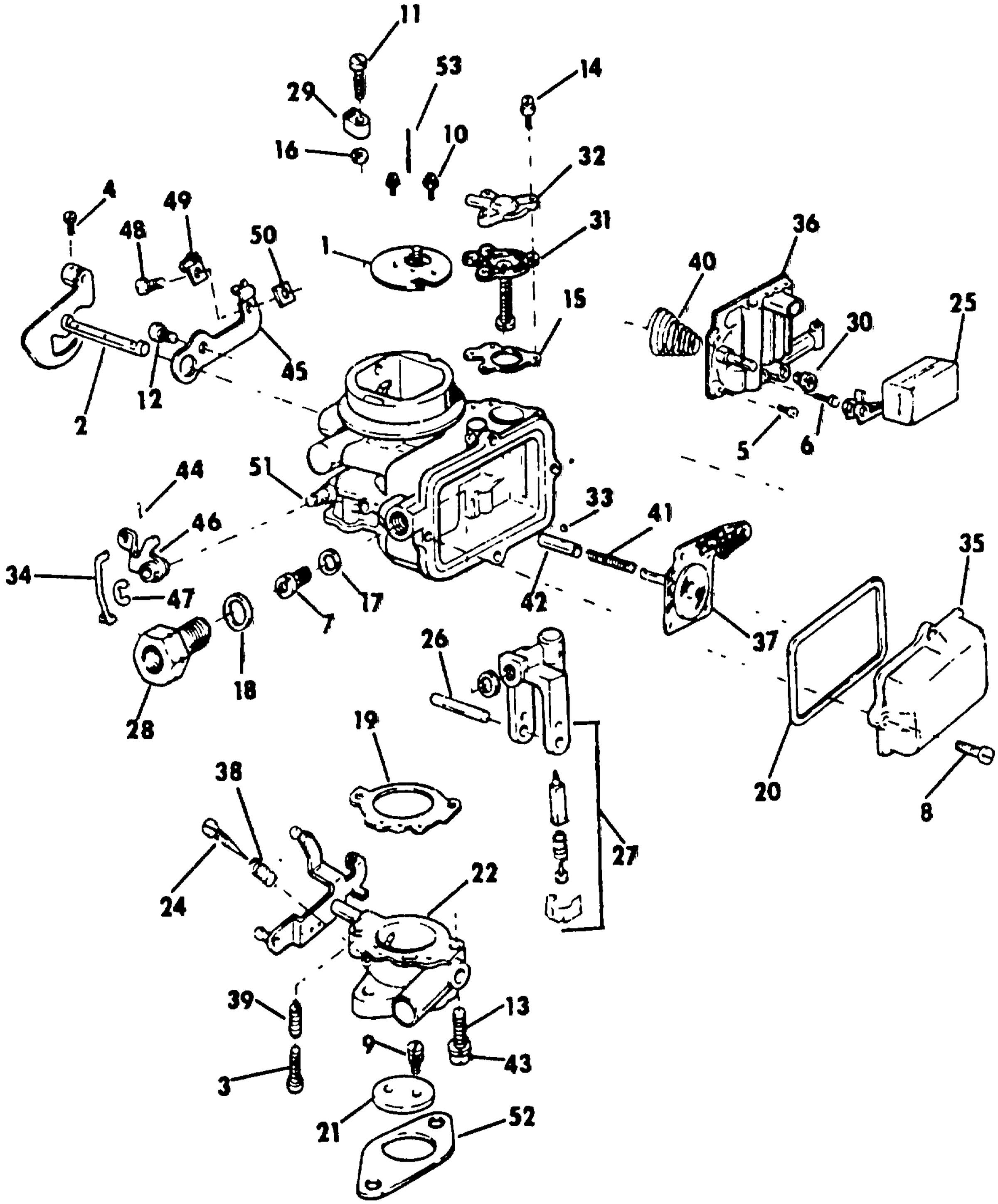
CARBURETOR-4858903-0

ITEM	PART NO.	DESCRIPTION	QTY.
1	4912040-5	CHOKE PLATE	1
2	4912041-3	CHOKE SHAFT	1
3	0913034-5	STOP SCREW	1
4	0925364-6	SCREW-SWIVEL	1
	0917395-6	LOCKWASHER	1
5	0926303-9	SCREW-SHORT	3
6	0931581-1	SCREW-: LONG	2
	0917459-0	LOCKWASHER	5
7	4912042-1	SCREW-FUEL INLET SEAT	1
8	0928591-4	SCREW-FLOAT BOWL	4
	0917365-9	LOCKWASHER	4
9	4912043-9	** SCREW.-THROTTLE PLATE	2
10	4912044-1	** SCREW-CHOKE PLATE	2
11	4912045-4	SCREW,-DISCHARGE NOZZLE	1
12	0925366-7	SCREW-CHOKE BRACKET	1
13	0931580-4	SCREW-THROTTLE BODY	2
14	0930456-9	SCREW-ECONOMIZER BODY	3
15	4912046-2	* GASKET-BODY	1
16	4912047-0	* GASKET-NOZZLE	1
17	4912048-8	* GASKET-SEAT	1
18	4912049-6	*GASKET-INLET	1
19	4912050-4	GASKET-BODY	1
20	4912051-2	* GASKET-BOWL	1
21	4912052-0	PLATE-THROTTLE	1
22	4912053-8	BODY-THROTTLE	1
24	4912054-6	** NEEDLE-IDLE ADJ	1
25	4912055-7	FLOAT	1
26	4912056-3	SHAFT-FLOAT	1
27	4912057-9	@VALVE--FUEL	1
28	4912058-7	FITTING-FUEL	1
29	4912059-5	NOZZLE-DISCHARGE	1
30	4912060-3	JET-MAIN	1
31	4912061-7	@STEM-ECONOMIZER	1
32	4912062-9	COVER	1
33	4912063-7	** BALL	1
34	4912064-5	** LINK-PUMP	1
35	4912065-2	BODY-FLOAT	1
36	4912066-0	BODY-ECONOMIZER	1
37	4912067-1	@DIAPHRAGM-PUMP	1
38	4912068-6	SPRING-IDLE ADJ	1
39	4912069-4	SPRING-STOP SCREW	1
. 40	4912070-2	SPRING-PUMP RETURN	1
41	4912071-0	SPRING--PUMP	1
42	4912072-8	SLEEVE-PUSH ROD	1



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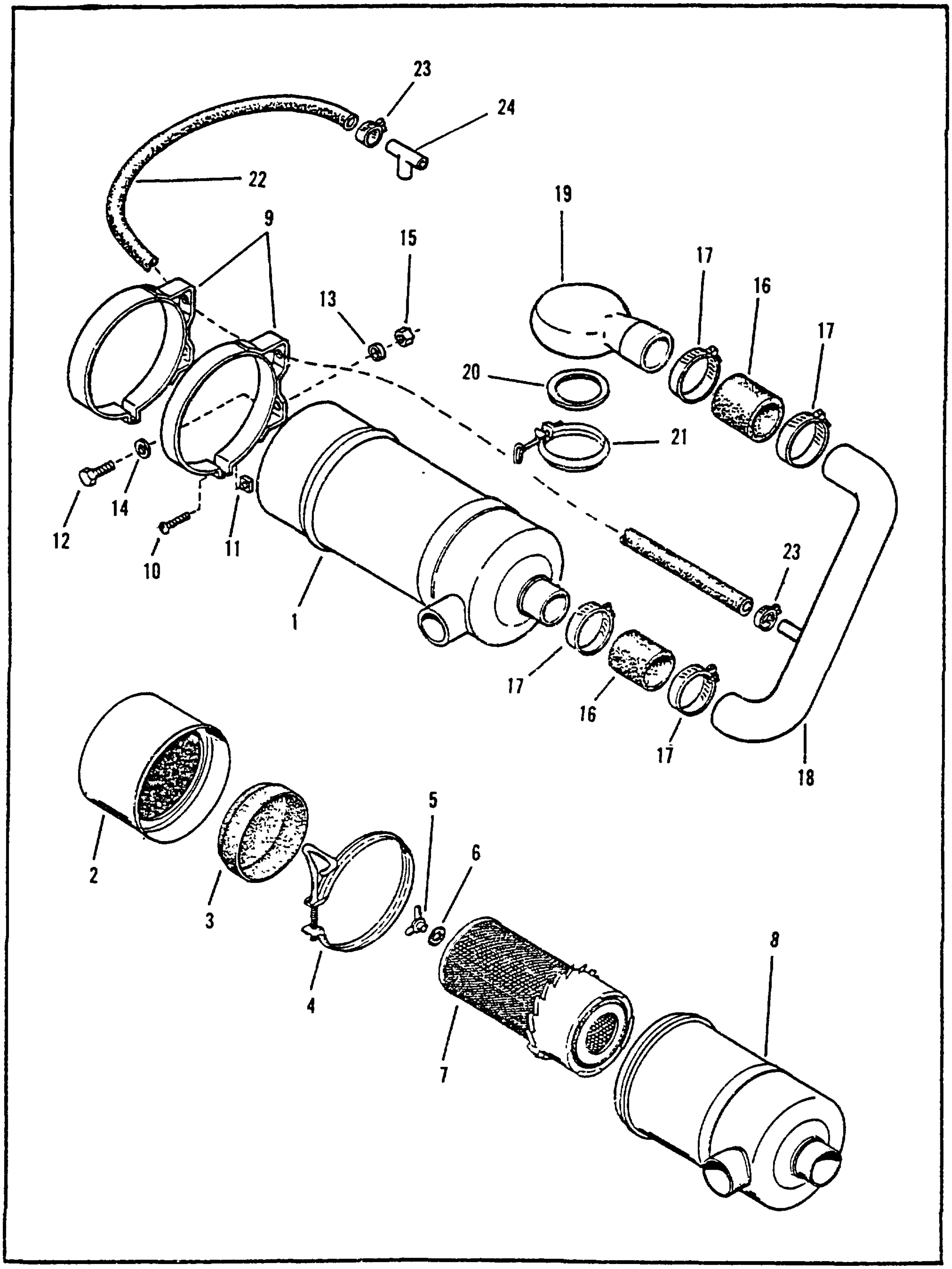
CARBURETOR-4858903-0

43	0916964-1	LOCKWASHER	1
44	0918445-8	** PIN-COTTER	1
45	4912073-8	BRACKET-CHOKE	1
46	4912074-4	** LEVER-PUMP	1
47	4912075-1	** RETAINER-LEVER	1
48	0901212-1	SCREW-CLAMP	1
	0917395-6	LOCKWASHER	1
49	4912076-0	CLAMP	1
50	0911023-0	NUT-CLAMP	1
51	4912077-7	STUD-LEVER	1
52	4912078-5	GASKET-FLANGE	1
53	4912079-3	PIN-DISTRIBUTION	1

* INCLUDED IN KIT 4912096-7
** INCLUDED IN KIT 4912097-5
@ INCLUDED IN KIT 4912098-3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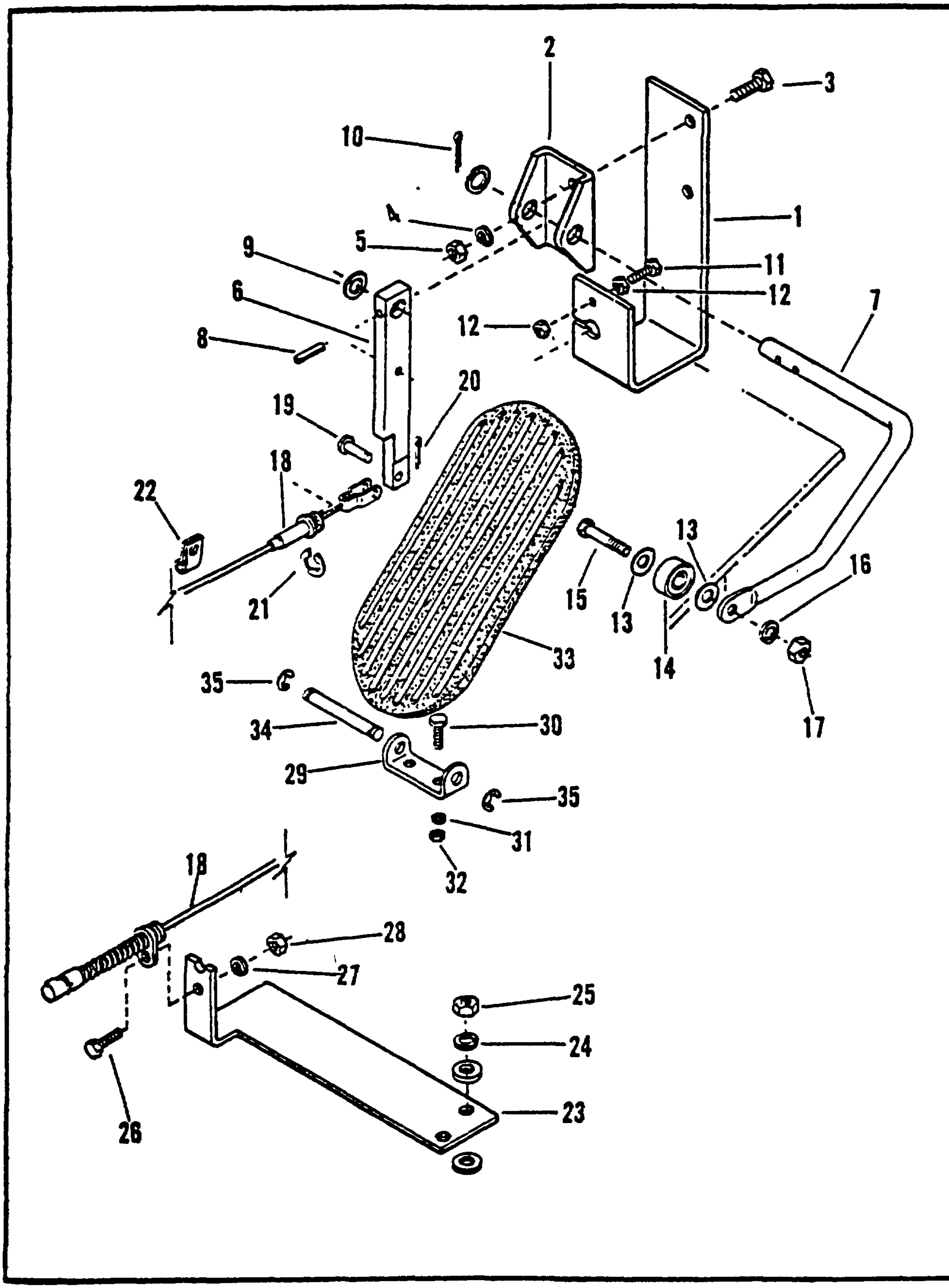
AIR CLEANER

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4842288-5	CLEANER-AIR	1	INCL ITEMS 2 THRU 8
2	4996249-1	CUP ASSY	1	
3	0640658-1	BAFFLE	1	
4	4996247-5	CLAMP ASSY	1	
5	4996250-9	SCREW-THUMB	1	
6	3046862-3	GASKET	1	
7	SMP 18-1052	ELEMENT	1	
8	4996244-2	BODY	1	
9	4789028-0	BAND-MTG	2	INCL ITEMS 10 AND 11
10	0906827-1	SCREW-MACHINE	2	
11	0910965-3	NUT-SQUARE	2	
12	0921965-0	CAPSCREW	4	
13	0916965-7	LOCKWASHER	4	
14	0916956-6	WASHER	4	
15	0916950-9	NUT	4	
16	4612722-1	HOSE	2	
17	0925758-5	CLAMP	4	
18	4868641-4	TUBE ASSY	1	
19	4860751-9	BONNET-CARBURETOR	1	
20	4877118-2	GASKET	1	
21	4856852-1	CLAMP	1	
22	4861452-3	HOSE	1	
23	0921910-6	CLAMP-SAE #6	2	
24	4804565-2	INDICATOR-FILTER	1	NOT ILLUSTRATED



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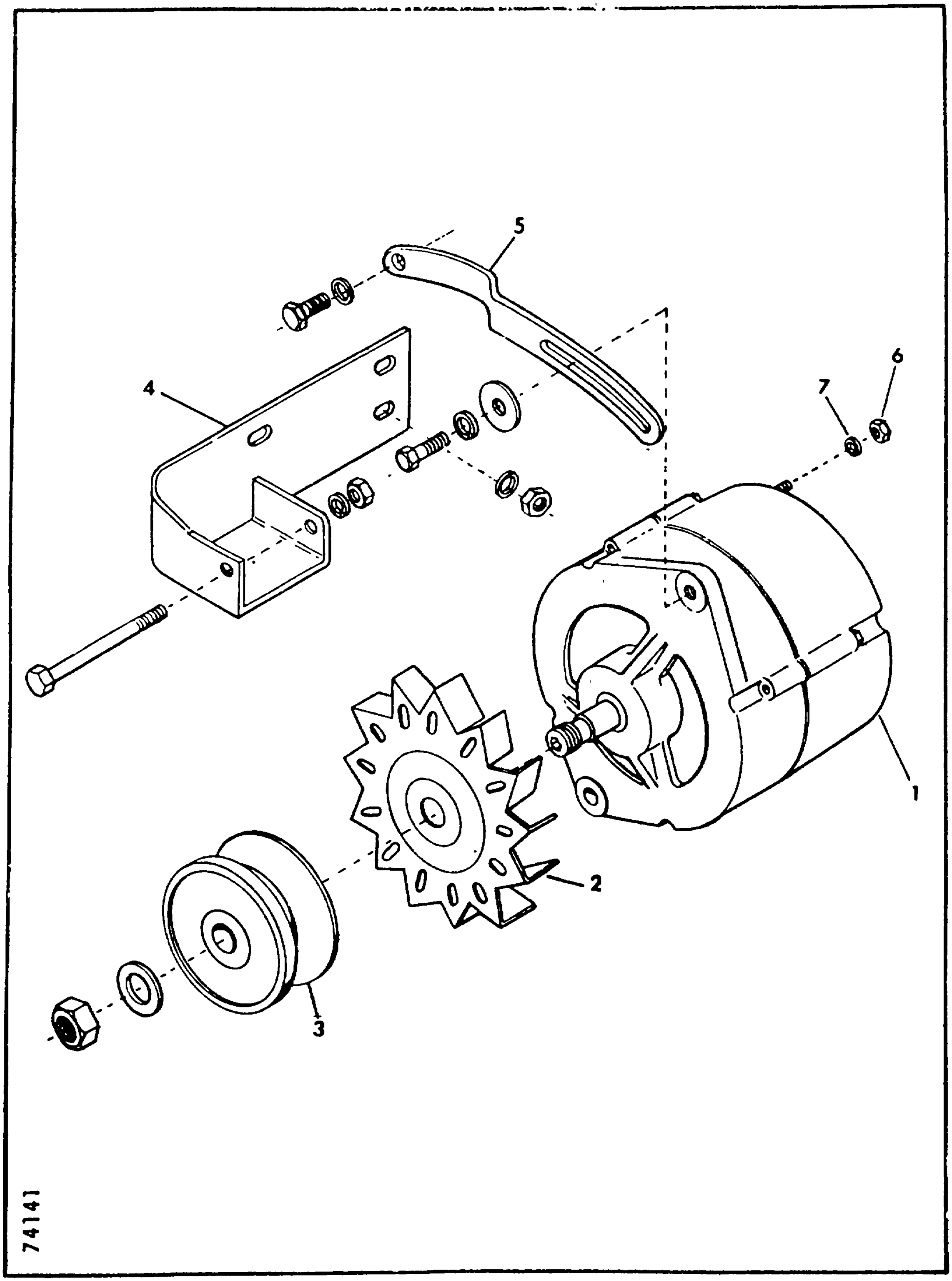
ACCELERATOR PEDAL & CABLE

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4880240-9	BRACKET	1	
2	4864085-8	SUPPORT	1	
3	0920415-7	CAPSCREW-.38"-16 x 1.25"	2	
4	0916965-7	LOCKWASHER-.38"	2	
5	0916950-9	NUT-.38"-16	2	
6	4880246-6	LEVER	1	
7	4868125-8	SHAFT-ACCELERATOR	1	
8	0916169-6	PIN-SPRING-.19" x .75"	1	
9	0919327-7	WASHER-.53"	2	
10	0929585-8	PIN-COTTER-.06" x 1"	1	
11	0925147-1	CAPSCREW-.25"-20 x 1.25"	1	
12	0916622-4	NUT-.25"-20	2	
13	0911987-6	WASHER-.38"	2	
14	4761270-0	BEARING	1	
15	0921967-6	CAPSCREW-.36"-16 x 1.13"	1	
16	0916965-7	LOCKWASHER- 38"	1	
17	0916950-9	NUT-.38"-16	1	
18	4868103-5	CABLE-ACCELERATOR	1	
19	0929591-6	PIN-YOKE-.19" x .58"	1	
20	0918445-8	PIN-.05" x 1"	1	
21	4255401-4	RING-SNAP	1	
22	4716090-8	CLAMP	1	
23	4867930-2	SUPPORT-ACCELERATOR CABLE	1	
24	0916965-7	LOCKWASHER-.38"	2	
25	0916950-9	NUT-.38-16	2	
26	0923341-2	CAPSCREW-.25"-20 x .75"	1	
27	0916964-0	LOCKWASHER-.25"	1	
28	0916622-4	NUT-.25"-20	1	
29	4735718-1	BRACKET	1	
30	0923341-2	CAPSCREW-.25"-20 x .75"	2	
31	0916964-0	LOCKWASHER-.25"	2	
32	0916622-4	NUT-.75"-20	2	
33	4765514-7	PEDAL	1	
	0926159-7	NUT-RETAINING-.312"-18	1	
	0925717-1	CAPSCREW-.312"-18 x 2"	1	PEDAL STOP-IN TOE PLATE
	0920161-7	NUT-.312'-18	1	
34	4774640-9	PIN	1	
35	4255183-8	E-RING	2	
	4868008-6	BALL	1	
	0916964-0	LOCKWASHER	1	
	0914192-0	NUT	1	
	0917378-2	WASHER	4	



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74141

ALTERNATOR
PRIOR TO SERIAL NO. 106400

ITEM	PART NO.	DESCRIPTION	QTY.	
1	3057631-8	ALTERNATOR ASSY	1	SEE PAGE 53
2	3057632-6	FAN	1	
3	4848486-9	PULLEY	1	
4	4866350-4	BRACKET ASSY	1	
	0922918-8	CAPSCREW-.38"-16 X 3.25'	1	
	0916965-7	WASHER-.38"	3	
	0916950-9	NUT-.38"-16	3	
5	4856618-6	STRAP-ADJUSTING	1	
	0921333-1	CAPSCREW-.31"-18 X 1"	1	
	0917356-8	LOCKWASHER-.31"	1	
	0918265-0	WASHER-.34"	1	
6	0917376-6	NUT-12-24	1	
7	0917389-9	LOCKWASHER-#12	1	

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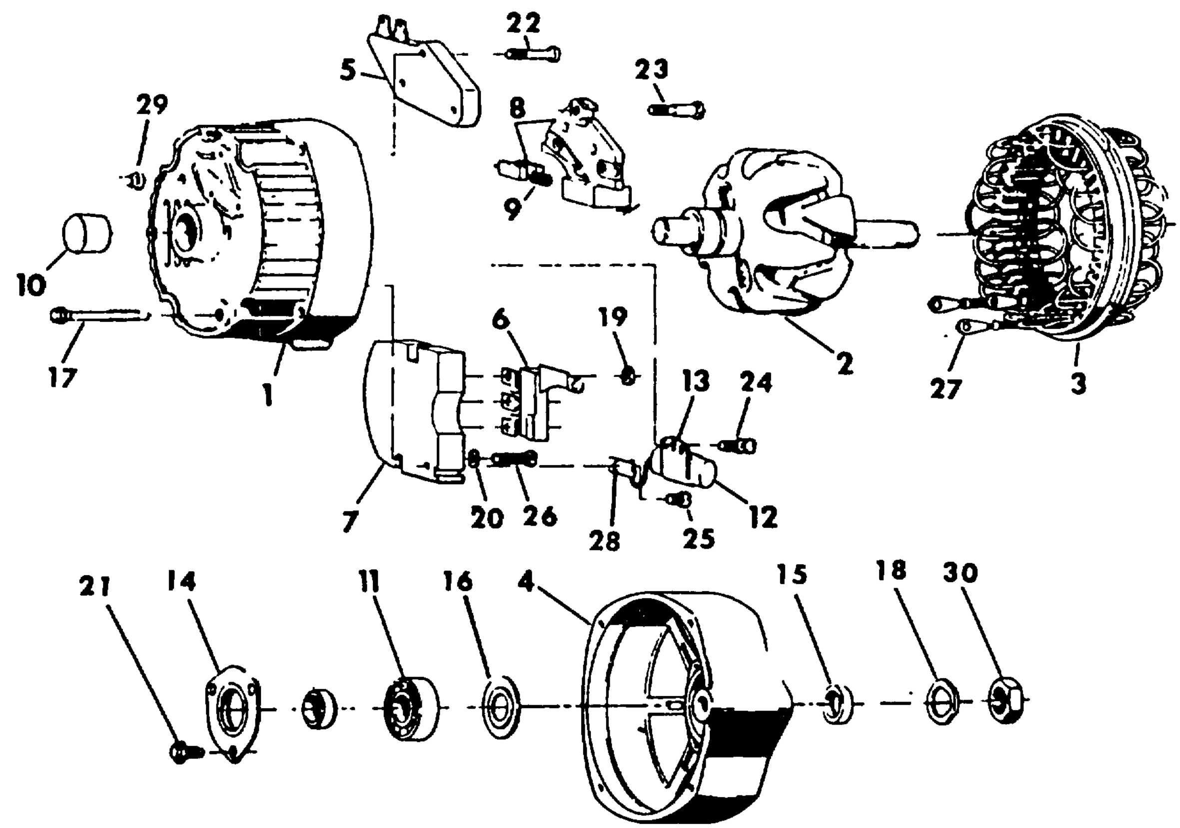
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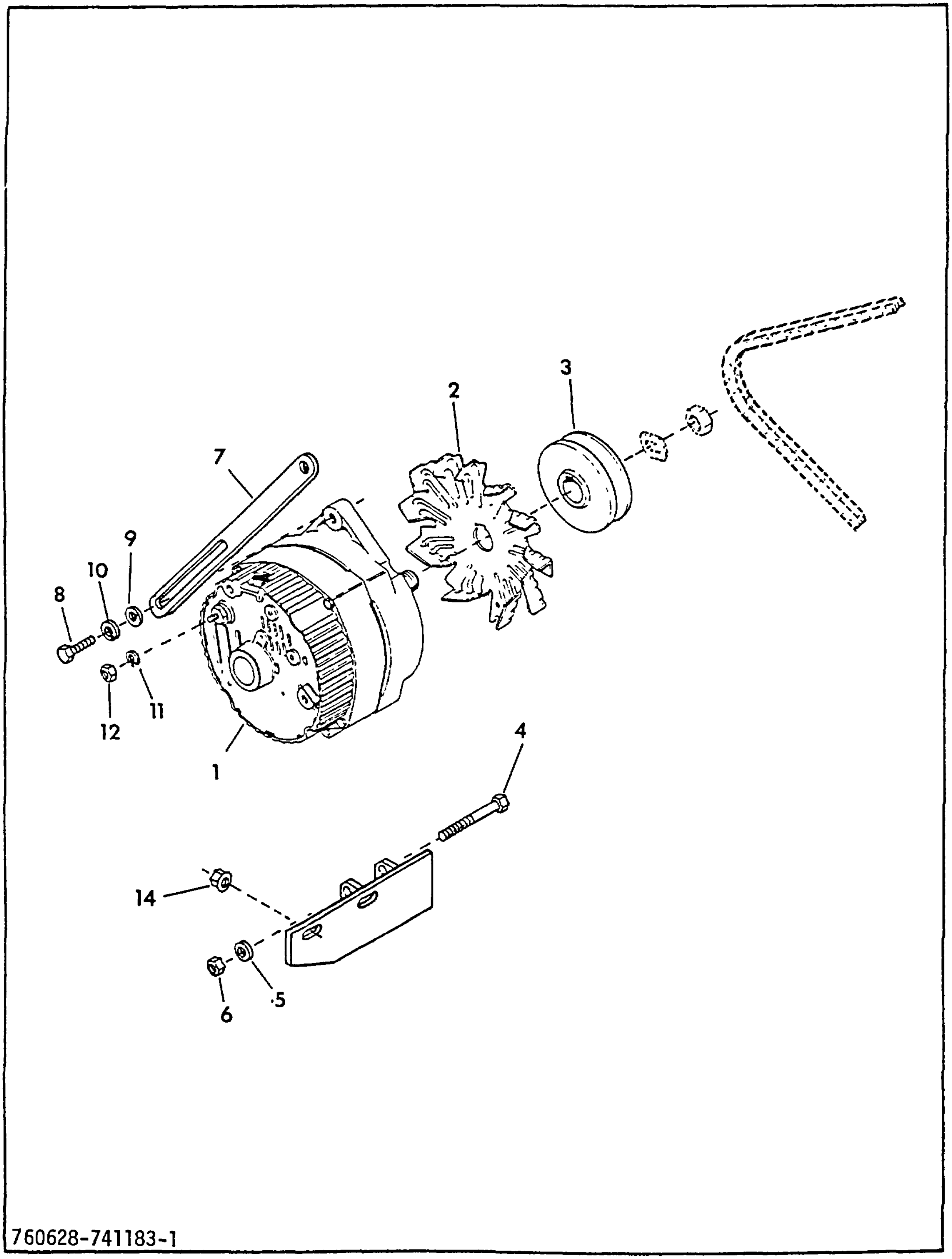
74142

ALTERNATOR ASSY-3057631-8
PRIOR TO SERIAL NO. 106400

ITEM	PART NO.	DESCRIPTION	QTY.
1	4908760-4	FRAME	1
2	4912638-6	ROTOR ASSY	1
3	1009610-5	STATOR ASSY	1
4	1142678-0	FRAME-DRIVE END	1
5	1172893-8	REGULATOR	1
6	1172891-2	DIODE TRIO	1
7	4912740-0	RECTIFIER BRIDGE	1
8	4912741-8	BRUSH HOLDER AND BRUSH ASSY	1
9	0242818-3	SPRING-BRUSH	2
10	1172895-3	BEARING-ROLLER	1
11	1148619-8	BEARING-BALL	1
12	1172896-1	CAPACITOR	1
13	4054848-9	BRACKET-CAPACITOR	1
14	1172897-9	TERMINAL PACKAGE-BATTERY	1
15	0242826-6	PLATE-RETAINER	1
16	0242828-2	COLLAR-SHAFT-INSIDE	1
17	0242829-0	COLLAR-SHAFT-OUTSIDE	1
18	1172899-5	WASHER-GREASE SLINGER	1
19	0242838-1	THRU BOLT	4
20	0242831-6	WASHER	1
21	0237006-2	LOCKWASHER	1
22	1173326-8	NUT-RECTIFIER BRIDGE	3
23	4054799-4	NUT-SHAFT	1
24	0243792-6	SCREW-RETAINER PLATE	3
25	1173327-6	SCREW	1
26	1173328-4	SCREW-BRUSH HOLDER	2
27	1173329-2	SCREW-CAPACITOR BRACKET	1
28	1173329-2	SCREW-CAPACITOR LEAD	1
29	1173330-0	SCREW-RECTIFIER BRIDGE	1
30	0242840-7	CLIP-STATOR LEAD TERMINAL	3

74142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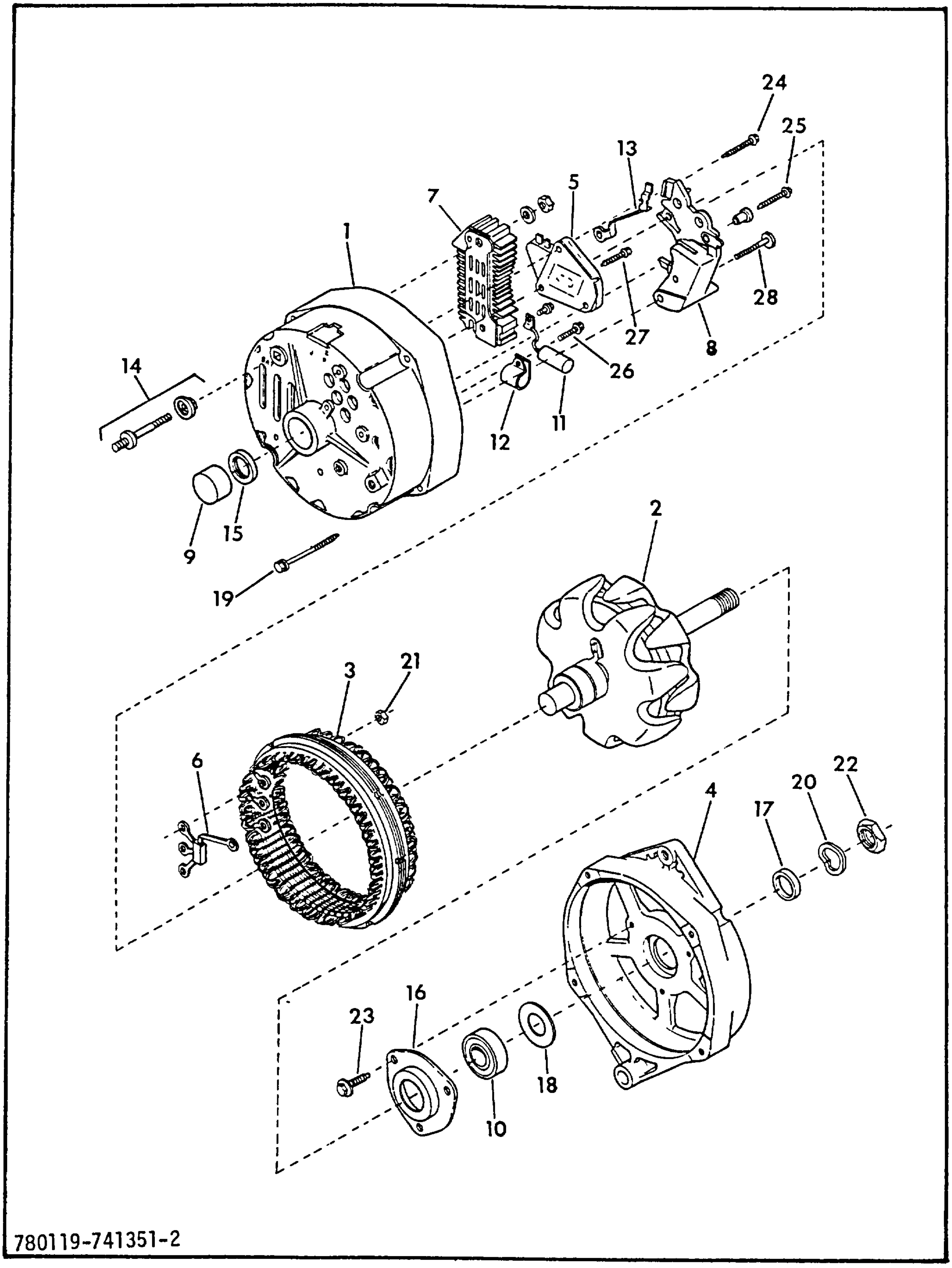
760628-741183-1

ALTERNATOR
EFFECTIVE/WITH SERIAL NO. 106400

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4883374-3	ALTERNATOR AY	1	SEE PAGE 53C
2	3057632-6	FAN	1	
3	4848486-9	PULLEY	1	
4	0922918-8	CPSC-.38-16 X 3.25	1	
5	0916965-7	LKW-.38	1	
6	0916965-7	NUT-.38-16	1	
7	4856618-6	STRAP-ADJ	1	
8	0921333-1	CPSC-.31-18 X 1.00	1	
9	0918265-0	WSHR-.31	1	
10	0917356-8	LKW-.31	1	
11	0917389-9	LKW-#12	1	
12	0917376-6	NUT-#12-24	1	
13	4866350-4	BRACKET AY-ALT	1	
14	4255041-8	NUT-FLANGE-.38-16	2	

760628-741183-1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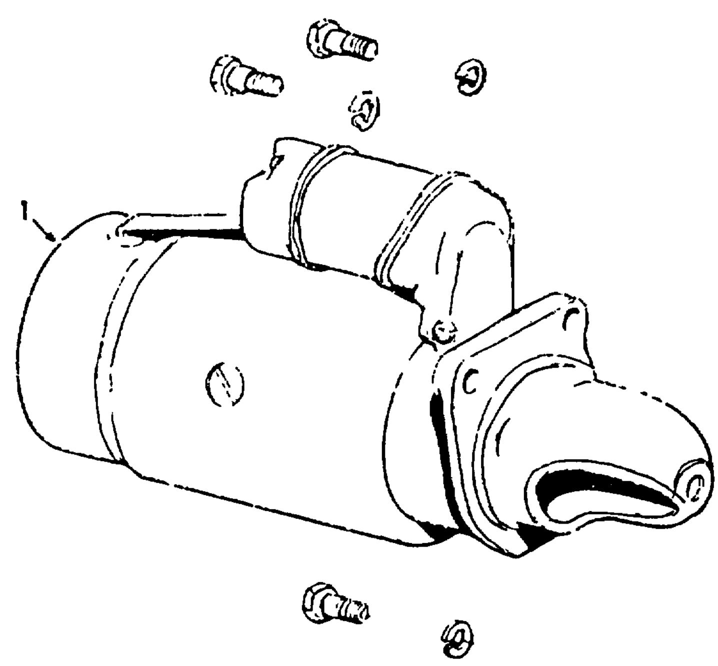
780119-741351-2

ALTERNATOR AY.-4883374-3
EFFECTIVE TO SERIAL NO. 106400

ITEM	PART NO.	DESCRIPTION	QTY.
1	4913144-4	FRAME	1
2	1174683-1	ROTOR AY	1
3	4913145-1	STATOR AY	1
4	1142678-0	FRAME-DRIVE END	1
5	1172893-8	REGULATOR	1
6	1172891-2	DIODE-TRIO	1
7	4912740-0	RECTIFIER	1
8	0262167-0	BRUSH & HOLDER 44.	1
9	1142670-7	BEARING	1
10	1148619-8	BEARING-DRIVE END	1
11	1172896-1	CAPACITOR	1
12	4054348-0	BRACKET-CAPACITOR	1
13	0262170-4	TERMINAL PKG-RELAY	1
14	1172897-9	TERMINAL PKG-BATTERY	1
15	1142677-2	RETAINER	1
16	0242826-6	PLATE-RTNR	1
17	0242829-0	COLLAR-OUTSIDE-DRIVE END	1
18	1172899-5	SLINGER-GREASE	1
19	0242838-1	BOLT-THRU	4
20	0237006-2	LKW-SHAFT-NUT-DRIVE END	1
21	0917385-7	NUT-#8-32	3
22	4054799-4	NUT-SHAFT-DRIVE END	1
23	0243792-9	SCREW-RTNR PLATE	3
24	0262168-8	SCREW AY	1
25	4908768-7	SCREW AY	2
26	1173329-2	SCREW & LKW	2
27	1013727-1	SCREW	1
28	0262169-6	SCREW	1

780119-741351-2

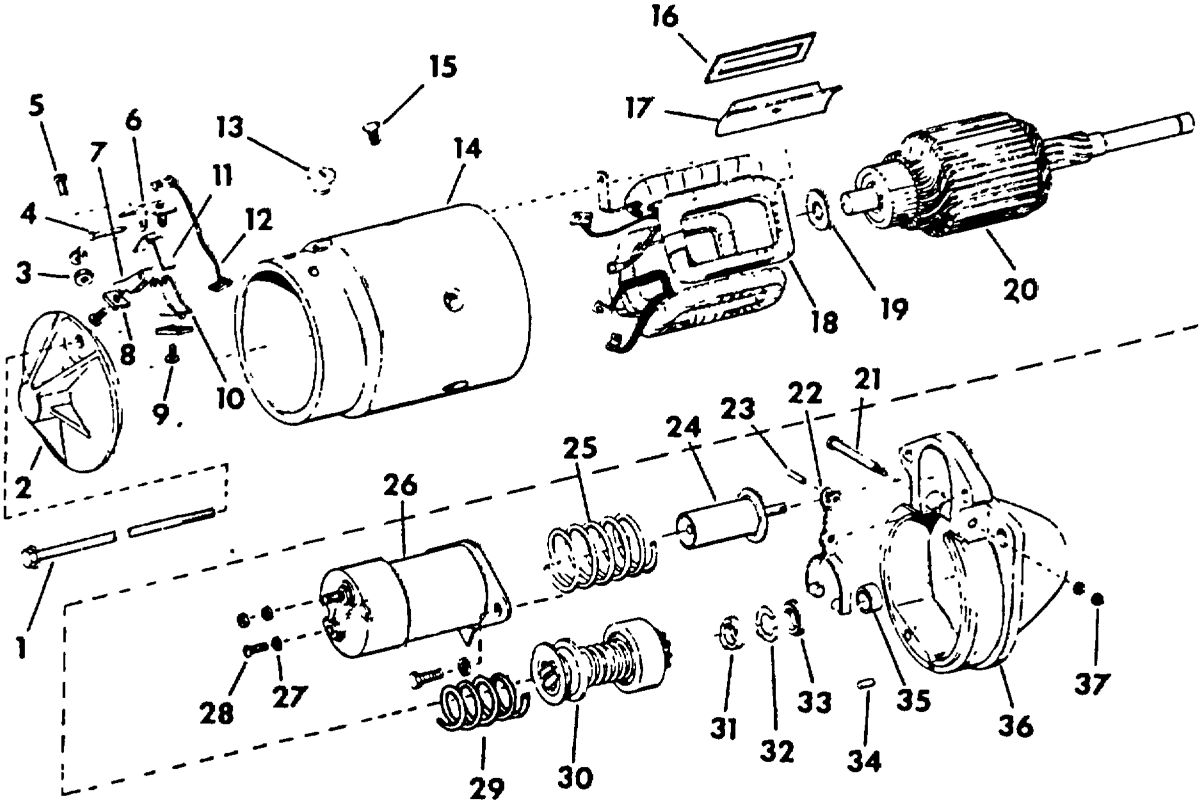


74143

STARTER
PRIOR TO SERIAL NO. 106400

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4876696-8	STARTER ASSY	1	SEE PAGE 56
	0920415-7	CAPSCREW-.38"-16 X 1.25"	2	
	0916965-7	LOCKWASHER-.38"	3	
	0921210-1	CAPSCREW	1	

74143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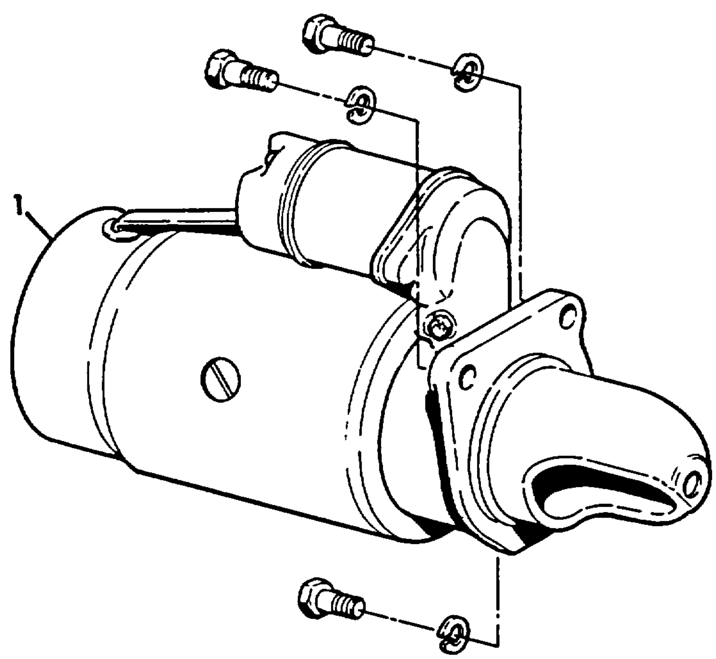
STARTER ASSY-4876696-8
PRIOR TO SERIAL NO. 106400

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4055881-0	BOLT-THRU	2	
2	4051275-8	FRAME-COMMUTATOR END	1	
3	0916621-6	NUT-SUPPORT ATTACHING SCREW-#10-24 4		
	0917365-9	LOCKWASHER-#10	4	
4	0250242-7	PIN-SUPPORT ATTACHING	2	
5	0916080-5	SCREW-SUPPORT ATTACHING-#10 -24 X .5"	4	
6	4051281-6	SUPPORT-BRUSH HOLDER PACKAGE	2	INCL ITEMS 3-4-5-6
7	4051279-0	HOLDER-BRUSH-INSULATED	2	
8	4051276-6	BRUSH	4	
9	0927150-3	SCREW-BRUSH ATTACHING-#8 -24 X .62"	2	
	0927149-5	SCREW-BRUSH ATTACHING-GROUND #8-32 X .62"	2	
10	4055871-0	HOLDER-BRUSH GROUND	2	
11	4051277-4	SPRING-BRUSH	4	
12	4060192-4	LEAD-BRUSH GROUND	2	
13	0243841-4	GROMMET	1	IN FIELD FRAME
14	-------------	FRAME-FIELD	1	ORDER 4876696-8
15	4054758-0	SCREW-POLE SHOE	4	
16	4051272-5	INSULATION	4	
17	4051269-1	SHOE-POLE	4	
18	4905637-1	COIL-FIELD	1	FOUR COILS
19	4042697-5	WASHER-BRAKE	1	
20	4908995-6	ARMATURE	1	
21	4997175-7	STUD-SHIFT LEVER	1	
22	4998851-7	LEVER-SHIFT	1	
23	4998179-9	PIN-PLUNGER	1	TO SHIFT LEVER
24	0246077-2	PLUNGER	1	
25	4997176-5	SPRING-PLUNGER RETURN	1	
26	4912314-4	SWITCH-SOLENOID	1	
	0901226-1	SCREW-.25"-20 X .5U	2	
	0916964-0	LOCKWASHER-.25"	2	
27	0909055-6	LOCKWASHER-#10	1	
28	0923703-3	SCREW-#10-32 X .5"	1	
29	4908996-4	SPRING-ASSIST	1	
30	4906418-1	DRIVE ASSY	1	
31	4997180-6	COLLAR-PINION STOP	1	
32	4998181-5	RING-PINION STOP RETAINER	1	
33	4998849-5	WASHER-THRUST	1	
34	4042650-4	PIN	1	
35	4044297-0	BUSHING	1	
36	4908997-2	HOUSING-DRIVE END	1	ORDER 4876696-8
37	0246098-8	NUT-PLATED-SHIFT LEVER STUD-.31" -18	1	
	0917356-8	LOCKWASHER-.31"	1	

74144

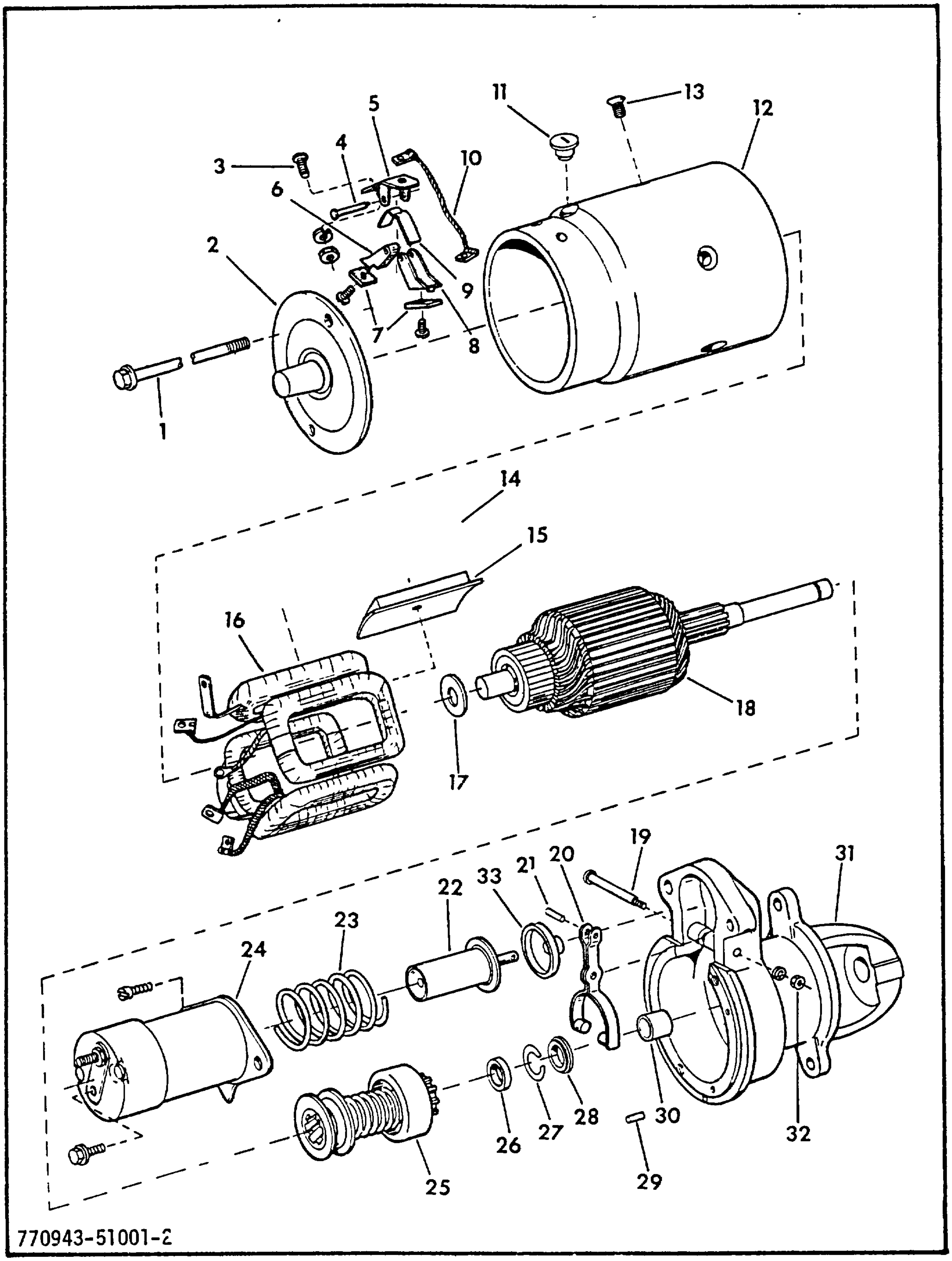


74143-72181-1

STARTER
EFFECTIVE WITH SERIAL NO. 106400

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4885883-1	STARTER ASSY	1	SEE PAGE 57C
	0920415-7	CAPSCREW-.38"-16 X 1.25"	2	
	0916965-7	LOCKWASHER-.38"	3	
	0921210-1	CAPSCREW-.38-16 X 1.00"	1	

74143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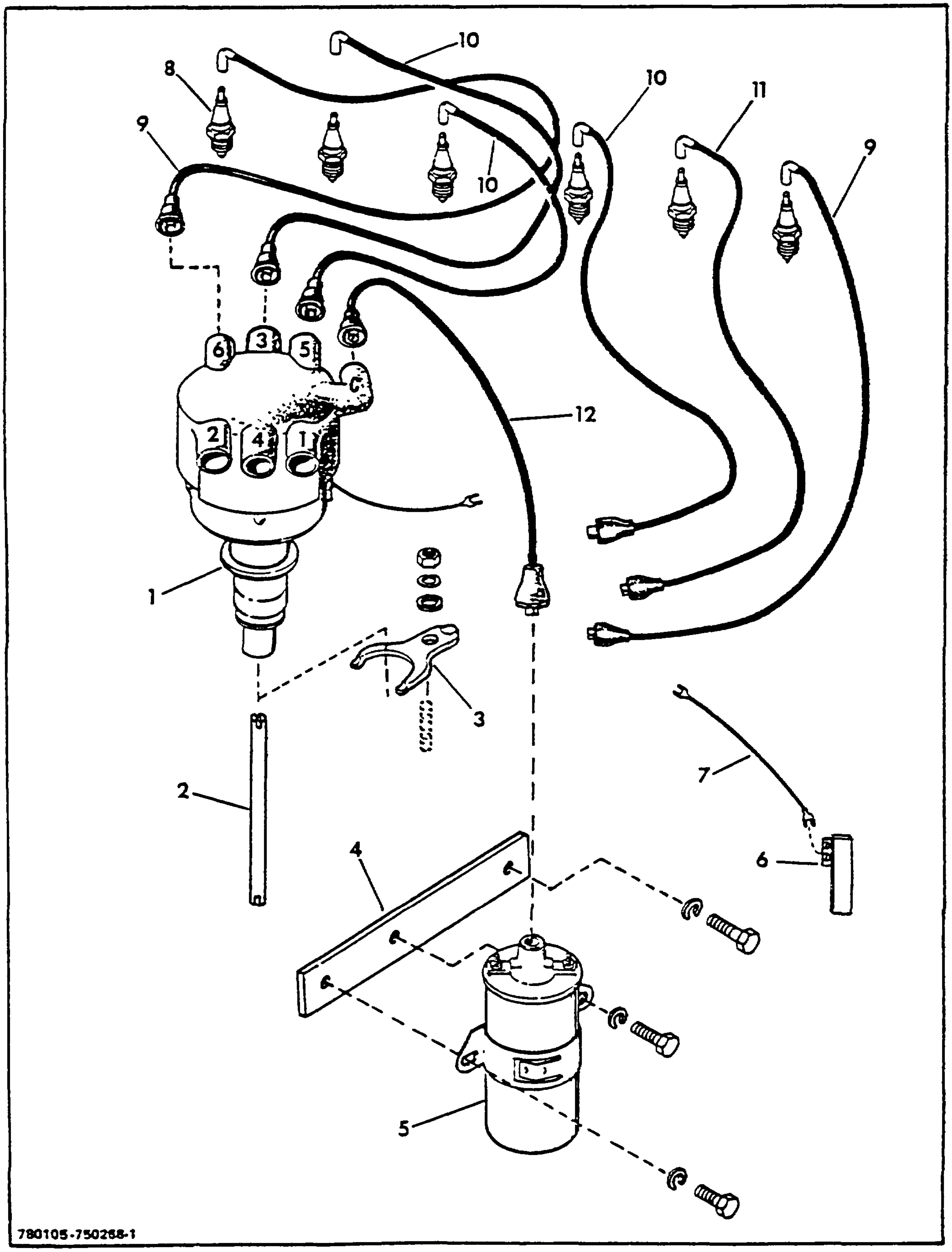
770943-51001-2

STARTER ASSY-4885883-1
EFFECTIVE WITH SERIAL NO. 106400

ITEM	PART NO.	DESCRIPTION	QTY.	
1	0231321-1	BOLT-THRU	2	
2	4913371-3	FRAME-COMMUTATOR END	1	
3	0916080-5	SCREW-SUPPORT-#10-24 X .50"	4	
	0917365-9	LOCKWASHER-#10	4	
	0916621-6	NUT-#10-24 X .50"	4	
4	0252042-7	PIN-SUPPORT ATTACHING	2	
5	4051281-6	SUPPORT-BRUSH HOLDER PKG	1	INCL 3-4-10
6	4051279-0	HOLDER-BRUSH-INS	2	
	0927150-3	SCREW-#8-24 X .62"	2	
7	4051276-6	BRUSH	4	
8	4055871-0	HOLDER-BRUSH-GND	2	
	0927149-5	SCREW-#8-32-.62	2	
9	4051277-4	SPRING-BRUSH	4	
10	4060192-4	LEAD-BRUSH-GND	2	
11	4913376-2	GROMMET	1	IN FIELD FRAME
12	-------------	FRAME-FIELD	1	ORDER 4885883-1
13	4054758-0	SCREW-POLE SHOE	4	
14	4051272-5	INSULATION-FIELD COIL	4	
15	4051269-1	SHOE-POLE	4	
16	4913372-1	COIL-FIELD	1	FOUR COILS
17	4042697-5	WASHER-BRAKE	1	
18	4908995-5	ARMATURE	1	
19	4997175-7	STUD-SHIFT LEVER	1	
20	4998851-2	LEVER-SHIFT	1	
21	4913304-4	PIN-PLUNGER	1	TO SHIFT LEVER
22	0246077-2	PLUNGER	1	
23	4997176-5	SPRING-PLUNGER RETURN	1	
24	4912314-4	SWITCH-SOLENOID	1	
	0901228-7	SCREW-.25"-20 X .75"	2	
25	4906418-1	DRIVE ASSY	1	
26	4997180-7	COLLAR-PINION STOP	1	
27	4997181-5	RING-PINION STOP RETAINER	1	
28	0243855-4	WASHER-THRUST	1	
29	4042650-4	PIN-DOWEL	1	
30	4044397-0	BUSHING	1	
31	4908997-2	HOUSING-DRIVE END	1	
32	0246098-8	NUT-SHIFT LEVER STUD	1	
	0917356-8	LOCKWASHER-.31"	1	
33	4913373-9	BOOT-PLUNGER	1	
34	4997184-9	SCREW-FIELD LEAD TO SW	1	

770943-55001-2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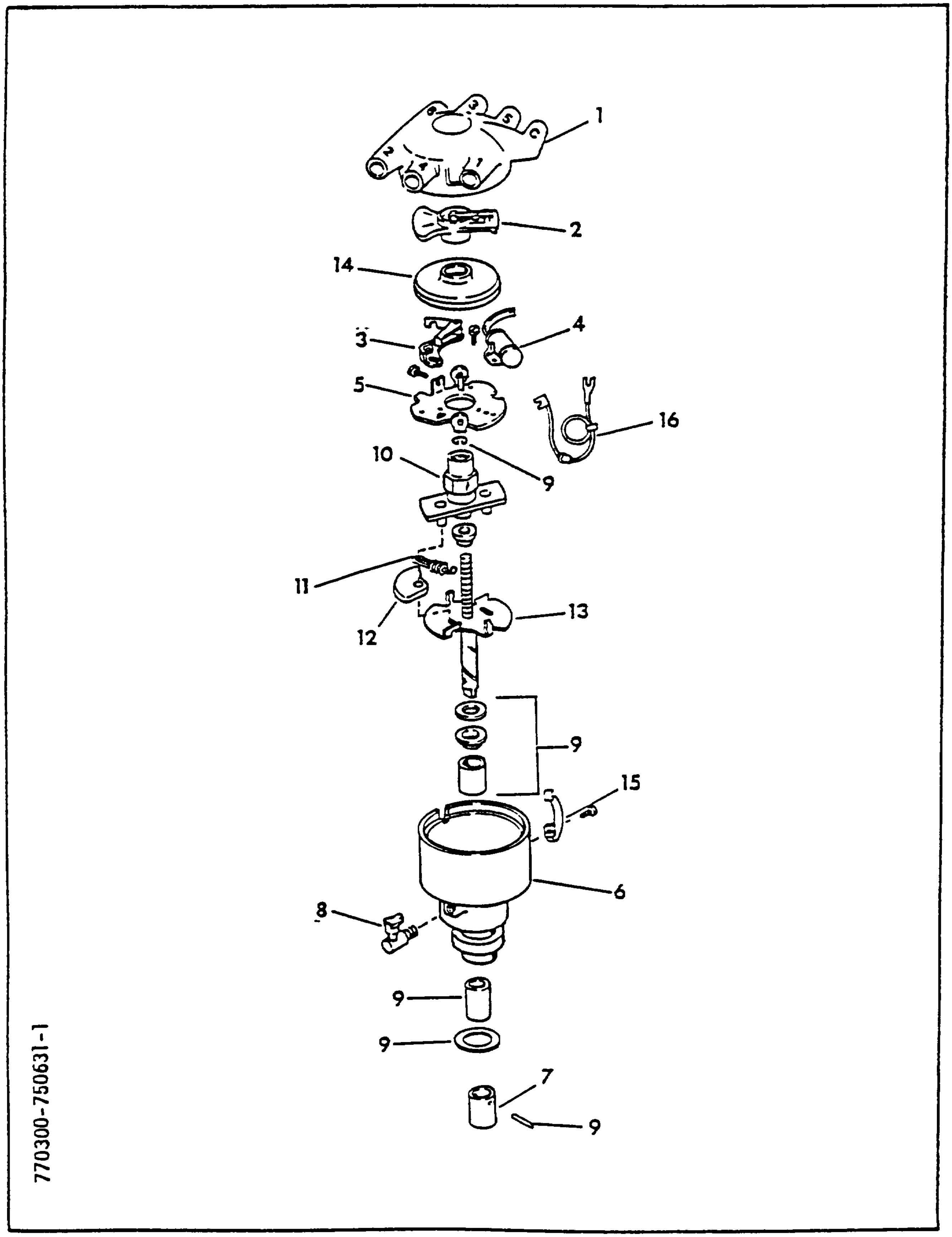
780105-750268-1

DISTRIBUTOR

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4858166-4	DISTRIBUTOR	1	SEE PAGE 61
2	--------------	SHAFT-DISTRIBUTOR DRIVE	1	SEE PAGE 13
3	4858103-7	CLAMP	1	
	0916950-9	NUT-.38"-16	1	
	0916965-7	LOCKWASHER-.38"	1	
	0918266-8	WASHER-.44"	1	
4	4858680-4	BRACKET	1	
	0923325-5	CAPSCREW-.31"-18 X .88"	2	
	0929489-3	CAPSCREW-.31"-18 X .38"	1	
	0917356-8	LOCKWASHER-.31"	3	
	0919326-9	WASHER-.34"	3	
	4767130-0	CLAMP	1	
	0918266-8	WASHER-.44"	1	
	0916950-9	NUT-.38"-16	1	
5	4515665-0	COIL	1	
6	4855690-6	RESISTOR	1	
7	4833505-3	WIRE ASSY-BLACK 16GA-5"	1	
8	4908597-0	PLUG-SPARK	6	
9	4862473-0	WIRE-IGNITION-14"	2	CYL NO 1& 6
10	4859424-6	WIRE-IGNITION-8"	3	CYL NO 3-4-5
11	4862472-8	WIRE-IGNITION-10"	1	CYL NO 2
12	4859423-8	WIRE-IGNITION-	1	COIL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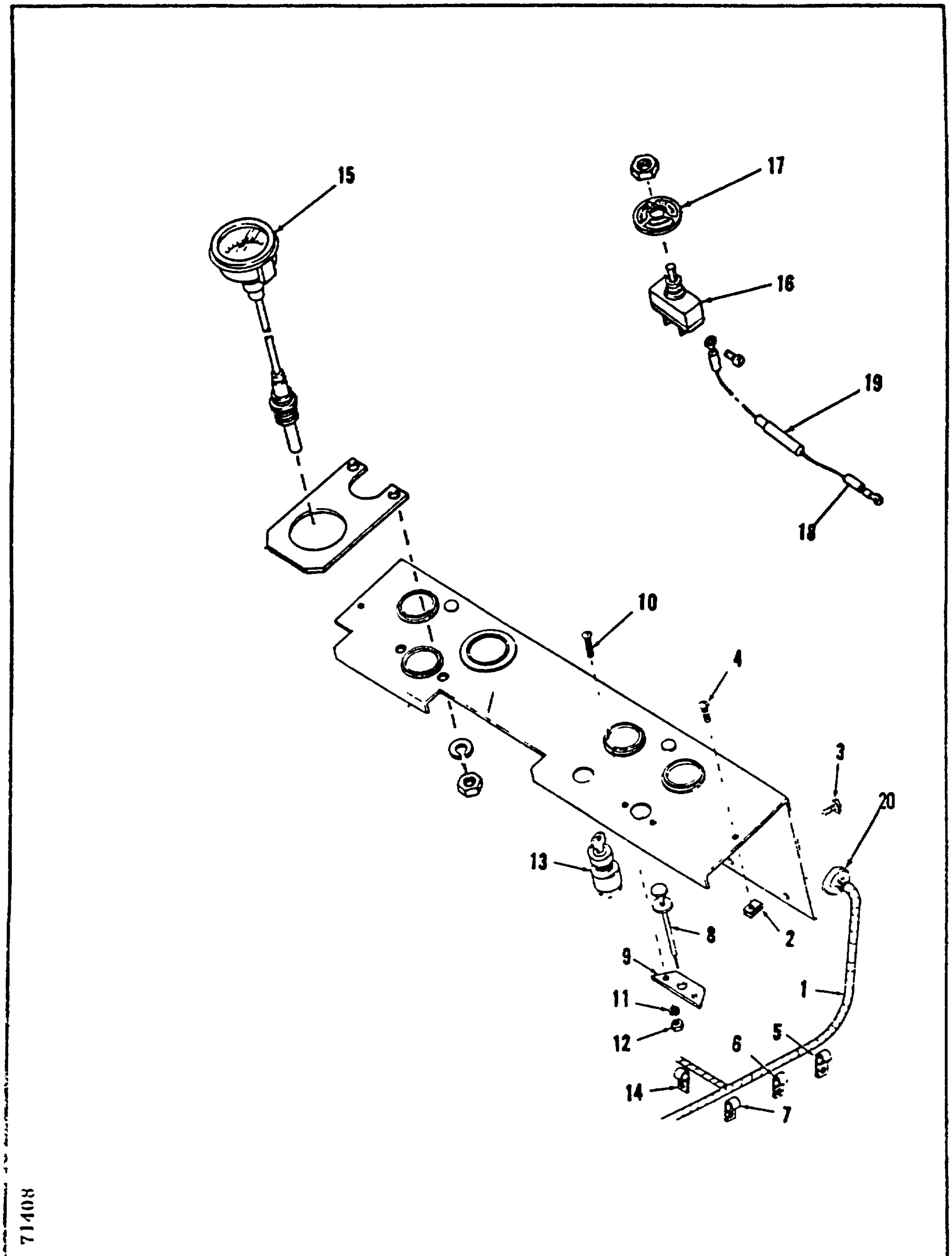
770300-750631-1

DISTRIBUTOR ASSY-4858166-4

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4909993-0	CAP	1	
2	4909103-6	*ROTOR	1	
3	4909100-2	*CONTACT SET	1	
4	4909101-0	*CONDENSER	1	
5	4909104-4	PLATE ASSY-BREAKER	1	INCL ITEMS 3 & 4
6	--------------	BODY	1	ORDER 4858166-4
7	4909110-1	COLLAR PKG	1	
8	4909113-5	FITTING-LUBE	1	
9	4909111-9	BEARING PKG	1	
10	4909995-5	CAM & STOP PLATE	1	
11	4909996-3	SPRING SET-WEIGHT	1	
12	4909109-3	WEIGHT SET	1	
13	4909994-8	SHAFT-DRIVE	1	
14	4909112-7	PLATE ASSY-SEAL	1	
15	4909114-3	HINGE PKG-CLAMP	1	
16	4909105-1	LEAD ASSY-PRIMARY	1	

*INCL IN KIT 4910178-5

770300-750631-1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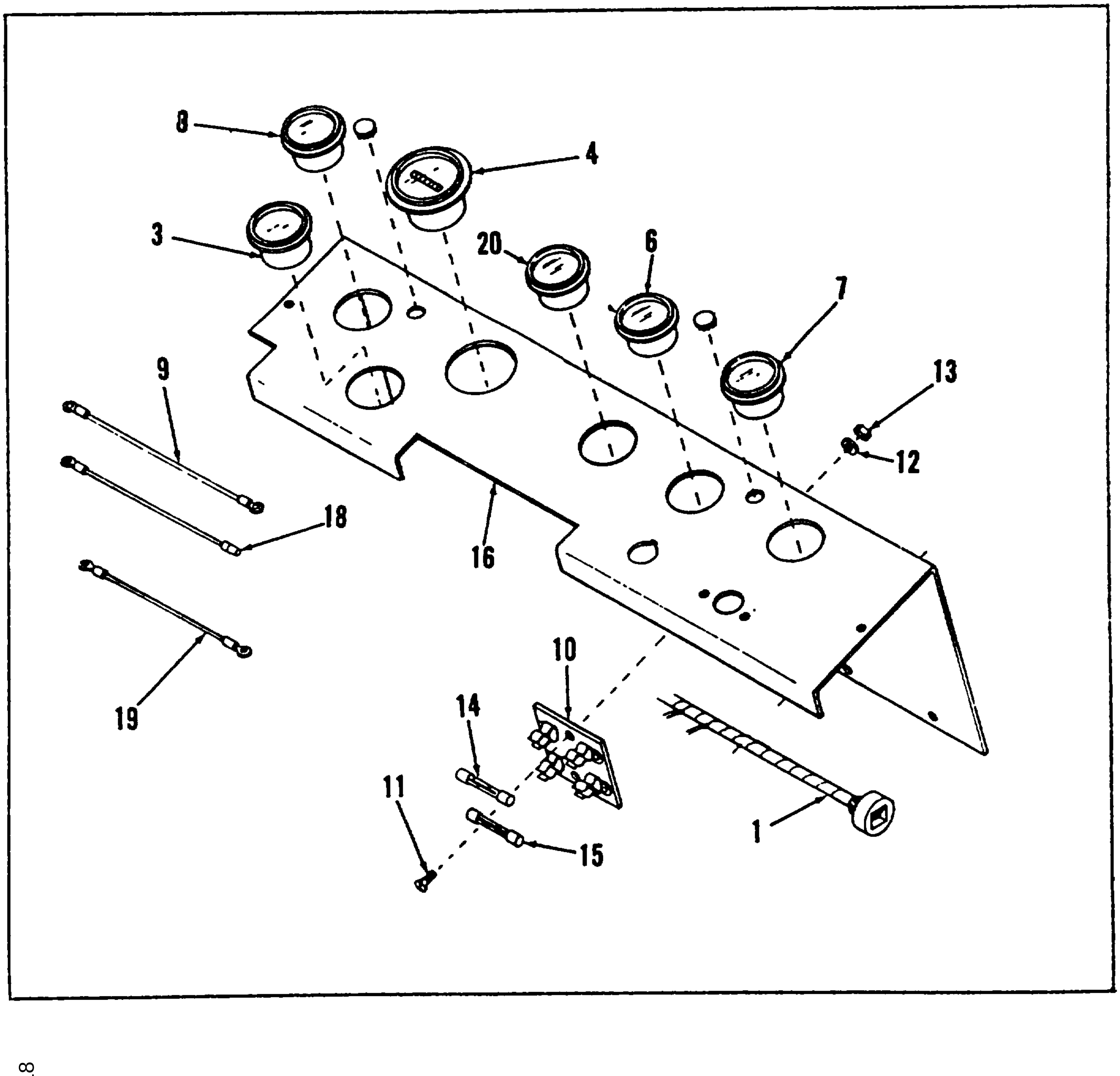
INSTRUMENT PANEL & CONNECTIONS

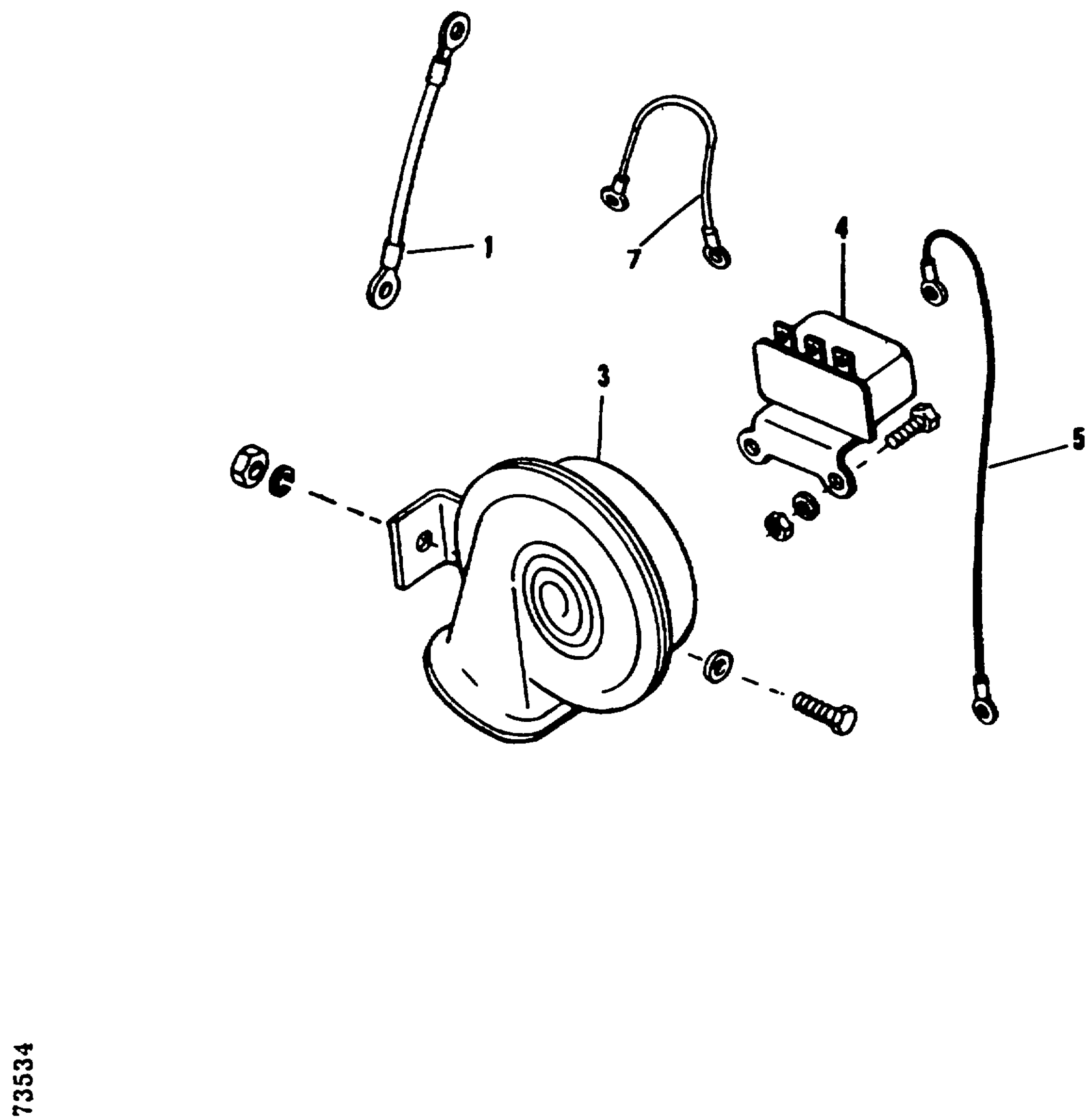
ITEM	PART NO.	DESCRIPTION	QTY.	
	4880568-3	PANEL ASSEMBLY-INSTRUMENT	1	
1	4880569-1	HARNESS-FRAME	1	INCL ITEM 20
2	0921355-4	NUT-SPEED-.31"-18	2	
3	0918713-9	SCREW	7	
4	0920787-9	CAPSCREW	2	
5	4716090-8	CLAMP-HORN BRACKET & CORNER POST	2	
6	4767130-0	CLAMP-FRAME	2	
7	4767130-0	CLAMP-COIL BRACKET	1	
8	4863737-5	CONTROL-CHOKE	1	
9	4766588-0	ADAPTOR	1	
10	0920572-5	SCREW-#10-24 X.5"	2	
11	0917365-9	LOCKWASHER		
12	0916621-6	NUT-#10-24	2	
13	4848483-6	SWITCH-IGNITION	1	
14	4255355-2	TYRAP	4	NOT ILLUSTRATED
15		NOT USED		
16	4724733-3	SWITCH-LIGHT	1	
17	4727352-9	PLATE-SWITCH	1	
18	4724728-3	CABLE W/FUSE HOLDER	1	
19	4757912-3	FUSE	1	
	0916964-0	LOCKWASHER	4	
	0916622-4	NUT	4	
	0925205-7	CAPSCREW-.31-18 x .62	2	
	0917356-8	LOCKWASHER	2	
	4859816-3	PLATE SWITCH	1	
	4844611-6	WIRE ASSY	1	
	4255521-9	CONNECTOR	1	
	4832743-1	DIODE ASSY	1	
	4881588-0	LINK	1	
	4881589-8	CIRCUIT BREAKER	1	
20	0931576-3	CONNECTOR	1	



71418

INSTRUMENT PANEL ASSEMBLY

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4880570-9	HARNESS-PANEL	1	INCL ITEM 2
2	0931575-5	CONNECTOR	1	
3	4818262-0	GAUGE-ENGINE TEMPERATURE	1	
4	4860293-4	HOURMETER	1	
5	4408658-5	TERMINAL	1	
6	4818260-4	GAUGE-OIL PRESSURE	1	
7	4818263-8	AMMETER	1	
8	4818261-2	GAUGE-FUEL	1	
9	4879223-8	WIRE ASSEMBLY	1	
10	4708362-1	HOLDER-FUSE	1	
11	0923861-9	SCREW	2	
12	0917459-0	LOCKWASHER	2	
13	0917479-8	NUT	2	
14	4705279-0	FUSE-10 AMP	1	
15	4705279-0	FUSE-10 AMP	1	
16	4880572-5	PANEL-INSTRUMENT	1	
	4864615-2	BRACKET-HOLDER	1	
17				
18	4848476-0	WIRE ASSEMBLY	1	
19	4791361-1	WIRE ASSEMBLY	1	
	4860448-2	WASHER-INSULATING	2	
20	4819491-4	GAUGE-TEMPERATURE	1	
	4833505-3	WIRE ASSY	1	
	0918155-3	CAPSCREW	4	
	0909367-5	LOCKWASHER	5	
	0916622-4	NUT	5	
	4864274-8	WIRE ASSY	1	
	4830537-9	WIRE ASSY	1	
	0918156-1	CAPSCREW	1	
	4746438-3	CAPACITOR	1	
	4876533-3	RELAY	1	
	4880573-3	BRACKET-RELAY	1	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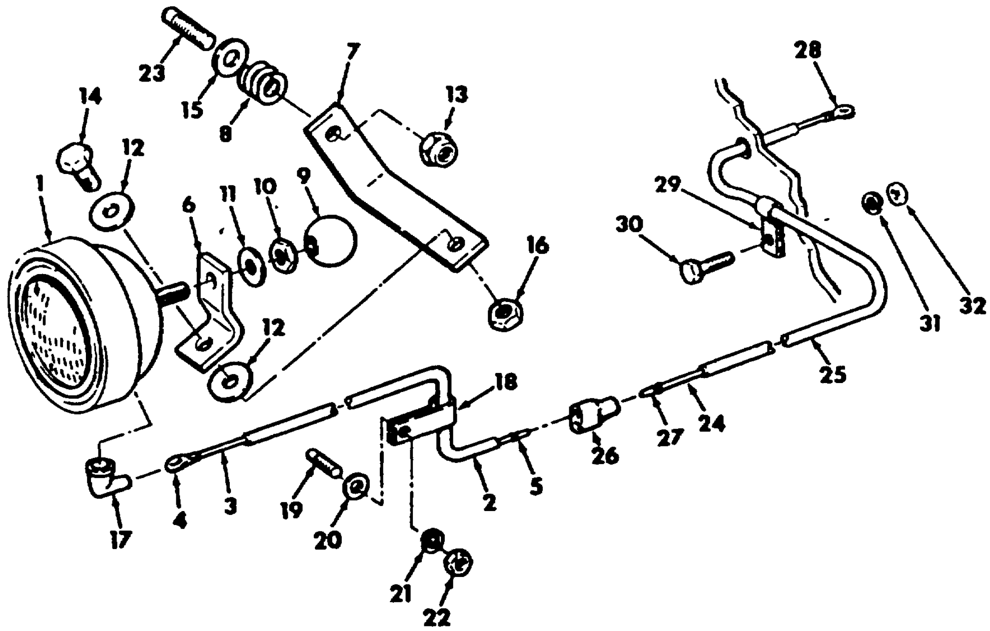
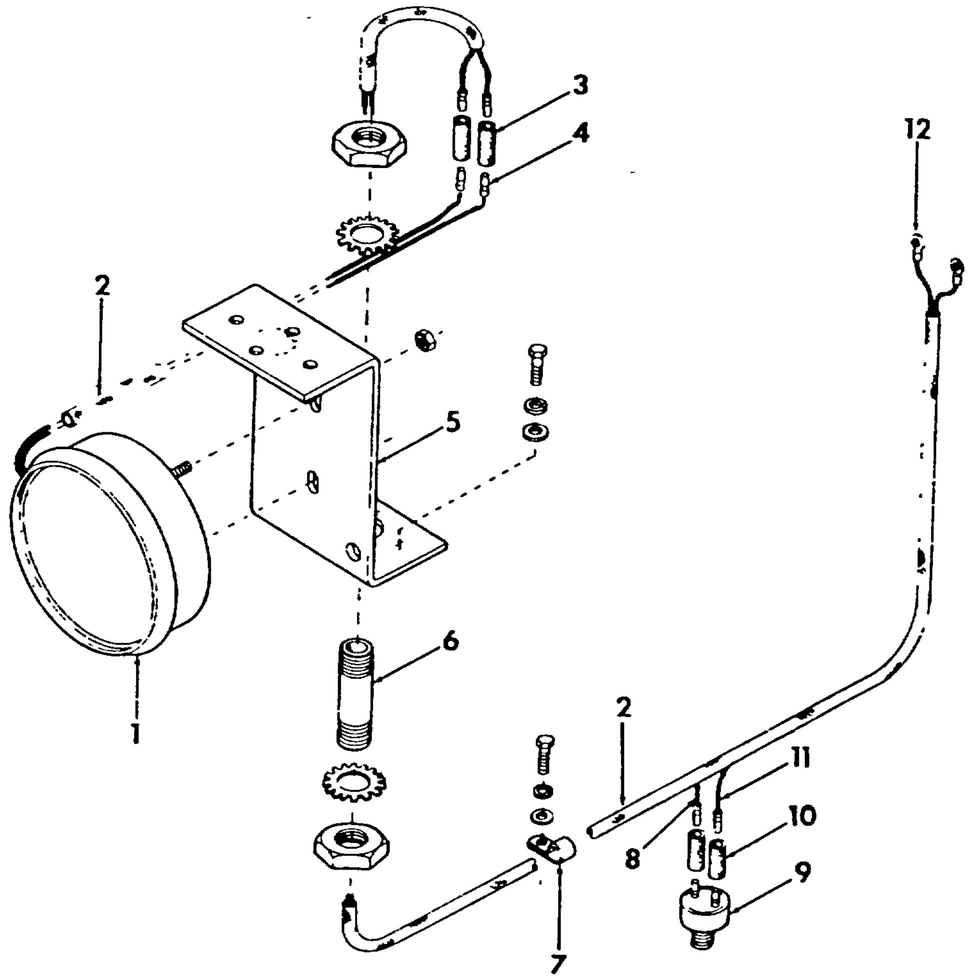
HORN GROUP

ITEM	PART NO.	DESCRIPTION	QTY.
1	4876866-7	WIRE ASSY-ENGINE GROUND	1
	0915898-1	LOCKWASHER	4
2			
3	4830173-3	HORN	1
4	4721573-6	RELAY	1
	0923282-8	CAPSCREW	1
	0916964-0	LOCKWASHER	1
	0916622-4	NUT	1
5	4775899-0	WIRE ASSY	1
6		NOT USED	
7	4791435-4	WIRE ASSY	1



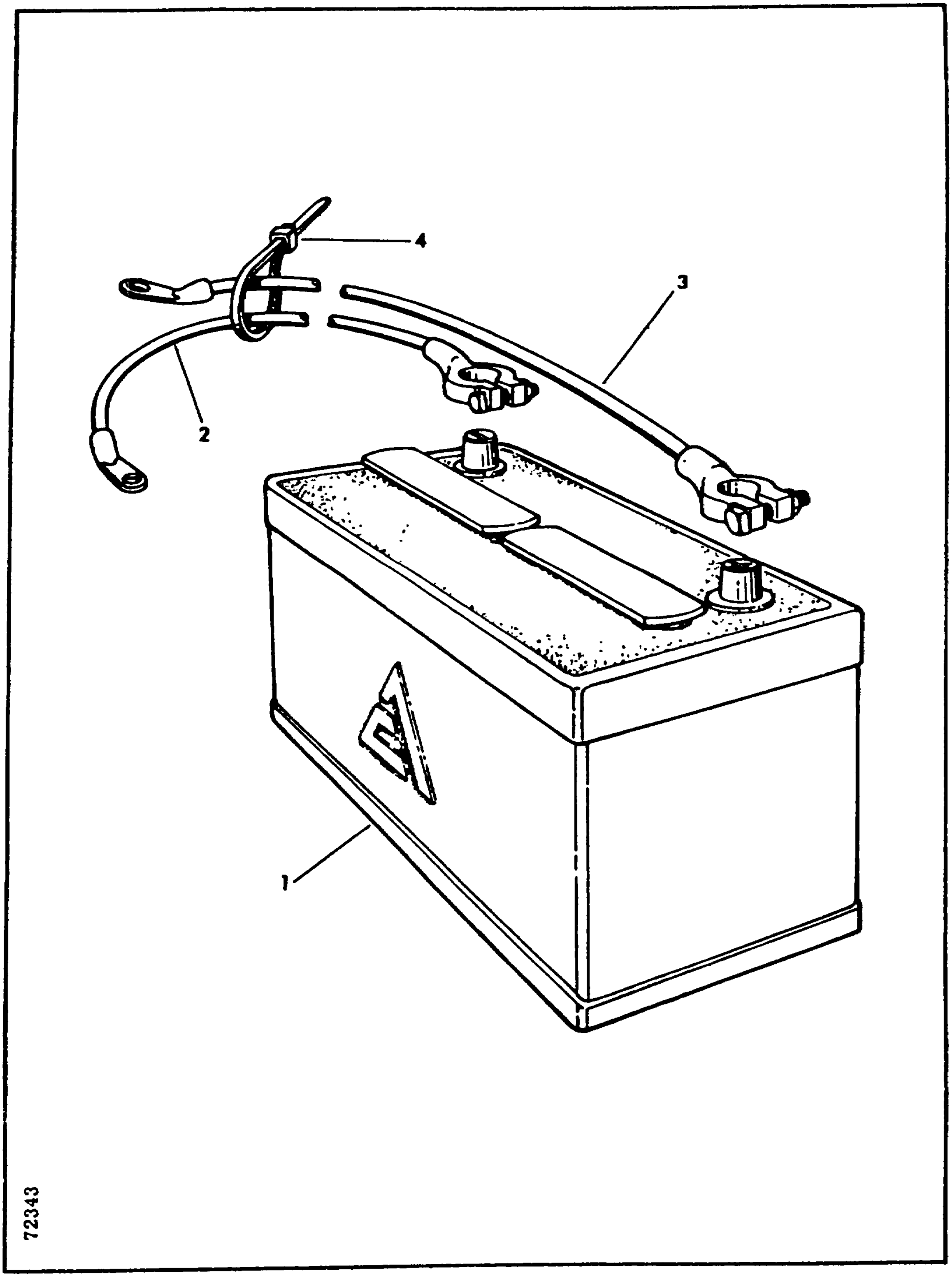
HEADLIGHT & CONNECTIONS

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4775866/9	HEADLAMP ASSEMBLY	1	INCL ITEM 33
2	4737639-7	LOOM-FLEXIBLE-.19" x 100"	1	
3	4715032/1	WIRE-16 GA.-96"	1	BLACK
4	4254846/1	TERMINAL	1	
5	4724667/3	TERMINAL-TIP	1	
6	4775868/5	BRACKET	1	
7	4775869/3	BRACKET	1	
8	4781446/2	SPRING	1	
9	4775867/7	KNOB	1	
10	0913744/9	NUT-JAM-.5"-13	1	
11	0918431/8	WASHER-.5"	1	
12	0901043/0	WASHER-BRASS-.53"	2	
13	4254976/6	NUT-LOCK	1	
14	0923092-1	CAPSCREW-.5"-13 x 1.12"	1	
15	0927326/9	WASHER-.78"	1	
16	4254976/6	NUT-LOCK	1	
17	4757678/0	BOOT-RUBBER	1	
18	4254481/7	CLIP	4	ON MAST
19	4255195/2	STUD	4	WELDED TO MAST
20	0923912-0	WASHER-.31"	8	
21	0917356/8	LOCKWASHER-.31"	4	
22	0920161/7	NUT-JAM-.31"-18	4	
23	4255431/1	STUD	1	WELDED TO MAST
24	4704828-5	WIRE-16 GA.-30"	1	BLACK
25	4737639-7	LOOM-FLEXIBLE-.25" x 34"	1	
26	4724666/5	CONNECTOR-WIRE	1	
27	4724667/3	TERMINAL-TIP	1	
28	4254846/1	TERMINAL	1	
29	4251645/0	CLIP	1	
30	0921210-1	CAPSCREW-.38"-16 x 1"	1	
31	0916965/7	LOCKWASHER-.38"	1	
32	0916950/9	NUT-.38"-16	1	
	4255355-2	TIE-CABLE	2	
33	4905822-5	LAMP-SEALED BEAM	1	NOT ILLUSTRATED



STOP & TAIL LIGHT

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4770449-9	LAMP-STOP & TAIL	1	INCL LAMP
	0928348-2	LAMP	1	
2	4715039-6	LOOM	2	
3	4736044-1	CONNECTOR	2	
4	4724667-3	TERMINAL	4	
	4408660-1	TERMINAL	2	
5	4816384-4	BRACKET	1	
6	0901502-5	NIPPLE-PIPE	1	
	0920321-7	NUT-LOCK	2	
	0929356-4	LOCKWASHER	2	
8	4798004-0	WIRE	1	
9	4726629-1	SWITCH		
10			1	
11	4715028-9	WIRE	1	
12	4715028-9	WIRE	1	
	4734887-5	SLEEVE	2	
	4255355-2	TYWRAP	3	
	4255570-6	BOOT	2	
	4767130-0	CLAMP	2	
	4772127-9	CLAMP	1	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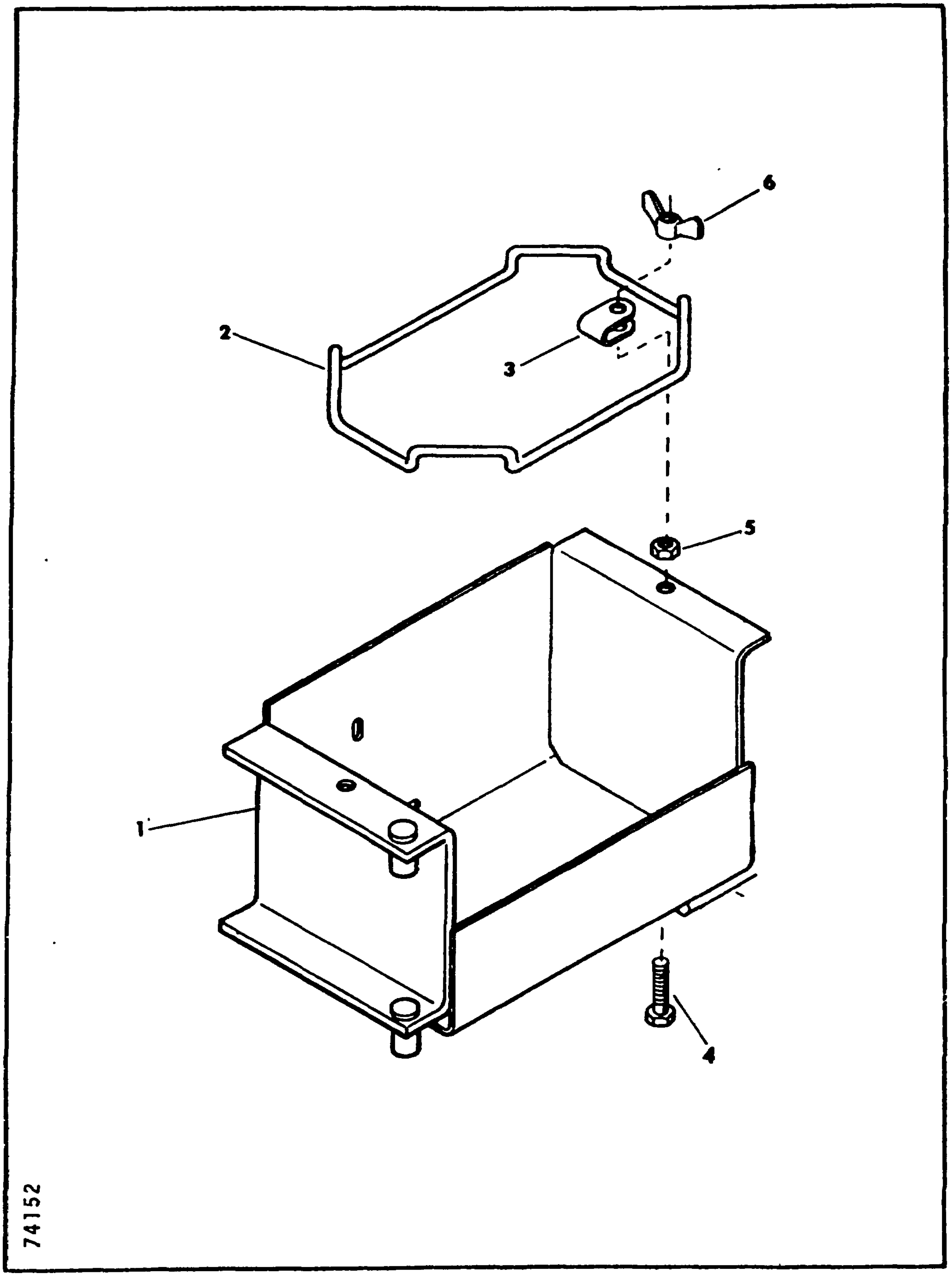
BATTERY

ITEM	PART NO.	DESCRIPTION	QTY.	
1	0243472-8	BATTERY	1	DRY
2	4801304-9	CABLE-BATTERY	1	NEGATIVE
3	4801154-8	CABLE-BATTERY	1	POSITIVE
	4255355-2	TYWRAP	1	
	4746222-1	ELECTROLITE	1	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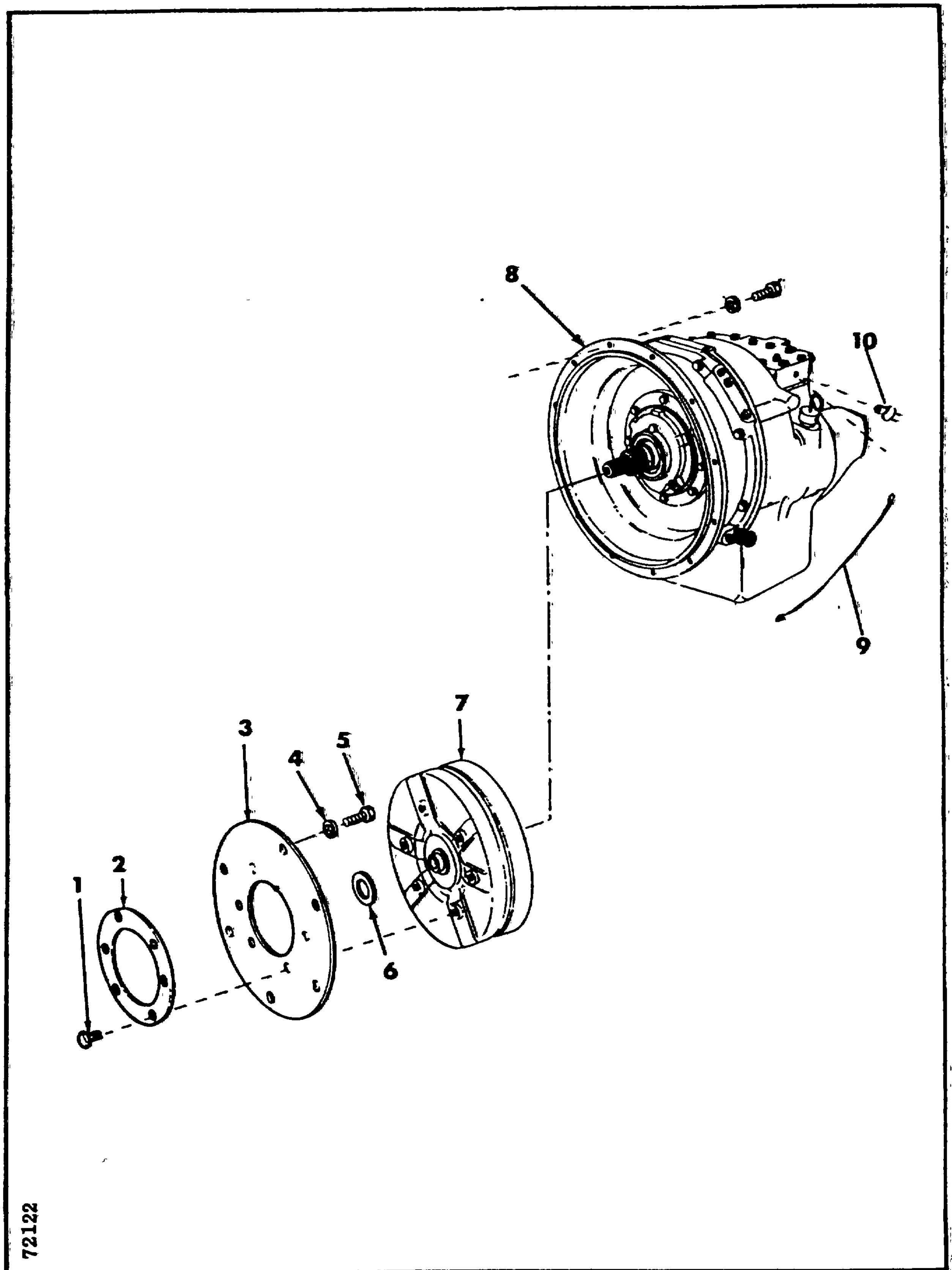
BATTERY TRAY

ITEM	PART NO.	DESCRIPTION	QTY.
1	4860679-2	TRAY ASSY	1
2	4771179-1	HOLDDOWN	1
3	4771148-6	CLIP	2
4	0923423-8	CAPSCREW	2
5	0920161-7	NUT	2
6	0918468-0	NUT-WING	2

74152



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TRANSMISSION - POWER SHIFT

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4752002-8	BOLT- PLATE TO CONVERTOR	6	
2	4755381-3	PLATE- REINFORCING	1	
3	4761032-4	PLATE- DRIVE	1	
4	4755380-5	LOCKWASHER	6	
5	4254864-4	BOLT	6	
6		NOT USED		
7	4859285-1	CONVERTOR- TORQUE	1	
8	4856441-3	TRANSMISSION	1	SEE PAGE 77
	0921210-1	CAPSCREW- .38" -16 X 1"	12	
	0920427-2	LOCKWASHER- .38"	12	
9	4751032-6	WIRE	2	
10	4909868-4	SWITCH-NEUTRAL START	1	

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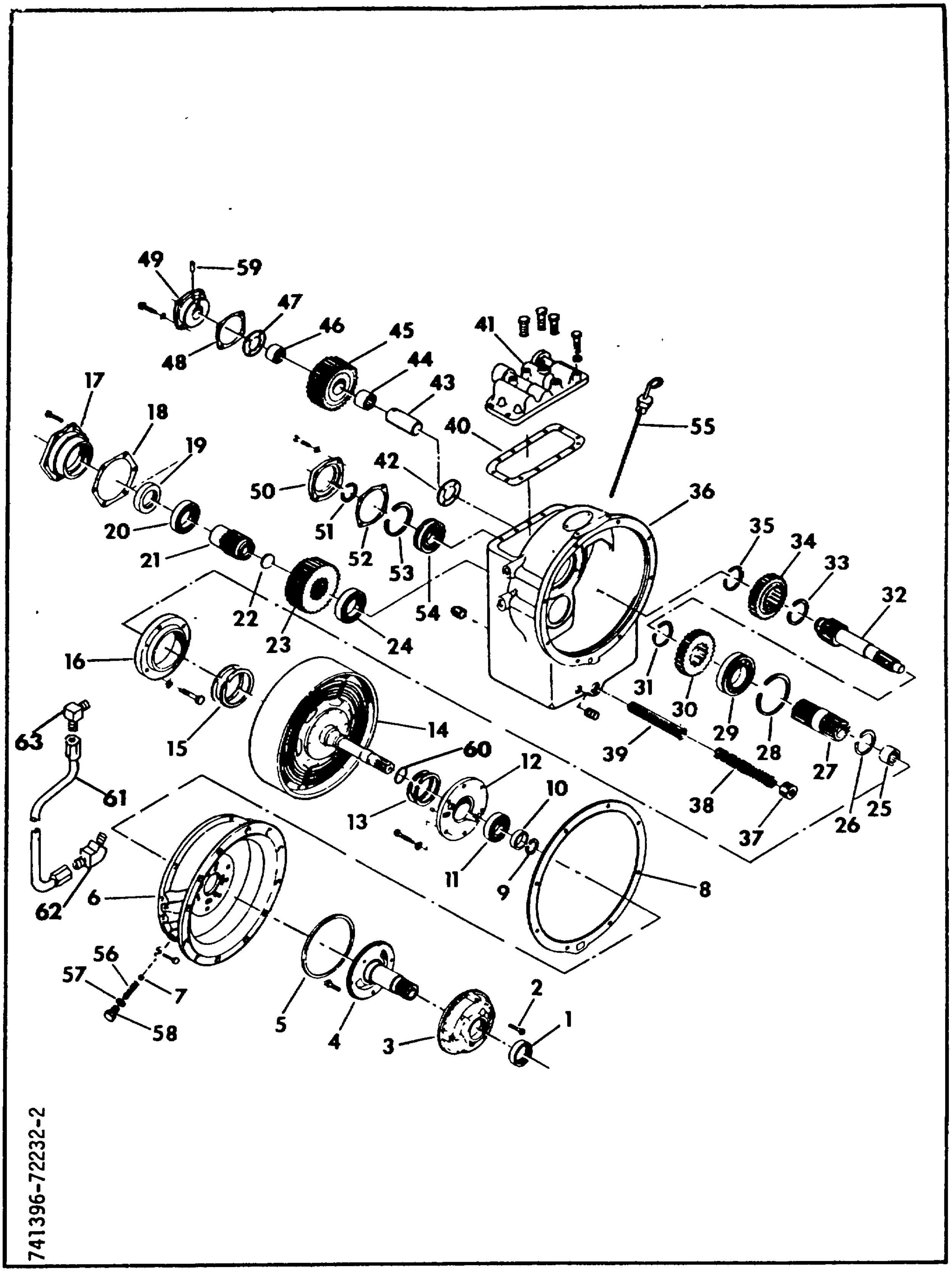

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TRANSMISSION ASSY-4856441-3

ITEM	PART NO.		DESCRIPTION	QTY.	
-	4907656-5		PUMP ASSY	1	INCL ITEMS 1-3-4-10-12
1	0927023-2	*	SEAL	1	
2	0923124-2		SCREW-.38"-16X3.75"	4	
3	--------------		SUPPORT	1	ORDER 4907656-5
4	--------------		RING-COLLECTOR	1	ORDER 4907656-5
	0929543-7		SCREW-.25"-20 X 1"	1	
	0916614-1		LOCKWASHER-.25"	1	
	0923124-2		SCREW-.38"-16 X 3.75"	4	
5	4905789-6	*	GASKET-PUMP	1	
6	4909316-4		HOUSING	1	INCL ITEM 11 & PLUG 0920131-0
	0919134-7		PLUG-.12" PT	5	
	0920131-0		PLUG-.38"	4	
7	0917146-3		BALL-CHROME STEEL-.44"	1	
8	4909118-4	*	GASKET	1	
9	4905790-4		RING-RETAINING	1	
10	4905792-0		SPACER-BEARING	1	
11	0067766-6		BEARING	1	
12	4905793-8		RETAINER & PLUG ASSY	1	
	0921333-1		CAPSCREW-.31"-18 X 1"	6	
	0917356-8		LOCKWASHER-.31"	6	
13	4987600-6	*	RING	2	
14	4909317-2		CLUTCH ASSY-FWD & REV	1	SEE PAGE 83
15	4995592-5	*	RING-SEALING	2	
16	4995595-8		RETAINER	1	
	0928075-1		SCREW & LOCKWASHER-.31"-18 X 1"	5	
17	4987585-9		RETAINER	1	
	0926671-9		CAPSCREW-.31"-18 X .88"	6	
18	4987586-7	*	GASKET	1	
19	4254667-1	*	SEAL-OIL	1	
20	4254658-0		BEARING	1	
21	1002933-8		SHAFT-OUTPUT	1	INCL ITEM 22
22	0910007-4		PLUG-EXPANSION-1.38"	1	
23	4987583-4		GEAR-MAIN DRIVE	1	
24	4254658-0		BEARING-BALL	1	
25	0080325-4		BEARING-NEEDLE	1	
26	4987702-0		RING-SNAP	1	
27	4995594-1		SHAFT-REVERSE DRIVE	1	
28	4995626-1		RING-SNAP	1	
29	4995627-9		BEARING-BALL	1	
30	4987593-3		GEAR	1	
31	4987702-0		RING-SNAP	1	
32	4987595-8		SHAFT-DRIVE	1	
33	4987702-0		RING-SNAP	1	
34	4987593-3		GEAR	1	
35	4987702-0		RING-SNAP	1	

741396-72232-2

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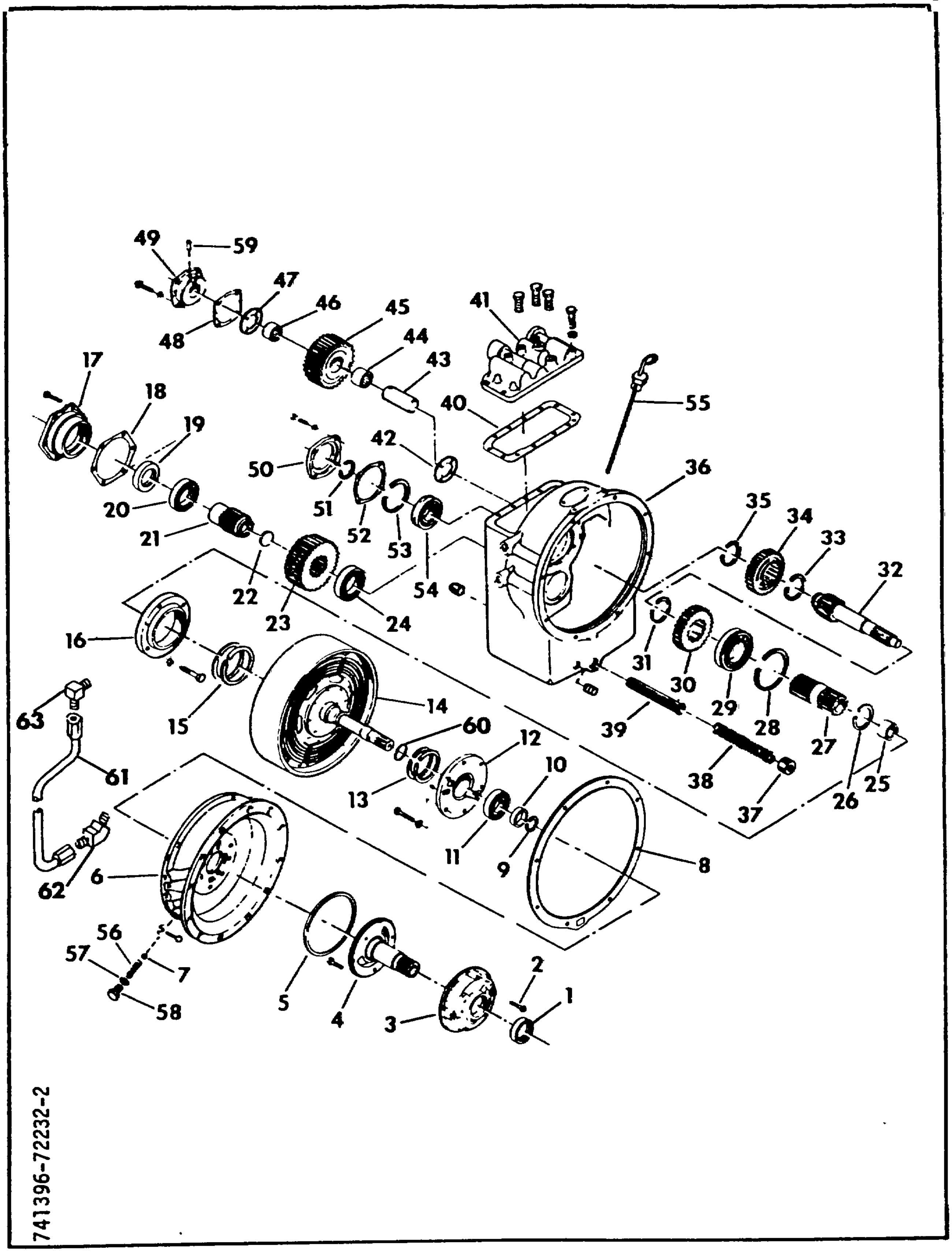

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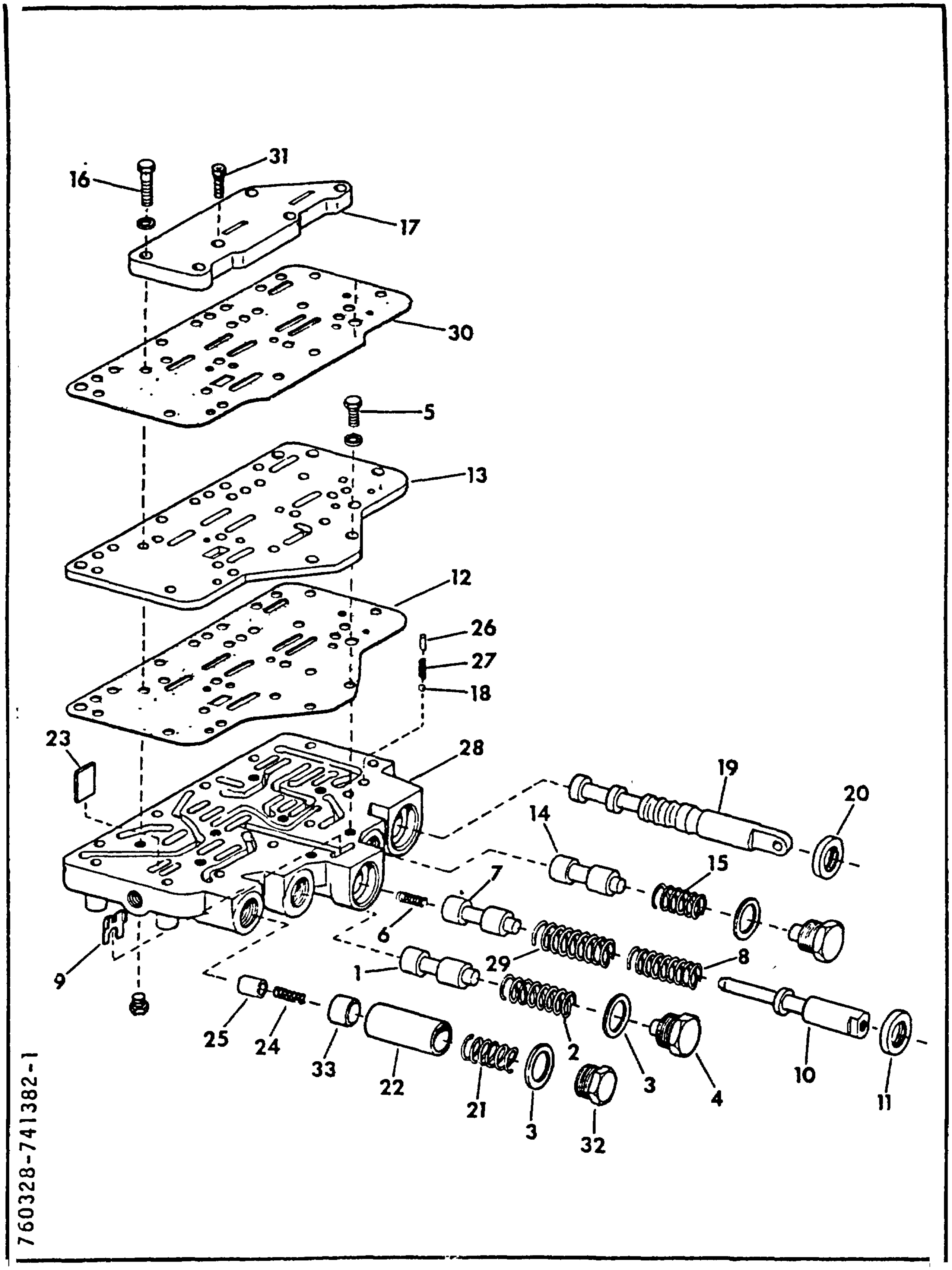
741396-72232-2

TRANSMISSION ASSY-4856441-3 (CONTINUED)

ITEM	PART NO.		DESCRIPTION	QTY.	
36	4909121-8		CASE-TRANSMISSION	1	INCL PLUG 0920130-2
	0919224-6		CAPSCREW-.38"-16 X 1.12"	5	
	0921971-8		CAPSCREW-.38"-16 X 1.62"	3	
	0910287-2		LOCKWASHER-. 38"	8	
	0920130-2		PLUG-.25" PT	2	
	4707650-0		PLUG-DRAIN	1	
	0920131-0		PLUG	2	
	0905261-4		PLUG-.5" PT	1	
37	0918888-9		PLUG-1" PT	1	
38	4999355-3		SPRING	1	
39	4999354-6		SCREEN	1	
40	4909120-0	*	GASKET-VALVE BODY	1	
41	4909135-8		VALVE ASSY	1	SEE PAGE 81
	0931140-8		CAPSCREW-W/LOCKWASHER-.31"-18X2"	3	
	0918066-2		CAPSCREW-W/LOCKWASHER-.31"-18X1.5"	1	
	0931139-0		CAPSCREW-.31"-18X1.12"	3	
	0931141-6		CAPSCREW-.31"-18X2.5"	3	
42	4997587-3		WASHER-THRUST	1	
43	4987588-3		SHAFT	1	
44	4253326-5		BEARING	1	
45	4987587-5		GEAR	1	
46	4253326-5		BEARING	1	
47	4997587-3		WASHER-THRUST	1	
48	4987590-9	*	GASKET	1	
49	4908325-6		RETAINER-IDLER SHAFT	1	
	0926671-9		CAPSCREW-.31"-18x.88"	4	
50	4987597-4		RETAINER	1	
	0926671-9		CAPSCREW-.31"-18X.88"	4	
51	4987703-8		RING-RETAINING	1	
52	4987596-6	*	GASKET	1	
53	1007047-2		RING-RETAINING	1	
54	4253543-5		BEARING-BALL	1	
55	4987644-4		DIPSTICK	1	
56	4906409-0		SPRING	1	
57	4991741-2		WASHER	1	
58	4991740-4		SEAT	1	
59	4987589-1		PIN	1	
60	4905788-8	*	RING-SEALING	1	
61	4909917-9		TUBE	1	
62	0917496-2		ELBOW-45°	1	
63	0910978-6		ELBOW-90°	1	

* INCL IN KIT 4909869-2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TRANSMISSION VALVE ASSY-4909135-8

ITEM	PART NO.		DESCRIPTION	QTY.	
1	4909124-2		VALVE-REGULATOR	1	
2	4987631-1		SPRING-REGULATOR VALVE	1	
3	4987634-5	*	GASKET	3	
4	4987635-2		SCREW-VALVE RETAINER	2	
5	0920026-2		CAPSCREW-.31"-18 X .56"	2	
	0917356-8		LOCKWASHER-.31"	2	
6	4988062-8		SPRING	1	
7	4909126-7		VALVE-INCHING	1	
8	4991747-9		SPRING-INCHING VALVE-INNER	1	
9	4909127-5		STOP-INCHING VALVE PLUNGER	1	
10	4909128-3		PLUNGER-INCHING VALVE	1	
11	4254697-8	*	SEAL-OIL	1	
12	4909129-1	*	GASKET-VALVE BODY	1	
13	4910352-6		PLATE-VALVE BODY	1	
14	4987630-3		VALVE-REGULATOR	1	
15	4987673-3		SPRING	1	
16	0918065-4		CAPSCREW-.31"-18 X 1.25"	6	INCL LKW
17	4909131-7		COVER-VALVE BODY	1	
18	0915771-0		BALL-CHROME STEEL-.25"	1	
19	4909132-5		VALVE-SELECTOR	1	
20	4254666-3	*	SEAL-OIL	1	
21	4912280-7		SPRING	1	
22	4912281-5		VALVE-CONV REG	1	
23	4909138-2		PLATE-VALVE STOP	1	
24	4909139-0		SPRING	1	
25	4909140-8		VALVE-LUBE REG	1	
26	4909142-4		PIN-INTERLOCK	1	
27	4909134-1		SPRING	1	
28	4909133-3		BODY-VALVE	1	
	0919134-7		PLUG-.12" PT	2	
29	1002963-5		SPRING-INCHING VALVE-OUTER	1	
30	4912284-9	*	GASKET-SEPARATOR PLATE	1	
31	4912285-6		SCREW	1	
32	4912282-3		PLUG-VALVE RETAINER	1	
33	4912283-1		PLUG-CONV REG	1	

*INCL IN KIT 4909869-2

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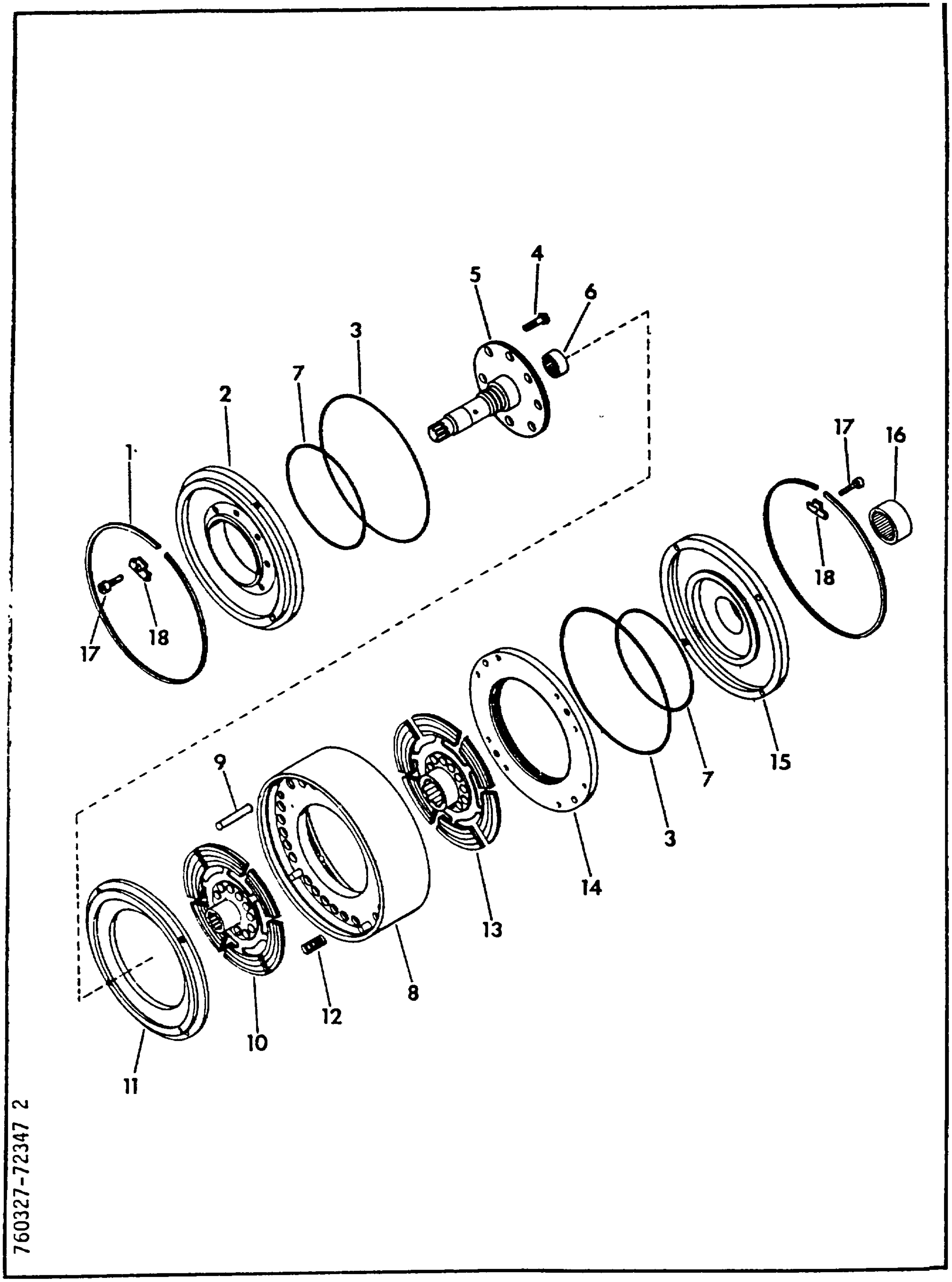
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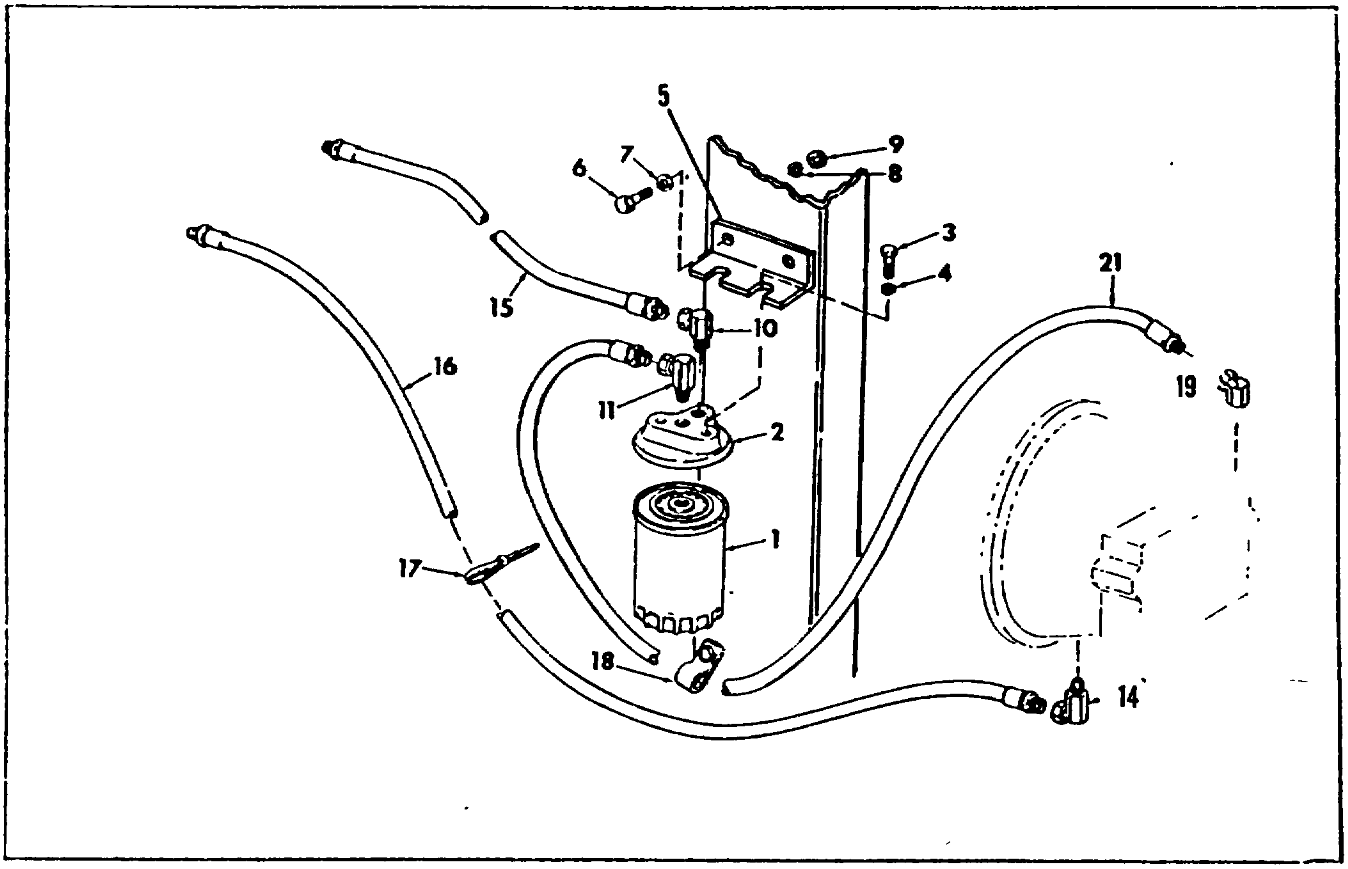
FORWARD & REVERSE DISC ASSY- 4909317-2

ITEM	PART NO.		DESCRIPTION	QTY.	
1	4987609-7		RING- CYLINDER RETAINING SNAP	2	
2	4909117-6		CYLINDER- FRONT	1	
	4996438-0		SCREW	1	
	4999539-2		PLATE- LOCK	1	
3	4909119-2	*	RING- PISTON SEALING	2	LARGE
4	4998673-0		BOLT- PLACE	8	
5	4905883-7		SHAFT - INPUT TURBINE	1	INCL ITEM 6
6	4254654-9		BEARING- NEEDLE	1	INPUT SHAFT
7	4987606-3	*	RING- PISTON SEALING	2	SMALL
8	4999280-3		DRUM- DISC	1	INCL ITEM 9
9	4987603-0		PIN- DRUM	4	
10	1002947-8		DISC- FORWARD DRIVE	1	
11	4909122-6		PISTON- CLUTCH	1	
12	4987611-3		SPRING- DRIVE DISC RETRACTOR	24	
13	1002946-0		DISC- REVERSE DRIVE	1	
14	4909122-6		PISTON- CLUTCH	1	
15	4909315-6		CYLINDER- REAR	1	
	4996438-0		SCREW	1	
	4999539-2		PLATE - LOCK	1	
16	4255470-9		BEARING- NEEDLE	1	

* INCLUDED IN KIT 4909869-2

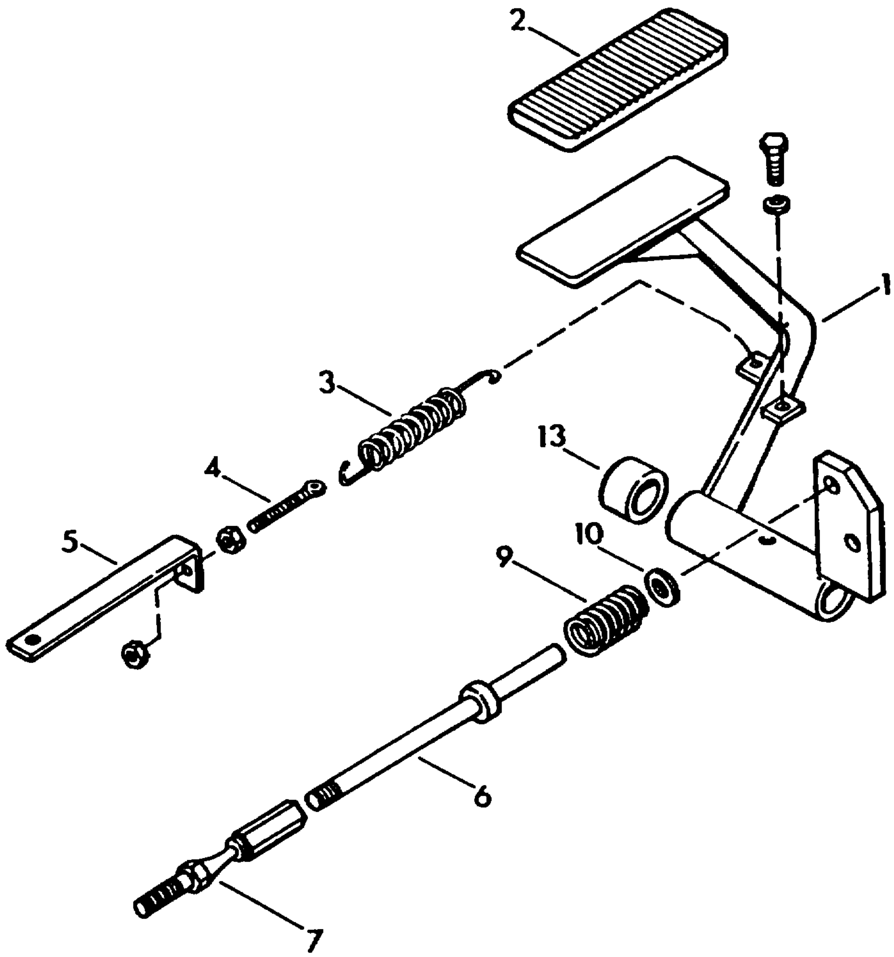
72348



71533

TRANSMISSION FILTER

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4878421-9	FILTER	1	
2	4824293/7	BASE- FILTER	1	
3	0921980-9	CAPSCREW- .31"-24 X .62"	2	
4	0917356/8	LOCKWASHER- .31"	2	
5	4859849-4	BRACKET	1	
6	0921332-3	CAPSCREW- .31"-18 X .75"	2	
7	0917356-8	LOCKWASHER- .31"	2	
8		NOT USED		
9	0917372-5	NUT- .31"-18	2	
10	4811115/7	FITTING- SHORT	1	
11	4708605/3	ELBOW- LONG	1	
14	4708603-8	FITTING	1	
15	4769239-7	HOSE- .51"	1	TO RADIATOR
16	4864653-3	HOSE-	1	
17	4255355-2	TY-WRAP	2	
18		NOT USED		
19	4252647-5	ADAPTER 45°	1	
20		NOT USED		
21	4750421-2	HOSE -33”	1	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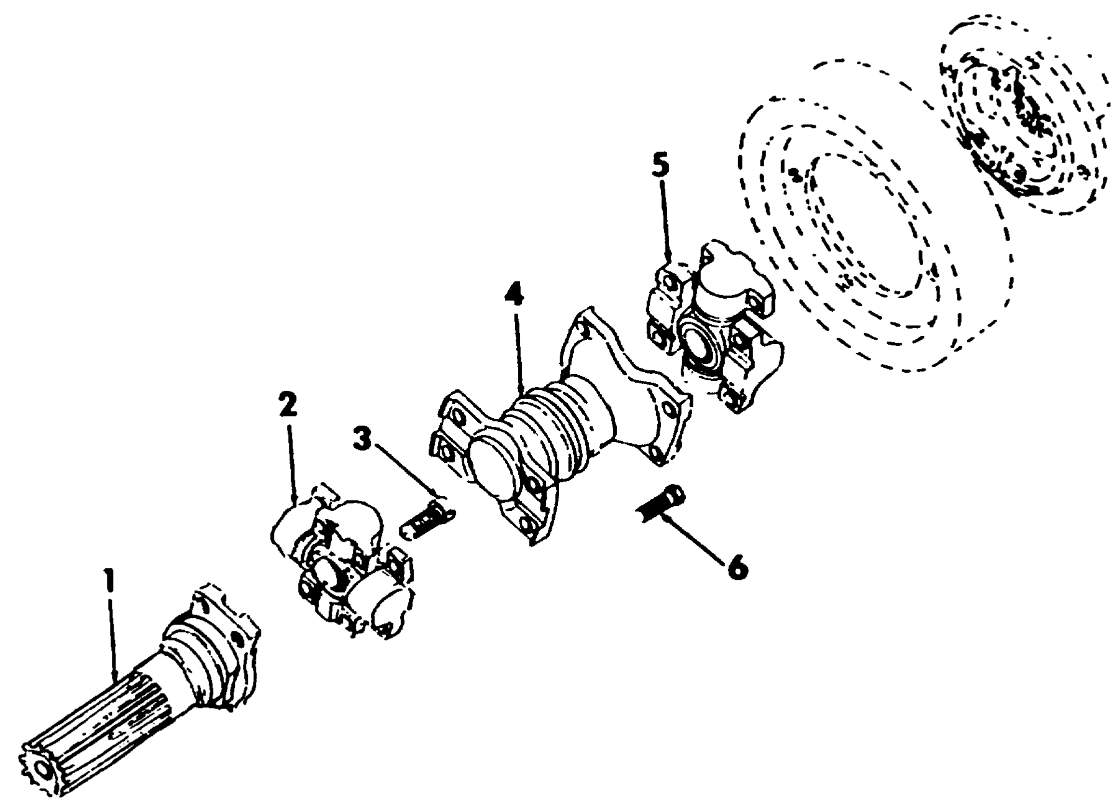
INCHING CONTROL

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4857249-9	PEDAL ASSY	1	INCL ITEM 13
	0912808-3	FITTING-LUBE	1	
	0913744-9	NUT-JAM	1	
	0919350-9	SETSCREW	1	
	0923870-0	WASHER	1	
	0916004-5	PIN-SPRING	1	
2	4869251-1	PAD	1	
3	4803166-0	SPRING	1	
4	4511898-1	SCREW-ADJUSTING	1	
	0920438-9	NUT	2	
5	4861679-1	ANCHOR	1	
6	4858899-0	ROD-INCHING	1	
	0920263-1	NUT	1	
7	4745363-4	JOINT-BALL	1	
8	0928221-1	CAPSCREW	1	
	0917356-8	LOCKWASHER	1	
9	4803175-1	SPRING	1	
10	0919326-9	WASHER	1	
13	4707331-7	BUSHING	2	

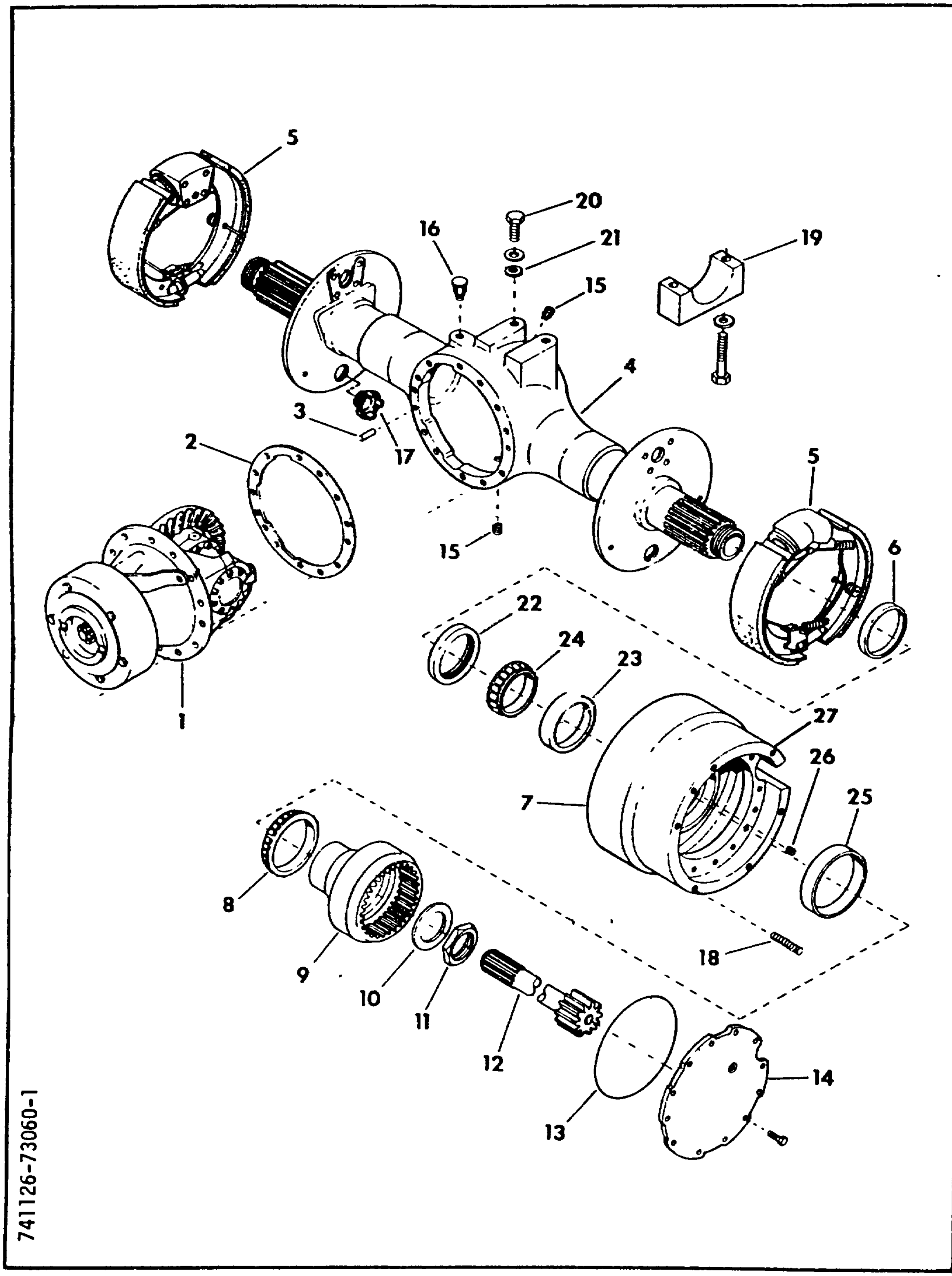
73660



71391

UNIVERSAL JOINT - P/S

ITEM	PART NO.	DESCRIPTION	QTY.	
	4854017-3	JOINT-UNIVERSAL	1	INCL ITEMS 2-4-5 & 6
1	4771623-8	FLANGE	1	
2	4993479-7	CROSS ASSY	1	INCL BEARINGS
3	4829298-1	CAPSCREW-NYLOC	8	
4	4908922-0	TUBE-COUPLING	1	
5	4993479-7	CROSS ASSY	1	INCL BEARINGS
6	4980048-5	CAPSCREW	8	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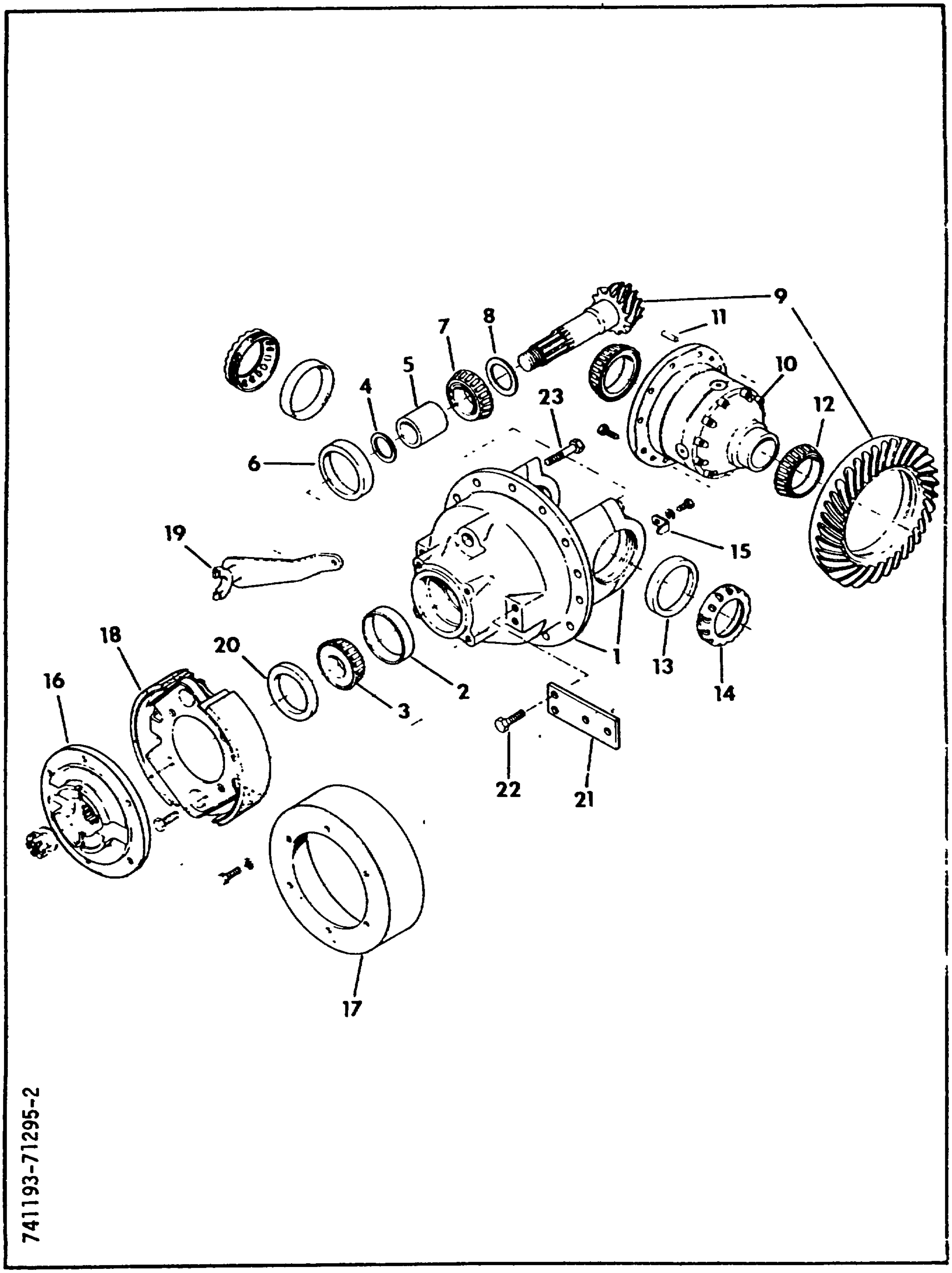
741126-73060-1

DRIVE AXLE - 4822148-5

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4822149-3	CARRIER ASSY	1	SEE CARRIER ASSY
	4751644-8	BOLT-.44"-14 X 1"	12	
2	4823470-2	GASKET	1	
3	4827731-3	DOWEL-VENT	2	
4	4854028-0	AXLE-DRIVE	1	
5	4819996-2	BRAKE UNIT-LEFT HAND	1	SEE PAGE 105
	4819997-0	BRAKE UNIT-RIGHT HAND	1	
6	4819991-3	SLEEVE-WEAR	2	
7	4820067-9	HUB ASSY	2	
8	0927350-9	CONE-BEARING	2	
9	4819117-5	GEAR-RING	2	
10	4840052-7	WASHER-THRUST	2	
11	4840053-5	NUT	2	
12	4819144-9	SHAFT-AXLE	2	
13	0927185-9	O-RING	2	
14	4820068-7	CARRIER-PLANETARY	2	PAGE 99
	4752075-4	BOLT-PLACE	24	
15	0035250-0	PLUG-PIPE-.5"	2	
16	4703438-4	BREATHER,	1	
17	4854029-8	PLUG	1	
18	4774988-2	STUD-WHEEL	12	
	4820863-1	CAP-SUPPORT	2	
	4820677-5	CAPSCREW-.88"-9 X 5"	4	
19	4822141-0	WASHER-.88"	4	
20	4820070-3	BOLT-.75"-10 X 2"	2	
	4836781-7	WASHER-.12" THICK	4	
	4820063-8	WASHER-SHIM-.25" THICK	*	
21	4836780-9	WASHER-SHIM-.19" THICK	*	*USE AS REQUIRED
22	4819990-5	SEAL-SHAFT	1	
23	0927348-3	CUP	1	
24	0927347-5	CONE	1	
25	0927349-1	CUP	1	
26	4859594-6	PLUG-PIPE	1	
27	4819444-3	HUB DUAL	1	

741126-73060-1



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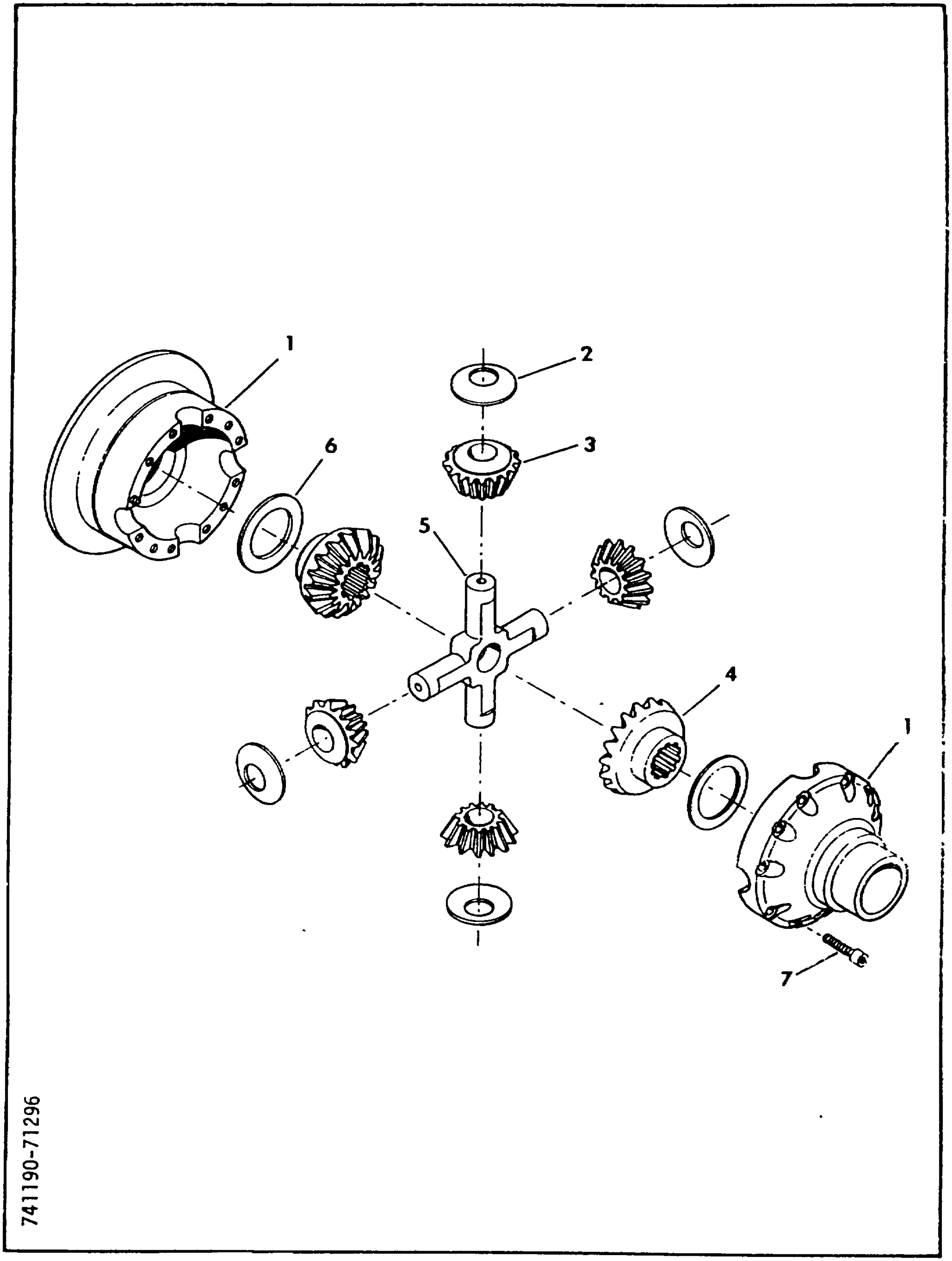
741193-71295-2

CARRIER ASSY-4822149-3

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4819451-8	HOUSING ASSY-CARRIER	1	INCL ITEM 23
2	4253276-2	CUP-BEARING	1	
3	4254736-4	CONE-BEARING	1	
	4819980-6	SHIM-.002"	*	
	4819981-4	SHIM-.003"	*	
	4819982-2	SHIM-.005"	*	
4	4819983-0	SHIM-.010"	*	* USE AS REQUIRED
	4819984-8	SHIM-.020"	*	
	4819985-5	SHIM-.030"	*	
	4819986-3	SHIM-.050"	*	
5	4819454-2	SPACER-PINION	1	
6	0927091-9	CUP-BEARING	1	
7	0927090-1	CONE-BEARING	1	
	4819455-9	SHIM-.002"	*	
	4819456-7	SHIM-.003"	*	
8	4819457-5	SHIM-.005"	*	* USE AS REQUIRED
	4819458-3	SHIM-.010"	*	
	4819459-1	SHIM-.020"	*	
9	4821837-4	GEAR SET-3.7:1 RATIO	1	
10	4819210-8	DIFFERENTIAL-4 PINION	1	SEE PAGE 95
	4819998-8	CAPSCREW	10	
11	0917611-6	PIN-GROOVE-.38" X .75"	2	
12	0927137-0	CONE-BEARING	2	
13	0927138-8	CUP-BEARING	2	
14	4819995-4	ADJUSTER-BEARING	2	
15	4786677-7	LOCK-BEARING ADJUSTMENT	2	
	4839089-2	BOLT	2	
	4822142-8	WASHER	2	
16	4819443-5	FLANGE-U-JOINT	1	
	0929341-6	NUT-1"-14	1	
	4819993-9	WASHER	1	
17	4828052-3	DRUM	1	
	0928383-9	CAPSCREW-.38"-16 X .75"	6	
	0922465-0	WASHER-PLAIN-.41" ID	6	
18	4838679-1	BRAKE-PARKING	1	SEE PAGE 111
	4752075-4	BOLT-.5"-13 X 1"	4	
19	4827915-2	LEVER BRAKE	1	
20	4819989-7	SEAL-SHAFT	1	
21	4838269-1	ANCHOR-CABLE	1	
22	4254902-2	BOLT	2	
23	4840041-0	BOLT- HOUSING	4	
	4819453-4	CAP	2	

741193-71295-2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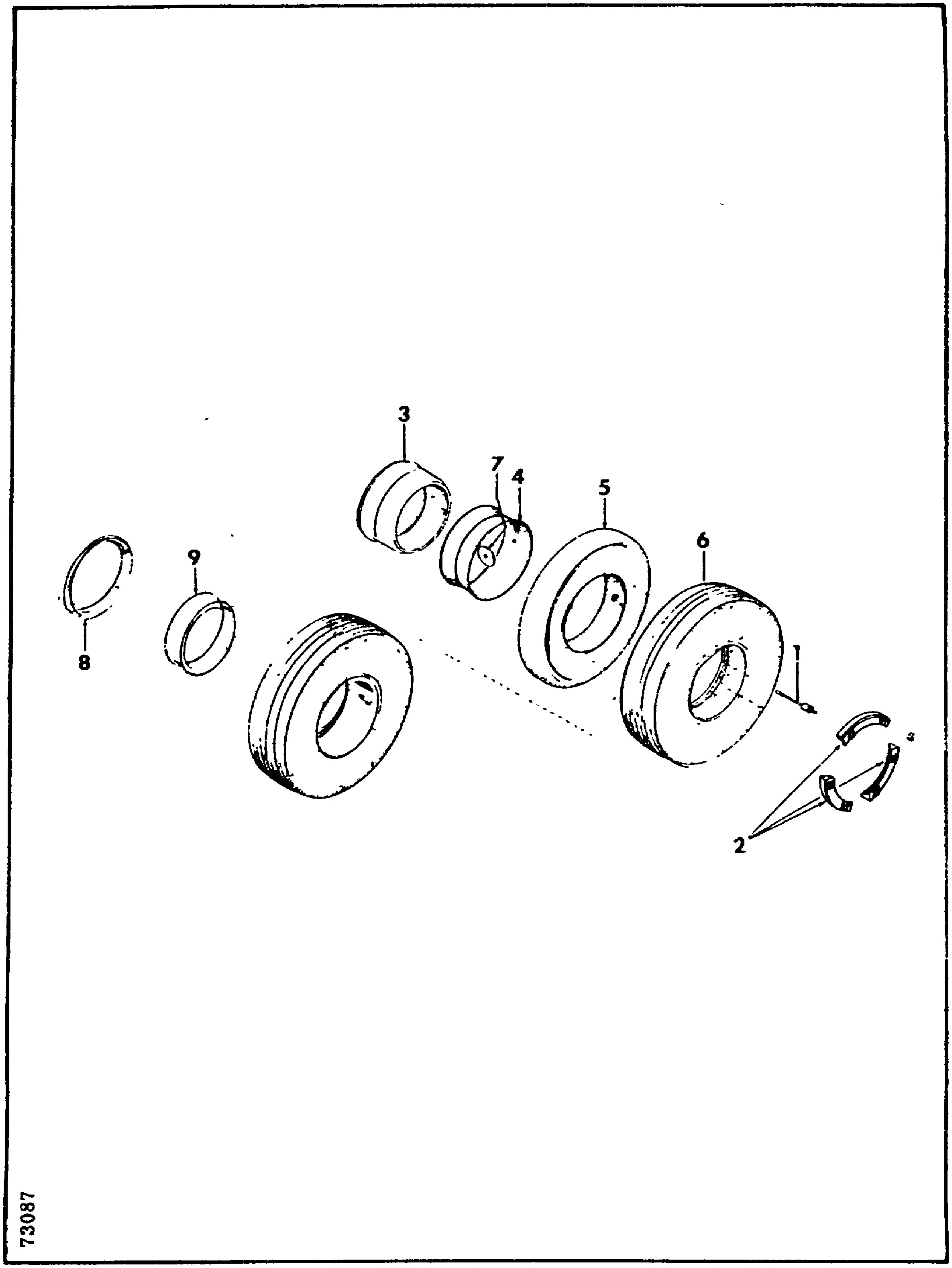
741190-71296

DIFFERENTIAL ASSY-4819210-2

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4906187-2	CASE-DIFFERENTIAL	1	TWO PIECES-INCL ITEM 7
2	4906181-5	WASHER-SPRING	4	
3	4906183-1	GEAR-PINION	4	
4	4906184-9	GEAR-BEVEL	2	
5	4906180-7	SPIDER	1	
6	4906182-3	WASHER-THRUST	2	
7	0914787-7	CAPSCREW-.38"-24 X 1.5"	12	

741190-71296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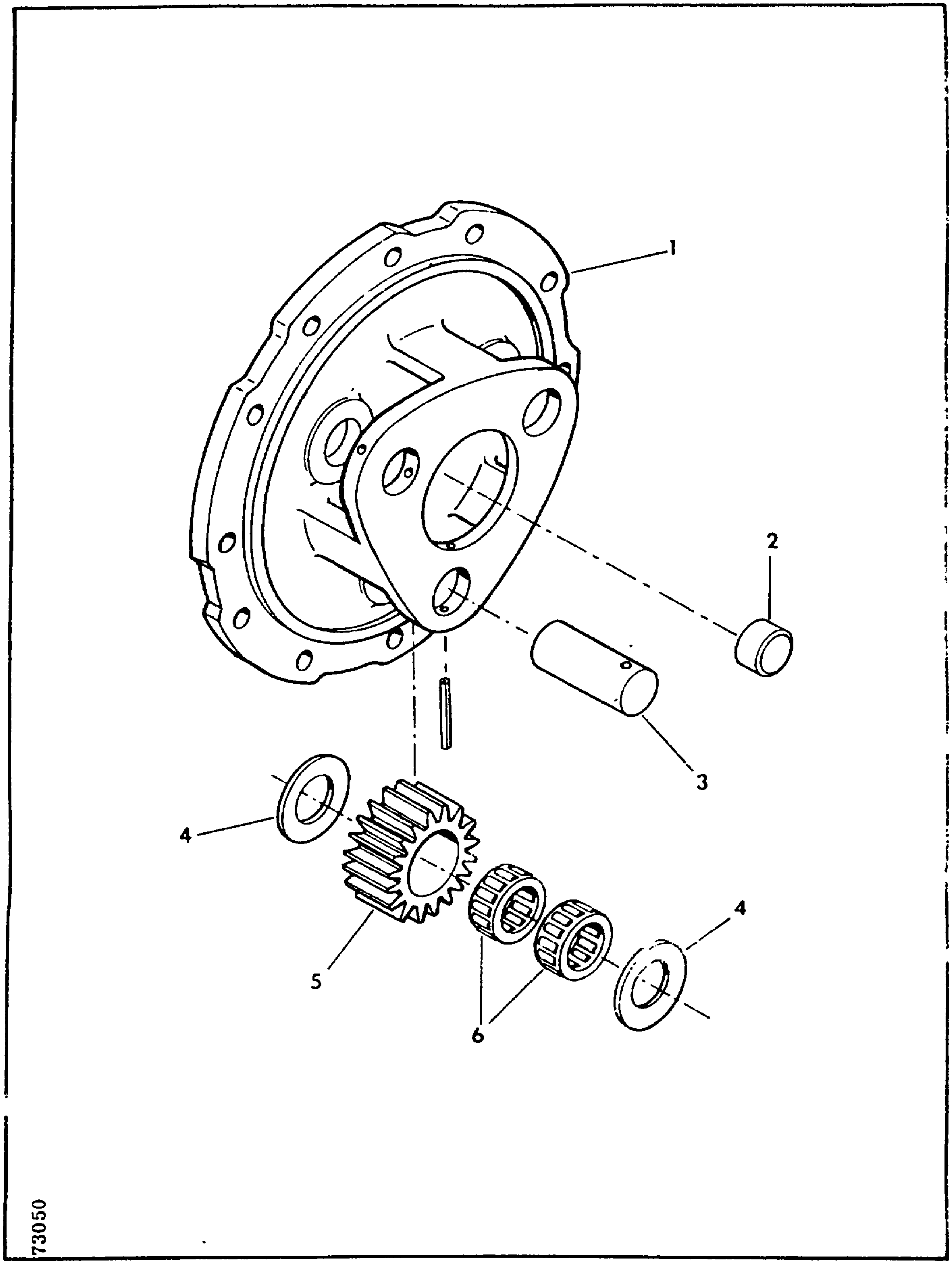
DRIVE WHEEL-DUAL

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4726660-6	EXTENSION- VALVE STEM	2	
2	4711943-3	RING	6	
	0915726-4	NUT- .63" -11	12	
3	4774924-7	RIM- BASE	4	
4		NOT USED		
5	4712890-5	TUBE	4	OBTAIN LOCALLY
6	4806199-8	TIRE- PNEUMATIC- 7.50 X 15-12 PLY	4	OBTAIN LOCALLY
7	4758882-7	DISC- FLAP	4	
8	4774925-4	RING- SIDE	4	
9	4771651-9	BAND- SPACING	2	

73087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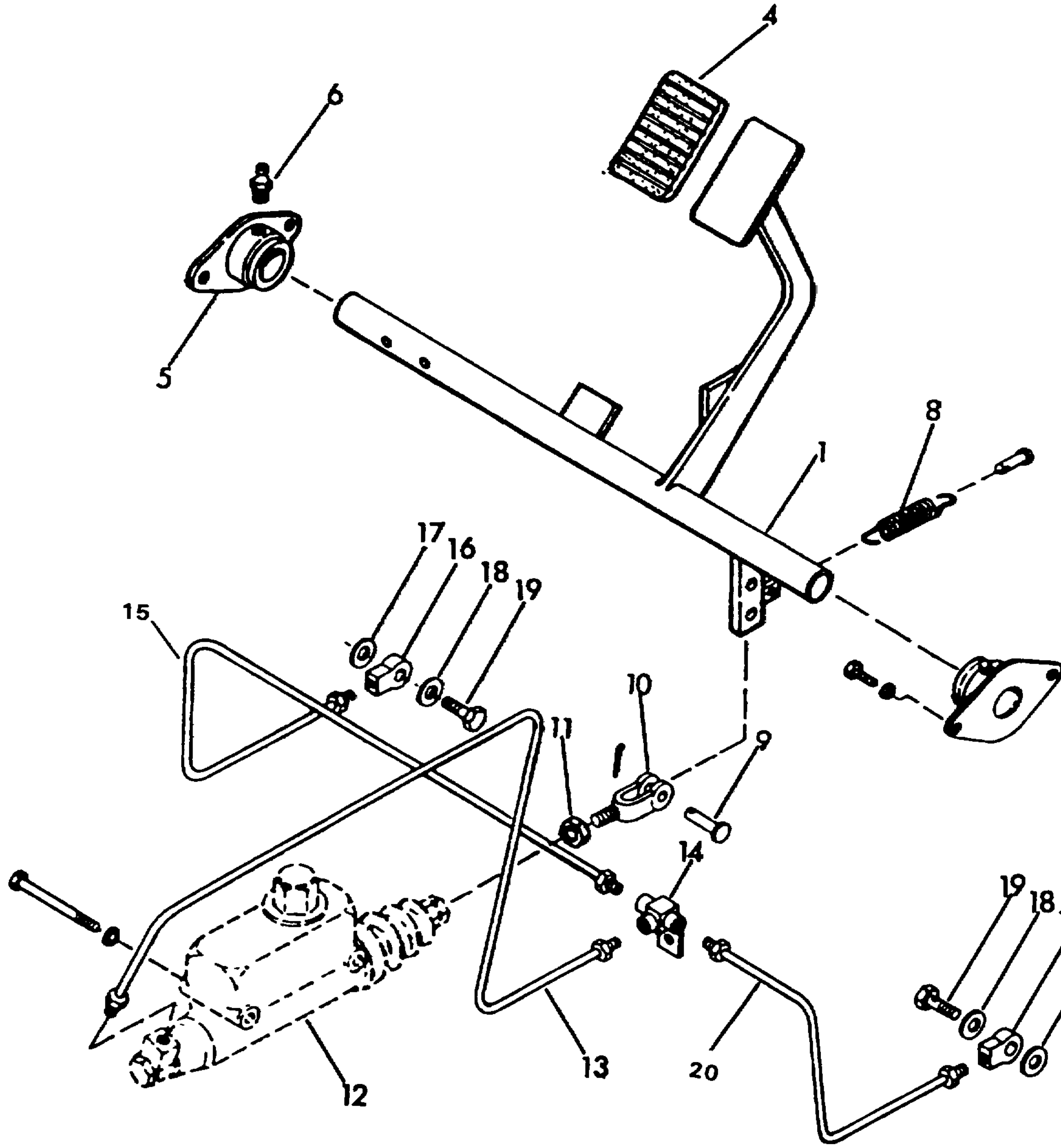
PLANETARY CARRIER-4820068-7

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4854978-6	CARRIER-PLANETARY	2	ORDER 4820068-7
2	4774104-6	PLUG-THRUST	2	
3	4819992-1	SHAFT-GEAR	6	
	0926387-2	PIN-SPIROL-.16" X 1.75"	6	
4	4819993-9	WASHER-THRUST	12	
5	4819206-6	GEAR-PLANETARY	6	
6	4820073-7	BEARING-NEEDLE	12	

73050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BRAKE PEDAL

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4857358-8	PEDAL ASSY	1	INCL ITEM 2
2				
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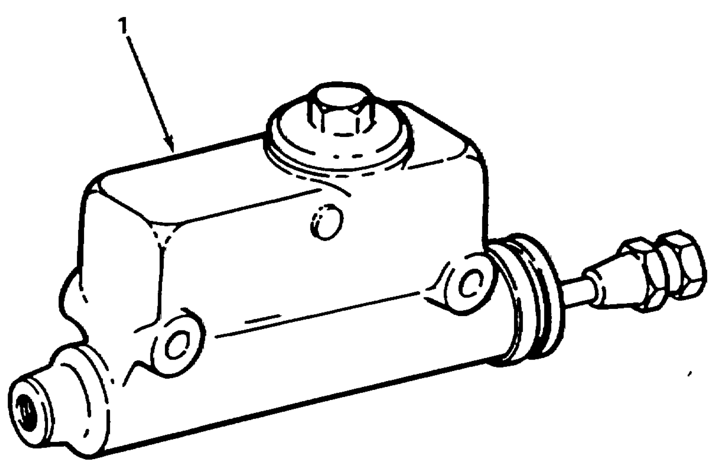
4	4824664-9	PAD	1	
5	4832715-9	BEARING- SELF- ALIGNING	2	INCL FITTING
	0914465-0	FITTING- LUBE- STRAIGHT .12" PT	2	
	0922586-3	CAPSCREW- .38" -16 X .75"	4	
	0916965-7	LOCKWASHER- .38"	4	
6				
7				
8	4763183-3	SPRING- PEDAL RETURN	1	
9	0929592-4	PIN- YOKE- .44" X 1.19"	1	
	0918447-4	PIN- COTTER- .09" X .75"	1	
10	4784720-7	YOKE	1	
11	0922471-8	NUT- .44" -20	1	
12	4824971-8	CYLINDER- MASTER	1	SEE PAGE 103
	0922918-8	CAPSCREW- .38" -16 X 4.50"	2	
	0916965-7	LOCKWASHER- .38"	2	
13	4868685-1	LINE-CYLINDER TO TEE	1	
14	4823927-1	TEE	1	
15	4828368-3	LINE- L H	1	
16	4829346-8	FITTING	1	
17	4708316-7	GASKET- FITTING	2	
18				
19	4833486-6	BOLT- FITTING	1	
20	4823929-7	LINE- R H	1	
	4772127-9	CLAMP	1	
	0667252-1	GASKET	1	
	0917378-2	WASHER	4	
	4845163-7	BOLT-MASTER CYLINDER SWITCH	1	

72942

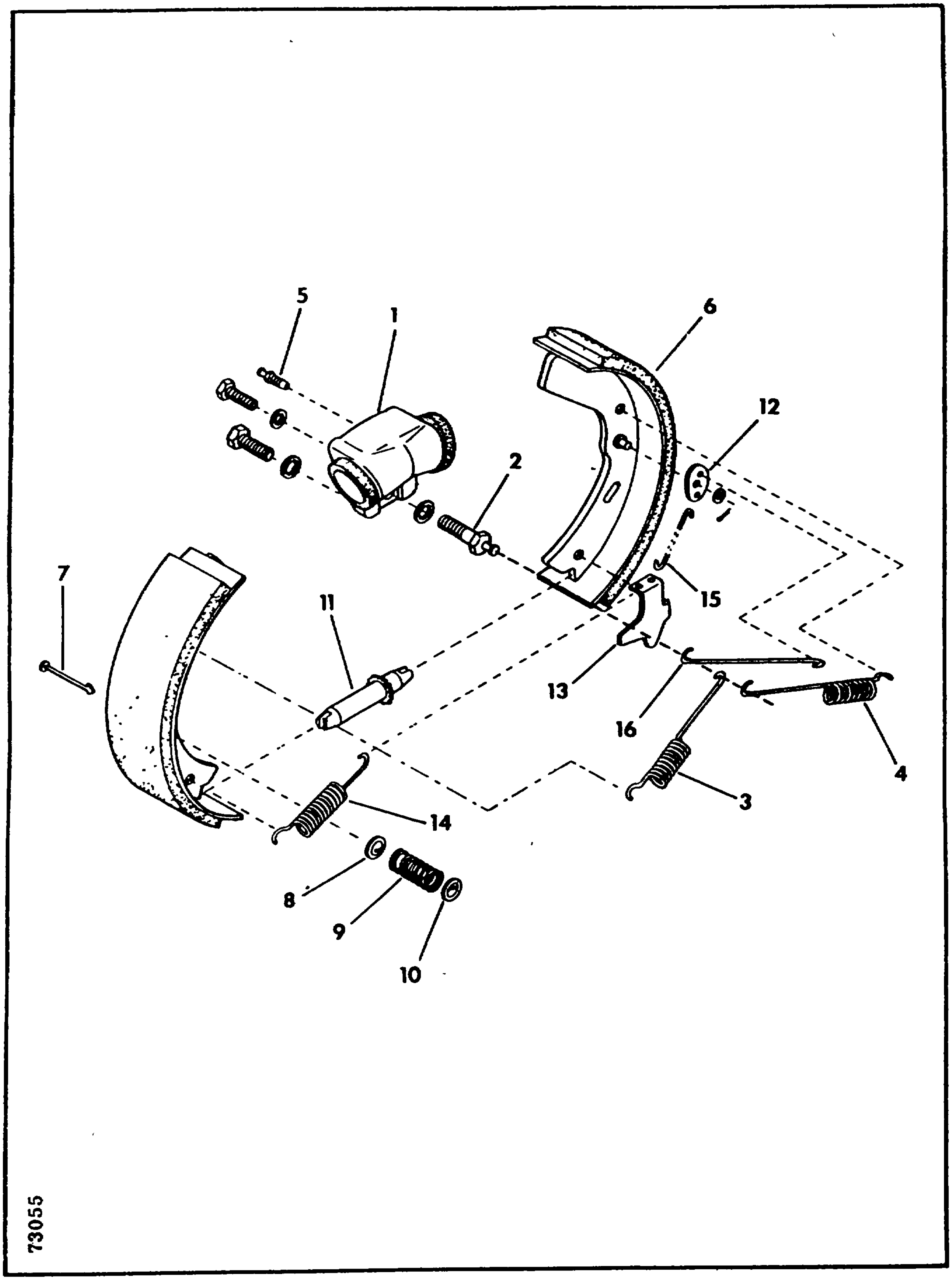


TA502567

BRAKE MASTER CYLINDER - 4824971-8

ITEM	PART NO.	DESCRIPTION	QTY.	
1	-------------	BODY- CYLINDER	1	SERVICE WITH 4824971-8

73086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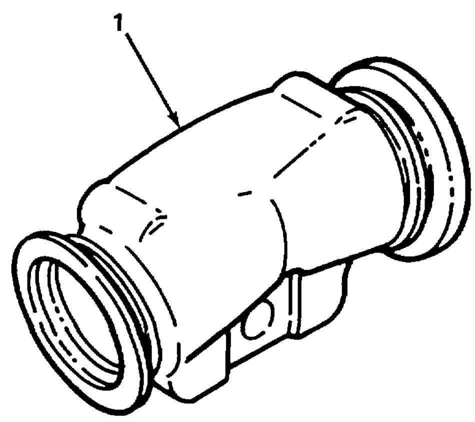
BRAKE UNIT
4819996-2 - LH
4819997-0 - RH

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4906120-3	CYLINDER	2	SEE PAGE 107
	0919190-9	CAPSCREW-.5"-20 X 1.38"	4	NOT INCLUDED IN BRAKE UNIT
	0909589-4	LOCKWASHER-.5"	4	
	0916395-7	CAPSCREW-.44"-20 X 1.25"	4	
	0922844-6	LOCKWASHER-.44"	4	
2	4906123-7	BOLT-CYLINDER	2	
	0909589-4	LOCKWASHER-.5"	2	NOT INCLUDED IN BRAKE UNIT
3	4906152-6	SPRING-RETURN-LEFT HAND-#35 GREEN	2	
4	4906153-4	SPRING-RETURN-RIGHT HAND-#35 BROWN	2	
5	4829343-5	BLEEDER	2	
6	4829357-5	PACKAGE-LINED SHOES	2	WHEEL SET
	4829358-3	PACKAGE-LINED SHOES	1	AXLE SET
7	4906135-1	PIN-SHOE HOLD DOWN	4	
8	4906136-9	CUP-SHOE HOLD DOWN	4	
9	4906137-7	SPRING-SHOE HOLD DOWN-#30 ORANGE	4	
10	4765162-5	CUP-SHOE HOLD DOWN	4	
11	4906139-3	ADJUSTING SCREW ASSY	1	LEFT HAND BRAKE UNIT
	4906140-1	ADJUSTING SCREW ASSY	1	RIGHT HAND BRAKE UNIT
12	4906143-5	LEVER-TOGGLE	2	
	4906144-3	WASHER-.25"	2	
	4906145-0	PIN-COTTER	2	
13	4906146-8	LEVER-ADJUSTING	1	LEFT HAND BRAKE UNIT
	4906147-6	LEVER-ADJUSTING	1	RIGHT HAND BRAKE UNIT
14	4906148-4	SPRING-ADJUSTING-#22 PURPLE	2	
15	4906149-2	LINK-LOWER-PINK	2	
16	4906150-0	LINK-UPPER-ORANGE	1	LEFT HAND BRAKE UNIT
	4906151-8	LINK-UPPER-YELLOW	1	RIGHT HAND BRAKE UNIT

73055

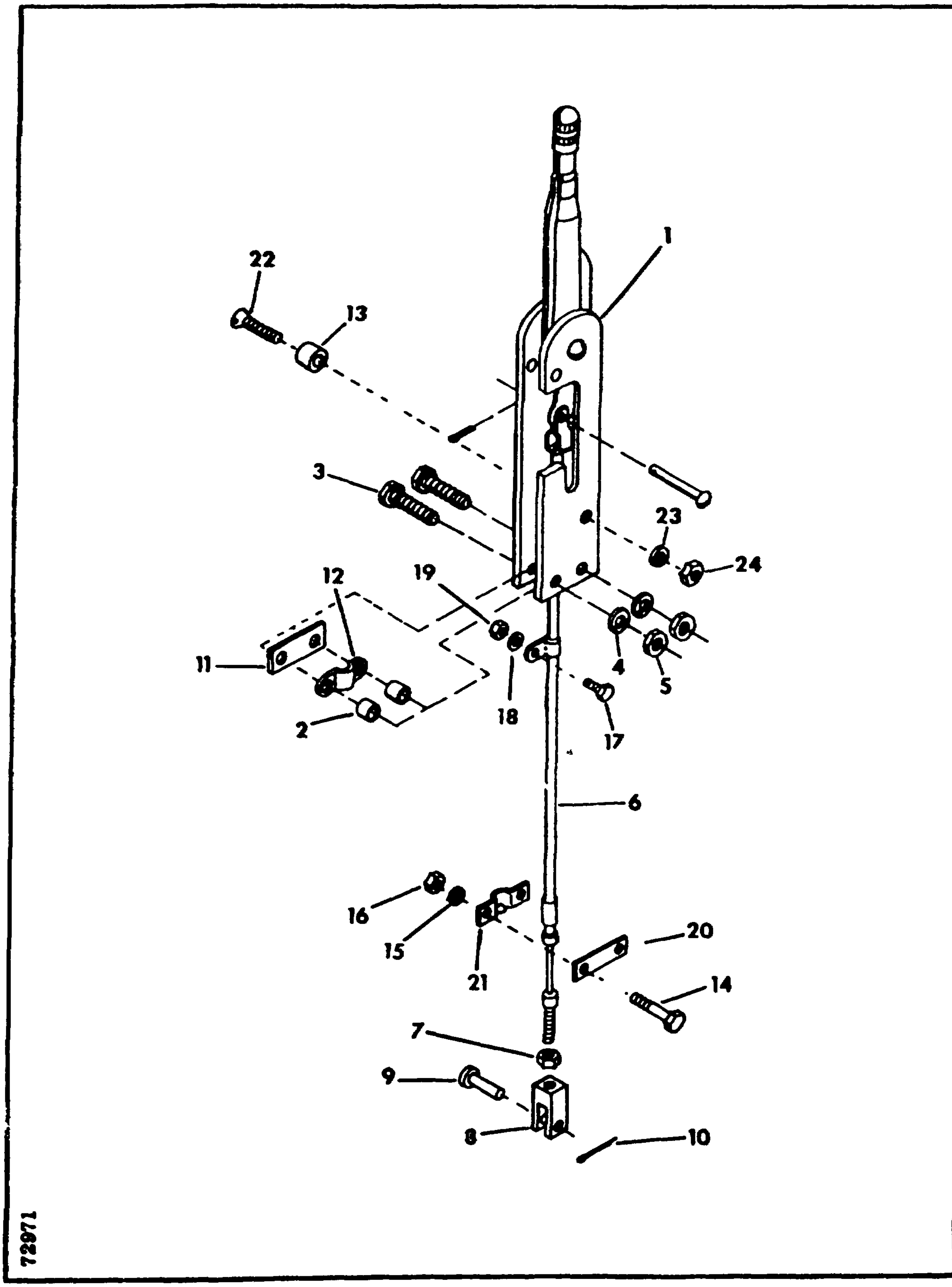


TA502568

WHEEL CYLINDER - 4906120-3

ITEM	PART NO.	DESCRIPTION	QTY.	
1	-------------	BODY- CYLINDER	1	SERVICE WITH 4906120-3

73054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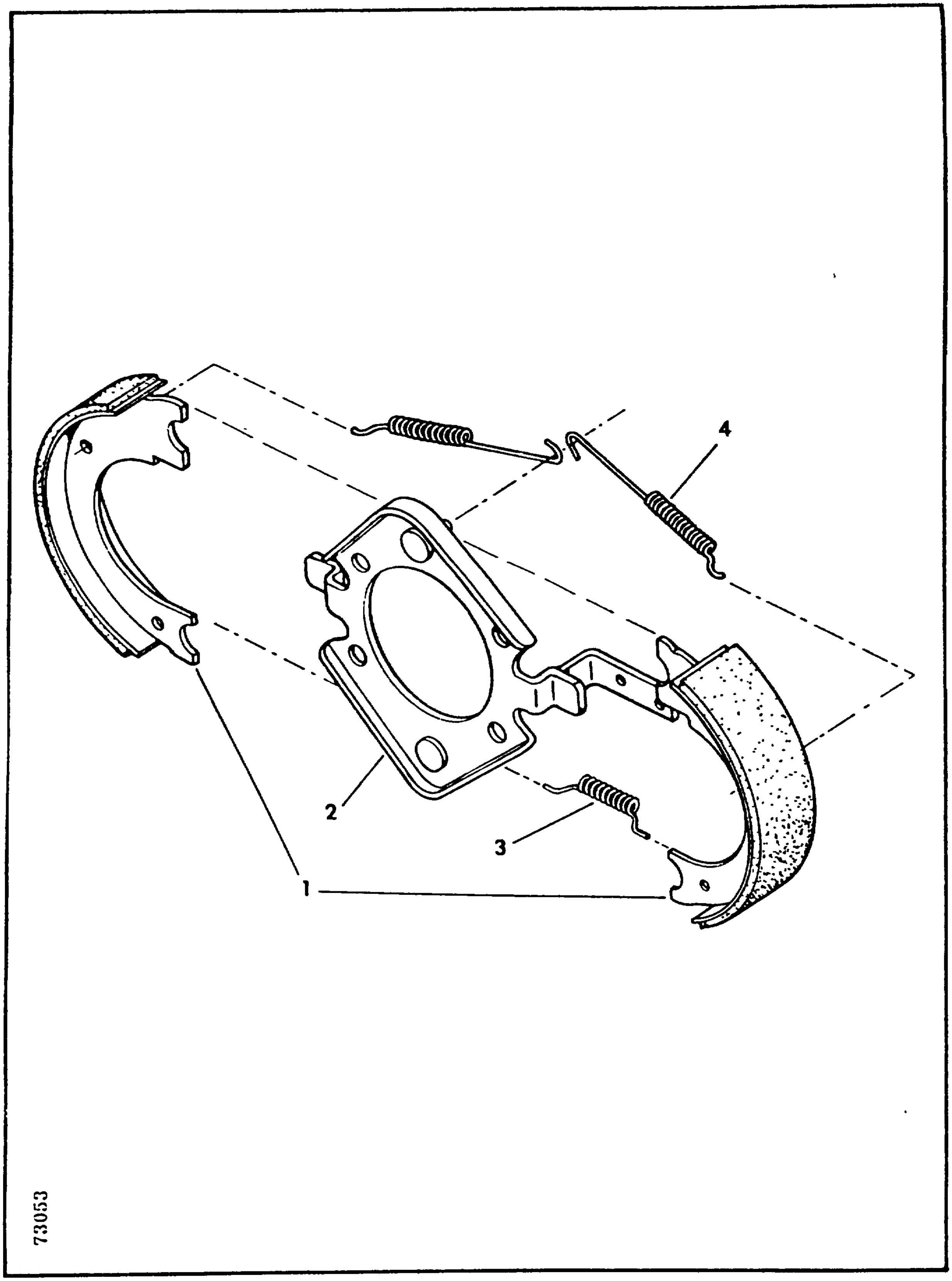
PARKING BRAKE LEVER

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4722511-5	LEVER	1	
2	4707401-8	SPACER	2	
3	0921719-1	CAPSCREW- .31" -18 x 2.50	1	
4	0917356-8	LOCKWASHER- .31"	1	
5	0917372-5	NUT- CAP 31-18	2	
6	4822716-9	CABLE- BRAKE	1	
7	0920438-9	NUT- .31" -24	1	
8	0923405-5	YOKE- .31"	1	
9	0923093-9	PIN- YOKE- .31"	1	
10	0918451-6	PIN- COTTER- .75	1	
11	4507415-0	PLATE	1	
12	4750202-6	CLAMP	1	
13	4750203-4	SPACER	2	
14	0921221-8	CAPSCREW- .31"-18 X 1.5"	2	
15	0917356-8	LOCKWASHER- .31"	2	
16	0917372-5	NUT- .31"-18	2	
17	0921221-8	CAPSCREW- .31" - 18 X 1.5"	1	
18	0917356-8	LOCKWASHER-. 31"	1	
19	0917372-5	NUT- .31" -18	1	
20	4507415-0	PLATE	1	
21	4750202-6	CLAMP	1	
22	0921221-8	CAPSCREW- .31"-18 X 1.5"	1	
23	0917356-8	LOCKWASHER- .31"	2	
24	0917372-5	NUT- .31"-18	2	
	0918265-0	WASHER	1	NOT ILLUSTRATED
	4772127-9	CLAMP	1	



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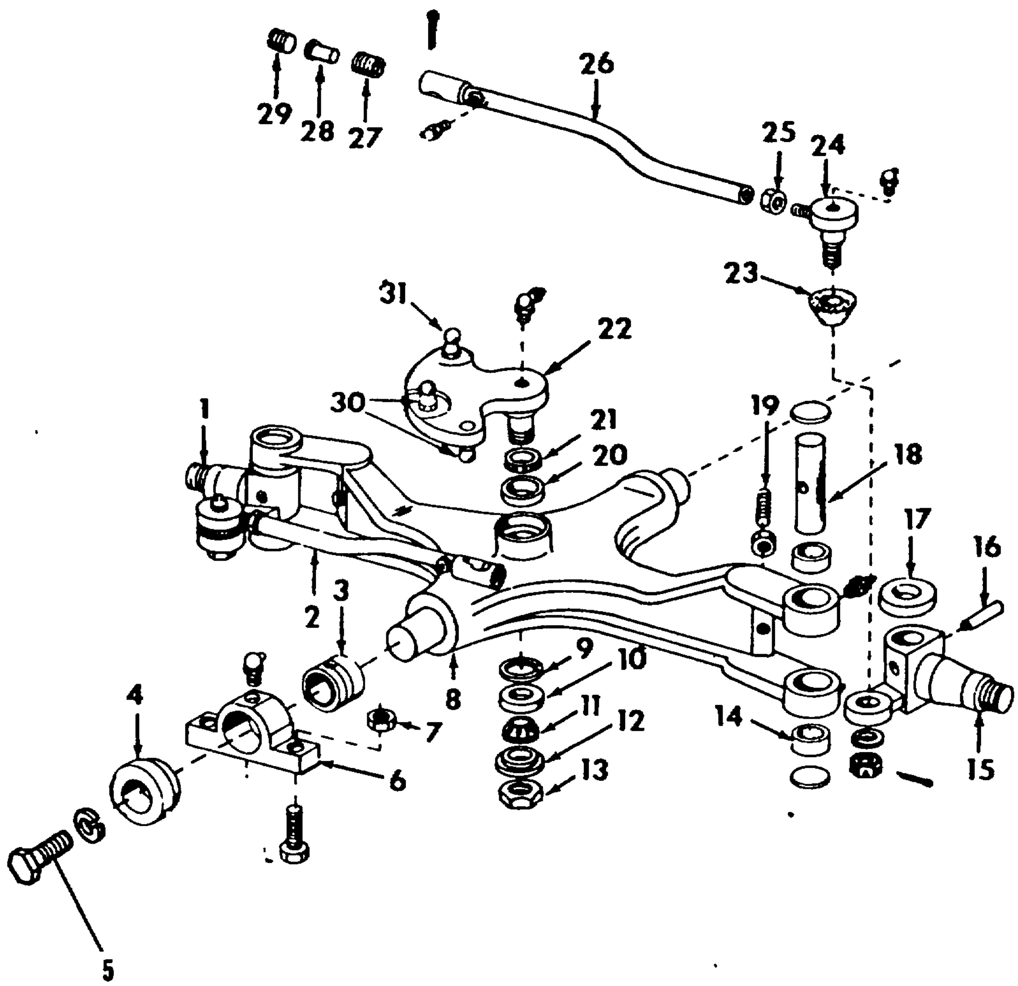
PARKING BRAKE - 4838679-1

ITEM	PART NO.	DESCRIPTION	QTY.
1	4906600-4	PACKAGE - LINED SHOES	1
2	4906601-2	PLATE- BRAKE SUPPORT	1
3	4906602-0	SPRING- ANCHOR	1
4	4906603-8	SPRING- RETURN	2

73053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STEER AXLE

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4806774-8	SPINDLE-L.H.	1	
2	4880834-3	ROD-TIE-L.H.	1	INCL ITEMS 23-24-25-27-28 & 29
	0918268-4	WASHER-.62"	1	
	0915538-3	FITTING-LUBE-650-.25"-28 NS	1	
	0918453-2	PIN-COTTER-.12" X 1.75'	1	
	0923500-3	PIN-COTTER-.12" X 1.5"	1	
	0915275-2	FITTING-LUBE-65"-.12" PT	1	
3	4806763-1	BUSHING-SELF-ALIGNING BALL	2	
4	4839231-0	SPACER	2	
5	0924623-2	CAPSCREW	1	
	0922037-7	NUT-JAM	1	
6	4841556-6	HOUSING-AXLE MOUNTING	1	
	0925387-3	CAPSCREW-.75"-10 X 4"	2	
	0919332-7	LOCKWASHER-.75"	2	
	0922212-6	FITTING-LUBE-90°-.12" PT	2	
7	0913160-8	NUT-.75"	2	
8	4880840-6	AXLE ASSY-STEER	1	
9	4255823-9	RING-SNAP	1	
10	4255821-3	CUP-LOWER BEARING	1	
11	4255822-1	CONE-LOWER BEARING	1	
12	4806771-4	WASHER	1	
13	4806772-2	NUT-PIVOT ARM RETAINING	1	
14	0930384-3	BEARING-NEEDLE	4	
15	4806773-0	SPINDLE-R.H.	1	
16	0926243-7	PIN-ROLL-.25" X 2.25"	2	
17	4844327-9	WASHER	4	
18	4806775-5	PIN-KING	2	
	0914465-0	FITTING-LUBE-STRAIGHT-.12" PT	4	
	0910014-0	PLUG-EXPANSION-1.5"	4	
19	0919350-9	SETSCREW-LIMIT STOP-.5"-13 X 2"	2	
	0913744-9	NUT-.5"-13	2	
20	4255819-7	CUP-UPPER BEARING	1	
21	4255820-5	CONE-UPPER BEARING	1	
22	4880833-1	ARM ASSY-PIVOT	1	INCL ITEMS 30 & 31
	0915276-0	FITTING-LUBE-900-.12" PT	1	
23	4992358-4	COVER	2	
24	4992361-8	SOCKET-BALL	2	
	0918270-0	NUT-.62"-18	2	
25	4987758-2	NUT	2	
26	4880835-6	ROD-TIE-R.H.	1	INCL ITEMS 23-24-25-27-28 & 29
	0918268-4	WASHER-.62"	1	
	0915538-3	FITTING-LUBE-650-.25"-28 NS	1	
	0915275-2	FITTING-LUBE-650-.12" PT	1	
	0918453-2	PIN-COTTER-.12" X. 1.75"	1	
	0923500-3	PIN-COTTER-.12" X 1.5"	1	
27	4981979-0	SPRING	2	
28	4981981-6	SEAT-BALL	2	
29	4981978-2	PLUG-ADJUSTING	2	
30	4873410-7	STUD-BALL	2	
31	4807682-2	STUD-BALL	1	
	4880836-4	TUBE-SHIELD	1	

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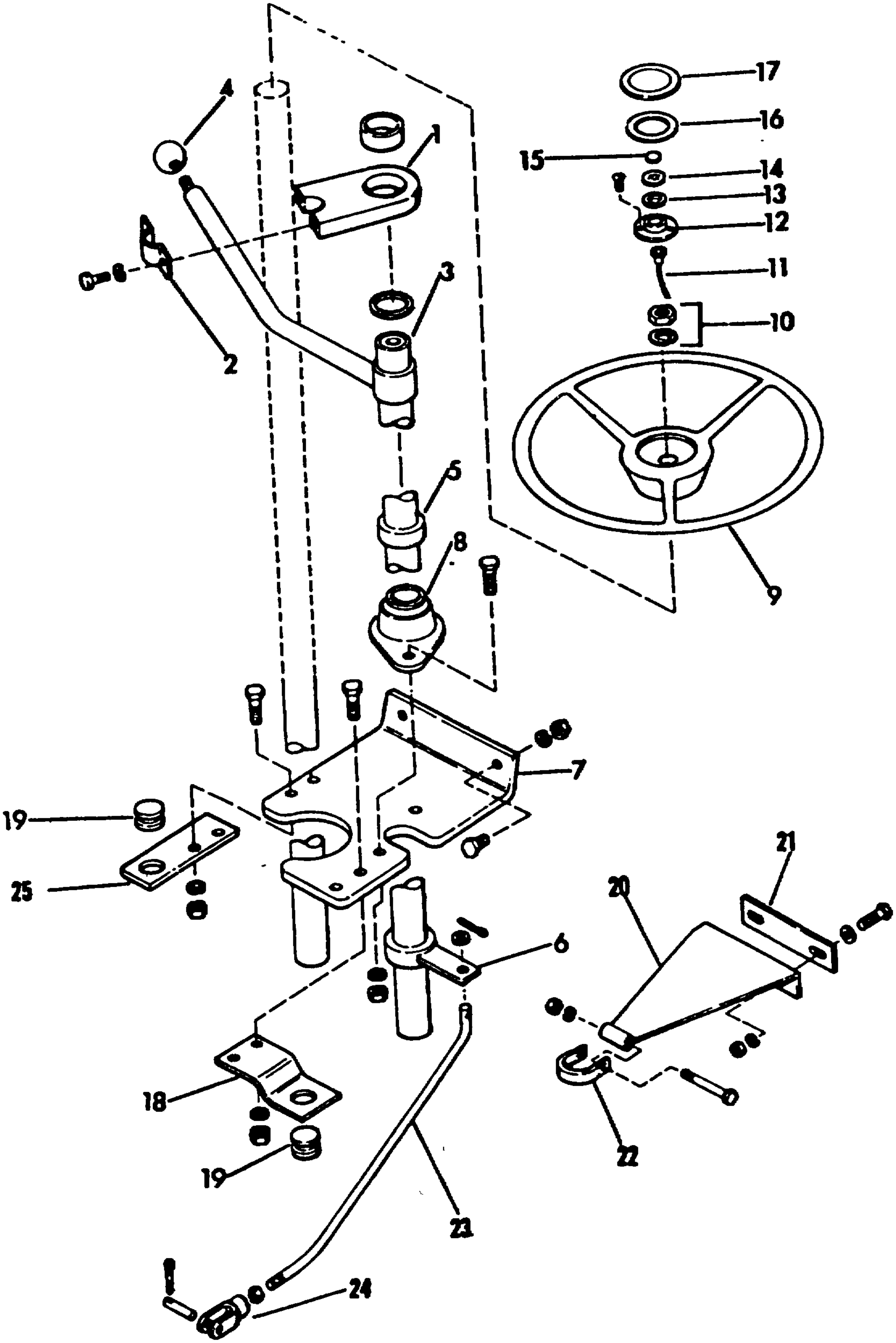

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SHIFTING ASSY - POWER SHIFT

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4861046-3	BRACKET ASSY- UPPER	1	INCL BUSHING
	4847462-1	BUSHING- 1.12" ID X 1.38" OD X .75"	1	
2	4827968-1	CLAMP- STEER COLUMN	1	
	0923341-2	CAPSCREW- .25" -20 X .75"	2	
	0916964-0	LOCKWASHER- .25"	2	
3	4861170-1	LEVER- SHIFTING	1	
4	0233770-7	KNOB	1	
5	4840790-2	COLLAR- SHIFTING	1	INCL CLAMPING SCREW
6	4869059-8	LEVER	1	INCL CLAMPING SCREW
	0928956-2	PLUG	1	
7	4861677-5	BRACKET	1	
	0921969-2	CAPSCREW- .375-16 X 1.5	2	
	0916965-7	LOCKWASHER-	2	
8	4832715-9	BEARING- FLANGE	1	
	0923325-5	CAPSCREW- .31" -18 X .88"	2	
	0917356-8	LOCKWASHER- .31"	2	
	0917372-5	NUT- .31" -18	2	
9	4709816-5	WHEEL- STEERING	1	
10	4785070-6	NUT	1	
	0919426-7	LOCKWASHER- .88"	1	
11	4704830-1	WIRE ASSY	1	
12	4786323-8	PLATE	1	
	0920102-1	SCREW- WOOD- #10 X .62"	3	
13	4786324-6	CUP	1	
14	4786325-3	SPRING	1	
15	4786326-1	CAP- CONTACT	1	
16	4786327-9	BUTTON	1	
17	4878949-9	COVER	1	
18	4858161-5	STOP- BRAKE PEDAL	1	
	0921333-1	CAPSCREW- .31" -18 X .75"	4	
	0917356-8	LOCKWASHER- .31"	4	
	0917372-5	NUT- .31-18	4	
19	4720549-7	GROMMET	2	
20	4860752-7	SUPPORT ASSY	1	
	0922130-0	CAPSCREW- .38" -16 X 2.25"	2	
	0916965-7	LOCKWASHER- .38"	2	
	0916950-9	NUT- .38" -24	2	

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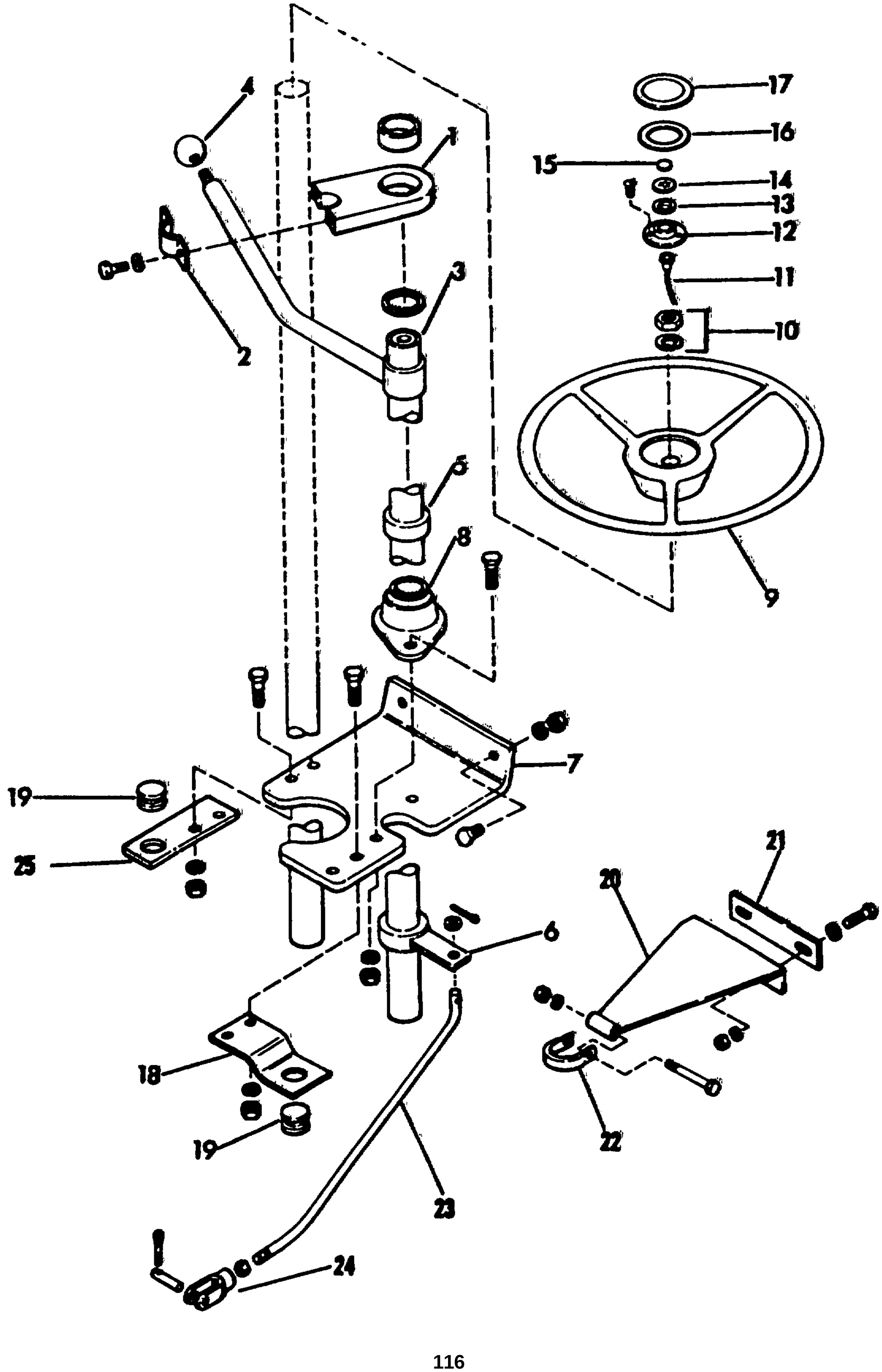
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SHIFTING ASSY - POWER SHIFT (CONTINUED)

ITEM	PART NO.	DESCRIPTION	QTY.	
21	4704052-2	SHIM- .0747"	3	USE AS REQUIRED
	0931528-4	CAPSCREW- .38" -16 X 1.50"	4	
	4255041-8	NUT	4	
22	4765753-1	CLIP	1	
23	4869179-4	ROD- SHIFT	1	
	0924293-4	WASHER- .34" X .75"	1	
	0919313-7	PIN- COTTER- .09" X .5"	1	
	0920438-9	NUT- .31" -24	1	
24	4847561-0	YOKE	1	
	0923093-9	PIN YOKE	1	
25	4858160-7	STOP INCH PEDAL	1	
	4843874-1	INSULATION	1	

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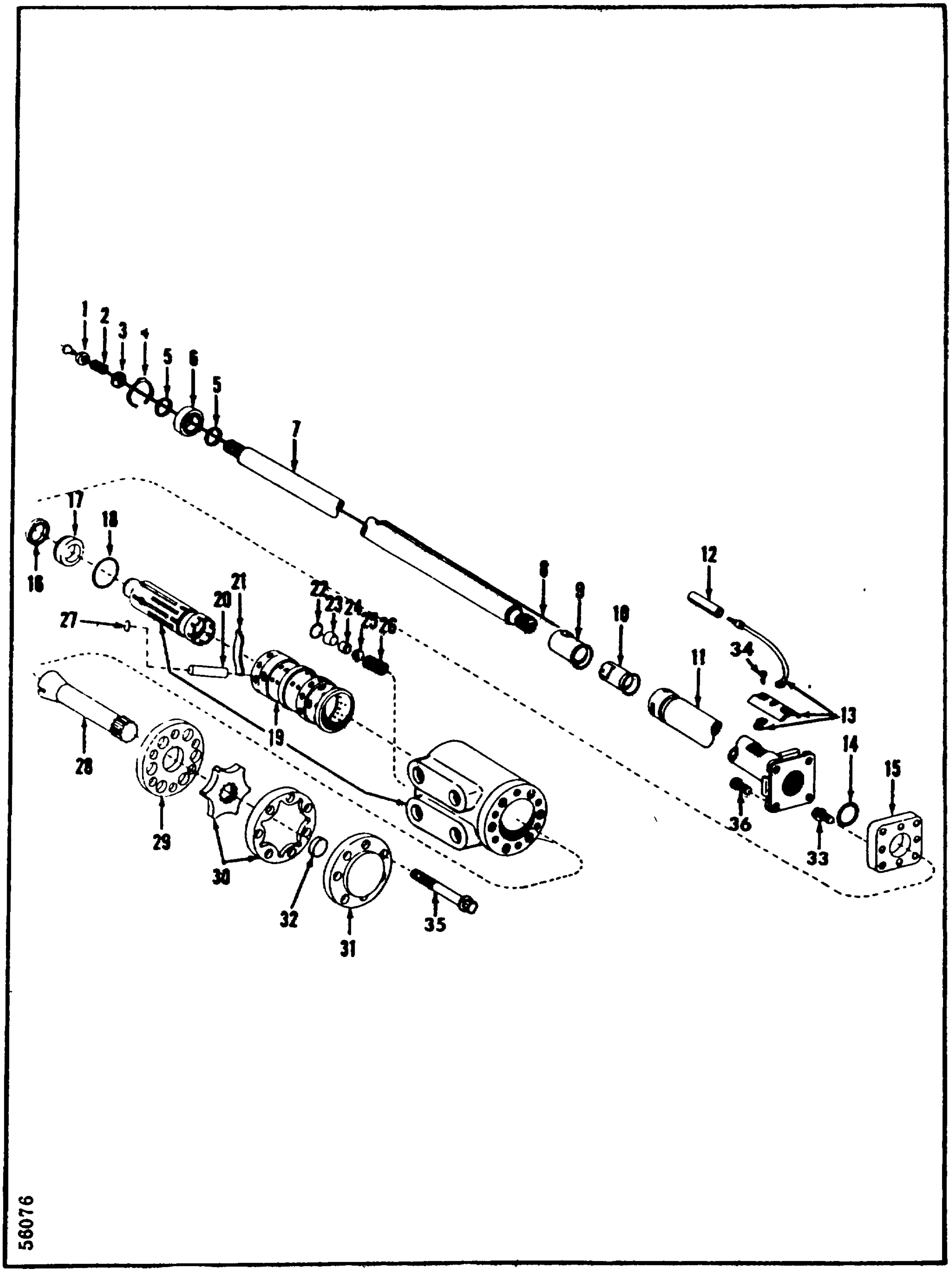
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STEER UNIT-4881053-5
PRIOR TO SERIAL NO. 106400

ITEM	PART NO.		DESCRIPTION	QTY.	
1	4786329-5		INSULATOR	1	
2	4786330-3		SPRING	1	
3	4786331-1		WASHER	1	
4	4995371-4		RETAINER	1	
5	4994912-6		RING	2	
6	4994913-4		BEARING	1	
7	4994915-9		SHAFT	1	
8	4995381-3		WIRE ASSY	1	
9	4995378-9		RING	1	
10	4995379-7		INSULATOR RING	1	
11	4994916-7		TUBE & FLANGE	1	
12	4995380-5		CONNECTOR	1	
13	4995383-9		BRUSH ASSY	1	
14	4995372-2	*	SEAL	1	
15	4994903-5		PLATE	1	
16	4994908-4	*	SEAL	1	
17	4912940-6		BUSHING	1	
18	4912941-4	*	SEAL	1	
19	4912942-2		CONTROL PARTS	1	INCL ITEMS 20 THRU 26
20	4994900-1		PIN-CENTERING	1	
21	4994901-9		SPRING	6	
22	0923559-9	*	SEAL	1	
23	4994910-0		PLUG	1	
24	4994907-6		SEAT	1	
25	0921874-4		BALL-GRADE 25-.25"	1	
26	4994906-8		SPRING	1	
27	4905876-1		DISC-CENTERING PIN	2	
28	4905877-9		DRIVE	1	
29	4998258-0		PLATE	1	
30	4912938-0		GEROTER SET	1	
31	4998320-8		CAP	1	
32	4912939-8		SPACER	1	
33	0922751-3		CAPSCREW-TWELVE PT- .31"-18 X .63"	4	
34	4995382-1		SCREW	2	
35	4912937-3		CAPSCREW	7	
36	0922845-3		CAPSCREW-TWELVE PT- .38'-16 X .75"	2	
	0921969-2		CAPSCREW	2	
	0916965-7		WASHER	2	
	0916950-8		NUT	2	
	0923903-9		CAPSCREW	2	

* INCLUDED IN KIT 4912964-5

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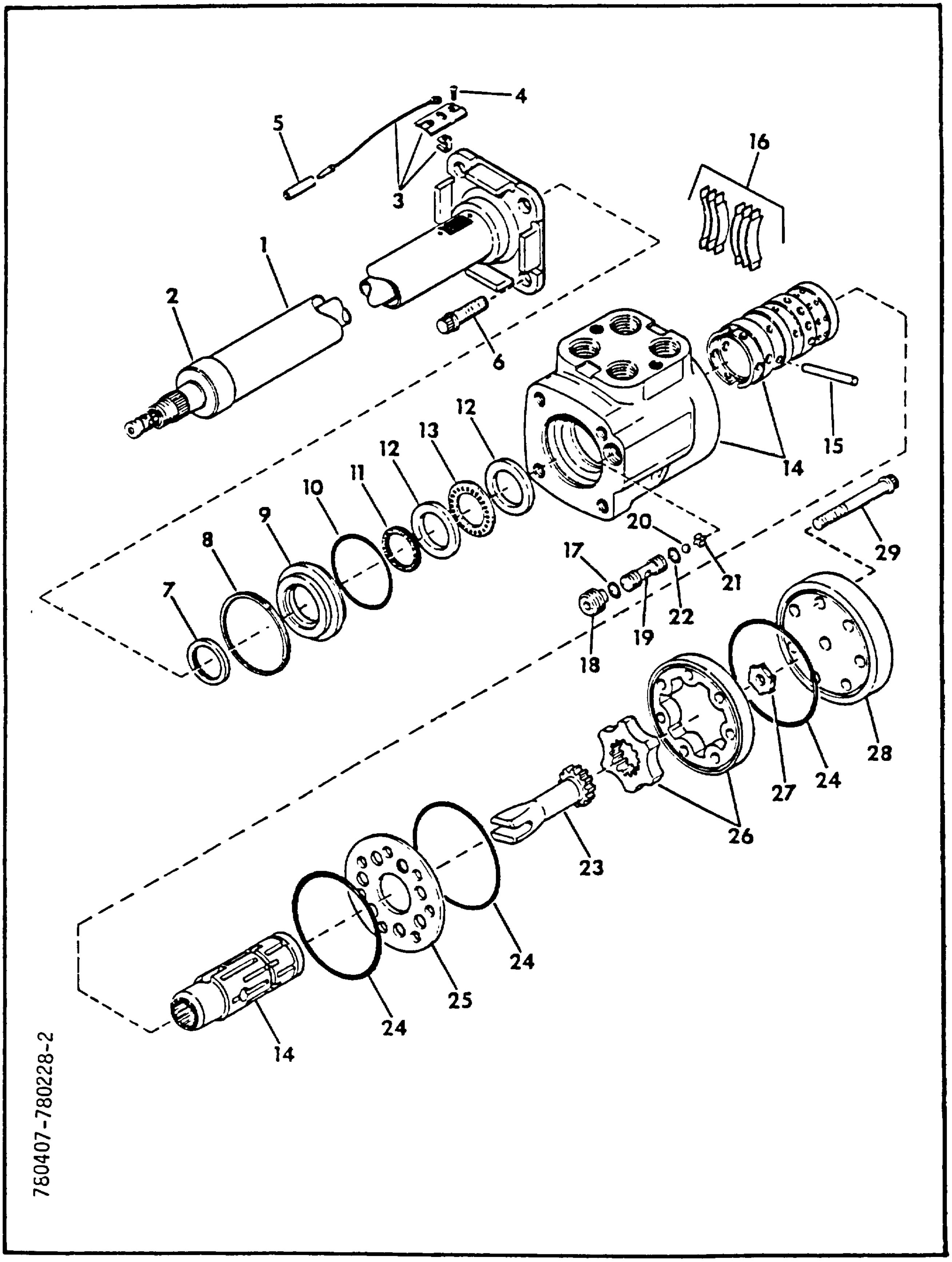
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780407-780228-2

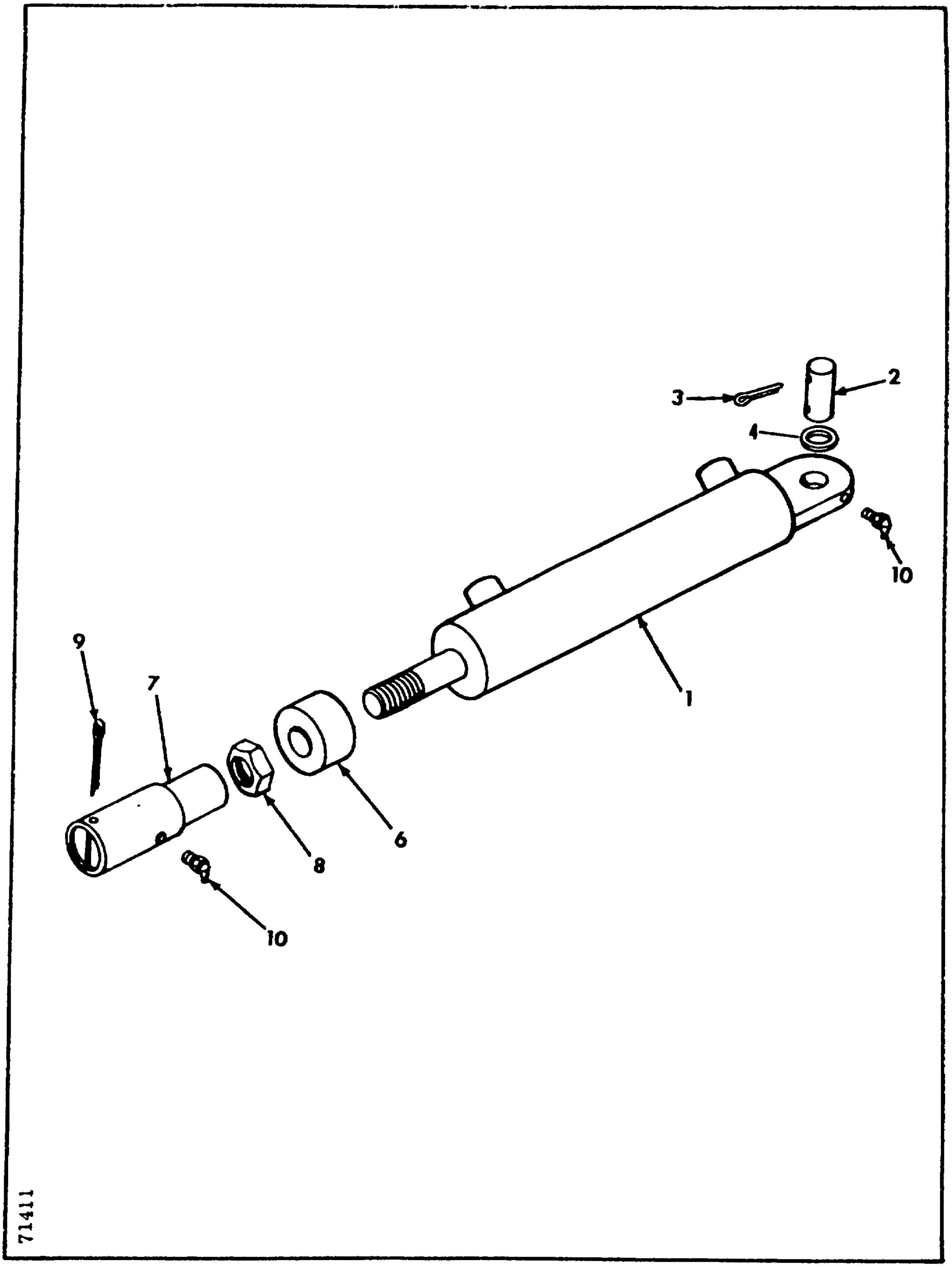
STEER UNIT
EFFECGIVE WITH SERIAL NO. 106400

ITEM	PART NO.		DESCRIPTION	QTY.	
1	4914197-1		COLUMN ASSY-STEERING	1	INCL ITEMS 2 THRU 6
2	4914151-8		CAP-OUTER TUBE	1	
3	4995383-9		BRUSH ASSY-HORN	1	
4	4995382-1		SCREW	2	
5	4995380-5		CONNECTOR	1	
6	0923335-4		CAPSCREW-.38"-16 X .75"	2	12 PT
-	4890423-9		CONTROL UNIT-STEERING	1	INCL ITEMS 7 THRU 29
7	4995372-2	*	SEAL	1	
8	4912468-8		RING-SNAP	1	
9	4912469-6		BUSHING-SEAL GLAND	1	
10	4912470-4	*	SEAL-O-RING	1	
11	0239191-0	*	SEAL-QUAD RING	1	
12	4914167-4	#	RACE-THRUST	2	
13	4912473-8	#	BEARING-NEEDLE	1	
14	4914279-7		CONTROL PARTS	1	INCL ITEMS 15 & 16
15	4994900-1		PIN-CENTERING	1	
16	4994901-9		SPRING-CENTERING	6	
17	4912968-7	*	SEAL-O-RING	1	
18	4914166-6		SETSCREW	1	
19	4914163-3		SEAT-CHECK BALL	1	
20	4914162-5		BALL-CHECK	1	
21	4914161-7		RETAINER-CHECK BALL	1	
22	0923559-9	*	O-RING-#-011	1	
23	1132770-7		DRIVE	1	
24	4912459-5	*	O-RING	3	
25	4914158-3		PLATE-SPACER	1	
26	4914228-4		GEROTOR SET	1	
27	4912463-9		SPACER	1	
28	4914155-9		CAP-END	1	
29	4912937-2		CAPSCREW	7	

* INCL IN KIT 4914283-9

\# INCL IN KIT 4912471-2

780407-780228-2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POWER STEERING LINKAGE

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4881057-6	CYLINDER ASSY	1	SEE PAGE 123
2	4812705-4	PIN ANCHOR	1	
3	0920117-9	PIN COTTER-.56 X 1.5	2	
4	0919390-5	WASHER	2	
6	4880847-1	SPACER	1	
7	4873406-5	SOCKET-PRIOR TO S/N 106400	1	SEE PAGE 127
7	4882430-4	SOCKET-EFF W/SN 106400	1	SEE PAGE 127A
8	0922186-2	NUT-.88"-14	2	
9	0918465-5	PIN-COTTER-.125 X 2.25	1	
10	0915276-0	FITTING-LUBE 45 DEG-.25PT	2	

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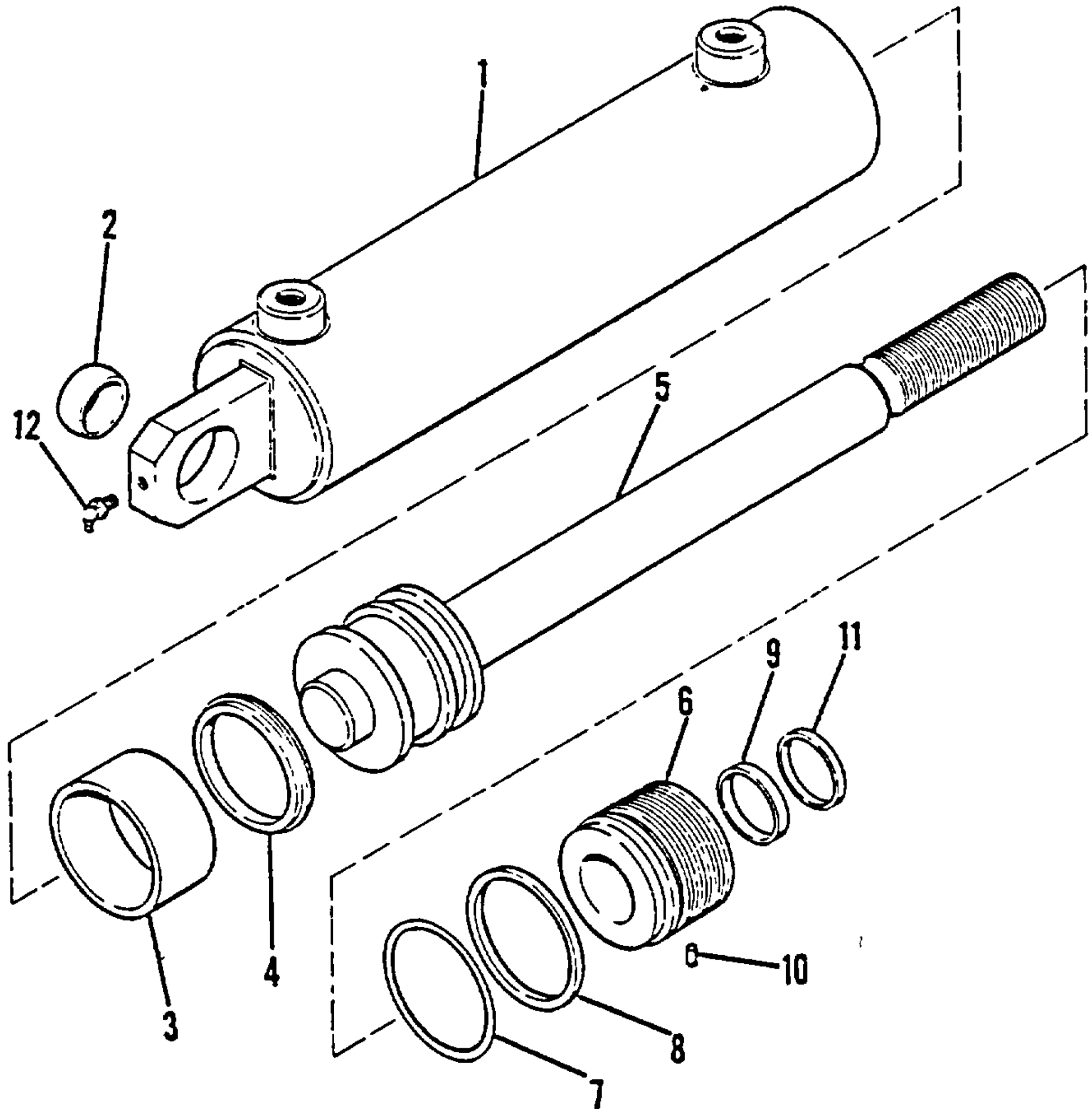
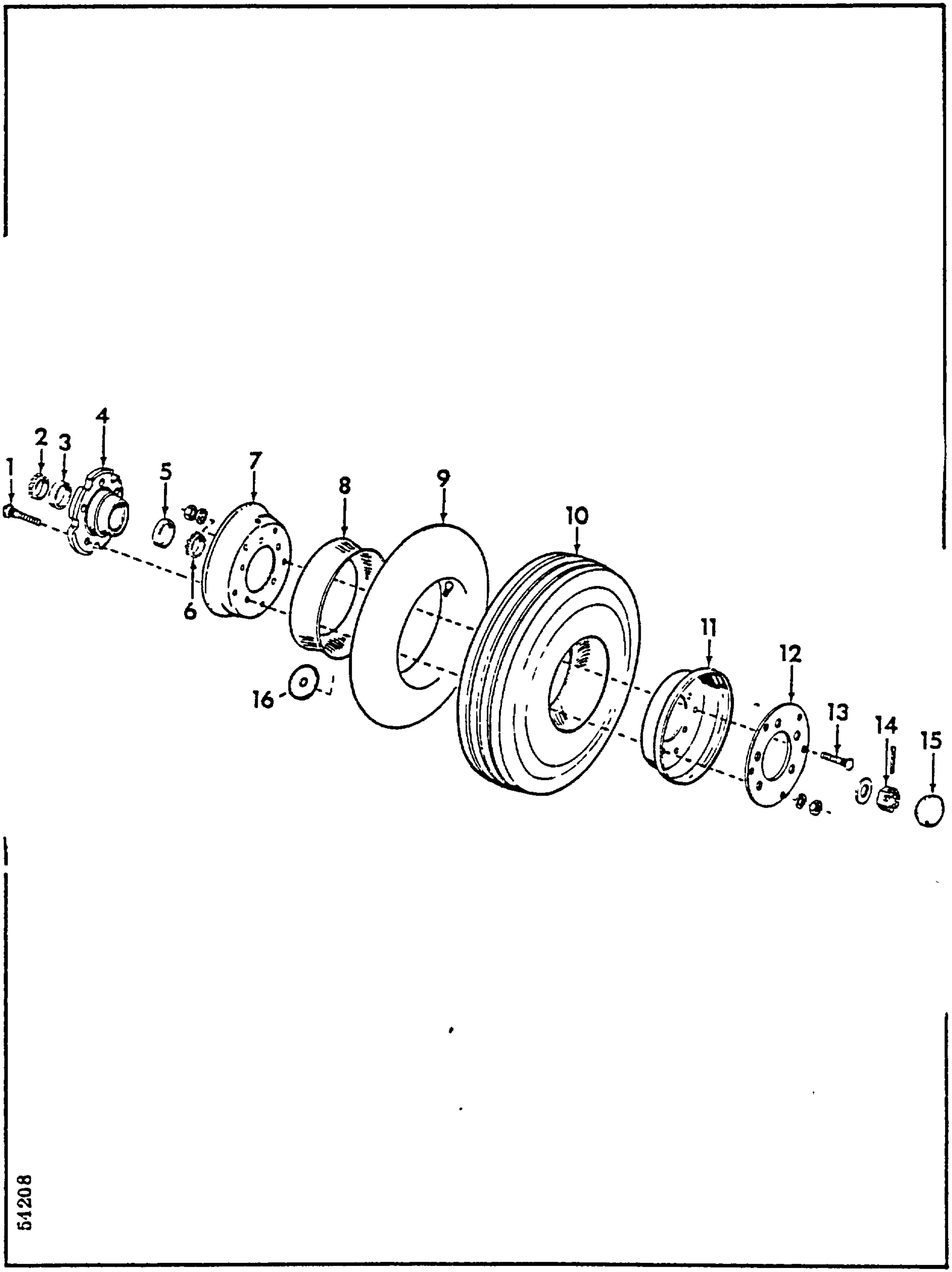


POWER STEERING CYLINDER

ITEM	PART NO.		DESCRIPTION	QTY.
1	4881055-0		TUBE ASSEMBLY	1
2	4829439-1		BUSHING	1
3	4814109-7	*	BEARING	1
4	4814133-7	*	T-RING	1
5	4881058-4		PLUNGER ASSEMBLY	1
6	4814134-5		GLAND-PACKING	1
7	0923582-1	*	O-RING	1
8	0926625-5	*	RING-BACKUP	1
9	4814108-9	*	PACKING-ROD	1
10	4816749-8	*	PELLET-NYLON	2
11	4857829-8	*	RING-WIPER	1
12	0930679-6		FITTING LUBE	1

* INCLUDED IN KIT 4906332-4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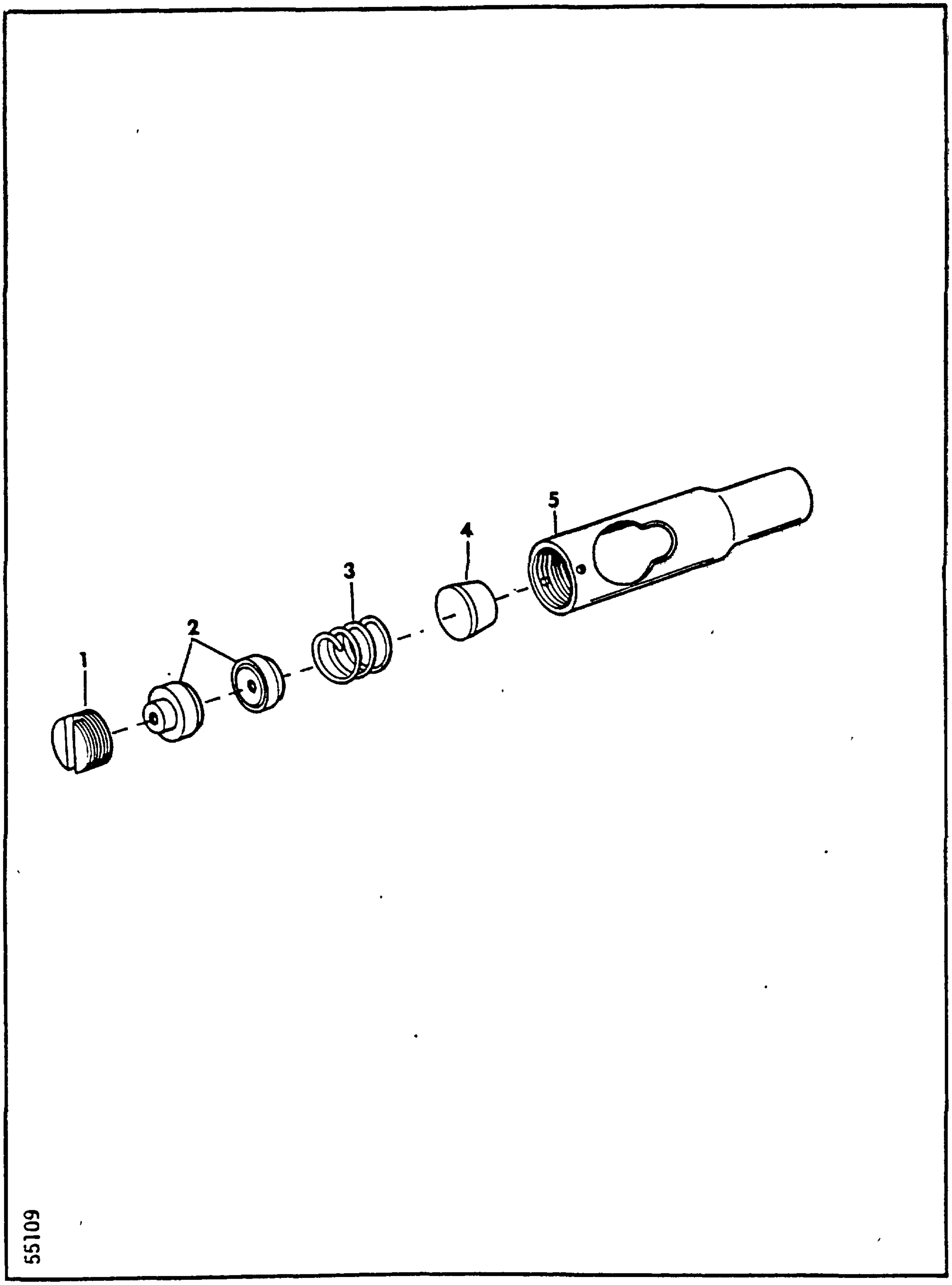
STEER WHEEL

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4255646-4	BOLT-RIB-NECK	12	
	0916966-5	LOCKWASHER- .5"	12	
	0919423-4	NUT- .5"-20	12	
2	4254984-0	CONE-INNER BEARING	2	
3	0042887-0	CUP-INNER BEARING	2	
4	4799393-6	HUB	2	
5	4253284-6	CUP-OUTER BEARING	2	
6	4250052-0	CONE-OUTER BEARING	2	
7	4737517-5	DISC-INNER	2	
8	4866558-3	FLAP-DISC	2	OBTAIN LOCALLY
9	4807778-8	TUBE	2	OBTAIN LOCALLY
10	4806197-2	TIRE UNIT- 7.50 X 10-14 PLY	2	INCLUDE ITEMS 8 AND 9
11	4807776-2	DISC-OUTER	2	
12	4789293-0	RING-STIFFNER	2	
13	4255637-3	BOLT-RIB NECK .5"-20	12	
	0916966-5	LOCKWASHER- .5	12	
	0919423-4	NUT-PLATED GR 5- .38"-24	12	
14	4718022-9	NUT-BEARING ADJUSTING	2	
	0923414-7	WASHER- 1.03"	2	
	0925719-7	PIN-COTTER-.13" X 2"	2	
15	4747622-1	CAP-HUB	2	
	0921958-5	CAPSCREW .250-20 X .500	6	
	0916964-0	LOCKWASHER	6	
	4254986-5	SHIELD GREASE	2	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BALL SOCKET - 4873406-5
PRIOR TO SERIAL NO. 106400

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4912304-5	PLUG-ADJUSTING	1	
2	4912305-2	SEAT-BALL	2	
3	4912306-0	SPRING	1	
4	4912307-8	SEAT	1	
5	--------------	TUBE ASSY	1	ORDER ITEM 4

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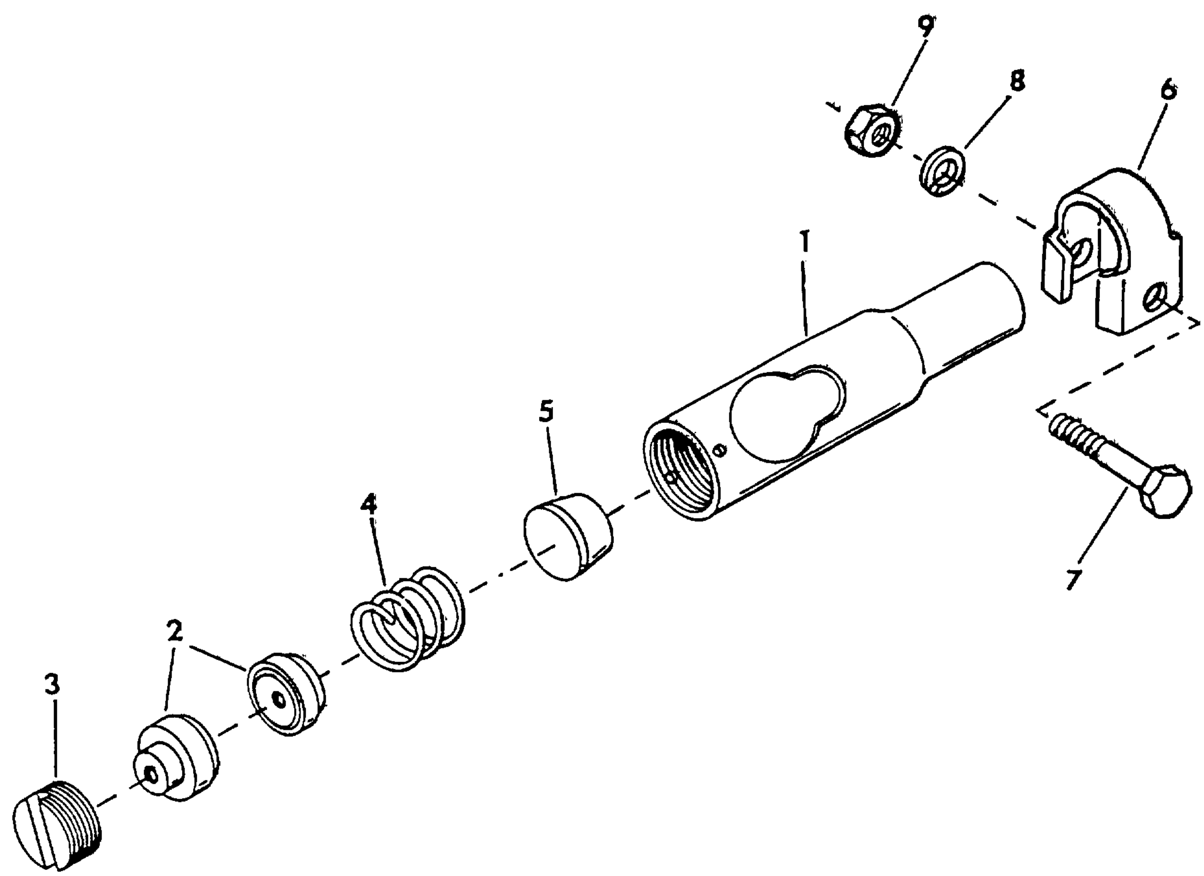
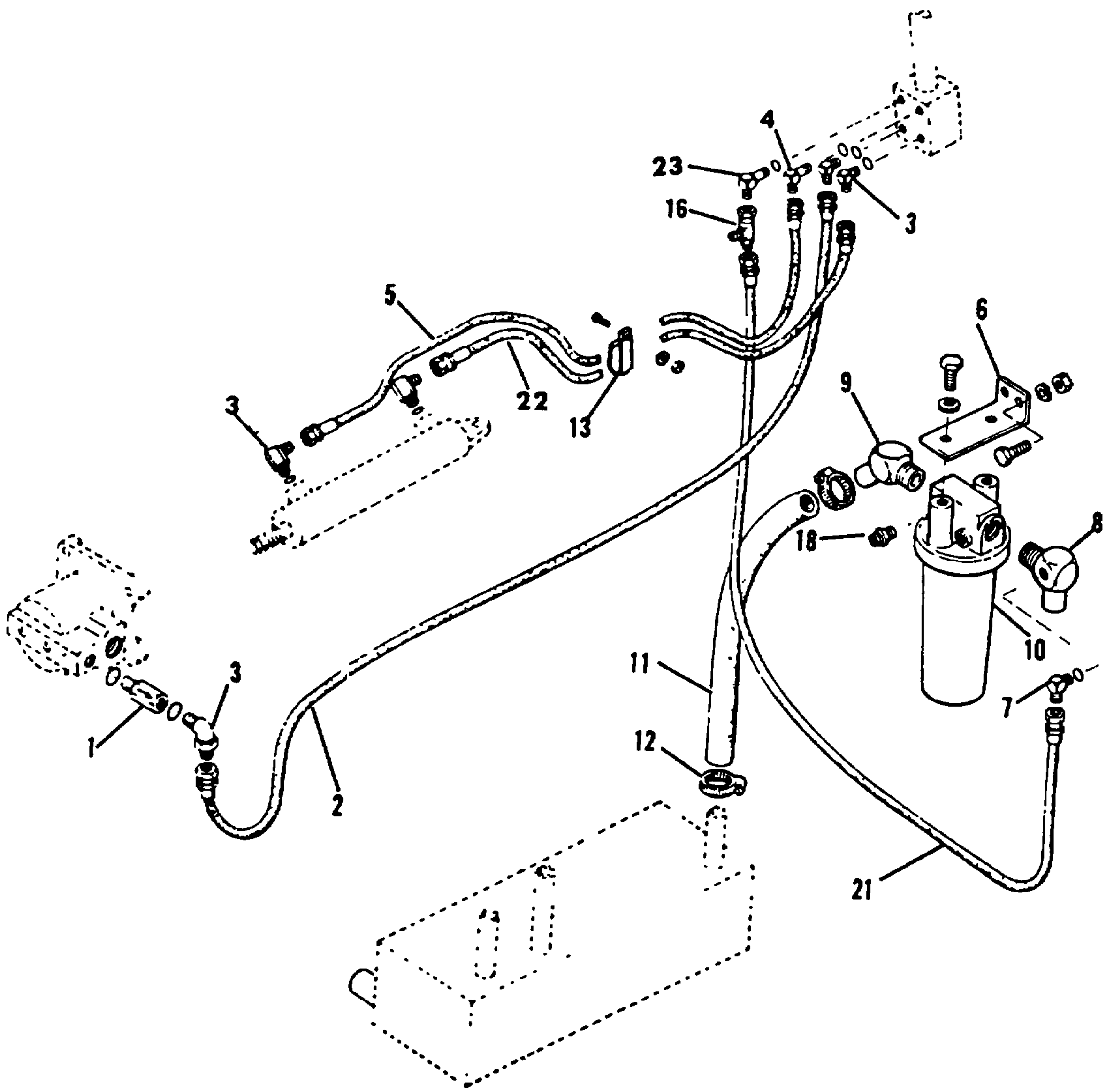


780766-54853-1

BALL SOCKET-4882430-4
EFFECTIVE/W SERIAL NO. 106400

ITEM	PART NO.	DESCRIPTION	QTY.
1	--------------	TUBE	1
2	4912305-2	SEAT-BALL	2
3	4912304-5	PLUG-ADJ.	1
4	4912306-0	SPRING	1
5	4912307-8	SEAT	1
6	4838627-3	CLAMP	1
7	0924681-0	CPSC-.50-20 X 2.50	1
8	0916966-5	LKW-.50	1
9	0928510-7	NUT-.50-20	1

780766-54853-1



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STEERING HYDRAULICS

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4839229-1	VALVE-CHECK	1	
	0921885-0	O-RING #906-.47ID	1	
2	4855593-2	HOSE	1	
3	0922523-6	ELBOW-SHORT .56"-18	4	
	0921885-0	O-RING #906-.47ID	4	
4	0925295-8	ELBOW-LONG .5"-18	2	
	0921885-0	O-RING #906-.47ID	2	
5	4826247-1	HOSE-ASSEMBLY 22.0L	1	
6	4880578-2	BRACKET-FILTER	1	
	0921210-1	CAPSCREW-.38-16 X .75	2	
	0916965-7	LOCKWASHER-.38	2	
	0918266-8	WASHER	2	
	0916950-9	NUT-.38-16	2	
7	0919172-7	CONNECTOR-.38P-.562-18	1	
8	0929191-5	ELBOW	1	
9	0930978-2	ELBOW-900-1.0 BARB	2	
10	4878477-1	FILTER-OIL	1	SEE PAGE 139
	0923114-3	CAPSCREW-.5"-13 X 1	2	
	0916966-5	LOCKWASHER-.5"	2	
11	4811214-8	HOSE-1.0 ID	1	
12	0922660-6	CLAMP	2	
13	0930233-2	CLAMP	2	
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16	0921297-8	TEE-900	1	
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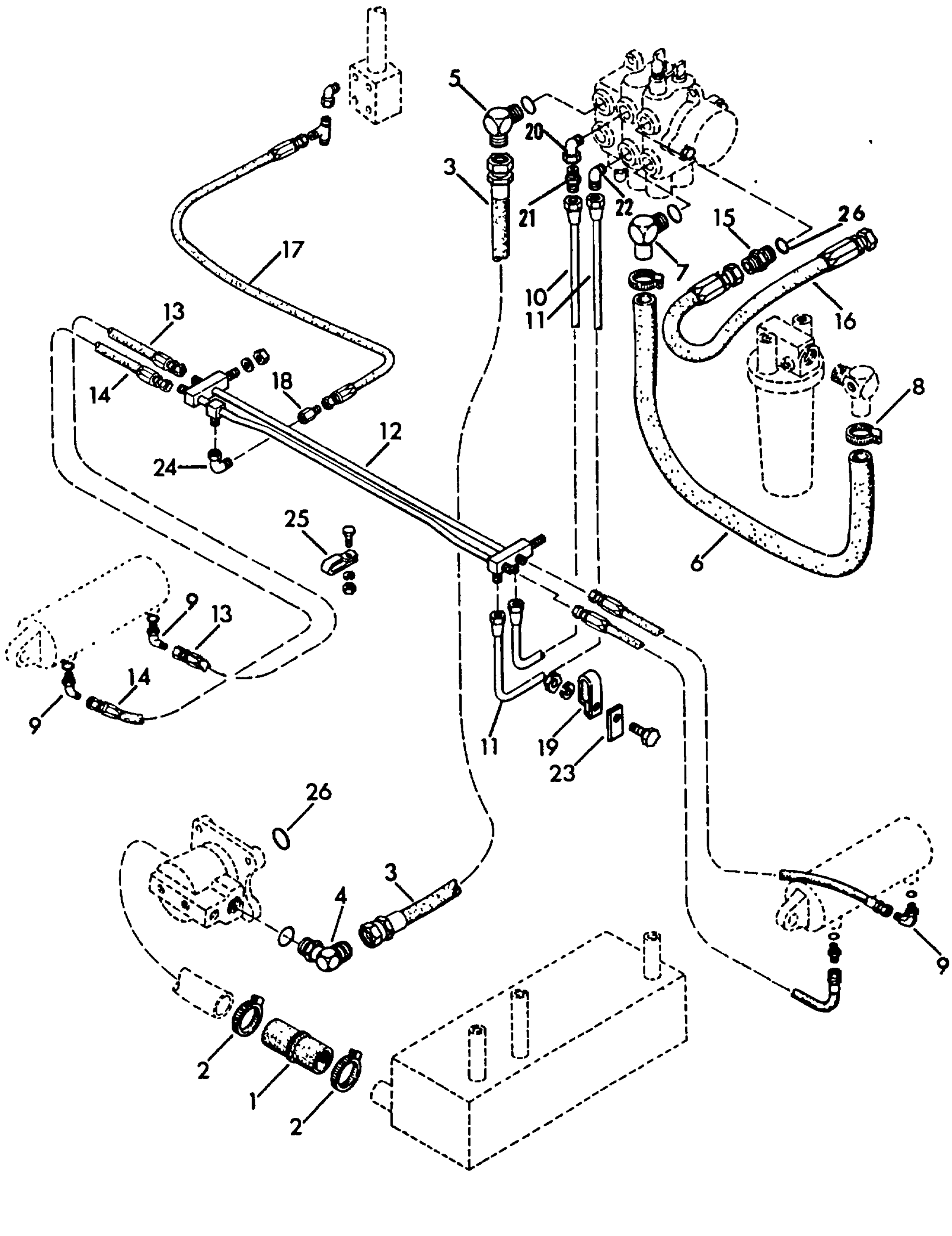
21	4855211-1	HOSE .	1	
22	4826249-7	HOSE-ASSEMBLY 48.0 LG	1	
23	0922522-8	ADAPTER	1	
	0921013-9	ELBOW	1	
	0919327-7	WASHER	2	
	0923905-4	ELBOW	1	
	0928046-2	CLAMP	2	
	0915815-5	WASHER	4	
	0921333-1	CAPSCREW	2	



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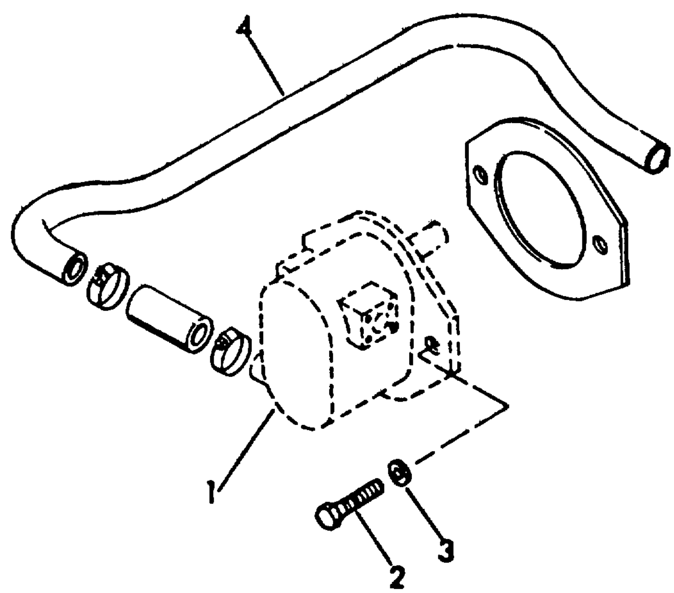
MAIN HYDRAULICS

ITEM	PART NO.	DESCRIPTION	QTY.
1	4834072-3	HOSE SUCTION	1
2	0921912-2	CLAMP HOSE SAE SIZE 32	2
3	4862068-6	HOSE ASSY	1
4	0921203-6	ELBOW	1
	0921206-9	O-RING #912 -.92"	1
5	0921728-2	ELBOW 450	1
6	4861845-8	HOSE 1.0 ID	1
7	4859845-2	ELBOW	1
8	0922660-6	CLAMP - HOSE	2
9	0922571-5	ELBOW - 90	4
10	4858913-9	TUBE - VALVE	1
11	4858914-7	TUBE - VALVE	1
12	4860744-4	TUBE CROSSOVER	1
13	4832052-7	HOSE - TILT CYLINDER	2
14	4818829-6	HOSE TILT CYLINDER -	2
15	0922974-i	ELBOW - 450 W/O RING	1
16	4862067-8	HOSE - LIFT	1
17	4863254-1	HOSE - TILT RETURN	1
18	4839229-4	VALVE - CHECK	1
	0921885-0	O-RING #906 - .47 ID	1
19	4716090-8	CLAMP	2
20	0922571-5	ELBOW 90	2.
21	4843526-7	ADAPTER	2
22			
23			
24	0921013-9	ELBOW 90	1
25	0928046-2	CLAMP	2
	0917356-8	LOCKWASHER .31	2
	0917372-5	NUT .31 -18	2
	0921333-1	CAPSCREW .31 -18 X .88	2
	0915815-5	WASHER	2
26	0921206-9	O-RING	1
	0928010-8	CLAMP	1
	0921969-2	CAPSCREW	1
	0916965-6,	LOCKWASHER	1
	0916950-9	NUT	1
	0928010-8	CLAMP	2
	0921205-1	O-RING	2
	4716091-6	CLAMP	1
	0915815-5	WASHER	2
	0921333-1	CAPSCREW	1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HYDRAULIC PUMP

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4881066-7	PUMP	1	SEE PAGE 135
2	0920328-2	CAPSCREW-.500-13 X 1.5	2	
3	0916966-5	LOCKWASHER .5	2	
4	4880579-0	TUBE	1	
	4822178-2	SCREEN	1	
	4834072-3	HOSE SUCTION	1	
	0921912-2	CLAMP	2	
	4877790-8	GASKET	1	

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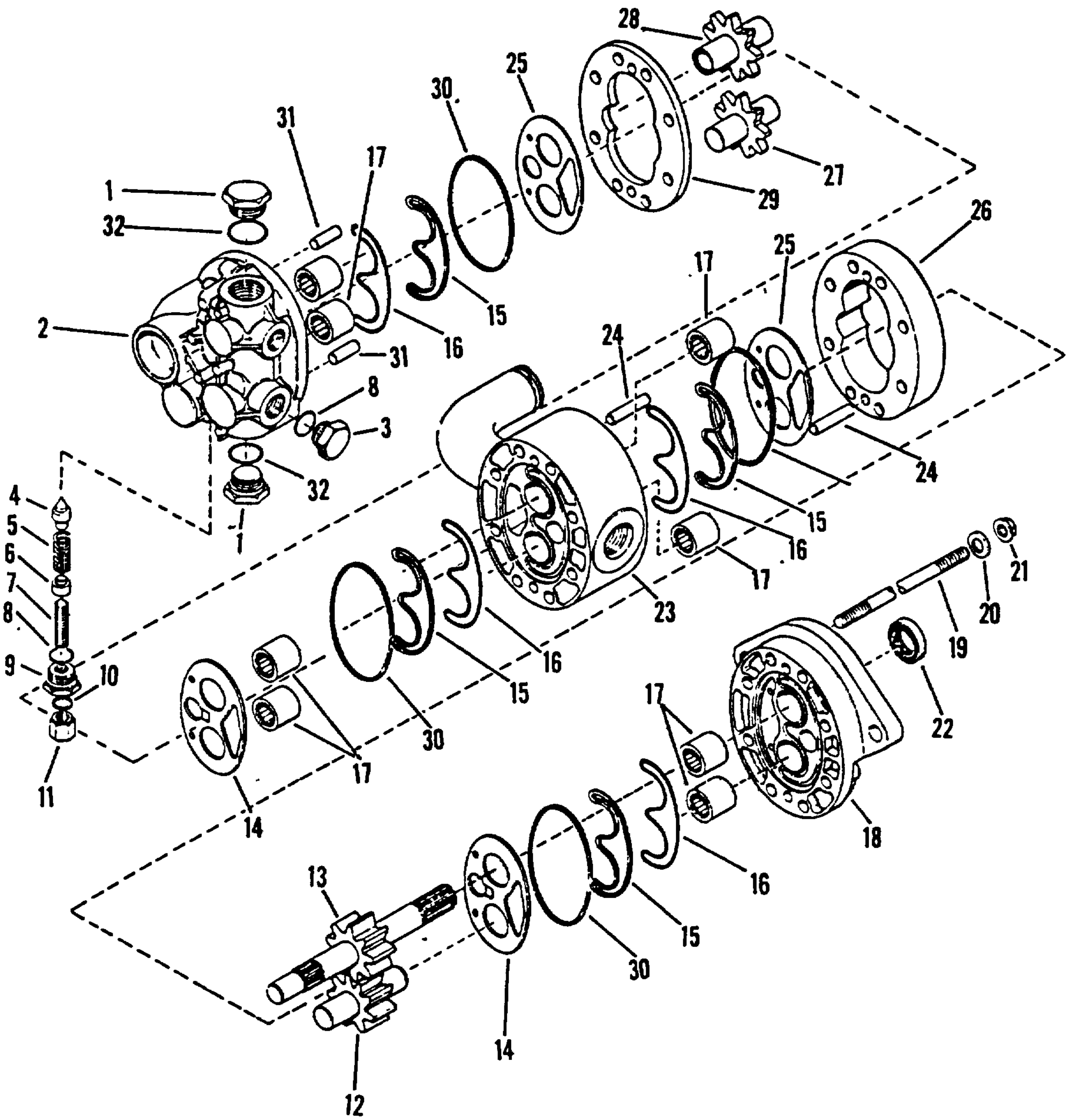
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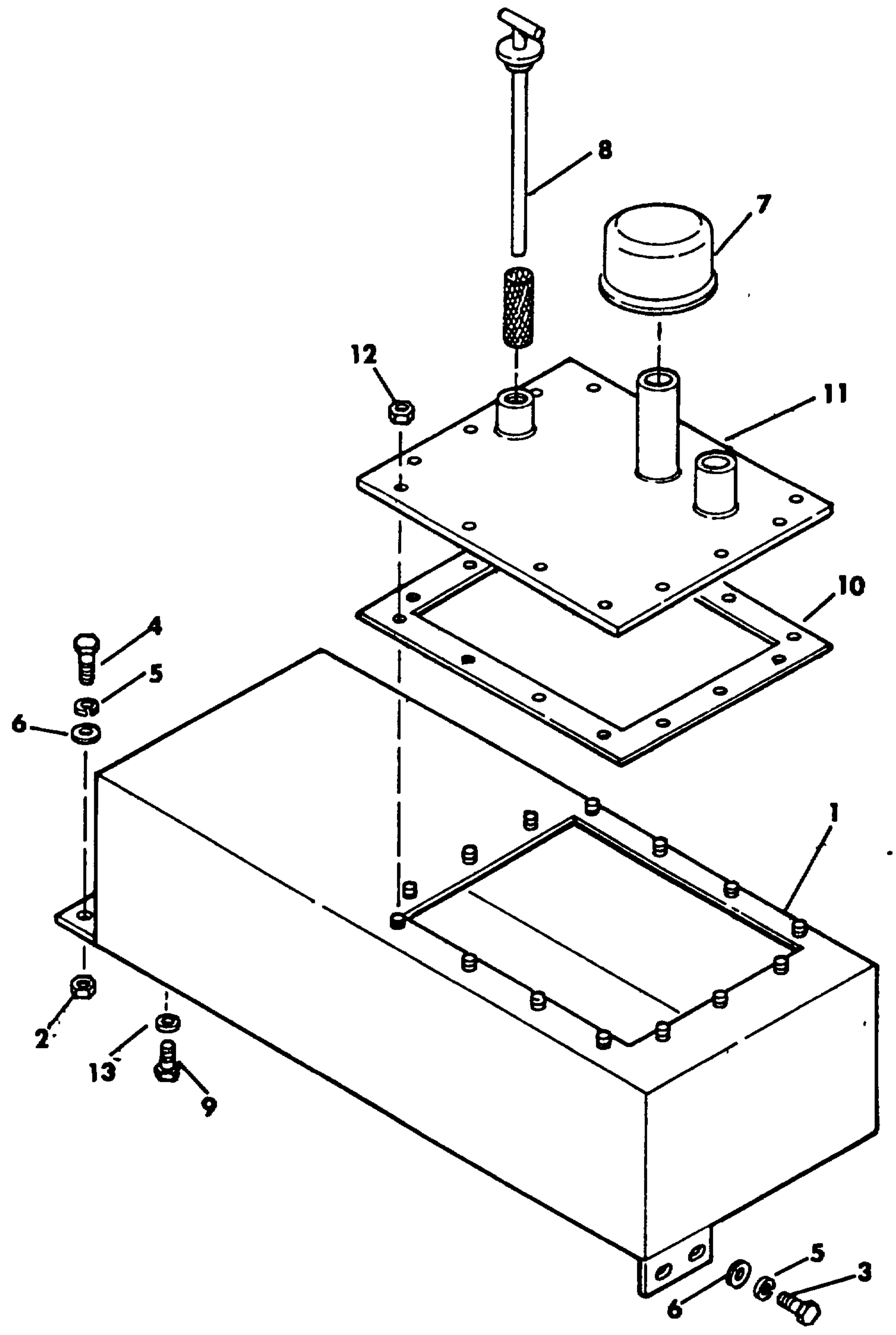
HYDRAULIC PUMP ASSEMBLY 4881066-7

ITEM	PART NO.	DESCRIPTION	QTY.
1	4912659-2	PLUG	2
2	4912669-1	COVER	1
3	4912629-5	PLUG	1
4	4912656-8	POPPET	1
5	0253885-8	SPRING-COMPRESSION	1
6	4912660-0	GUIDE-SPRING	1
7	4912666-7	SET-SCREW	1
8	0928486-0	O-RING-#-910	2
9	0253888-2	PLUG	1
10	0258635-2	GASKET	1
11	3033594-7	CAP-VALVE	1
12	4912661-8	SHAFT & GEAR AY-IDLER	1
13	4912630-3	SHAFT & GEAR AY-DRIVE	1
14	0258627-9	PLATE-WEAR	2
15	*0255944-1	SEAL-LOAD	4
16	*0255945-8	SEAL-PRE-LOAD	4
17	0234692-2	BEARING-NEEDLE	8
18	0250355-5	BODY AY	1
19	4912664-2	STUD	8
20	4912668-3	WASHER	8
21	4912658-4	NUT	8
22	0250324-1	SEAL-OIL	1
23	4912671-7	BEARING PLATE AY	1
24	0241954-7	PIN-DOWEL	2
25	4912657-6	PLATE-WEAR	2
26	4912662-6	PLATE-GEAR	1
27	4913070-1	GEAR-IDLER	1
28	4913069-3	GEAR-DRIVE	1
29	4913071-9	PLATE-GEAR	1
30	*0255946-6	O-RING	4
31	0248188-5	PIN-DOWEL	2
32	0929393-7	0-RING-#-914	2

*INCL IN KIT 0255947-4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RESERVOIR

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4877801-3	RESERVOIR-HYDRAULIC OIL	1	INCL ITEMS 10-11-12 AND 14
2	0916950-9	NUT	2	
3	0922130-0	CAPSCREW-.375-16 X 2.25"	2	
4	0921210-1	CAPSCREW-.38"-16 X 1"	2	
5	0916965-7	LOCKWASHER- .38"	4	
6	0918266-8	WASHER- .38"	4	
7	4835378-3	FILTER-AIR	1	
8	4828802-5	DIPSTICK	1	
9	4855689-8	PLUG-MAGNETIC	1	
10	4909184-6	GASKET	1	
11	4909183-8	COVER	1	
12	0923362-8	NUT-LOCK-.31"-18	12	
13	4845678-4	WASHER NYLON	1	
14	4847427-4	DIFFUSER	1	NOT ILLUSTRATED
	4806357-2	SCREEN-FILLER	1	

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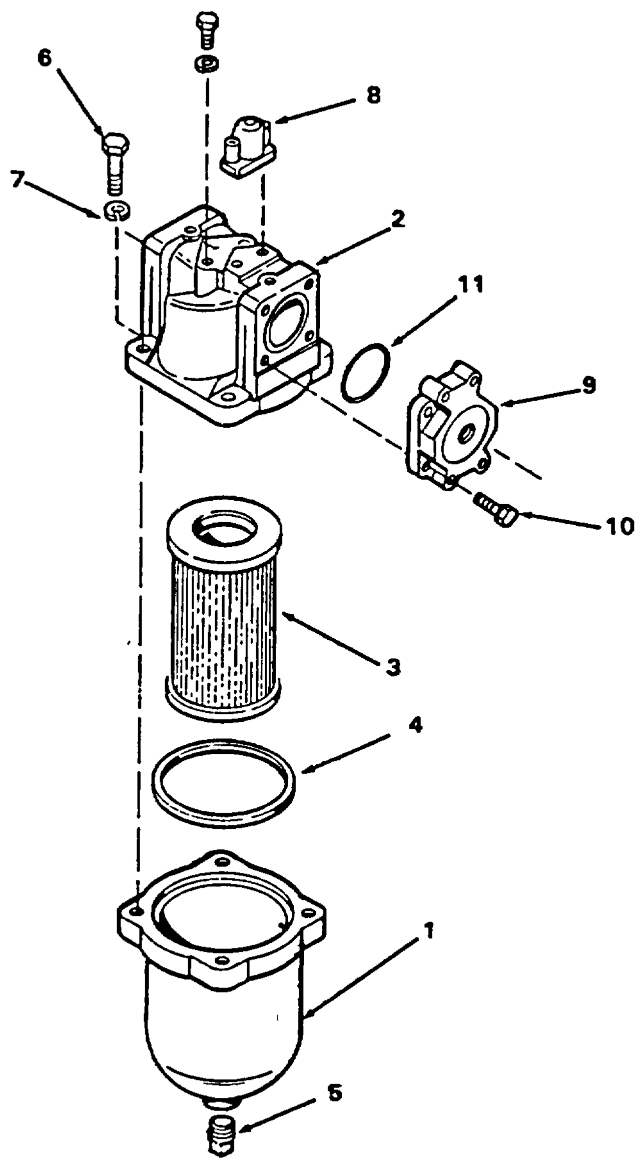
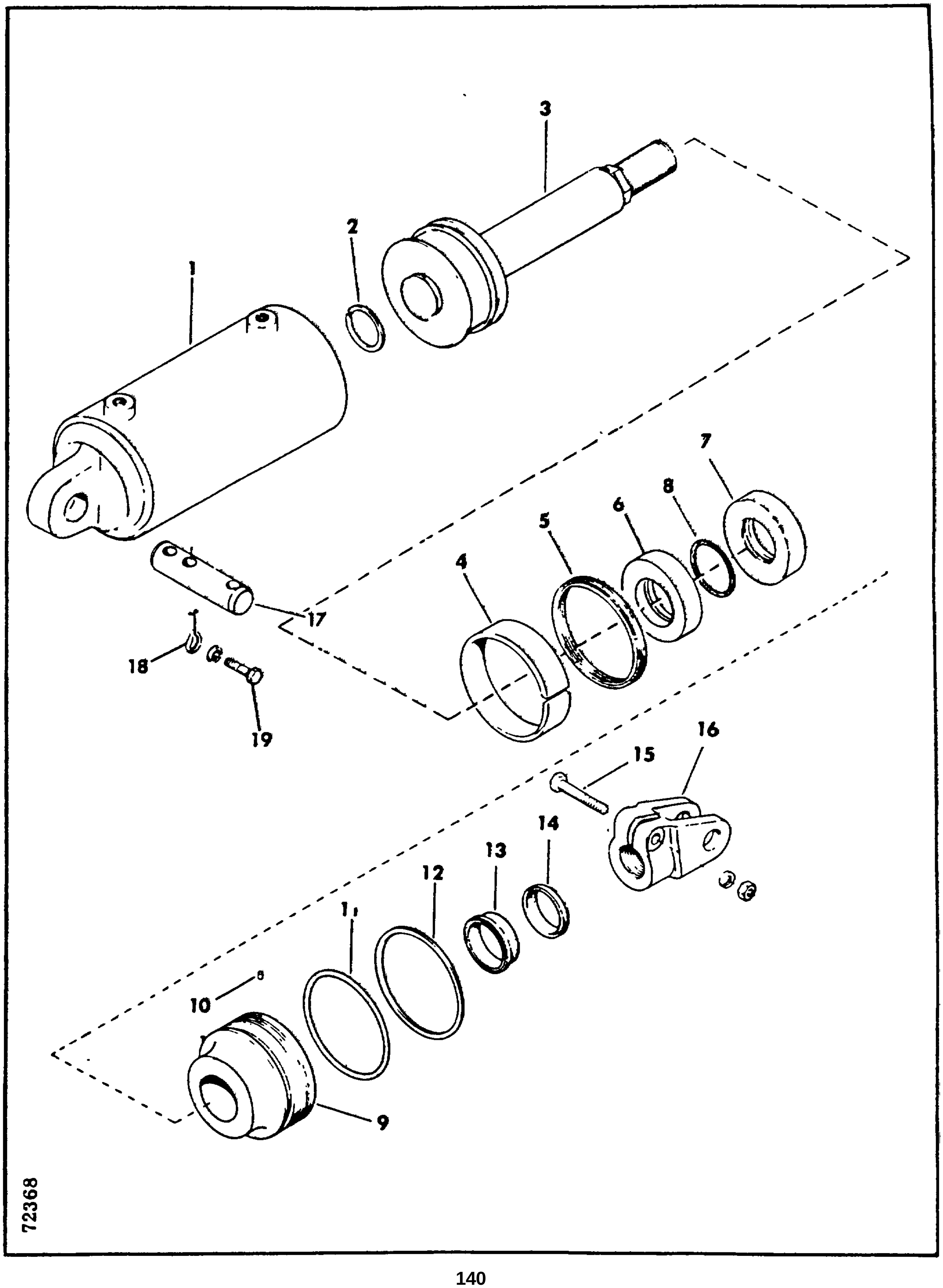
HYDRAULIC FILTER 4878477-1

ITEM	PART NO.	DESCRIPTION	QTY.
1	4912566-9	HOUSING	1
2	4912557-3	HEAD	1
3	4907477-6	ELEMENT	1
4	4912558-6	SEAL-HOUSING	1
5	0901653-6	PLUG	1
6	0920648-3	CAPSCREW	4
7	0919383-0	WASHER	4
8	4912559-4	INDICATOR	1
	0922026-0	SCREW	2
9	4912560-2	ADAPTER	2
10	0922996-4	CAPSCREW	8
11	4912561-0	SEAL-ADAPTER	2





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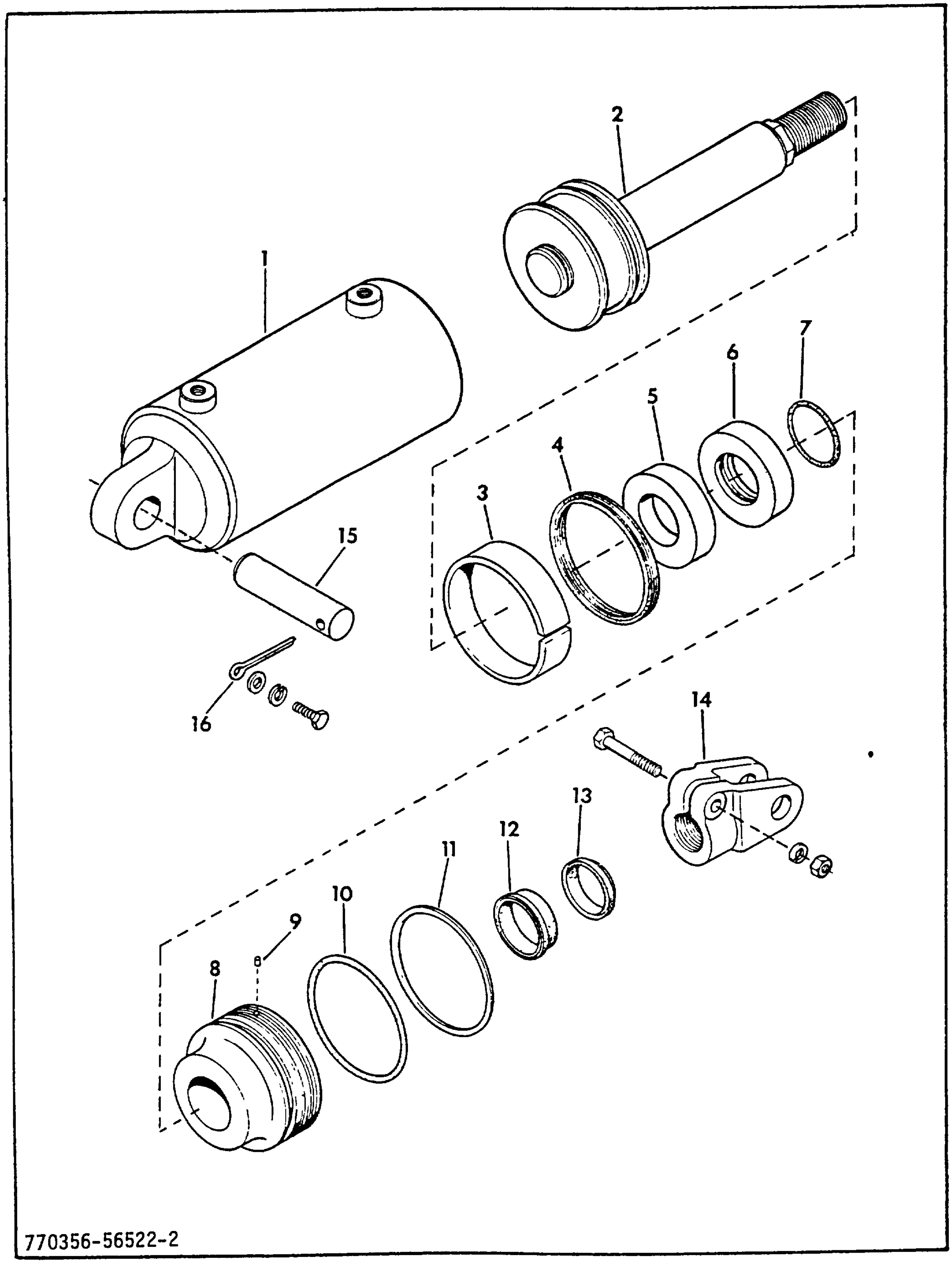
TILT CYLINDER AND CONNECTIONS
PRIOR TO SERIAL NO. 106400

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4827392-4	CYLINDER ASSEMBLY	2	INCL ITEMS 1 THRU 14
2	4803481-3	TUBE-CYLINDER	2	
3	4829337-7	ROD & PLUNGER ASSEMBLY	2	
4	4814109-7	# BEARING	2	
5	4814133-7	# PACKING-PISTON	2	
6	4818457-7	SPACER	1	
7	4822760-7	SPACER-W/O-RING GROOVE	1	
8	0923649-8	O-RING-#-218-1.23" ID CLASS 1A	1	USED W/ITEM 7 ONLY
9	4814134-5	GLAND	2	
10	4816749-8	# PELLET-NYLON	4	
11	0923582-1	O-RING-#-229-2.36" ID-CLASS 1A	2	
12	0926625-5	# RING-BACK-UP-#-232-2.75" ID	2	
13	4814108-9	# PACKING-GLAND	2	
14	4857829-8	# WIPER-ROD	2	
15	0923293-5	CAPSCREW-.5"-20 X 2.25"	2	
	0916966-5	LOCKWASHER-.5"	2	
	0919423-4	NUT-.5"-20	2	
16	4712841-8	YOKE-CYLINDER	2	
17	4774994-0	SHAFT-CYLINDER MOUNT	2	
18	4868459-1	PIN-COTTER	2	
19	0921210-1	CAPSCREW-.38"-16 X 1"	2	
	0916965-7	LOCKWASHER-.38"	2	

INCLUDED IN KIT 4906332-4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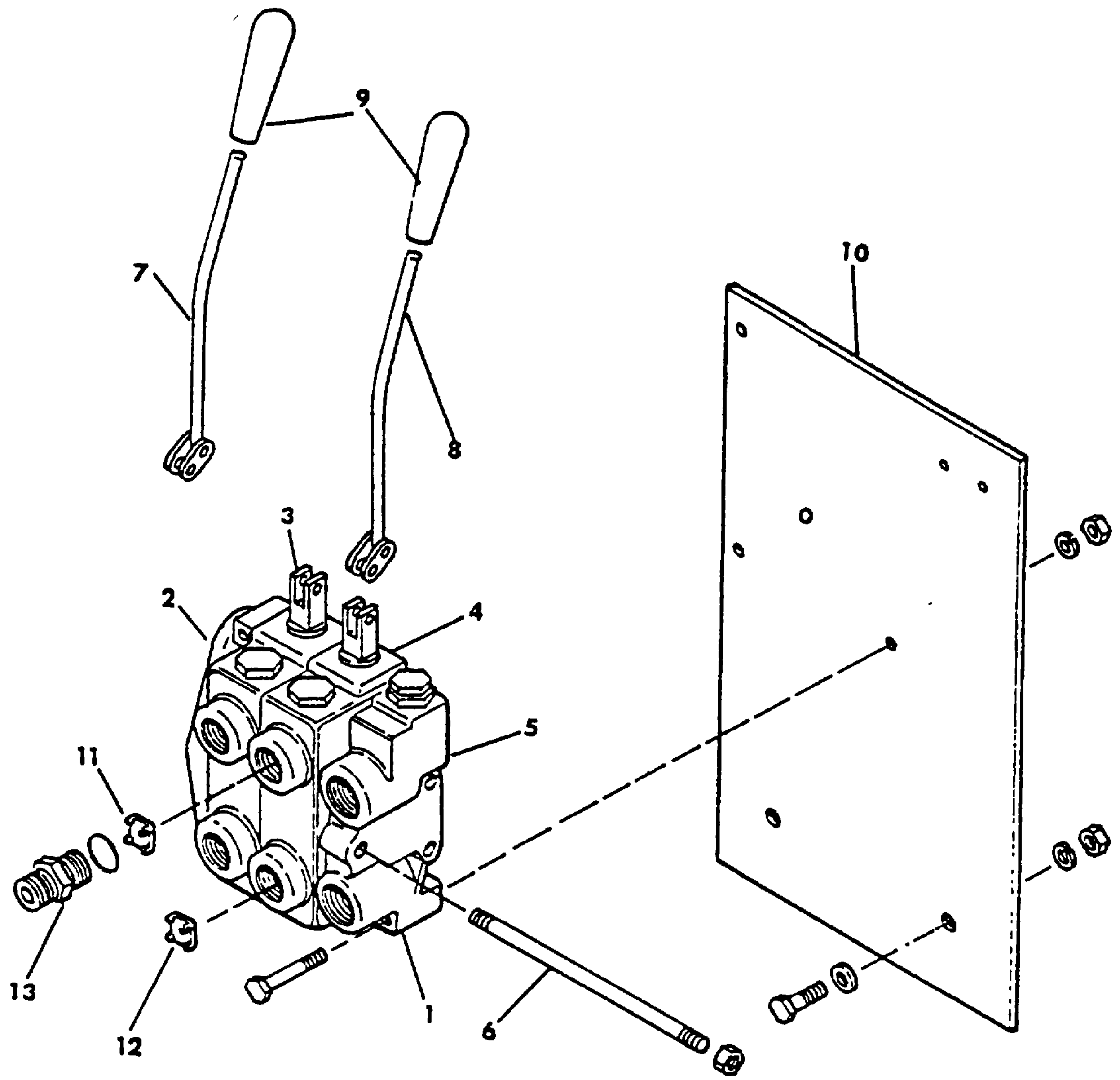
770356-56522-2

TILT CYLINDER AND CONNECTIONS
EFFECTIVE WITH SERIAL NO. 106400

ITEM	PART NO.	DESCRIPTION	QTY.	
	4868672-9	CYLINDER ASSEMBLY	2	INCL. ITEMS 1 THRU 13
1	4866957	TUBE-CYLINDER	2	
2	4866955-0	ROD & PLUNGER ASSY	2	
3	4814109-7	# BEARING	2	
4	4814133-7	# PACKING-PISTON	2	
5	4769567-0	SPACER	2	
6	4769566-2	SPACER-W/O-RING GROOVE	2	
7	0923649-8	O-RING-#-218-1.23" ID CLASS 1A	2	USED W/ITEM 6 ONLY
8	4814134-5	GLAND	2	
9	4816749-8	# PELLET-NYLON	4	
10	0923582-1	# O-RING-#-229-2.36" ID CLASS 1A	2	
11	0926625-5	# RING-BACK UP-#-232-2.75" ID	2	
12	4814108-9	# PACKING-GLAND	2	
13	4857829-8	# WIPER-ROD	2	
14	4714616-2	YOKE-CYLINDER	2	
	0923293-5	CAPSCREW-.5"-20 X 2.25"	2	
	0916966-5	LOCKWASHER-.5"	2	
	0919423-4	NUT-.5"-20	2	
15	4774994-0	SHAFT-CYLINDER-MOUNT	2	
16	4868459-1	PIN-COTTER	2	
	0921210-1	CAPSCREW-.38"-16 X 1"	2	
	0916965-7	LOCKWASHER-.38"	2	
17	4906332-4	KIT-REPAIR INCLUDES ITEMS MARKED #	2	

INCLUDED IN ITEM 17

770356-56522-2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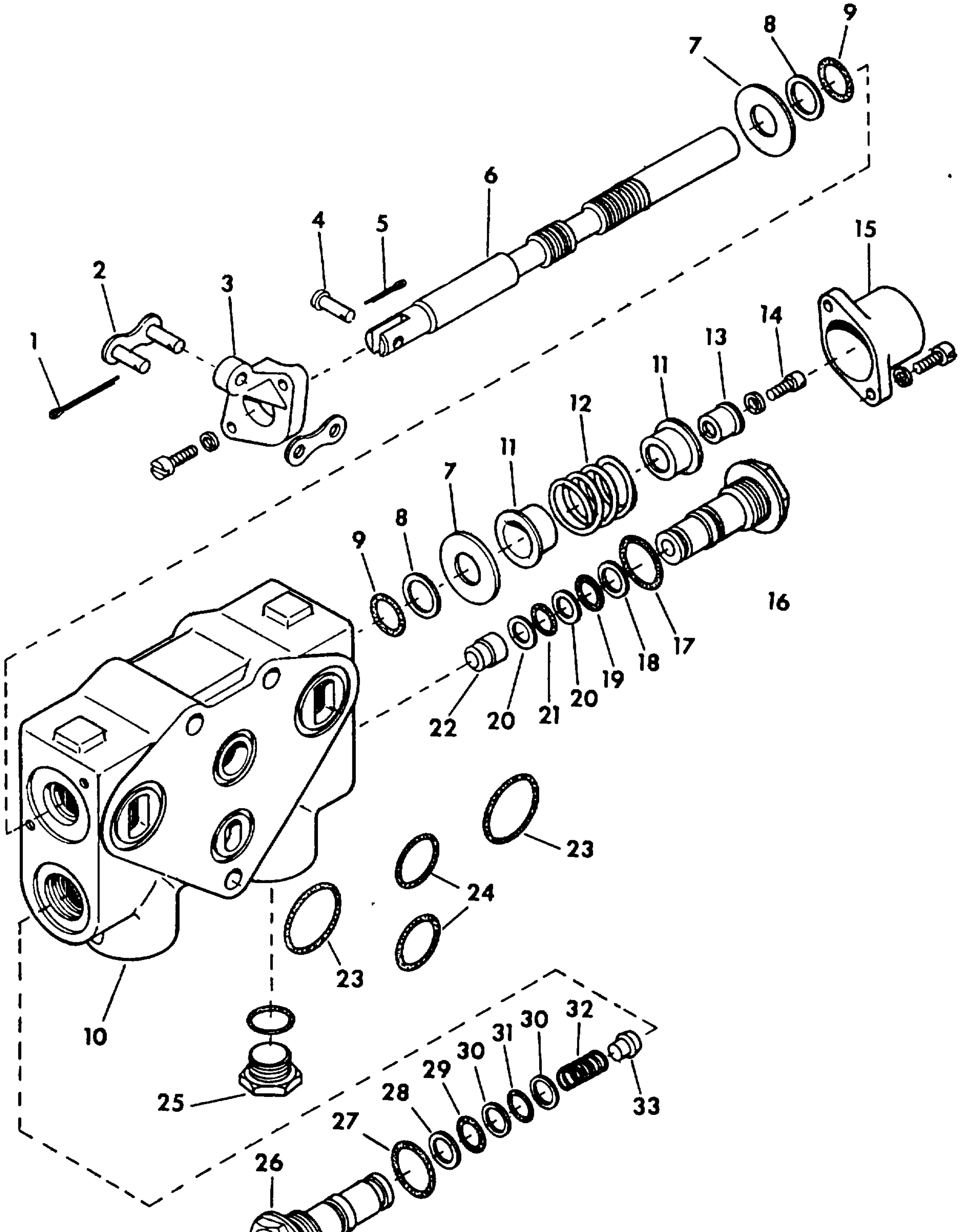
CONTROL VALVE

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4860728-7	VALVE-CONTROL	1	INCL. ITEMS 2 THRU 6
	0925689-2	CAPSCREW	3	
	0917356-8	LOCKWASHER	3	
	0917372-5	NUT	3	
2	4908363-7	SECTION-OUTLET	1	INCL. PLUG & O-RING
	0924102-7	PLUG	1	
	0921206-9	O-RING	1	
3	4907308-3	SECTION-LIFT	1	SEE PAGE 145
4	4907309-1	SECTION-TILT	1	SEE PAGE 147
5	4908159-9	SECTION-INLET	1	SEE PAGE 149
6	4907312-5	ROD-TIE	3	
	0906652-3	NUT	6	
	0917356-8	LOCKWASHER	6	
7	4858691-1	HANDLE-LIFT	1	
8	4858689-5	HANDLE-TILT	1	
9	0233770-7	KNOB-HANDLE	2	
10	4858686-1	PLATE	1	
	0920328-2	CAPSCREW	2	
	0916966-5	LOCKWASHER	2	
	0916951-7	NUT	2	
11	4777000-3	POPPET	1	
12	4868104-3	POPPET	1	
13	4843526-7	ADAPTER	2	
	0921205-1	O-RING	2	
	0923290-1	WASHER	2	



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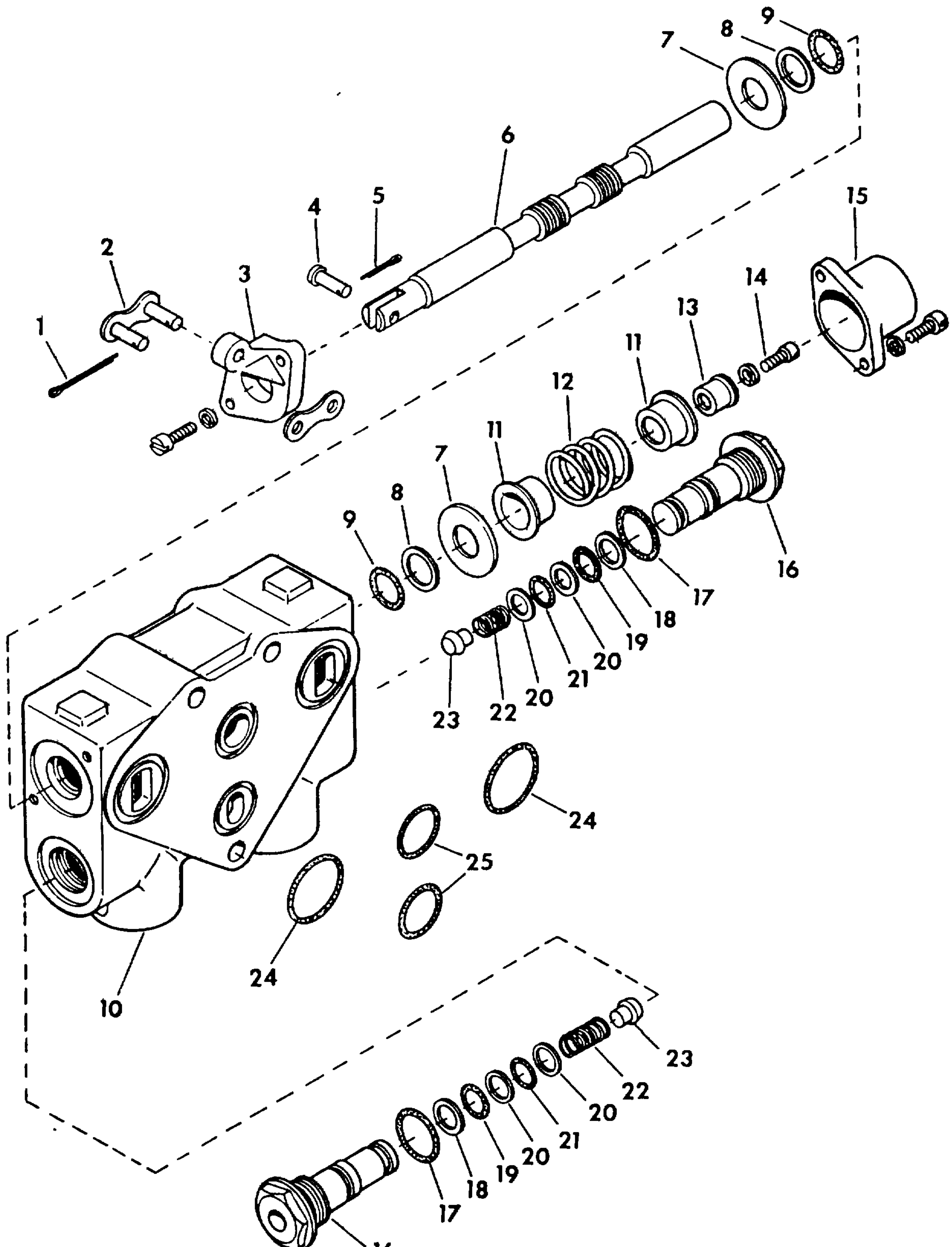
PLUNGER SECTION ASSY-4907308-3

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4103365-5	PIN-COTTER	1	
2	4908395-9	LINK ASSY	1	
3	4908299-3	BRACKET-HANDLE	1	
	0901229-5	SCREW	2	
	0916964-0	LOCKWASHER	2	
4	4908392-6	PIN-HANDLE	1	
5	4908393-4	PIN-COTTER	1	
6		SPOOL-VALVE	1	ORDER 4907308-3
7	4908378-5	*RETAINER SEAL	2	
8	4908390-0	*WASHER-BACKUP	2	
9	0923574-8	*O-RING	2	
10		HOUSING	1	ORDER 4907308-3
11	4908399-1	COLLAR-STOP	2	
12	4908374-4	SPRING-CENTERING	1	
13	4908400-7	COLLAR-SPOOL	1	
14	0914820-6	SCREW	1	
	0917356-8	LOCKWASHER	1	
15	4908398-3	BONNET	1	
	0901229-5	SCREW	2	
	0916964-0	LOCKWASHER	2	
16	4908397-5	PLUG-CHECK	1	
17	0921206-9	*O-RING	1	
18	4908396-7	*WASHER-BACKUP	1	
19	0923561-5	*O-RING	1	
20	4908391-8	*WASHER-BACKUP	1	
21	0924003-7	*O-RING	1	
22	4908383-5	PLUG-3 WAY CONVERSION	1	
23	0923562-3	**O-RING	2	
24	0923946-8	**O-RING	2	
25	0928208-8	PLUG	1	
	0921205-1	O-RING	1	
26	4908397-5	PLUG	1	
27	0921206-9	*O-RING	1	
28	4908396-9	*WASHER-BACKUP	1	
29	0923561-5	*O-RING	1	
30	4908391-8	*WASHER	1	
31	0924003-7	*O-RING	1	
32	4908384-3	SPRING-CHECK	1	
33	4908388-4	PLUG-CHECK	1	

* INCL IN KIT 4908368-6
** INCL IN KIT 4908366-0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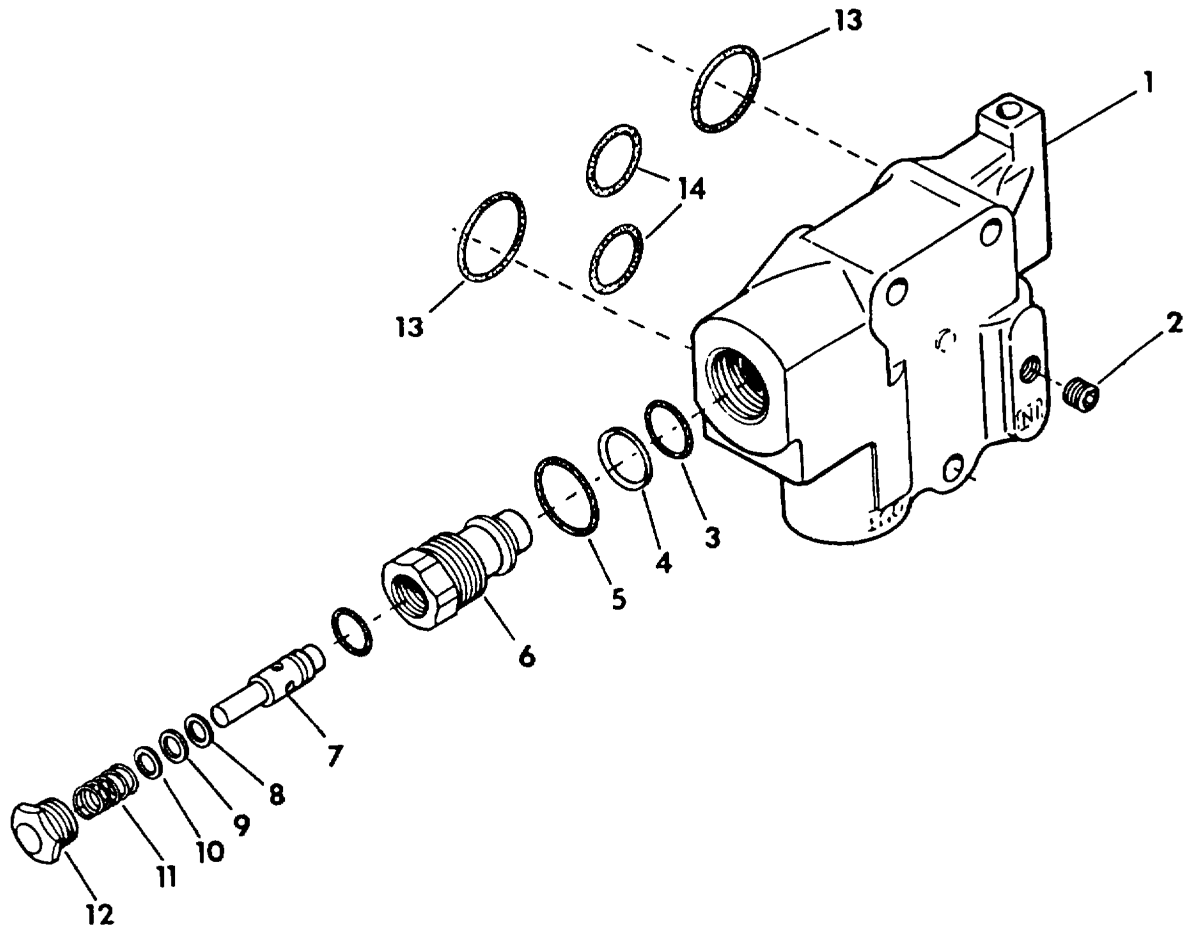
PLUNGER SECTION ASSY-4907309-1

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4103365-5	PIN-COTTER	1	
2	4908395-9	LINK ASSY	1	
3	4908299-3	BRACKET-HANDLE	1	
	0901229-5	SCREW	2	
	0916964-0	LOCKWASHER	2	
4	4908392-6	PIN-HANDLE	1	
5	4908393-4	PIN-COTTER	1	
6		SPOOL-VALVE	1	ORDER 4907309-1
7	4908378-5	*RETAINER-SEAL	2	
8	4908390-0	*WASHER-BACKUP	2	
9	0923574-8	*O-RING	2	
10		HOUSING	1	ORDER 4907309-1
11	4908399-1	COLLAR-STOP	2	
12	4908374-4	SPRING-CENTERING	1	
13	4908400-7	COLLAR-SPOOL	1	
14	0914820-6	SCREW	1	
	0917356-8	LOCKWASHER	1	
15	4908398-3	BONNET	1	
	0901229-5	SCREW	2	
	0916964-0	LOCKWASHER	2	
16	4908397-5	PLUG-CHECK	2	
17	0921206-9	*O-RING	2	
18	4908396-7	*WASHER-BACKUP	2	
19	0923561-5	*O-RING	2	
20	4908391-8	*WASHER-BACKUP	4	
21	0924003-7	*O-RING	2	
22	4908384-3	SPRING	2	
23	4908388-4	PLUG-CHECK	2	
24	0923562-3	**O-RING	2	
25	0923946-8	**O-RING	2	

* INCL IN KIT 4908368-6
** INCL IN KIT 4908366-0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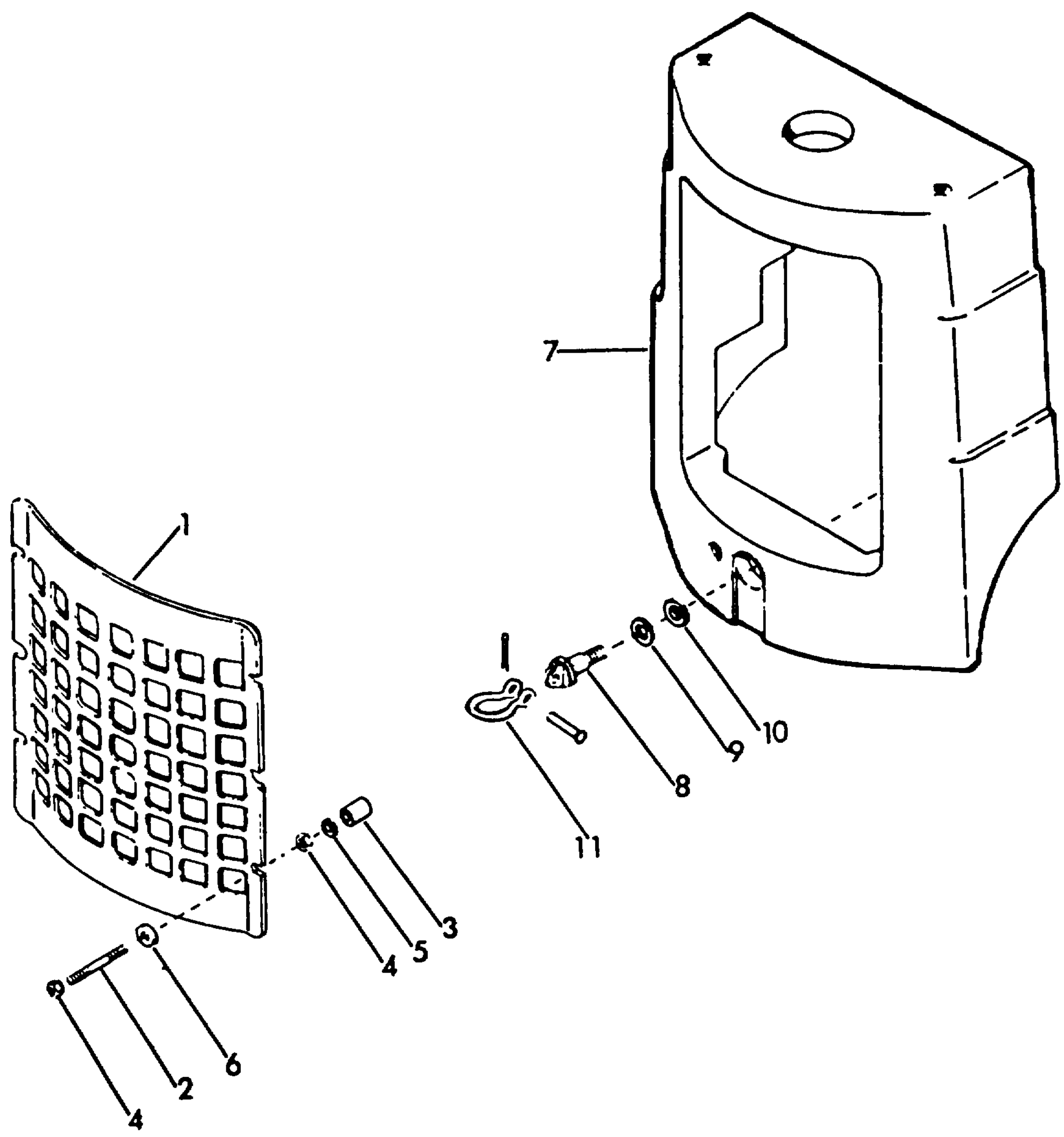
INLET SECTION-4908159-9

ITEM	PART NO.	DESCRIPTION	QTY.	
1		COVER	1	ORDER 4908159-9
2	4255491-5	PLUG	1	
3	0923848-6	*O-RING	1	
4	4908389-2	*WASHER-BACKUP	1	
5	0923563-1	*O-RING	1	
6	4908387-6	BODY	1	
7	4908386-8	POPPET	1	
	0921206-9	*O-RING	1	
8	4908381-9	WASHER	1	
9	4908380-1	WASHER	1	
10	4908379-3	WASHER	1	
11	4908382-7	SPRING	1	
12	4908385-0	CAP	1	
13	0923562-3	**O-RING	1	
14	0923946-8	**O-RING	1	
	0924102-7	PLUG	1	
	0921206-9	O-RING	1	
		* INCL IN KIT 4908367-8		
		** INCL IN KIT 4908366-0		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COUNTERWEIGHT

ITEM	PART NO.	DESCRIPTION	QTY.
1	4877808-8	GRILL	1
2	0919372-3	CAPSCREW	4
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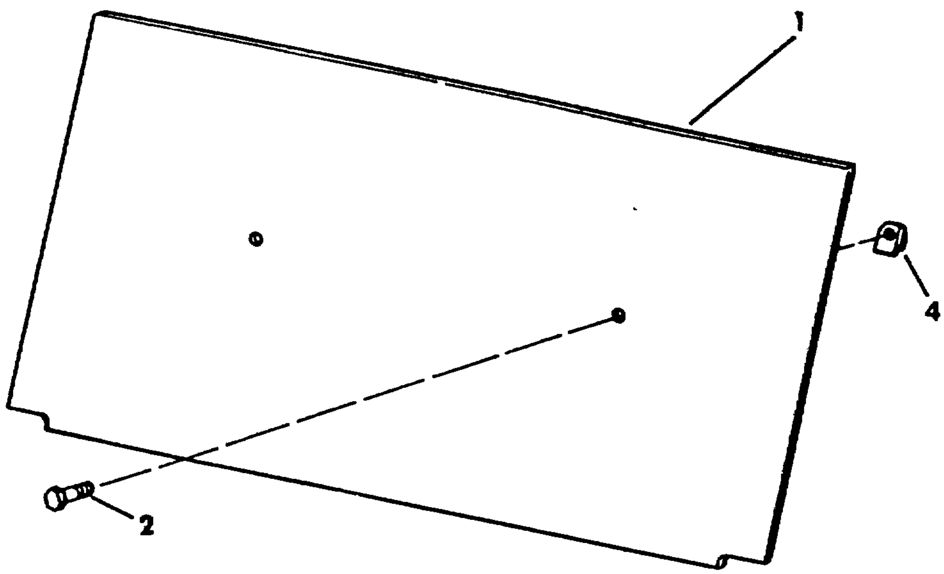
5	0918906-9	WASHER-.41" X 1.12"	4
6	0929365-5	WASHER-.38"	4
7	4863249-1	COUNTERWEIGHT ASSY	1
8	4862079-3	STUD-TOWING	1
9	4863265-7	SHIM	2
10	0924373-4	WASHER-1.44" X 2.75"	1
11	0920571-7	SHACKLE-.62"	1
	4866992-3	SHIM	2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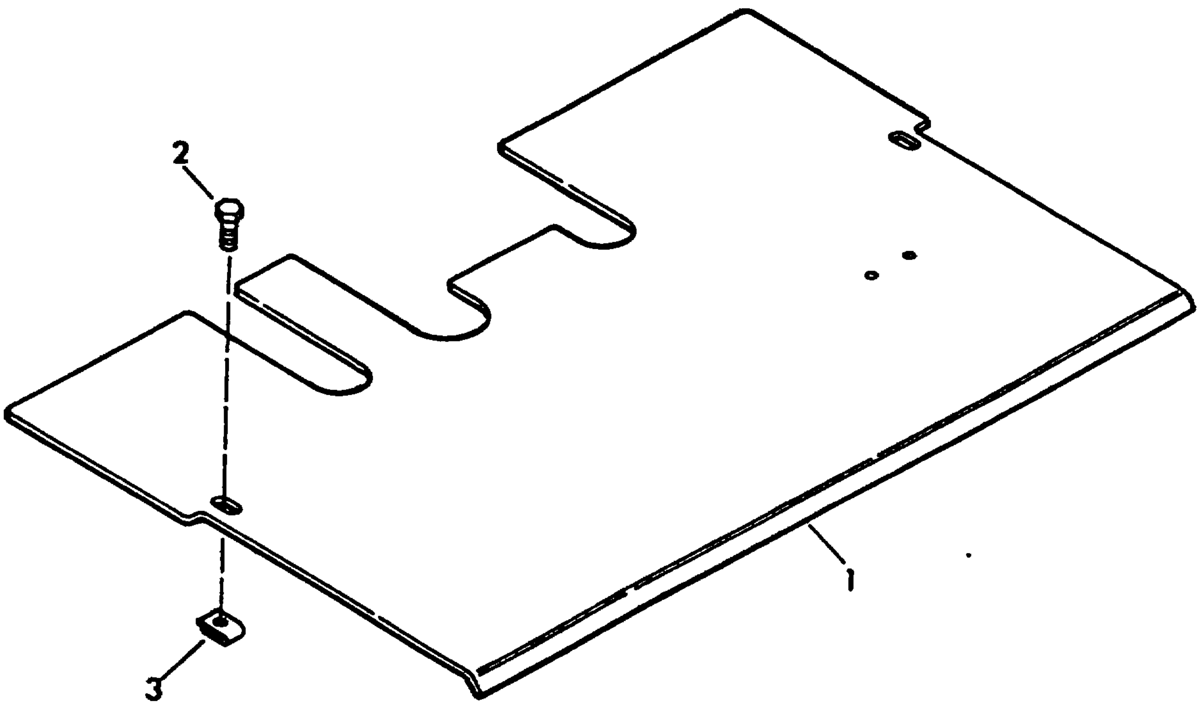
FLOOR PLATE - POWER SHIFT

ITEM	PART NO.	DESCRIPTION	QTY.
1	4868120-9	PLATE-FLOOR	1
2	0918249-4	SCREW-TRUSS HD-.31-18 X .75	2
3	0916803-0	LOCKWASHER-INT-.38" (NOT USED)	2
4	0921355-4	NUT-SPEED	2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TOE PLATE - POWER SHIFT

ITEM	PART NO.	DESCRIPTION	QTY.
1	4868199-3	PLATE- TOE	1
2	0918249-4	CAPSCREW- .31" -18 X 1"	4
3	0921355-4	NUT- SPEED- .31" -18	4

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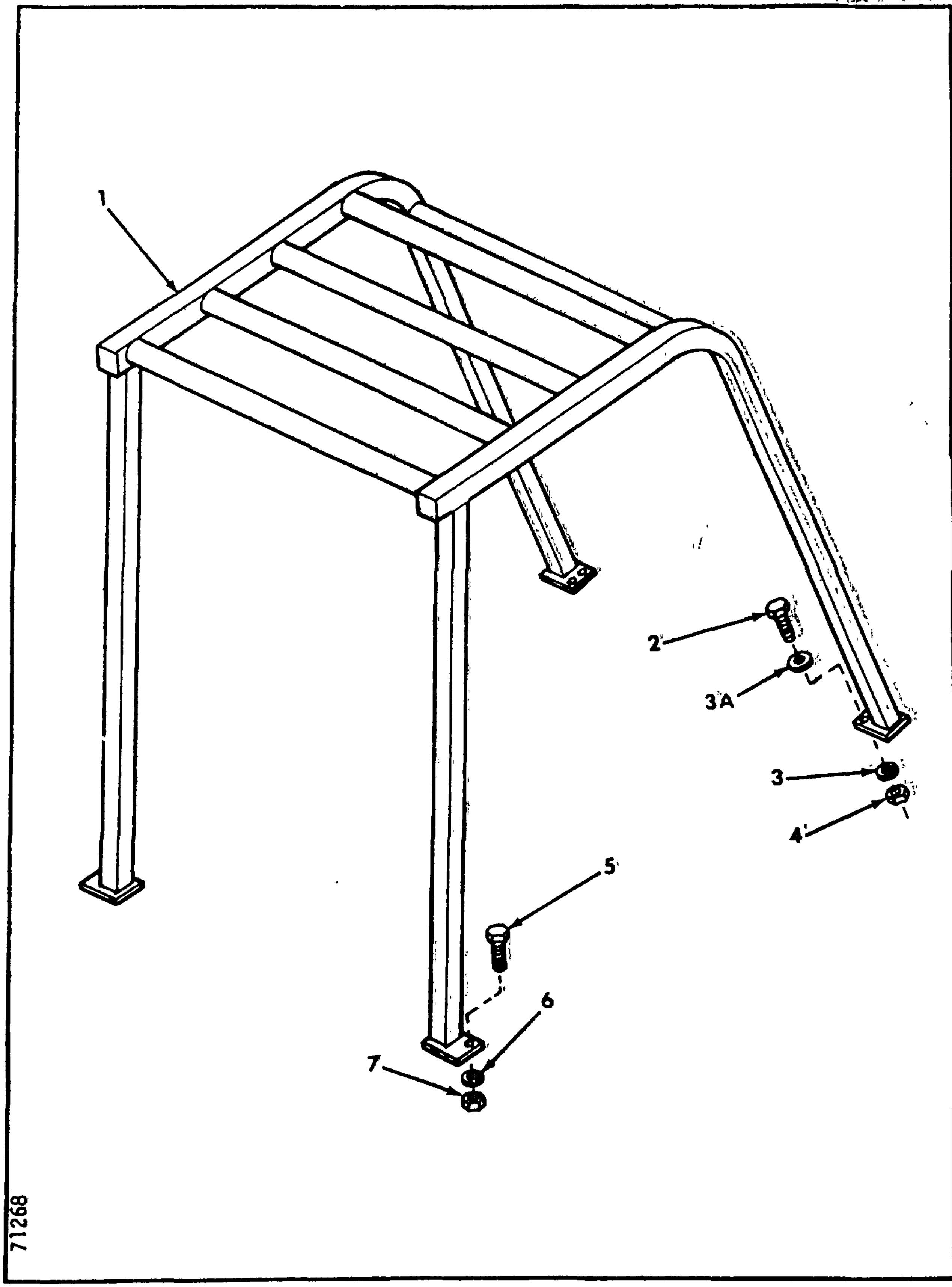
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OVERHEAD GUARD

ITEM	PART NO.	DESCRIPTION	QTY.
1	4866946-9	GUARD ASSY	1
2	0921176-4	CAPSCREW- .5" -13 X 1.25"	4
3	0916966-5	LOCKWASHER- .5"	4
3A		NOT USED	
4	0916951-7	NUT- .5" -13	4
5	0919089-3	CAPSCREW- .5" -13 X 1.75"	2
6	0916966-5	LOCKWASHER- .5"	2
7	0916951-7	NUT- .5" -13	2

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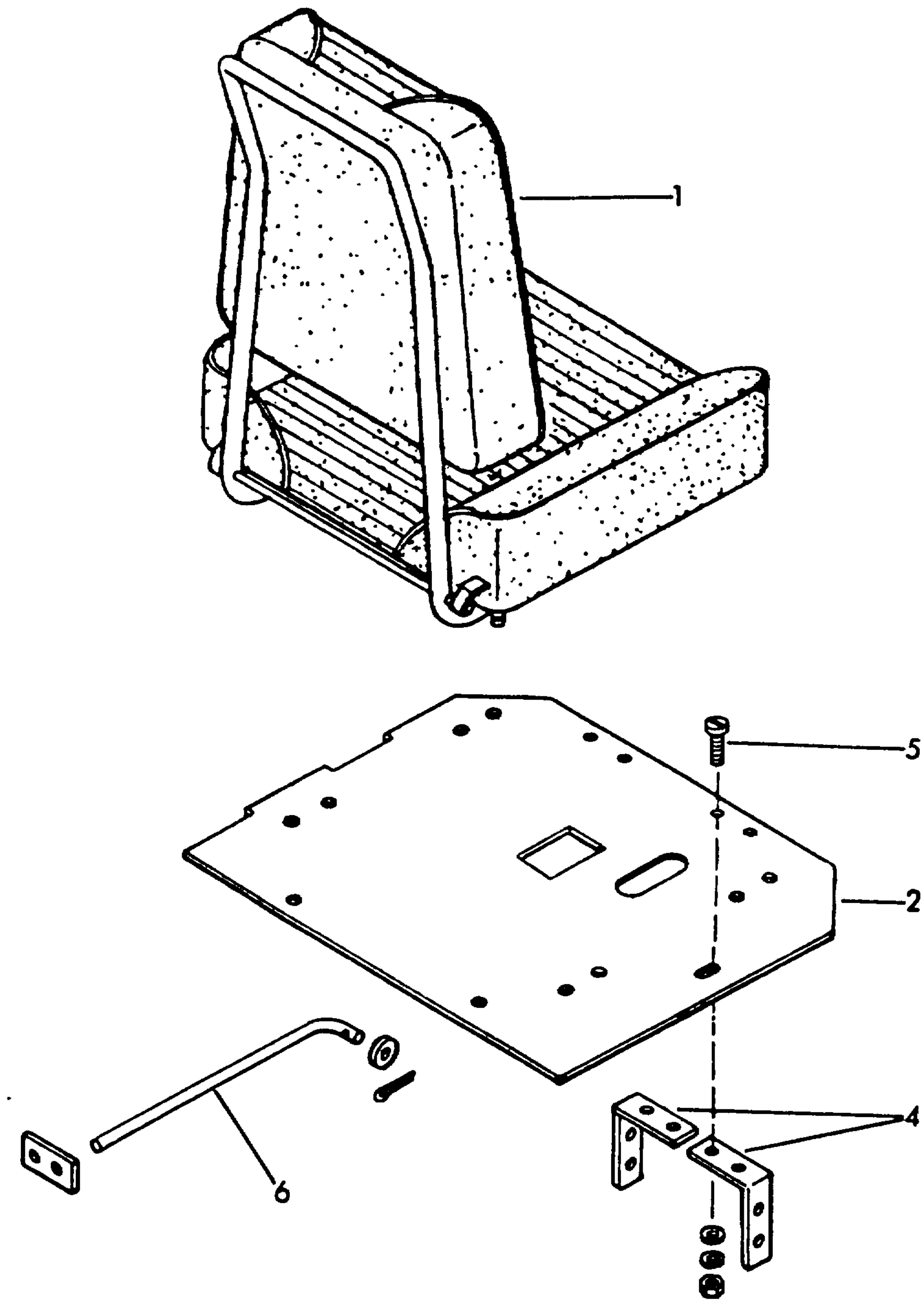
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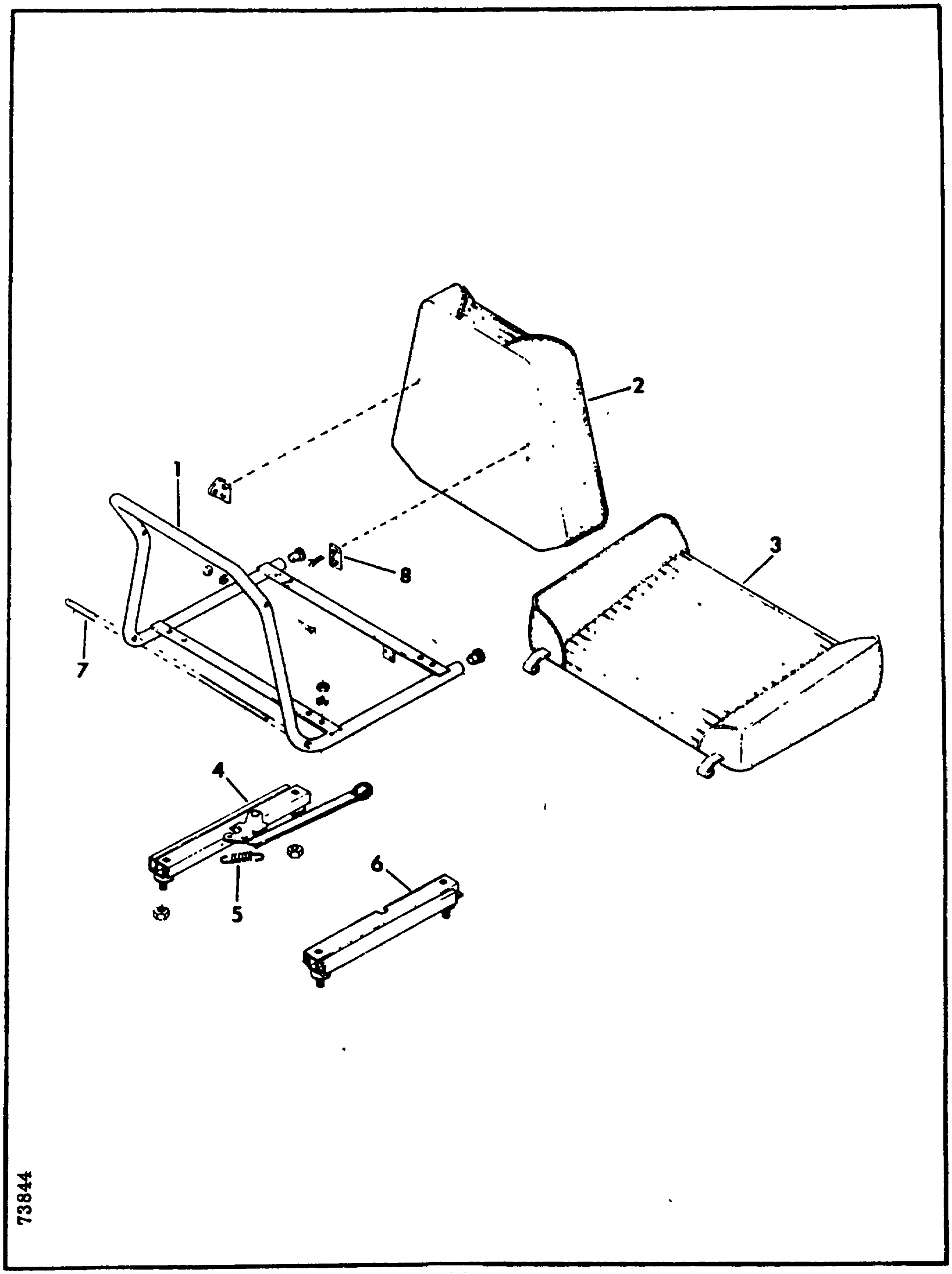
SEAT

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4842513-6	SEAT ASSY	1	SEE PAGE 161
2	4858142-5	SUPPORT ASSY	1	
	0917356-8	LOCKWASHER-.38"	4	
	0918265-0	WASHER-.38"	4	
3		NOT USED		
4	4858144-1	ANGLE-HINGE	2	
5	0921332-3	CAPSCREW-.31"-18 X .75"	4	
	0918265-0	WASHER-.31"	4	
	0917356-8	LOCKWASHER-.31"	4	
	0917372-5	NUT-.31"-18	4	
6	4860695-8	PROP SEAT	1	
	0917378-2	WASHER-.38"	1	
	0918447-4	PIN-COTTER-.12 X 1"	1	
	4750039-2	CLAMP	1	
	0923938-5	CAPSCREW-.375"-16 X 3.50	2	
	0916965-7	LOCKWASHER	2	
	0916950-9	NUT	2	
	0925369-1	CAPSCREW-#8-32 X .5	2	
	0917365-8	LOCKWASHER-#8	2	
	0917415-2	NUT-#8-32	2	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SEAT ASSY

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4907651-6	FRAME	1	INCLUDES PLASTIC TIPS
	4906408-2	TIP- BLACK PLASTIC- .88"	2	
2	4828474-9	CUSHION-BACKREST	1	INCLUDES ITEM 8
	0900537-2	SCREW- .25" -20 X 1.5"	2	
	0918264-3	WASHER-PLATED- .28"	2	
	0920329-0	NUT-STOP- .25" -20	2	
3	4907649-0	CUSHION-SEAT	1	
4	4907382-8	ADJUSTER-SLIDE	1	INCL ITEM 5
	0917366-7	CAPSCREW-PLATED- .31" -24 X .87"	2	
	0917356-8	LOCKWASHER-PLATED- .31"	2	
	0920263-1	NUT-PLATED- .31" -24	2	
	0917372-5	NUT-PLATED- .31" -18	2	
5	4907476-8	SPRING-ADJUSTER	1	
6	4907383-6	SLIDE	1	
	0917366-7	CAPSCREW-PLATED- .31" -24 X .87"	2	
	0917356-8	LOCKWASHER-PLATED- .31"	2	
	0920263-1	NUT-PLATED- .31" -24	2	
	0917372-5	NUT-PLATED- .31" -18	2	
7	4819871-7	ROD1		
	0918448-2	PIN-COTTER-PLATED- .09" -1"	2	
8	4906618-6	HINGE-BACKREST	2	
	0900576-0	SCREW- .25" -20 X .75"	4	

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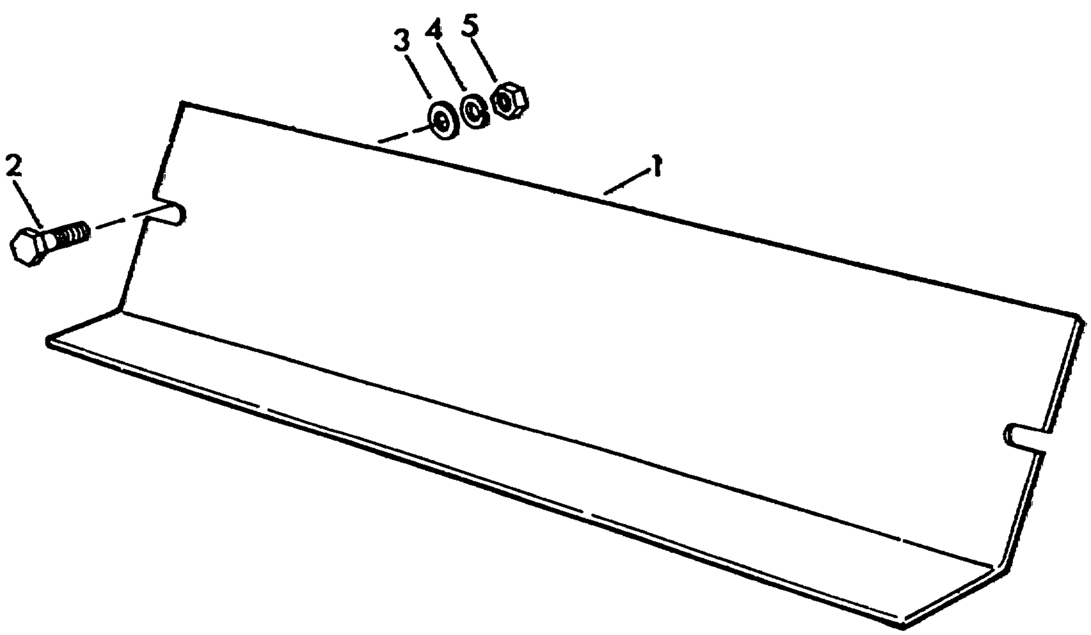

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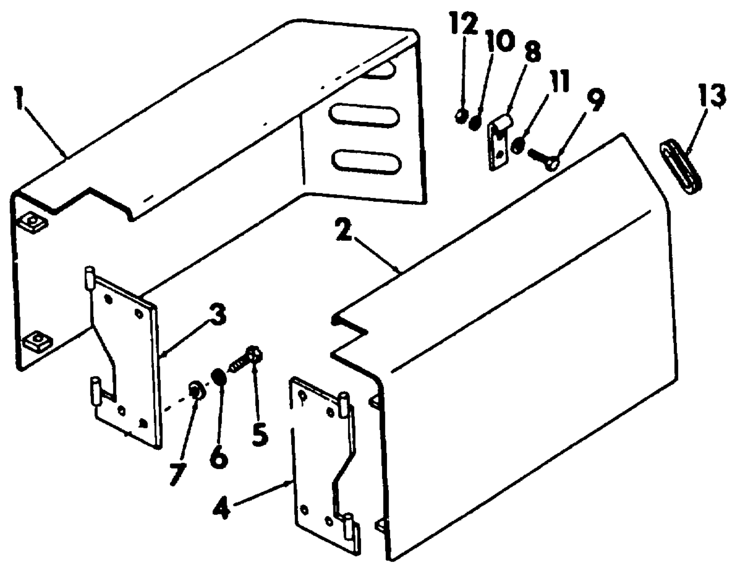
DECK

ITEM	PART NO.	DESCRIPTION	QTY.
1	4858174-8	GUARD	1
2	0921332-3	SCREW-RD HD-.31-18 X .75	2
3	0917642-1	WASHER	4
4	0917356-8	LOCKWASHER	2
5	0916159-7	NUT	2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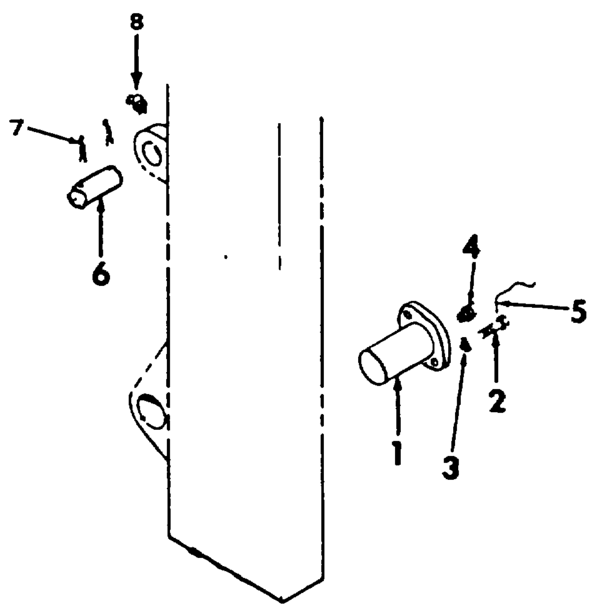
SIDE PANEL

ITEM	PART NO.	DESCRIPTION	QTY.
1	4881062-6	PANEL ASSY-LEFT HAND	1
2	4881064-2	PANEL ASSY-RIGHT HAND	1
3	4863263-2	HINGE ASSY-LEFT HAND	1
4	4866767-7	HINGE ASSY-RIGHT HAND	1
5	4255060-8	CAPSCREW-.375"-16 X 1.25"	4
6	0916965-7	LOCKWASHER-.38" NOT USED	4
7	0917378-2	WASHER-.38"	4
8	4867999-7	CLIP	3
9	0923341-2	CAPSCREW-.25"-20 X .75"	2
10	0916964-0	LOCKWASHER-.25"	4
11	0918264-3	WASHER-.25"	4
12	0916622-4	NUT-.25"-20	2
13	4826029-3	GROMMET-RUBBER	2
	0924009-4	CAPSCREW-.250-20 X 1.25"	2
	0926326-0	WASHER #14	4
	0924035-9	NUT-JAM	2
	4860529-9	TRIM	1
	0929544-5	CAPSCREW	2
	4879818-5	LATCH ASSY	2

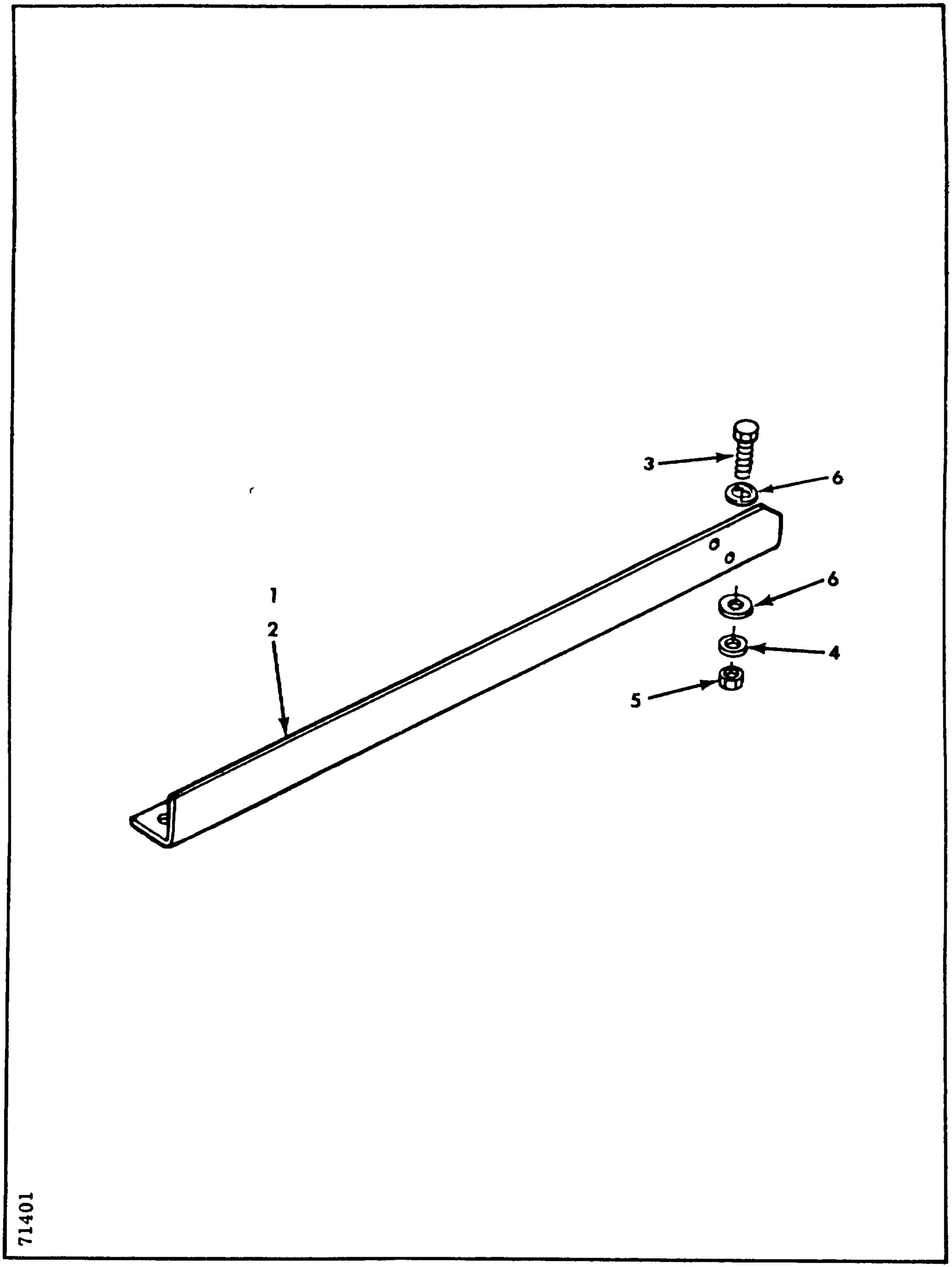


71398

MAST MOUNTING

ITEM	PART NO.	DESCRIPTION	QTY.
1	4718482-5	PIN-MAST	2
2	4335601-3	CAPSCREW-.38" -16 X 1.25"	4
3	0916965-7	LOCKWASHER-.38"	4
4	0915276-0	FITTING-LUBE-650	2
5	4742113-6	WIRE	2
6	4826276-0	PIN	2
7	0919430-9	PIN-COTTER-.25" X .5"	4
8	0918187-6	FITTING-LUBE-450-.25"-28	2

71398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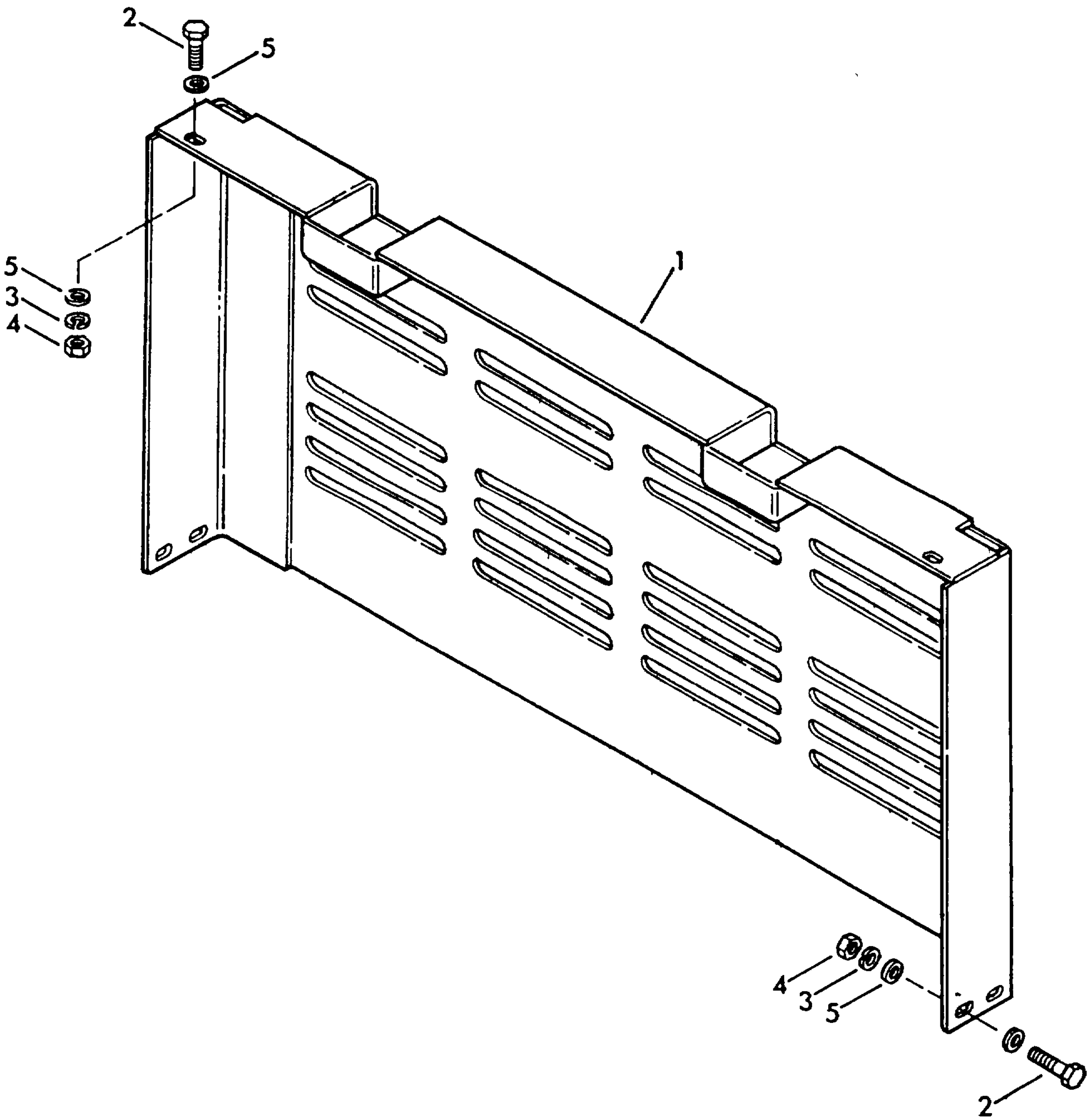
CROSS TIE

ITEM	PART NO.	DESCRIPTION	QTY.
1	4868814-7	ANGLE-LH	1
2	4880577-4	ANGLE-RH	1
3	0921210-1	CAPSCREW-3.8"-16 X 1"	4
4	0916965-7	LOCKWASHER-.38"	4
5	0916950-9	NUT-.38"-16	2
6	0917378-2	WASHER- .38"	6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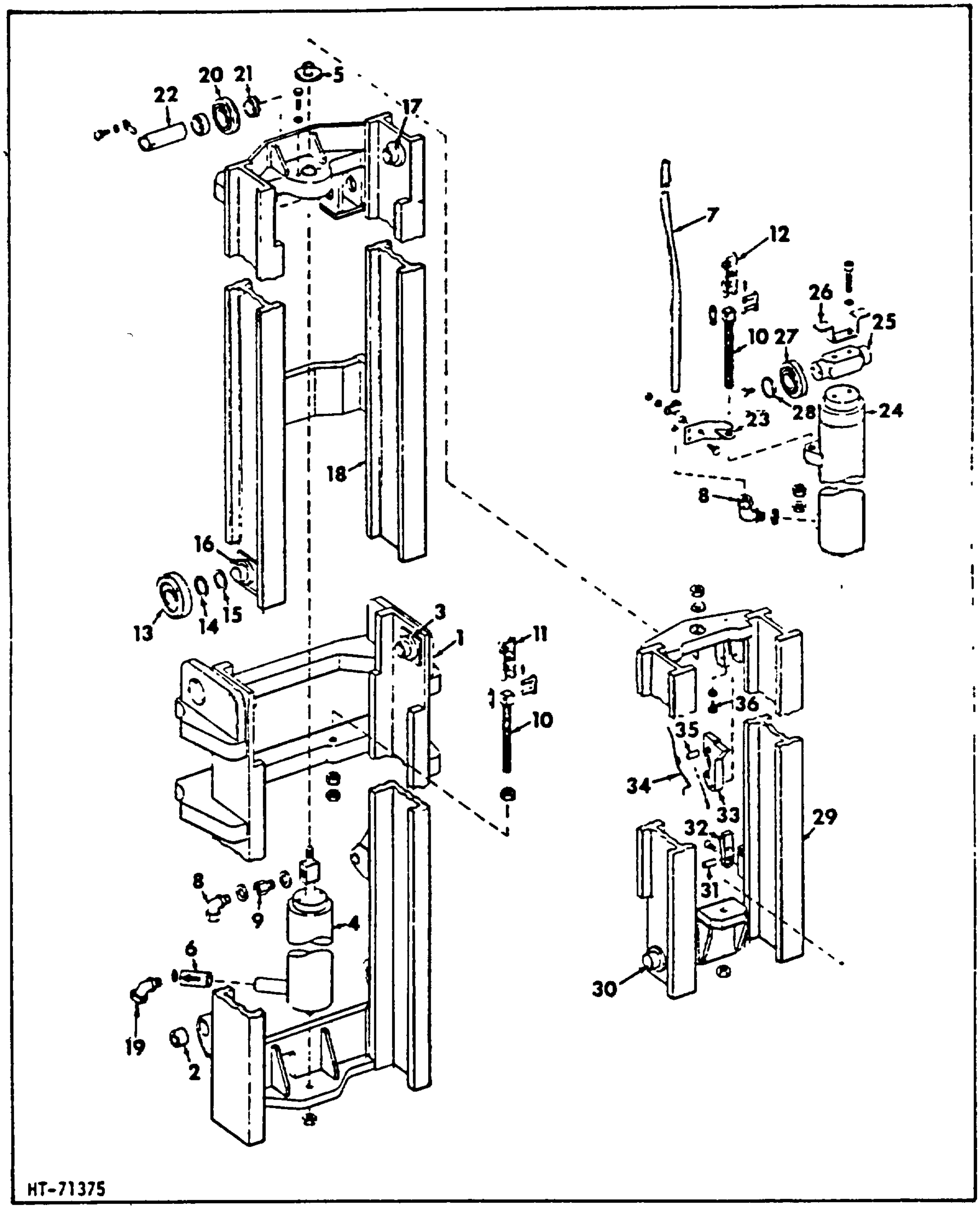
FRONT SCREEN

ITEM	PART NO.	DESCRIPTION	QTY.
1	4860714-7	SCREEN	1
2	0920415-7	CAPSCREW-.38"-16 X 1.25"	4
3	0916965-7	LOCKWASHER- .38	4
4	0916950-9	NUT- .38"-16	4
5	0918266-8	WASHER - .38" X .81"	8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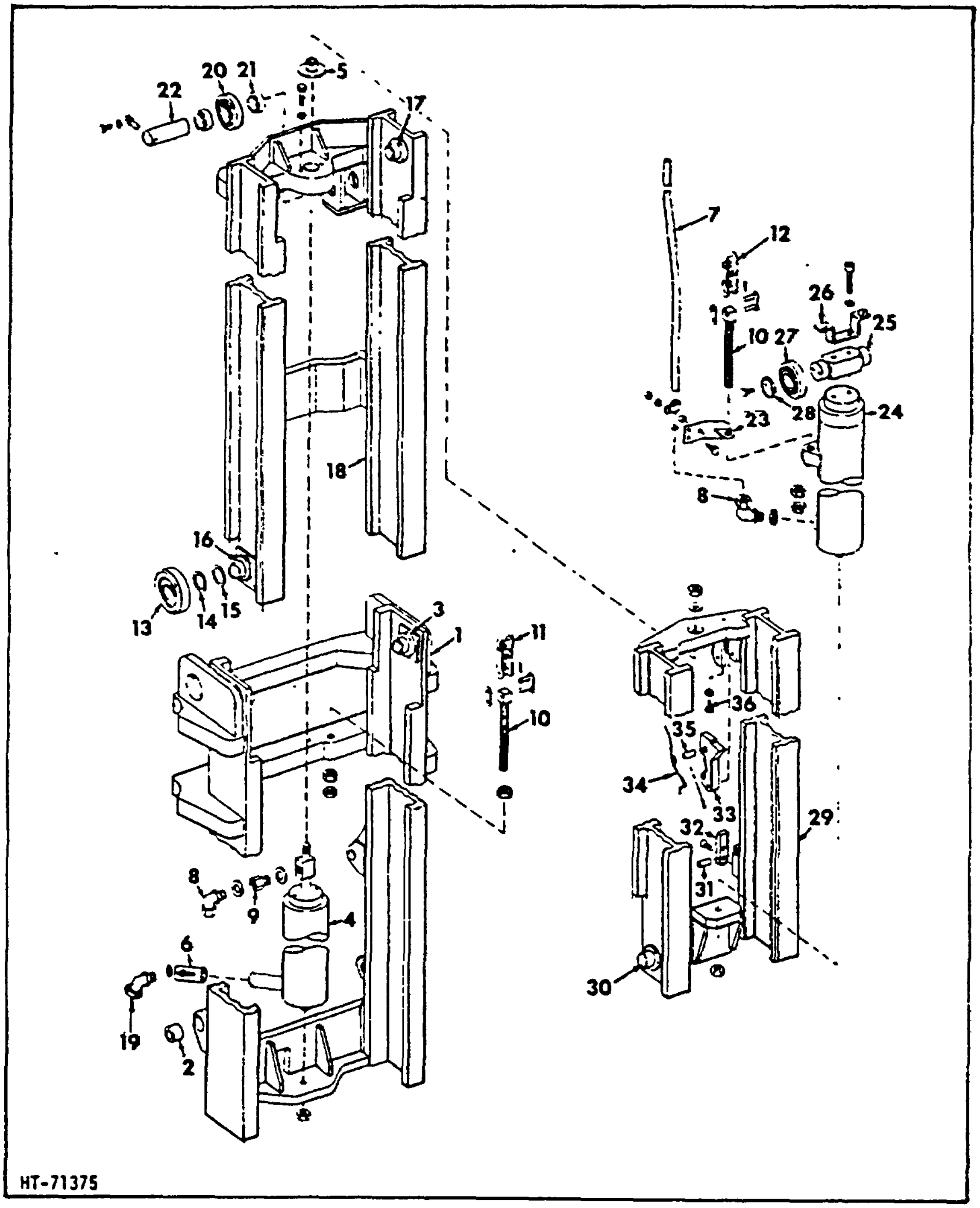
MAST ASSY-TRI-MAX LIFT-180"

ITEM	PART NO.	DESCRIPTION	QTY.	
-	4880581-6	LIFT ASSEMBLY	1	INCL ITEMS 1 THRU 35
1	4826512-8	CHANNEL ASSY-OUTER	1	INCL ITEMS 2 AND 3
2	4715712-8	BUSHING-MAST PIVOT	2	
3	4827374-2	STUD-ROLLER	2	WELDED TO ITEM 1
4	4860932-5	CYLINDER ASSY-SECONDARY	1	SEE PAGE 177
	0903634-4	CAPSCREW- .38"-16 x 2"	2	
	0904206-0	LOCKWASHER-.38"	2	
	0929747-0	NUT-JAM-LOCK-.75"-16	1	
	0914770-3	WASHER-.78"	1	
5	4831699-6	SPACER	1	
6	4821904-2	REGULATOR-FLOW	1	
7	4820538-9	TUBE-CONNECTING	1	
	4255538-3	CLAMP	1	
	0922465-0	WASHER-.41"	1	
	0903630-2	CAPSCREW-.38"-16 x 1"	1	
	0904206-0	LOCKWASHER-.38"	1	
	0910324-3	NUT-.38"-16	1	
8	4816684-7	ELBOW	2	INCL O-RING AND NUT
	4905843-1	NUT UNIT	2	
	0921206-9	O-RING-#-912-.924" ID	2	SAE TYPE 1
9	4811940-8	BUSHING	1	
	0921206-9	O-RING-#-912-.924" ID	2	SAE TYPE 1
10	4766398-4	ANCHOR-CHAIN	4	
	0910365-6	NUT-.88"-14	4	
	0911193-1	NUT-JAM- .88"-14	8	
	0905347-1	WASHER-.88"	2	
11	4719981-5	CHAIN-MAST LIFT	2	
	4701705-8	LINK-CONNECTING	2	
	0919313-7	PIN-COTTER-.09" x .5"	4	
12	4719978-1	CHAIN-CARRIAGE	2	
	4701705-8	LINK-CONNECTING	2	
	0919313-7	PIN-COTTER-.09" x .5"	4	
13	4820659-3	BEARING-ROLLER	8	
14	4820649-4	SHIM-.015"	*	USE AS REQUIRED
15	4820648-6	SHIM-.040"	*	USE AS REQUIRED
16	4827374-2	STUD-WELDED TO BOTTOM OF ITEM 18	2	
17	4820652-8	STUD-WELDED TO TOP OF ITEM 18	2	
18	4826522-7	CHANNEL ASSY-INTERMEDIATE	1	INCL ITEMS 16 AND 17
19	0921728-2	ELBOW-45°-.75" TUBE x 1.12"-12	1	INCL O-RING
	0921206-9	O-RING-#912-.924" ID	1	SAE TYPE 1
20	4803665-1	BEARING-ROLLER	2	
21	4821913-3	SPACER	4	
22	4821912-5	SHAFT-ROLLER BEARING	2	
	4763868-9	PIN-COTTER-.5" x 2"	2	
	0903629-4	CAPSCREW-.38"-16 x .75"	2	
	0904206-0	LOCKWASHER-.38"	2	
23	4820895-3	SUPPORT-TUBE	2	
	0913708-4	SCREW-FH-.31"-18 x .75"	4	
24	4820530-6	CYLINDER ASSY-PRIMARY	1	SEE PAGE 176
	0929748-0	NUT-JAM-LOCK-.75"-16	1	
25	4820650-2	CROSSHEAD	1	
26	4820462-2	GUARD-CHAIN	1	
	0904283-9	CAPSCREW-.5"-13 x 3"	2	
	0904208-6	LOCKWASHER-.5"	2	
27	4803665-1	BEARING-ROLLER	2	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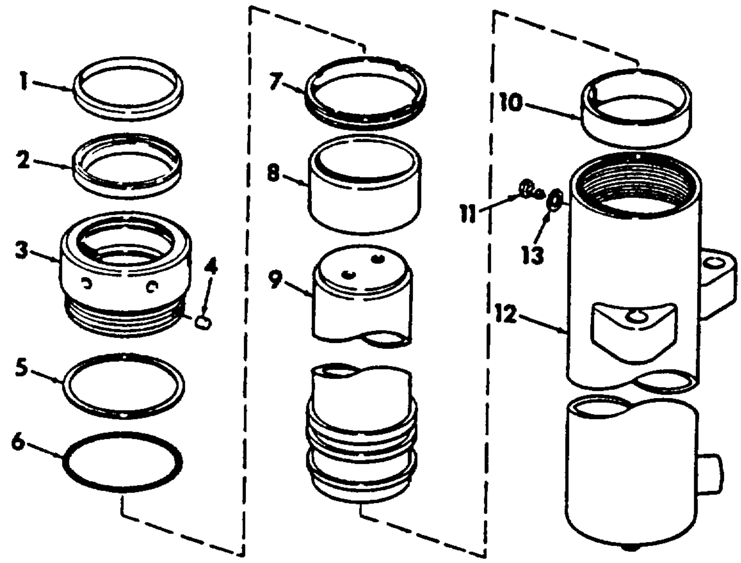
MAST ASSY-TRI-MAX LIFT-180" (CONTINUED)

ITEM	PART NO.	DESCRIPTION	QTY.	
28	4820651-0	RETAINER	2	
	0922262-1	CAPSCREW-.38"-16 x .88"	4	
29	4826532-6	CHANNEL ASSY-INNER	1	INCL ITEM 30
30	4820652-8	STUD-ROLLER-WELDED TO ITEM 29	2	
31	4828633-0	BUSHING-CHAIN	2	IN CHAIN ANCHOR
32	4820830-0	STOP-INNER MAST	2	
	0927472-1	SCREW-FH-HEX SOC-.5"-13 x 1.5"	4	W/NYLOK INSERT
33	4827856-8	INTERLOCK	1	
	0922645-7	CAPSCREW-.5"-13 x 2.25"	1	
34	4828568-8	SPRING-INTERLOCK	1	
35	4828179-4	PIN-INTERLOCK PIVOT	1	
	0911100-6	WASHER-.63"	1	
	0918448-2	PIN-COTTER-.09" x 1"	2	
36	0903772-2	CAPSCREW-.31"-18 x 1"	1	
	0914321-5	NUT-JAM-.31"-18	1	



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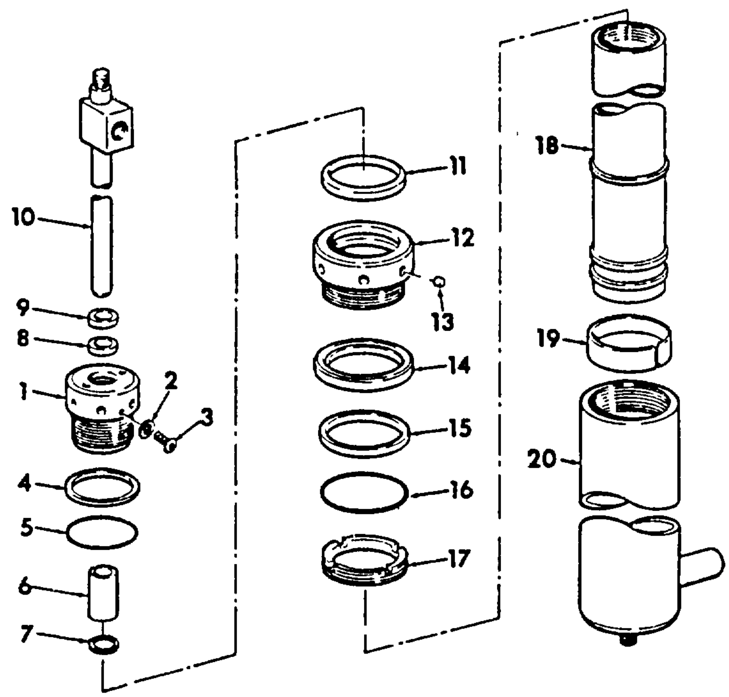
LIFT CYLINDER - 4820530-6

ITEM	PART NO.		DESCRIPTION	QTY.	
1	4863396-0	*	RING-WIPER	1	
2	4820536-3	*	PACKING-"U" CUP	1	
3	4863074-3		NUT-GLAND	1	
4	4827468-2	*	PELLET-NYLON	2	
5	0927442-4	*	RING-BACKUP-#-243-4.13"ID	1	
6	0924779-2	*	O-RING-#-243.4.11"ID-CLASS 1B	1	
7	-------------		STOP-CYLINDER	0	NOT USED
8	-------------		SPACER	0	NOT USED
9	4820505-8		RAM ASSY	1	
10	4820527-2	*	BEARING	1	
11	0929652-6	*	SCREW-PAN HD-W/INT LKW-#8-32 x .25"	1	BLEEDER
12	4820522-3		TUBE ASSY	1	
13	4833571-5		WASHER-NYLON	1	

*INCLUDED IN KIT 4906392-8



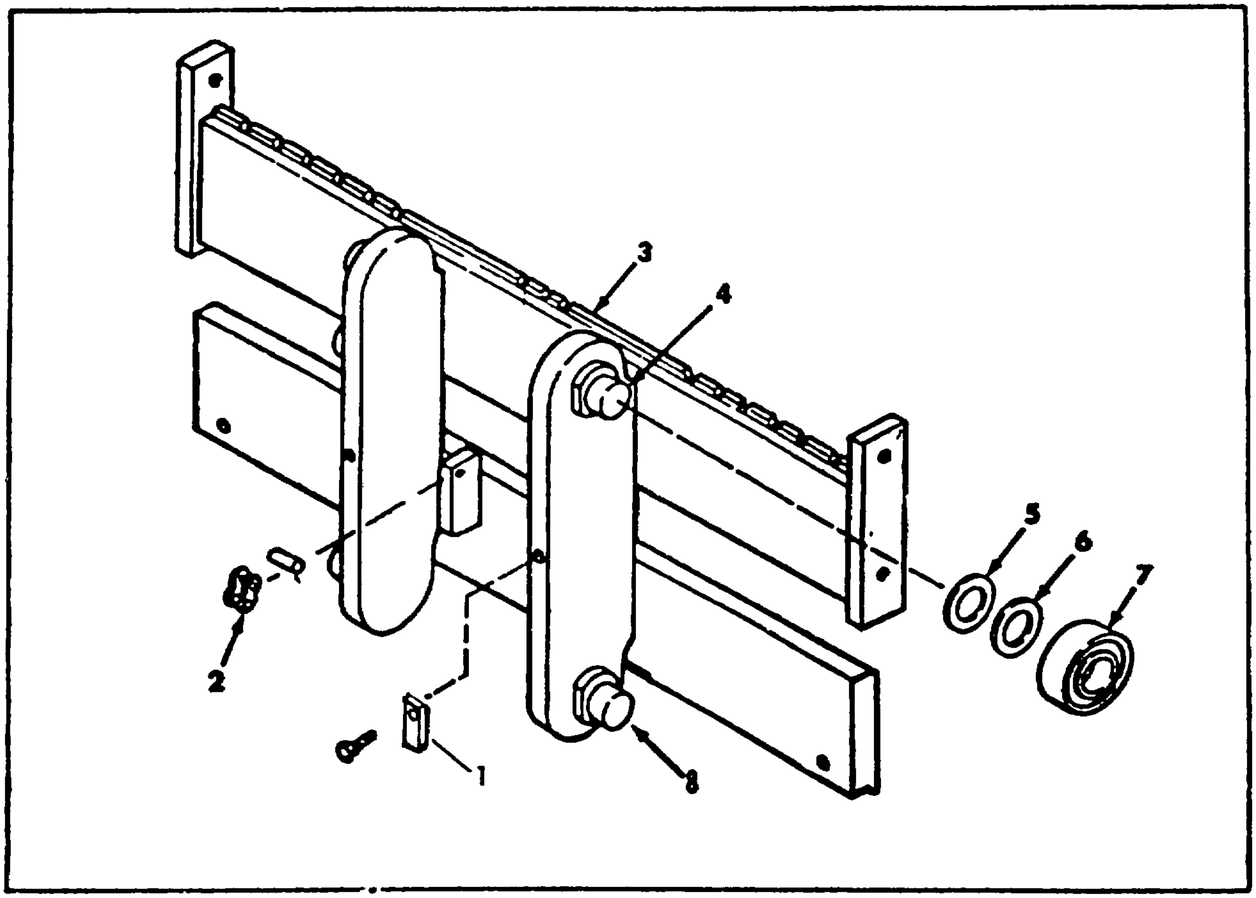
LIFT CYLINDER (SECONDARY) - 4860932-5

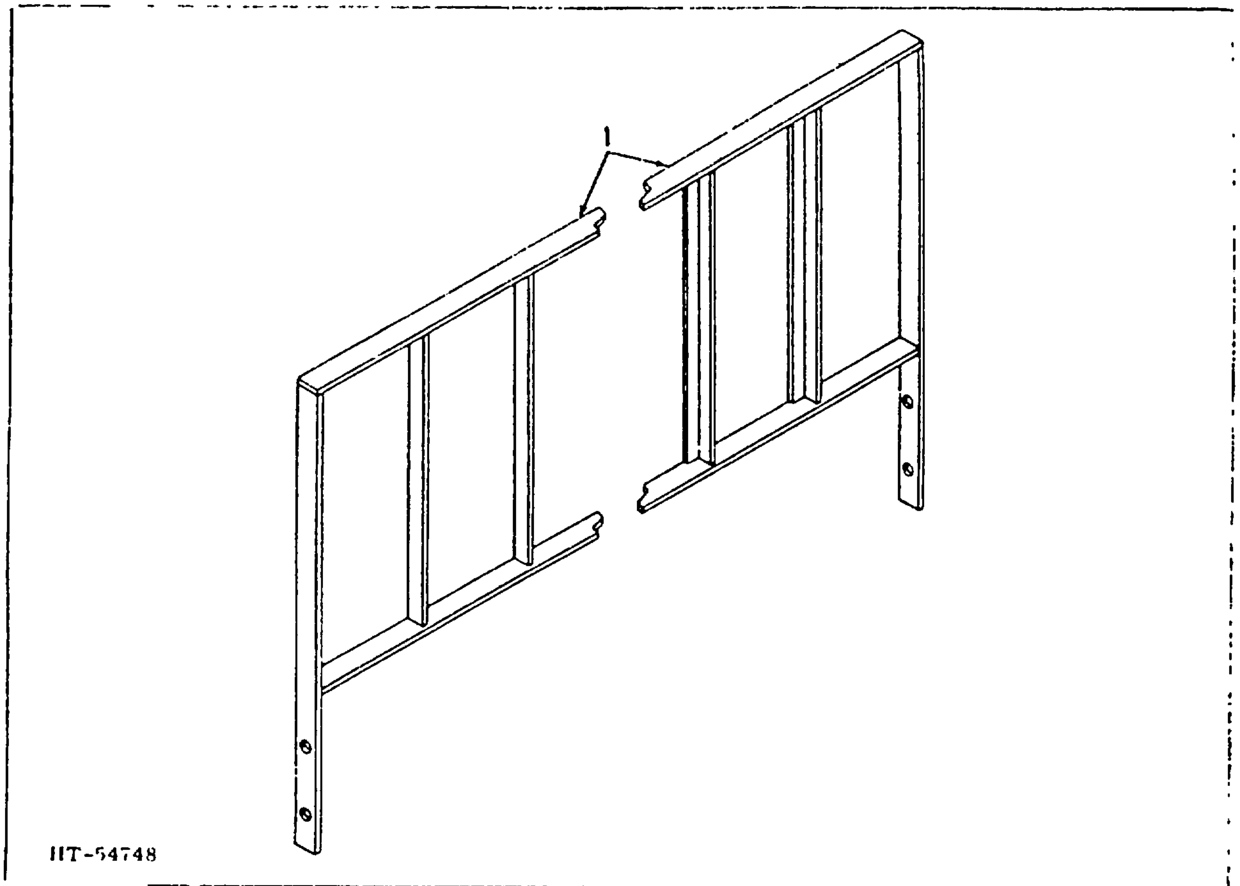
ITEM	PART NO.		DESCRIPTION	QTY.	
1	4860920-0		NUT-GLAND	1	
2	4833571-5		WASHER-NYLON	1	
3	0929652-6		SCREW-PAN HD-W/INT LKW-#8-32 x .25"	1	BLEEDER
4	0927441-6	*	RING-BACKUP-#-235-3.131"D	1	
5	0924903-8	*	O-RING-#-235-3.109"ID	1	CLASS 1B
6	4823215-1	*	BEARING-CYL FEED TUBE	1	
7	7929802-2		RING-RETAINING-1.312" FREE DIA	1	
8	4827208-2	*	PACKING-ROD	1	
9	4863395-2	*	RING-WIPER	1	
10	4820490-3		TUBE ASSY	1	
11	4863396-0	*	RING-WIPER	1	
12	4863074-3		NUT-GLAND	1	
13	4827468-2	*	PELLET-NYLON	4	
14	4820536-3	*	PACKING-ROD	1	
15	0927442-4	*	RING-BACKUP-#-243-4.131"D	1	
16	0924779-2	*	O-RING-#-243.4.109"ID	1	CLASS 1B
17	--------------		STOP-CYLINDER	0	NOT USED
18	4820549-6		RAM ASSY	1	
19	4820527-2	*	BEARING	1	
20	4820342-6		TUBE ASSY-OUTER	1	

* INCLUDED IN KIT 4910351-8

CARRIAGE ASSEMBLY

ITEM	PART NO.	DESCRIPTION	QTY.	
	0912292-0	CAPSCREW	2	
	0919332-7	LOCKWASHER	2	
1	4827858-4	STOP	1	
	0927449-9	SCREW	1	
2	4701705-8	LINK CONNECTING	2	
3	4851340-2	FRAME	1	INCL ITEM 4 and 8
4	4820652-8	STUD-ROLLER	4	
5	4820649-4	SHIM-.015 (AS REQUIRED)	*	
6	4820648-6	SHIM-.040 (AS REQUIRED)	*	
7	4820659-3	BEARING	6	
8	4820653-2	STUD-ROLLER	2	
	0921360-4	CAPSCREW	2	
	0917373-3	LOCKWASHER	2	
	0915726-4	NUT	2	
	0926680-0	SCREW	2	
	4828633-0	BUSHING	1	





CARRIAGE BACKREST

ITEM	PART NO.	DESCRIPTION	QTY.
1	4880846-3	BACKREST ASSY	1
	0923110-1	CAPSCREW	4
	0919332-7	LOCKWASHER	4

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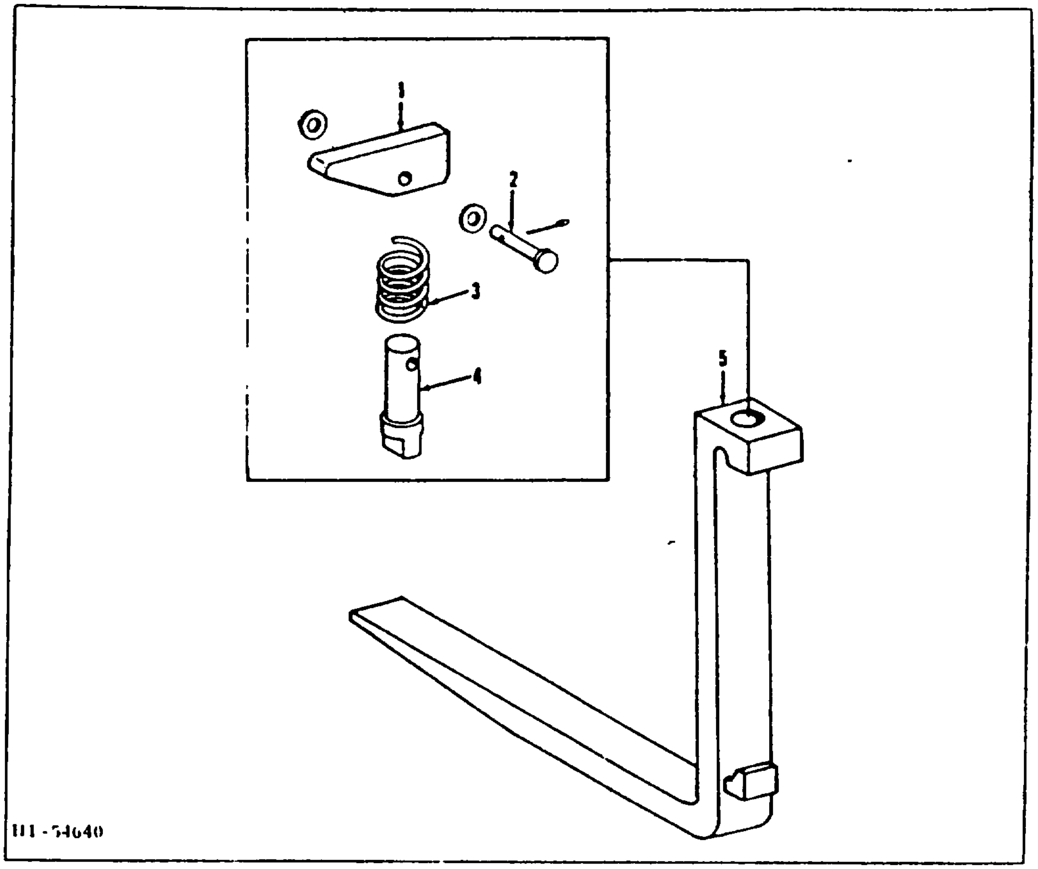


FORK COMPONENTS

ITEM	PART NO.	DESCRIPTION	QTY.
1	4804779-9	* LATCH	2
2	4804768-2	* PIN- CLEVIS	2
	0924353-6	* WASHER- PLAIN- .81" X.44"	4
	0911062-8	* PIN- COTTER- .06" X .5"	2
3	4807680-6	* SPRING- LOCK	2
4	4104777-3	* PIN- LOCK	2
5	4877516-7	FORK	2

* INCL IN KIT 4999341-5

CHAPTER V

SUPPLEMENTAL OPERATING, MAINTENANCE
AND REPAIR INSTRUCTIONS

FOR

TRUCK, FORK LIFT, PNEUMATIC TIRES: 6,000 LB.
180" LIFT, ALLIS CHALMERS MODEL ACP60PS
(MIL-T-52862/5 & MIL-T-52862GEN)
NSN 3930-01-052-5050
MHE 233

SECTION I - GENERAL

1.1 PURPOSE: To provide the user and support personnel supplemental maintenance and repair parts instructions applicable to the 6,000 Lb. Allis Chalmers Model ACP60PS Forklift Truck.

1.2 SCOPE: This SOMARPI applies to Department of the Army Units, Organizations and Activities that use and/or support the Truck, Lift, Fork, 6,000 Lb., Pneumatic Tire, 180" Lift Height, NSN 393001-052-5050.

1.3 DESCRIPTION: The 6,000 Lb., Gasoline Engine Driven, Pneumatic Tire Forklift Truck is manufactured by Allis Chalmers Corporation, Matteson, Illinois. The truck is a front drive, rear steer vehicle with a lift height of 180". It has a constant mesh power shift transmission. The truck is equipped with hydraulic brakes on both drive wheels and a parking brake is mounted on the differential. It has a roller type lift assembly with two independent lift chains. A control valve to operate the hydraulic lift and tilt cylinders is located to the right of the operator. The instrument panel includes: a gas gauge, oil pressure gauge, ammeter and a direct reading engine hourmeter. The vehicle has a 12 volt system consisting of a heavy duty alternator, voltage regulator and starting motor. The truck is equipped with power steering. The truck has a six cylinder Continental Engine.

1.4 OPERATIONAL CONCEPT: The 6,000 Lb. Allis Chalmers Model ACP60PS is intended to be used for stacking, unstacking and moving cargo in and around warehouses, loading platforms and docks within the military supply system; also for moving cargo in and out of highway trailers and railroad cars. Trucks are intended for operation over paved, semi-prepared and other hard surfaces for short distances.

1.5 PROCUREMENT STATUS: The procurement contract number is DSA 700-76-C-8536.

1.6 EQUIPMENT PUBLICATIONS

a. This technical manual, TM 10-3930-645-14&P, will be the sole publication concerning the use and support of the Truck, Fork Lift, 6,000-pound capacity, pneumatic tire, 180-inch lift height, Allis-Chalmers ACP-60-PS, Army Model MHE 233, NSN 3930-01-052-5050.

b. Request for additional publications should be made through normal Army requisition channels.

1.7 PERSONNEL AND TRAINING

a. AMOS Requirements: Qualitative and Quantitative Personnel Requirements Information (QQPRI) will be disseminated IAW AR 611-1. The following MOS's can operate and maintain the end item.

(1) Operator: 62F & 76V

(2) Organizational Maintenance: 63B & 63G

(3) Direct & General Support Maintenance: 63B, 63G & 63H

b. Training:

(1) New Equipment Training Team (NETT): New Equipment Training Teams are available to major field commands. Request for NETT's should be forwarded to: Commander, US Army Tank-Automotive Command, ATTN: AMSTA-MLT, Warren, MI 48397-5000. Training teams should be requested only when trained personnel are not available in the Command to operate and/or maintain the truck.

(2) New Materiel Introductory Teams (NMIT): Major field commands requiring briefings to Command Staff and Users should forward their requests to Commander, US Army Tank-Automotive Command, ATTN: AMSTA-MLT, Warren, MI 48397-5000. Receiving Commands are responsible for the itinerary of NMIT's.

1.8 LOGISTICS ASSISTANCE (AR 700-4): US Army Tank-Automotive Command's Field Maintenance Technicians stationed at CONUS and OCONUS Installations are available to furnish on-site training and/or technical assistance. Assistance can be obtained by contacting and/or technical assistance. Assistance can be obtained by contacting the appropriate Logistics Assistance Office (LAO) listed In Appendix B, AR 700-4.

1.9 WARRANTY: Warranty period for the forklift truck is one year following the date of acceptance by the Government. See Appendix A for warranty claim guidelines (IAW DA Pam 738-750).

1.10 RECOMMENDING PUBLICATION CHANGES: You can Improve this publication by recommending Improvements, using DA Form 2028 (Recommended Changes to Publications and Blank Forms) and mail direct to the Commander, US Army Tank-Automotive Command, ATTN: AMSTA-MBS, Warren, MI 48397-5000.

SECTION II - MAINTENANCE

2.1 MAINTENANCE CONCEPT:

a. The 6,000 Lb. Allis Chalmers Model ACP60PS will not require special or new maintenance considerations. Maintenance operations can be accomplished within the current maintenance support concept for Material Handling Equipment.

b. Nature and Extent of Maintenance:

(1) Maintenance Allocation Chart (MAC): Maintenance will be performed as necessary by the category indicated in the MAC (Appendix B) to retain and/or restore serviceability. Units may exceed their authorized scope and function in the MAC when approved by the appropriate commander.

(2) Operator Maintenance: Operator maintenance is limited to daily preventive maintenance checks and routine servicing. (See Appendix C).

(3) Organizational Maintenance: Organizational maintenance consists of scheduled preventive maintenance services, limited removal, minor repair and adjustments.

(4) Direct-Support Maintenance: Direct Support Maintenance consists of repairs on-site and for return to the user of the end item/assemblies which can be maintained efficiently with a minimum of tools and test equipment.

(5) General Support Maintenance: General Support will overhaul and repair for return to stock items designated by the area support commander.

(6) Depot Maintenance: There is no scheduled depot maintenance on the 6,000 Lb. Allis Chalmers Model ACP60PS.

c. Maintenance Expenditure Limit: The Maintenance Expenditure Limit is based on a life expectancy of 11 Years. Limits on repair are based upon 50% replacement cost through the life expectancy of the end item (See Appendix D).

2.2 RELIABILITY & MAINTAINABILITY: Reliability & Maintainability will be assessed through the field evaluation of current users. Specific numerical RAM requirements or objectives are not established.

2.3 MODIFICATIONS: Modifications will be accomplished by the end item manufacturer after MERADCOM acceptance and TARCOM approval.

2.4 EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR): Equipment Improvement Recommendations will be submitted IAW DA Pam 738-750.

2.5 EQUIPMENT SERVICEABILITY CRITERIA (ESC): For Equipment Serviceability Criteria see Appendix C.

2.6 SHIPMENT AND STORAGE

a. Shipment & Storage: Refer to TB 740-97-2 for procedures covering preservation of equipment for shipment. General procedures for shipment are found in FM 55-15, with more specific information in TM 55-2200-001-12 for rail and TM 55-450-16 series for air transport.

b. Administrative Storage: Refer to TM 740-90-1 for instructions covering administrative storage of equipment.

c. Weight Classification: The weight classification of the end item is 9,750 Lbs.

2.7 DESTRUCTION TO PREVENT ENEMY USE: Refer to and TM 750-244-3 and TM 750-244-6 for instructions governing destruction of equipment to prevent enemy use.

2.8 BASIC ISSUE ITEMS LIST (BIIL): See Appendix E.

2.9 SPECIAL TOOLS AND EQUIPMENT: Special tools and equipment are not required for the 6,000 Lb. Allis Chalmers Model ACP60PS.

2.10 MAINTENANCE AND OPERATING SUPPLY LIST: See Appendix F for a list of maintenance and operating supplies required for initial operation.

2.11 MAINTENANCE FORMS AND RECORDS: Operational, Maintenance and Historical forms and records will be IAW the current DA Pam 738-750.

SECTION III - REPAIR PARTS SUPPLY

3.1 a. The basic policies and procedures in AR 710-2 and AR 725-50 are generally applicable to repair parts management for Material Handling Equipment (MHE) items.

b. Manufacturer's parts manuals are furnished with MHE items instead of Department of the Army Repair Parts and Special Tool List (RPSTL).

c. National Stock Numbers (NSNs) are initially assigned only to PLL/ASL parts and major assemblies and suggested repair parts. Additional NSNs are assigned by the supply support acitvities as demands warrant.

d. Automated Processing (AUTODIN) of Federal Supply Code Manufacturer (FSCM) part number requisitions, without edit for matching NSNs, is authorized.

e. Weapon System Designator Codes on part requisitions are not required.

f. Repair parts are available from commercial sources for CONUS units and may be purchased locally IAW AR 710-2 and AR 735-110.

g. Initial Prescribed Load List (PLL) and Authorized Stockage List (ASL) will be distributed by Tank-Automotive Command (TACOM), AMSTA-FHM, Warren, MI 48397-5000.

3.2 PRESCRIBED LOAD LIST (PLL): The PLL, distributed by TACOM, is an estimated 15 days supply recommended for initial stockage at organizational maintenance. Management of PLL items will be governed by the provisions of AR 710-2 and local command procedures. A prepared list of PLL parts will be provided to OCONUS units before shipment of the end item. Selection of PLL parts for shipment to OCONUS units is based upon the receiving command's recommendations after their review of the TACOM prepared list. Organizations and activities in CONUS will establish PLL stocks through normal requisitioning process (Appendix G). NOTE: Local purchase of repair parts is authorized IAW AR 710-2 and AR 735-110.

3.3 AUTHORIZED STOCKAGE LIST (ASL): The ASL, distributed by TACOM, is an estimated 45 days supply of repair parts for support units and activities. An initial list of ASL parts will be provided to designated support units (OCONUS) before shipment of the end items. The parts shipped will be selected according to the recommendations of the receiving commands. Receiving commands will make their recommendations after review of the initial list distributed by TACOM. Support units and activities in CONUS will establish ASL stocks through the normal requisitioning process (See Appendix G). NOTE: Local purchase of repair parts is authorized IAW AR 710-2 and AR 735-110.

3.4 REQUISITIONING REPAIR PARTS (MIILSTRIP):

a. All MILSTRIP requisitions (DD Form 1348 series) prepared for repair parts support of MHE items will include the use of certain distribution and project codes.

b. Distribution Codes: The distribution code consists of a two part field. The first part (card column 54) designates the control activity that should receive supply and shipping status of all requisitions. The second part (card columns 55-56) identifies the end item by the use of a Weapons System Designator Code.

(1) CONUS customers will use code "F" in card column 54. OCONUS customers will use the appropriate code from Appendix P, paragraph P-3, AR 725-50 (see Appendix H).

(2) The Weapons System Designator Code for the 6,000 Lb. Allis Chalmers Model ACP60PS is not applicable. Card Columns 55 & 56 will be left blank on all requisitions for parts to support the designated end item.

c. Project Codes: The applicable Direct Support System (DSS) Project Code (FM 38-725), are no longer mandatory and are being phased out. However, CONUS and OCONUS customers, submitting non-NSN part number requisitions to the Defense Construction Supply Center (DCSC - Routing Identifier Code - "S9C"), will use MHE project codes "JZM" (OCONUS) and "BGX" (CONUS) in card columns 57-59.

3.5 SUBMITTING REQUISITIONS: Requisitions for NSN parts will be forwarded through the Defense Automated Addressing System (DAAS) to the Managing Supply Support Activity (See Appendix I). Requisitions for non-NSN parts will be forwarded through DAAS to the Defense Construction Supply Center (DCSC) (See Appendix J). Sample formats for requisitioning are found in Appendix K. NOTE: When the manufacturer's part number and federal supply code for manufacturer (FSCM) exceed the space in card columns 8 through 22 of A02/A0B requisitions, prepare an A05/A0E requisition (DD Form

1348-6) and mail it to: Commander, Defense Construction Supply Center, ATTN: DCSC-OSR, Columbus, Ohio 43215.

APPENDIX A

Warranty Guidelines

1. The warranty period is one year after delivery to the Government and applies to all supplies furnished under the contract (NOTE: See data plate on truck for date of delivery).

2. Allis Chalmers is required to extend to the Government the full benefits of the warranties granted by suppliers of major assemblies or components utilized in the end item.

3. The manufacturer's warranty is described in the service manuals (on back of front cover, TM-00-1259): "When a warranty circumstance arises, contact Allis Chalmers Service Administration (312/747-5151, extension 377), informing model, serial number, contract number relating to the particular unit and a summary as to the nature of the problem." Copies of the manual are overpacked with each vehicle.

4. If Allis Chalmers/Service Agency is not available, CONUS units notify the National Maintenance Point (NMP) by telephone, AUTOVON 369-2525/2686. Units, OCONUS, follow warranty reporting procedures in DA Pam 738-750.

5. All Warranty Claims, whether they are settled locally with a manufacturer's representative or processed through normal Army Maintenance Support Channels, must be reported to: US Army Tank-Automotive Command, ATTN: AMSTA-MVM, Warren, MI 48397-5000.

APPENDIX B

Maintenance Allocation Chart
For
Truck, Forklift, GED, PRT, 6,000 Lb.
Capacity, Allis Chalmers Model ACP60PS
NTSN 3930-01-052-5050

Section I - Introduction

1. General: This Maintenance Allocation Chart (MAC) designates responsibility for performance of maintenance functions to specific maintenance categories.

2. Maintenance Functions: Maintenance functions are as follows.

a. Inspect: To determine the serviceability of an item by comparing its physical, mechanical and/or electrical characteristics with established standards through examination.

b. Test: To verify serviceability and detect incipient failures by measuringr the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service: Operations required periodically to keep en item in proper operating condition; i.e., to clean (decontaminate), to preserve, to drain, to paint or to replenish fuel, lubricants, hydraulic fluids or compressed air supplies.

d. Adjust: To maintain, within prescribed limits, by bringing into proper or exact position or by setting the operating characteristics to specified parameters.

e. Align: To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate: To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Install: The act of emplacing, seating or fixing into position on item, part or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. Replace: The act of substituting a serviceable like type part, subassembly or module (component or assembly) for an unserviceable counterpart.

i. Repair: The application of maintenance services or other maintenance actions to restore serviceability to an item by correcting specific damage, fault, malfunction or failure in a part, subassembly, module (component or assembly), end item or system.

j. Overhaul: That maintenance effort (service/action) necessary to restore en item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMNR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild: Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc) considered in classifying Army equipment/components.

3. Column Entries: Columns used in the MAC are explained below:

a. Column 1 - Group Number: Column One (1) lists group numbers from TB 750-93-1, the purpose of which is to identify components, assemblies, subassemblies and modules with their next higher assemblies.

b. Column 2 - Component/Assembly: Column Two (2) contains the noun names of components, assemblies, subassemblies and modules for which maintenance is authorized.

c. Column 3 - Maintenance Functions: Column Three (3) lists the functions to be performed on the item listed in Column 2.

d. Column 4 - Maintenance Category: Column Four (4) specifies, by the listing of a "work time" figure in the appropriate sub column(s), the lowest level of maintenance authorized to perform the function listed in Column 3. This numeric figure represents the active time required to perform that maintenance function at the indicated category of maintenance. The number of man hours specified by the "work time" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the MAC.

e. Column 5 - Tools and Equipment: Column Five (5) specifies by code, those c;.on tool sets (not individual tools) and special tools, test and support equipment required to perform the designated function.

MAINTENANCE ALLOCATION CHART
SECTION II - ASSIGNMENT OF MAINTENANCE FUNCTIONS

(1)	(2)	(3)	(4)					(5)	(6)
GROUP NUMBER	COMPONENT/ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE CATEGORY					TOOLS AND EQUIP.	REMARKS
			C	O	F	H	D		
01	Engine								
0100	Engine Assembly	Service	0.4					1-11	
		Replace			6.0				
		Repair				12.0			
		Overhaul				28.0			
0101	Block, Short Assembly	Replace				8.0		1-11	
		Repair				16.0			
	Cylinder Head	Replace			2.0			1-11	
		Repair				3.0			
0102	Crankshaft	Replace				6.0		1-11	
		Repair				8.0			
	Gear, Crankshaft	Replace			4.5			1-11	
	Gear, Hydraulic	Replace			4.0			1-11	
0103	Flywheel Assembly	Replace			4.0			1-11	
		Repair			8.0				
	Gear, Ring	Replace			4.0			1-11	
0104	Pistons, Connecting Rods	Replace				4.2			
0105	Valves (Exhaust & Intake)	Adjust		1.5				1-11	
		Replace			3.5				
	Camshaft	Replace			6.0			1-11	
	Gear & Cover	Replace			4.0			1-11	
0106	Oil Pump	Replace			3.5			1-11	
		Repair				6.0			
	Oil Filter	Replace		0.5				1-4	
	Oil Pan	Replace			2.5			1-11	
0108	Manifold	Replace		1.0				1-4	
03	Fuel System								
0301	Carburetor	Adjust		0.3				1-4	
		Replace		0.5				1-4	
		Repair			2.0			1-11	

MAINTENANCE ALLOCATION CHART
SECTION II - ASSIGNMENT OF MAINTENANCE FUNCTIONS

(1)	(2)	(3)	(4)					(5)	(6)
GROUP NUMBER	COMPONENT/ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE CATEGORY					TOOLS AND EQUIP.	REMARKS
			C	O	F	H	D		
0302	Fuel Pump	Test		0.3				1-4	
		Replace		0.5				1-4	
	Lines, Fittings & Hoses	Replace		0.7				1-4	
0304	Air Cleaner & Indicator	Service		0.2				1-4	
		Replace		0.3				1-4	
0306	Fuel Tank	Service	0.2					1-11	
		Replace			1.0				
	Fuel Lines & Fittings	Replace		0.5				1-4	
0308	Governor	Replace		0.4				1-4	
		Repair			1.0			1-11	
0309	Filter Fuel	Replace		0.2				1-4	
0312	Accelerator, Throttle Controls	Replace		1.5				1-4	
04	Exhaust System								
0401	Muffler	Replace		0.6				1-4	
	Exhaust Pipe	Replace		0.6				1-4	
05	Cooling System								
0501	Radiator	Service	0.2	0.3				1-4	
		Replace		1.2				1-4	
		Repair			2.5			1-11	
0503	Thermostat	Test		0.5				1-4	
		Replace		0.5				1-4	
	Hoses, Upper & Lower	Replace		0.6				1-4	
0504	Water Pump Assembly	Replace		0.5				1-4	
		Overhaul			1.5			1-11	
0505	Fan, Assembly	Replace		0.4				1-4	
	Fan Belt	Replace		0.3				1-4	

MAINTENANCE ALLOCATION CHART
SECTION II - ASSIGNMENT OF MAINTENANCE FUNCTIONS

(1)	(2)	(3)	(4)					(5)	(6)
GROUP NUMBER	COMPONENT/ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE CATEGORY					TOOLS AND EQUIP.	REMARKS
			C	O	F	H	D		
06	Electrical System								
0601	Alternator	Test		0.2				1-4	
		Replace		0.5				1-4	
		Repair			1.5			1-11	
	Regulator	Replace			1.0			1-11	
0603	Starter Motor	Test		0.3				1-4	
		Replace		0.5				1-4	
		Repair			2.5			1-11	
	Switch, Starter Ignition	Replace		0.4				1-4	
0605	Distributor Assembly	Adjust		0.3				1-4	
		Replace		0.5				1-4	
	Ignition Coil	Replace		0.3				1-4	
	Wiring	Replace		0.2				1-4	
	Spark Plugs	Replace		0.3				1-4	
0607	Instructions, Panel	Replace		1.0				1-4	
		Repair			1.4			1-11	
	Hourmeter	Replace		0.3				1-4	
	Ammeter	Replace		0.3				1-4	
	Gauge, Oil Pressure	Replace		0.4				1-4	
	Gauge, Engine Temp.	Replace		0.3				1-4	
	Gauge, Fuel	Replace		0.3				1-4	
0608	Switch, Light	Replace		0.2				1-4	
	Box, Fuse	Replace		0.3				1-4	
0609	Lights, Headlights & Taillights	Replace		0.3				1-4	
0610	Sending Unit (Fuel, Oil & Temp)	Replace		0.4				1-4	

MAINTENANCE ALLOCATION CHART
SECTION II - ASSIGNMENT OF MAINTENANCE FUNCTIONS

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQUIP.	(6) REMARKS
0611	Horn, Relay & Wiring	Test		0.1				1-4	
		Replace		0.3				1-4	
0612	Battery	Service	0.2					1-4	
		Test		0.2				1-4	
		Replace		0.5				1-11	
		Repair			1.0				
07	Transmission								
0710	Transmission Assembly	Service	0.5	0.7				1-4	
		Test			1.0			1-11	
		Replace			6.0			1-11	
		Repair				8.0		1-11	
		Overhaul				16.0		1-11	
	Transmission Shafts & Gears	Replace				4.0		1-11	
0708	Torque Converter & Drive Plate	Replace			1.0			1-11	
0713	Transmission Clutch Forward & Reverse	Replace				8.0		1-11	
		Overhaul				10.0		1-11	
0714	Transmission Control Valve	Replace				1.5		1-11	
		Repair				3.5		1-11	
0714	Transmission Shift Lever & Linkage	Adjust		0.3				1-4	
		Replace		0.5				1-4	
0721	011 Filter, Transmission	Replace		0.4				1-4	
09	Propeller Shaft								
0900	Propeller Shaft	Service	.2					1-4	
		Replace			0.8			1-11	
		Repair			1.5			1-11	
10	Front Axle (Drive)								
1000	Front Axle Assembly	Service		0.5				1-4	
		Replace				4.0		1-11	
		Repair				8.0		1-11	
	Spindle, Axle	Replace			0.7			1-11	
	Axle Shaft	Replace			1.0			1-11	

MAINTENANCE ALLOCATION CHART
SECTION II - ASSIGNMENT OF MAINTENANCE FUNCTIONS

(1)	(2)	(3)	(4)					(5)	(6)
GROUP NUMBER	COMPONENT/ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE CATEGORY					TOOLS AND EQUIP.	REMARKS
			C	O	F	H	D		
	Bearings & Seals Axle Shaft	Replace				0.5		1-11	
1002	Differential Carrier	Replace Repair			4.0 8.0			1-11 1-11	
	Differential Assembly	Replace Repair			1.5 4.0			1-11 1-11	
1002	Ring Gear & Pinion	Replace			8.0			1-11	
	Pinion Seal & Bearings	Replace			1.5			1-11	
11	Rear Axle (Steering)								
1100	Rear Axle Assembly	Service Replace Repair Adjust		0.5 0.8	 4.0 6.0 			1-4 1-11 1-11 1-4	
	Spindle, Right or Left	Service Replace		0.3 	 1.5			1-4 1-11	
	Axle King Pin & Needle Bearings	Service Replace		0.3 	 1.5			1-4 1-11	
	Pivot Arm & Bearings	Service Replace		0.3 	 1.5			1-4 1-11	
	Axle Mounting, Trunnion Bearings & Housing	Service Replace		0.5 	 2.0			1-4 1-11	
	Tie Rods, Right & Left	Adjust Replace Service		0.4 0.3	 1.5 			1-4 1-11 1-4	
12	Brakes								
1201	Hand Brakes, Lever & Linkage	Adjust Service Replace		0.4 0.3 	 1.5			1-4 1-4 1-11	
	Parking Brake	Replace Repair			1.0 1.5			1-11 1-11	

MAINTENANCE ALLOCATION CHART
SECTION II - ASSIGNMENT OF MAINTENANCE FUNCTIONS

(1)	(2)	(3)	(4)					(5)	(6)
GROUP NUMBER	COMPONENT/ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE CATEGORY					TOOLS AND EQUIP.	REMARKS
			C	O	F	H	D		
1202	Service Brake	Service		0.4				1-4	
		Replace			4.0			1-11	
		Repair			6.0			1-11	
1204	Hydraulic Brake System	Service		0.3				1-4	
	Master Cylinder	Replace		1.0				1-4	
	Wheel Cylinder	Replace			2.0			1-11	
1206	Brake Pedal & Linkage	Replace		0.6				1-4	
		Repair		0.8				1-4	
13	Wheels								
1311	Wheel Assembly	Replace		0.6				1-4	
	Bull Gear	Replace		1.0				1-4	
	Bearings & Seals	Replace		1.0				1-4	
1313	Tires, Pneumatic with Tube	Inspect	0.1					1-4	
		Service	0.1					1-4	
		Replace		1.0				1-4	
		Repair			1.0			1-11	
14	Steering								
1407	Steering Wheel	Replace		0.5				1-4	
	Steering Column & Shaft	Replace			2.5			1-11	
	Steering Cylinder	Service		0.3				1-4	
		Replace			1.5			1-11	
		Repair			2.5			1-11	
1411	Hoses, Lines & Fittings	Replace			0.8			1-11	
		Repair			0.5			1-11	
	Hydraulic Filter Assembly	Replace		0.3				1-4	
	Hydraulic Filter Element	Replace		0.3				1-4	

MAINTENANCE ALLOCATION CHART
SECTION II - ASSIGNMENT OF MAINTENANCE FUNCTIONS

(1)	(2)	(3)	(4)					(5)	(6)
GROUP NUMBER	COMPONENT/ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE CATEGORY					TOOLS AND EQUIP.	REMARKS
			C	O	F	H	D		
1412	Hydraulic Cylinder	Replace		1.2				1-4	
		Repair			2.0			1-11	
1414	Steering Control Valve	Replace			1.0			1-11	
18	Body, Cab, Hood & Hull								
1801	Overhead Guard	Replace		0.5				1-4	
		Repair			1.0			1-11	
	Body Panel & Hoods	Replace		0.3				1-4	
		Repair			0.5			1-11	
1806	Seat Cushions Adjuster & Slide	Adjust	0.2					1-4	
		Replace		0.5				1-4	
		Repair			0.7			1-11	
24	Hydraulic Lift Compartment								
2401	Hydraulic Pump	Test			0.2			1-11	
		Replace			.7			1-11	
		Repair				2.0		1-11	
2402	Hydraulic Control Valve	Replace			1.0			1-11	
		Repair			2.0			1-11	
2403	Hydraulic Control Levers & Linkage	Replace		0.5				1-4	
		Repair			1.0			1-11	
2404	Hydraulic Tilt Cylinder	Replace			1.0			1-11	
		Repair			2.5			1-11	
2405	Cluster Cylinder	Replace			2.5			1-11	
		Repair				5.0		1-11	
2405	Mast & Carriage Assembly	Service		0.3				1-4	
		Adjust		0.3				1-4	
		Repair			3.5			1-11	
		Replace			2.0			1-11	
2406	Hydraulic Lines & Fittings	Replace			1.0			1-11	
2408	Oil Reservoir	Service		0.3				1-4	
		Replace			2.0			1-11	

MAINTENANCE ALLOCATION CHART

SECTION III - TOOL AND TEST EQUIPMENT REQUIREMENTS				
TOOL OR TEST EQUIPMENT REFERENCE CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
		Unless otherwise noted, all maintenance functions can be accomplished with the tools contained in the following common tool sets.		
1.	O,F,H	Tool Kit, General Mechanic Auto; Auto; SC 5180-90 CL-N26	5180-00-177-7033	W33004
2.	O,F,H	Shop Equipment, Auto Maint & Repair: Org Maint Common No. 1 - Less Power; SC 4910-95-CL-A74	4910-00-754-0654	W32593
3.	O,F,H	Shop Equipment, Auto Maint & Repair: Org Maint Supplemental No. 1 - Less Power; SC 4910-95 CL-A73	4910-00-754-0653	W32867
4.	O,F,H	Shop Equipment, Auto Maint & Repair: Org Common No. 2 - Less Power SC 4910-95-CL-A72	4910-00-754-0650	W32730
5.	F,H	Shop Set, Fuel & Electrical Systems, FM Basic - Less Power; SC 4910-95 CL-A01	4910-00-754-0714	T30414
6.	F,H	Shop Set, Auto Maint & Repair, FM Basic - Less Power; SC 4910-95-CL-A31	4910-00-754-0705	T24660
7.	F,H	Shop Set, Fuel & Electrical System, FM Supplemental No. 1 - Less Power; SC 4910-95-CL-A64	4910-00-390-7774	T30551
8.	F,H	Shop Equipment, Auto Maint & Repair: FM Supplemental No. 1 - Less Power; SC 4910-95-CL-A62	4910-00-754-0706	T24519

MAINTENANCE ALLOCATION CHART

SECTION III - TOOL AND TEST EQUIPMENT REQUIREMENTS				
TOOL OR TEST EQUIPMENT REFERENCE CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
9	F,H	Shop Set, Fuel & Electrical Systems: FM Supplemental 2 - Less Power; SC 4910-95-CL-A65	4910-00-390-7775	T30688
10	F,H	Tool Kit, Master Mechanics; SC 5180-90-CL-N04	5180-00-699-5273	W45060
11	F,H	Shop Equipment, Welding: FM; SC 3470-95-CL-A08	3470-00-357-7268	T16714
12	F,H	Tool Kit, Welders; SC 5180-90-CL-N39	5180-00-754-0661	W58075

SECTION IV. REMARKS

REFERENCE CODES	REMARKS)
NONE	NONE

APPENDIX C

PREVENTIVE MAINTENANCE CHECKS AND SERVICES

1. Do your before (B) PREVENTIVE MAINTENANCE just before you operate the vehicle. Pay attention to the CAUTIONS AND WARNINGS.

2. Do your (D) PREVENTIVE MAINTENANCE during operation. (During operation means to monitor the forklift and its components/systems while they are actually being operated).

3. Do your after (A) PREVENTIVE MAINTENANCE right after operating the vehicle. Pay attention to the CAUTIONS and WARNINGS.

4. Do your weekly (W) PREVENTIVE MAINTENANCE weekly.

5. Do your monthly (M) PREVENTIVE MAINTENANCE once a month.

6. If something doesn't work, troubleshoot it with the instructions in your commercial manual, TM-00-1259, page 2-11, or notify your supervisor.

7. Always do your PREVENTIVE MAINTENANCE in the same order so it gets to be a habit. Once you've had some practice, you'll spot anything wrong in a hurry.

8. If anything looks wrong and you can't fix it, write it on your DA Form 2404. If you find something seriously wrong, report it to organizational maintenance RIGHT NOW.

9. When you do your PREVENTIVE MAINTENANCE, take along the tools you will need to make all the checks. Take along a rag, you'll always need at least one.

WARNING

DRY CLEANING SOLVENT, USED TO CLEAN PARTS IS POTENTIALLY DANGEROUS TO PERSONNEL AND PROPERTY. DO NOT USE NEAR OPEN FLAME OR EXCESSIVE HEAT. FLASH POINT OF THIS SOLVENT IS 138°F.

A - Keep it clean: Dirt, grease, oil and debris only get in the way and may cover up a serious problem. Clean as you work and as needed. Use dry cleaning solvent (SD-2) on all metal surfaces. Use soap and water when you clean rubber or plastic material.

B - Bolts, nuts and screws: Check them all for obvious looseness; missing, bent or broken condition. You can't try them all with a tool, of course, but look for chipped paint, bare metal, or rust around bolt heads. If you find one you think is loose, tighten it, or report it to organizational maintenance if you cannot tighten it.

C - Welds: Look for loose or chipped point, rust or gaps where parts are welded together. If you find a bad weld, report it to organizational maintenance.

D - Electric wires and connectors: Look for cracked or broken insulation, bare wires, and loose or broken connectors. Tighten loose connectors and make sure the wires are in good shape.

E - Hoses and fluid lines: Look for wear, damage and leaks and make sure clamps and fittings are tight. Wet spots show leaks, of course, but a stain around a fitting or connector can mean a leak. if a leak comes from a loose fitting or connector, tighten it. If something is broken or worn out, report it to direct support maintenance.

11. It is necessary for you to know how fluid leakage affects the status of your vehicle. The following are definitions of the types/classes of leakage you need to know to be able to determine the status of your vehicle. Learn, then be familiar with them and REMEMBER - WHEN IN DOUBT, NOTIFY YOUR SUPERVISOR!

Leakage Definitions for Organizational PMCS

Class I	Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.
Class II	Leakage of fluid great enough to form drops but not enough to cause drops to drip from item being checked/ inspected.
Class III	Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

CAUTION

EQUIPMENT OPERATION IS ALLOWABLE WITH MINOR LEAKAGES (CLASS I OR II). OF COURSE, CONSIDERATION MUST BE GIVEN TO THE FLUID CAPACITY IN THE ITEM/SYSTEM BEING CHECKED/INSPECTED. WHEN IN DOUBT, NOTIFY YOUR SUPERVISOR.

WHEN OPERATING WITH CLASS I OR II LEAKS, CONTINUE TO CHECK FLUID LEVELS AS REQUIRED IN YOUR PMCS.

CLASS III LEAKS SHOULD BE REPORTED TO YOUR SUPERVISOR OR DIRECT SUPPORT.

OPERATOR/CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B-BEFORE D-DURING A-AFTER W-WEEKLY M-MONTHLY

ITEM NO	INTERVAL B	D	A	W	M	ITEM TO BE INSPECTED PROCEDURE: CHECK FOR AND HAVE REPAIRED, FILLED OR ADJUSTED AS NEEDED	EQUIPMENT IS NOT READY/ AVAILABLE IF:
						IMPORTANT: PERFORM WEEKLY AS WELL AS BEFORE OPERATIONS PMCS IF: 1. YOU ARE THE ASSIGNED OPERATOR AND HAVE NOT OPERATED THE ITEM SINCE THE LAST WEEKLY. 2. YOU ARE OPERATING THE ITEM FOR THE FIRST TIME. NOTE: HAVE ORGANIZATIONAL MAINTENANCE ADJUST ENGINE VALVE CLEARANCE AFTER FIRST 50 HOURS OF OPERATION.	
1						EXTERIOR OF VEHICLE	
	•					a. Check for leaks or appearance of leaks.	Class III leaks or any fuel leak.
	•					b. Visually check overhead guard for obvious cracks in welds.	Obvious cracks in welds.
2	•					HYDRAULIC RESERVOIR Check reservoir oil level, add oil if necessary to bring level up to full mark on dipstick, when mast is lowered and all cylinders retracted.	
3	•					TIRES Check tires for wear and correct pressure (100 psi)	Tire is flat.

OPERATOR/CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B-BEFORE D-DURING A-AFTER W-WEEKLY M-MONTHLY

ITEM NO	INTERVAL B	D	A	W	M	ITEM TO BE INSPECTED PROCEDURE: CHECK FOR AND HAVE REPAIRED, FILLED OR ADJUSTED AS NEEDED	EQUIPMENT IS NOT READY/ AVAILABLE IF:
4				•		RADIATOR Check radiator to insure that coolant is one inch below bottom of filler tube (add 50/50 mixture of water and antifreeze) (reference TB 750-651).	
5	•					ENGINE OIL LEVEL Check oil dipstick, add oil, if needed, to raise level to full mark.	
6			•			AIR CLEANER Check element to insure it's clean, wash if needed in warm soapy water (after six washings, have organizational maintenance replace it).	Element is missing or damaged.
7		•				HORN Check horn by pressing button.	
8		•				BRAKES Check that normal brake pressure stops truck.	Service brake will not atop truck.
9		•				STEERING Check that truck steers free & easy.	Steering sticks or truck is hard to steer.

OPERATOR/CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B-BEFORE D-DURING A-AFTER W-WEEKLY M-MONTHLY

ITEM NO	B	D	A	W	M	ITEM TO BE INSPECTED PROCEDURE: CHECK FOR AND HAVE REPAIRED, FILLED OR ADJUSTED AS NEEDED	EQUIPMENT IS NOT READY/ AVAILABLE IF:
10		•				ACCELERATOR	
						Check that accelerator goes smoothly.	Pedal sticks
11		•				LIFT LEVER	
						Check that lifting and lowering is smooth.	Lifting or lowering jerky or uncontrollable.
12		•				TILT LEVER	
						Check that forward and backward tilt is smooth and immediate.	Tilt does not operate.
13		•				LIGHTS	
						Check that lights are working and properly aligned.	
14						INSTRUMENT PANEL	
						Check for normal operating readings.	
		•				(1) Oil pressure gauge - More than five psi at idle speed, maximum operating range 30-40 psi,	
		•				(2) Ammeter - Registers above discharge when engine is operated at above idle speed.	Readings on gauges do not fall within specified ranges.
		•				(3) Water temperature - Registers below red portion of gauge.	
		•				(4) Transmission temperature gauge - Registers below 210°F.	

OPERATOR/CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B-BEFORE D-DURING A-AFTER W-WEEKLY M-MONTHLY

ITEM NO	INTERVAL B	D	A	W	M	ITEM TO BE INSPECTED PROCEDURE: CHECK FOR AND HAVE REPAIRED, FILLED OR ADJUSTED AS NEEDED	EQUIPMENT IS NOT READY/ AVAILABLE IF:
15				•		STEER AXLE STOPS Check to insure they are present and not damaged.	
16				•		BATTERY Inspect for electrolyte level, add distilled water if required (reference TM 9-6140-200-14).	Battery cracked or discharged.
17				•		RADIATOR ENGINE COMPARTMENT Inspect/clean air passages.	
18					•	BREATHER CAP ENGINE Remove and wipe clean.	
19					•	FAN BELT Inspect for frayed condition.	Belt missing, frayed or broken.

ORGANIZATIONAL
PREVENTIVE MAINTENANCE CHECKS AND SERVICES

1. Do your (Q) PREVENTIVE MAINTENANCE once each 3 months.

2. Do your (S) PREVENTIVE MAINTENANCE once each 6 months.

3. Do your (A) PREVENTIVE MAINTENANCE once each year.

4. Do your (B) PREVENTIVE MAINTENANCE once each two years.

5. Do your (H) PREVENTIVE MAINTENANCE at the hour interval listed.

6. Do your (MI) PREVENTIVE MAINTENANCE when the mileage of the vehicle reaches the amount listed.

7. If something doesn't work, troubleshoot it with the instructions in your commercial manual or notify your supervisor.

8. Always do your PREVENTIVE MAINTENANCE in the same order so it gets to be a habit. Once you've had some practice, you'll spot anything wrong in a hurry.

9. If anything looks wrong and you can't fix it, write it on your DA Form 2404. If you find something seriously wrong, report it to direct support maintenance RIGHT NOW.

10. When you do your PREVENTIVE MAINTENANCE, take along the tools you will need to make all the checks. Take along a rag, you'll always need at least one.

WARNING

DRY CLEANING SOLVENT, USED TO CLEAN PARTS IS POTENTIALLY DANGEROUS TO PERSONNEL AND PROPERTY. DO NOT USE NEAR OPEN FLAME OR EXCESSIVE HEAT. FLASH POINT OF THIS SOLVENT IS 138°F

A - Keep it clean: Dirt, grease, oil, and debris only get in the way and may cover up a serious problem. Clean as you work and as needed. Use dry cleaning solvent (SD-2) on all metal surfaces. Use soap and water when you clean rubber or plastic material.

B - Bolts, nuts, and screws: Check them all for obvious looseness, missing, bent or broken condition. You can't try them all with a tool, of course, but lock for chipped paint, bare metal, or rust around bold heads. If you find one you think is loose, tighten it, or report it to direct support maintenance if you can not tighten it.

C - Welds: Look for loose or chipped paint, rust or gaps where parts are welded together. If you find a bad weld, report it to direct support maintenance.

D - Electric wires and connectors: Look for cracked or broken insulation, bare wires, and loose or broken connectors. Tighten loose connectors and make sure the wires are in good shape.

E - Hoses and fluid lines: Look for wear, damage and leaks and make sure clamps and fittings are tight. Wet spots show leaks, of course. But a stain around a fitting or connector can mean a leak. If a leak comes from a loose fitting or connector, tighten it. If something is broken or worn out, report it to organizational maintenance.

10. It is necessary for you to know how fluid leakage affects the status of your vehicle. The following are definitions of the types/classes of leakage you need to know to be able to determine the status of your vehicle. Learn, then be familiar with them and REMEMBER - WHEN IN DOUBT, NOTIFY YOUR SUPERVISOR!

Leakage Definitions for Crew/Operator PMCS

Class I	Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.
Class II	Leakage of fluid great enough to form drops but not enough to cause drops to drip from item being checked/ inspected.
Class III	Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

CAUTION

EQUIPMENT OPERATION IS ALLOWABLE WITH MINOR LEAKAGES (CLASS I OR II). OF COURSE, CONSIDERATION MUST BE GIVEN TO THE FLUID CAPACITY IN THE ITEM/SYSTEM BEING CHECKED/INSPECTED. WHEN IN DOUBT, NOTIFY YOUR SUPERVISOR.

WHEN OPERATING WITH CLASS I OR II LEAKS, CONTINUE TO CHECK FLUID LEVELS AS REQUIRED IN YOUR PMCS.

CLASS III LEAKS SHOULD BE REPORTED TO YOUR SUPERVISOR.

ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES

Q-Quarterly S-Semiannually A-Annually B-Biennially H-Hours M-Miles

ITEM NO	INTERVAL						ITEM TO BE INSPECTED
	Q	S	A	B	H	MI	PROCEDURE: Check for and have repaired, filled, or adjusted as needed
							NOTE: **Adjust engine valve clearance after <u>first</u> 50 hours of operation.** **NOTE** **Perform Operator/Crew PMCS prior to or in conjunction with organizational PMCS if:.** a. There is a delay between the daily operation of the equipment and the organizational PMCS. b. Regular operator is not assisting/participating.
1					100		<u>MAST ASSEMBLY</u> a. Lubricate sliding and roller contact surfaces. b. Clean and inspect lift chains for bent or cracked links. Check adjustment and lubricate. c. Tighten top mast bolt to 135 ft. lbs. torque.
2					100		<u>BATTERY</u> Inspect specific gravity and charge as required (specific gravity above 1.250 with electrolyte at 80°F)-. Check that cables are secure and clean (reference TM 9-6140-200-14).
3					100		<u>ENGINE</u> a. Drain engine oil, replace oil filter and refill with five & one half quarts (see Appendix E)

ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES

Q-Quarterly S-Semiannually A-Annually B-Biennially H-Hours M-Miles

ITEM NO	INTERVAL Q	S	A	B	H	MI	ITEM TO BE INSPECTED PROCEDURE: Check for and have repaired, filled, or adjusted as needed
							b. Check fan belt tension - 1/2" to 3/4" deflection at point half way between fan and alternator pulleys with about 10 lbs. applied force.
4					100		<u>TRANSMISSION</u> Check fluid level in transmission on dipstick located under the trap door in the floor plate. Engine must be running and transmission in neutral. Parking brake applied. Add transmission fluid to bring level up to full mark on dipstick.
5					100		<u>DRIVE AXLE</u> Check and clean breather located on housing.
6					100		<u>FUEL TANK</u> Clean fuel strainer.
7					100		<u>DIFFERENTIAL</u> Check-oil level with truck on flat surface, add oil to bring level up to <u>inspection plug</u>.
8					200		<u>HYDRAULIC OIL FILTER</u> Replace. Check for leaks.
9					200		<u>TRANSMISSION OIL FILTER</u> Replace. Check for leaks.

ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES

Q-Quarterly S-Semiannually A-Annually B-Biennially H-Hours M-Miles

ITEM NO	INTERVAL						ITEM TO BE INSPECTED
	Q	S	A	B	H	MI	PROCEDURE: Check for and have repaired, filled, or adjusted as needed
10					200		HYDRAULIC OIL RESERVOIR Replace breather.
11					500		ELECTRICAL SYSTEM Check tightness of terminals, wires, cables, and electrical components.
12					500		HOSES, TUBES, AND FITTINGS Inspect, replace or have replaced if necessary, correct any leaks that are evident.
13					500		WHEELS a. Clean and lubricate steer wheel bearings. b. Inspect the brake shoes, have Direct Support replace as necessary (brake lining less than 0.125), turn cylinder if required (not to exceed 0.100).
14					500		BRAKE MASTER CYLINDER Check fluid level and add if necessary to bring level within 3/8" to 1/2" from top of reservoir.
15					500		BRAKE PEDAL Adjust, pedal should not reach floorboard when depressed with 1/2" free play.

ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES

Q-Quarterly S-Semiannually A-Annually B-Biennially H-Hours M-Miles

ITEM NO	INTERVAL						ITEM TO BE INSPECTED
	Q	S	A	B	H	MI	PROCEDURE: Check for and have repaired, filled, or adjusted as needed
16					500		<u>MAST ASSEMBLY</u> a. Check for side play of fork carriage and check chain adjustment if it is not level. b. Remove lift chains, clean and inspect for wear and broken or cracked links. Repair, install, adjust, and lubricate.
17					500		<u>ENGINE</u> a. Replace distributor points (0020 gap). b. Replace spark plugs (0.025 gap), c. Remove and clean/replace PCV valve.
18					500		<u>PARKING BRAKE</u> Check and adjust as necessary.
19					500		<u>CONTROL VALVE</u> Check linkage.
20					500		<u>UNIVERSAL JOINT</u> Check and adjust if necessary.

ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES

Q-Quarterly S-Semiannually A-Annually B-Biennially H-Hours M-Miles

ITEM NO	INTERVAL						ITEM TO BE INSPECTED
	Q	S	A	B	H	MI	PROCEDURE: Check for and have repaired, filled, or adjusted as needed
21					1000		<u>COOLING SYSTEM</u> Drain fluid, flush and refill.
22					1000		<u>TRANSMISSION</u> Drain fluid and refill.
23					1000		<u>DIFFERENTIAL</u> Drain oil and refill.
24					1000		<u>HYDRAULIC OIL RESERVOIR</u> Drain hydraulic oil, flush and refill.

APPENDIX D

Maintenance Expenditure Limits

NSN	Item Identification	Production Year	Years of Life Expectancy	Repair Limitations 50%	30%
3930-01-052-5050	Truck, Lift, Fork, Gasoline Engine Driven, 6,000 Lb. Capacity, 180" Lift, MHE 233	1978	11	1985	1989
		1979	11	1986	1990
		1980	11	1987	1991

APPENDIX E

BIIL

SMR CODE	NATIONAL STOCK NUMBER	DESCRIPTION REF NO. AND MFG CODE	USABLE ON CODE	UNIT OF MEASURE	QTY AUTH
		NOTE: **The following items are overpacked with the Allis Chalmers 6,000 Lb. Model ACP60PS**			
	7520-00-559-9616	Case, Cotton Duck: MIL-B-11743 (81349)		ea	1
	7510-00-889-3494	Log Book Binder: MIL-B-43064		ea	1

NOTE:

Later models will have - 7530-01-065-0166, Equipment Record Folder, each; authorized quantity 1

APPENDIX F

Maintenance and Operating Supply List

NOMENCLATURE: Truck, Lift, Fork, 6,000 Lb., GED, PT, 180” Lift	MAKE: Allis Chalmers	MODEL ACP60PS

MFR PART NO:	NSN 3930-01-052-5050	SERIAL NO. RANGE:	DATE:

COMPONENT APPLICATION	MFR PART NO. OR NAT’L STOCK NO.	DESCRIPTION	QTY REQ F/INITIAL OPN	QTY REQ F/8 HRS OPN	NOTES
Engine	9150-00-186-6668 9150-00-189-6728 9150-00-188-9858 9150-00-188-9859	OE/HDO-10 (5 gal) OE/HDO-10 (55 gal) OE/HDO-30 (5 gal) OE/HDO-30 (55 gal)	5 qts		See Attached Sheet
Fuel Tank	9130-00-264-6218	Bulk: Regular Grade	5 gal	8 gal	
Radiator	6850-00-181-7929	Water Antifreeze (1 gal)	None		
Hydraulic Brake	9150-00-252-6375	HBA	None		
Differential	9150-00-577-5844 9150-00-577-5847 9150-00-257-5440	GO-90 (5 gal) GO-140 (5 gal) GOS (5 gal)	None		
Transmission	*See Engine	OE/HDO-10	None		
Hydraulic Sys	*See Engine	OE/HDO-10	None		
Lubrication Fittings	9150-00-190-0907	GAA (35 lb. can)	None	As Req	

APPENDIX F

LUBRICANTS	CAPACITY	EXPECTED TEMPERATURES			INTERVALS
		Above 32°F Above 0°C	+40°F to -10°F +5° C to -23°F	0°F to -65°F -18°C to -50°C	
OE/HDO OIL, Engine, Heavy Duty					
Oil Can Points		OE/HDO 10	OE/HDO 10	OE/HDO 10	
Hydraulic Reservoir	5.9 gal. (22.3 lit.)				
Engine Crankcase (See Note 4)	5 qts. (4.8 lit.)	OE/HDO 30	OE/HDO 20	OE/HDO 10	
Transmission (See Note 5)	11 qts. (10.4 lit.)	OE/HDO 10	OE/HDO 10	OE/HDO 10	Intervals given are in hours of normal operation.
GO - LUBRICATING OIL, Gear					
Drive Axle	5 pts. (2.3 lit.)	GO140	G090	GOS	
GOS - LUBRICATING OIL, Gear, Sub-zero		ALL TEMPERATURES			
GAA - GREASE, Automotive and Artillery					
HBA - HYDRAULIC FLUID					
Brake Master Cylinder	3 pts. (1.4 lit.)				

NOTES:

1. FOR OPERATION OF EQUIPMENT IN PROTRACTED COLD TEMPERATURES BELOW -10°F. Remove lubricants prescribed in the key for temperatures above -10°F. Relubricate with lubricants specified in the key for temperatures below -10°F (-18°C).

2. OIL CAN POINTS. Every 50 hours lubricate accelerator and parking brake linkage, mast interlock, and control valve linkage, pins and clevises and all exposed adjusting threads with OE/HDO.

3. WHEEL BEARINGS AND BULL GEARS. Every 500 hours remove wheels. clean and inspect all parts, replace damaged or worn parts, repack bearings, and reassemble. Fill bull gear spaces to three-fourths height of teeth with grease GAA.

4. ENGINE CRANKCASE. Add one pint (0.478 liters) when oil filter is replaced.

5. TRANSMISSION. Add one quart (0.946 liters) when filter is replaced.

6. LUBRICANTS: The following is a list of lubricants with the Military Symbols and applicable Specification numbers. OE/HDOMIL-L-2104C, GO MIL-L-2105C, GOS MIL-L-10324, HBA MIL-H-5606, GAA MIL-G-10924

NOTE:

See Also TM-00-1259, page 2-107.

APPENDIX G

PRESCRIBED LOAD LIST/AUTHORIZED STOCKAGE LIST

ITEM: Truck, Forklift, 6,000 Lb., Gas Engine - P.R.T.

CONTRACT NO: DSA-700-76-C-8536

CONTRACTOR: Allis Chalmers, Matteson, Illinois

QUANTITY: 500 each

PREVIOUS PROCUREMENTS:

Contractor	Quantity	Year
Motec	366	FY62
Minn-Moline	74	FY60
Baker	77	FY70
Towmotor	779	FY70
Baker	548	FY68
Yale & Towne	285	FY63

MGR	NSN	PART NUMBER	FSCM	PART DESCRIPTION	U.M.	PLL 1-5	ASL 1-5	UNIT PRICE
S9C	2940-00-986-0276	4878421-9	30612	Filter, Transmission	Ea	1	1	1.03
S9C	2940-00-892-6214	4512207-4	09367	Filter, Lube Oil	Ea	4	10	1.76
S9C	2940-00-421-9655	4907477-6	30612	Element Filter, Hyd	Ea	1	2	1.15

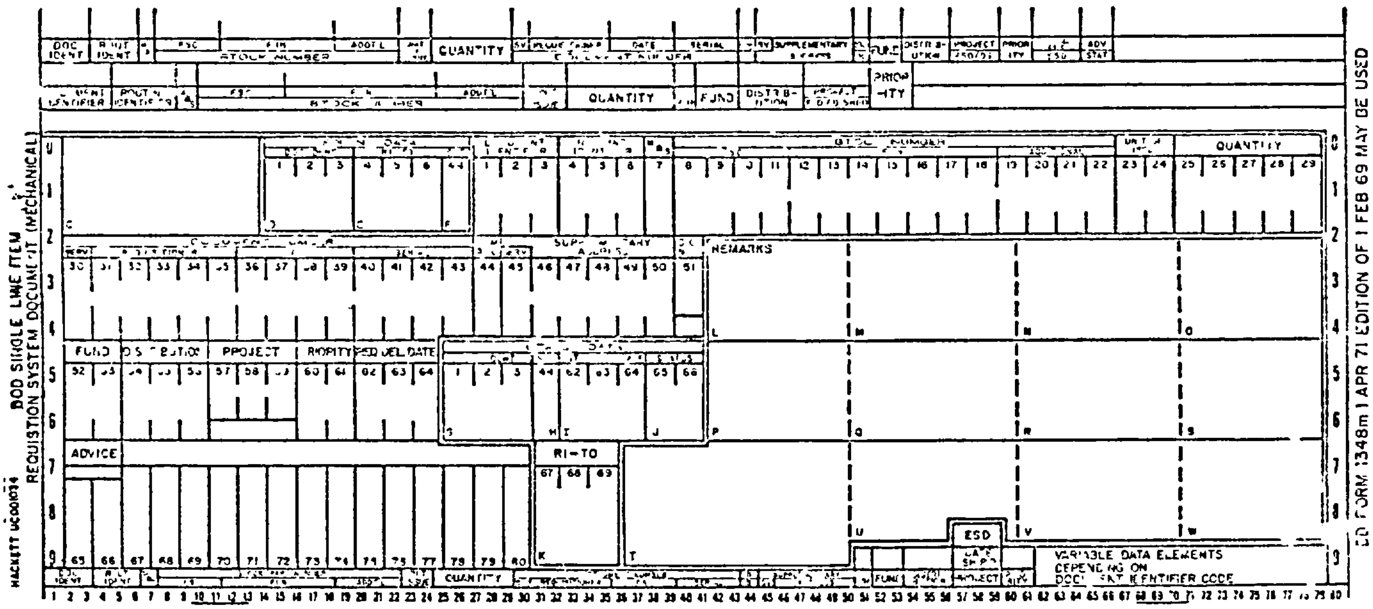
MGR	NSN	PART NUMBER	FSCM	PART DESCRIPTION	U.M.	PLL 1-5	ASL 1-5	UNIT PRICE
S9C	3030-00-567-9211	MS51066-36	96906	Belt, Fan	Ea	1	2	3.12
S9C	2920-00-293-5219	4910105-8	30612	Spark, Plug	Ea	6	24	.42
S9C	2920-00-888-9761	4909100-2	30612	Contact Points	Ea	1	3	.42
S9E	5910-00-521-5159	4909101-0	19728	Condenser	Ea	1	3	.39
S9C	2920-01-026-6649	4909993-0	30612	Cap, Distributor	Ea	0	1	7.95
S9C	2920-00-041-2543	4909103-6	30612	Rotor	Ea	1	3	.95
S9C	2940-01-054-5345	4907795-1	30612	Element, Air Cleaner	Ea	1	6	1.99

NOTE:

All ASL/PLL items are SMR Coded PAOZZ.

APPENDIX H

Distribution Codes



CC 55 & 56
Leave Blank

CC 54

CONUS customers will use "F" in column 54.

OCONUS customers will use the appropriate code below.

(extracted from Appendix P, paragraph P-3, AR 725-50, dated 29 Aug 75, with Change 1). Codes & Activities below:

A ---US Army Alaska Support Command
Fort Richardson, Alaska
APO Seattle, WA 98749

B ---USA International Logistics Center
New Cumberland Army Depot
New Cumberland, PA 17070 (For transceiver and mail)

D	US Army Security Agency Supply and Maintenance Center Vint Hill Farms Station Warrenton, VA 22186
E	US Army Aviation Systems Command P.O. Box 209 St. Louis, MO 63166
*F	US Army Logistics Control Activity Presidio of San Francisco, CA 94129
H	US Army Support Command, Hawaii (USASCH) Schofield Barracks, Hawaii APO San Francisco 96557
I	US Army Troop Support Command 4300 Goodfellow Boulevard St. Louis, MO 63120
J	US Army Supply and Maintenance Activity, Sagami (USASMAS) Sagami, Japan APO San Francisco 96343
K	US Army Inventory Management Center Camp Henery, Taegu, Korea APO San Francisco 96212
L	US Army Missile Command Redstone Arsenal, AL 35809
M	Reserved (DA)
O	Reserved (DA)
P	US Army Electronics Command ATTN: Director of Materiel Management Fort Monmouth, NJ 07703
Q	US Army Materiel Command, Europe APO New York 09052
R	Director for Supply Operations US Army Base Command, Okinawa APO San Francisco 96248

S --US Army Armament Command
Rock Island, IL 61202

T---Reserved (DA)

*U ---US Army Medical Materiel Agency
Fredrick, MD 21701

V --Reserved (DA)

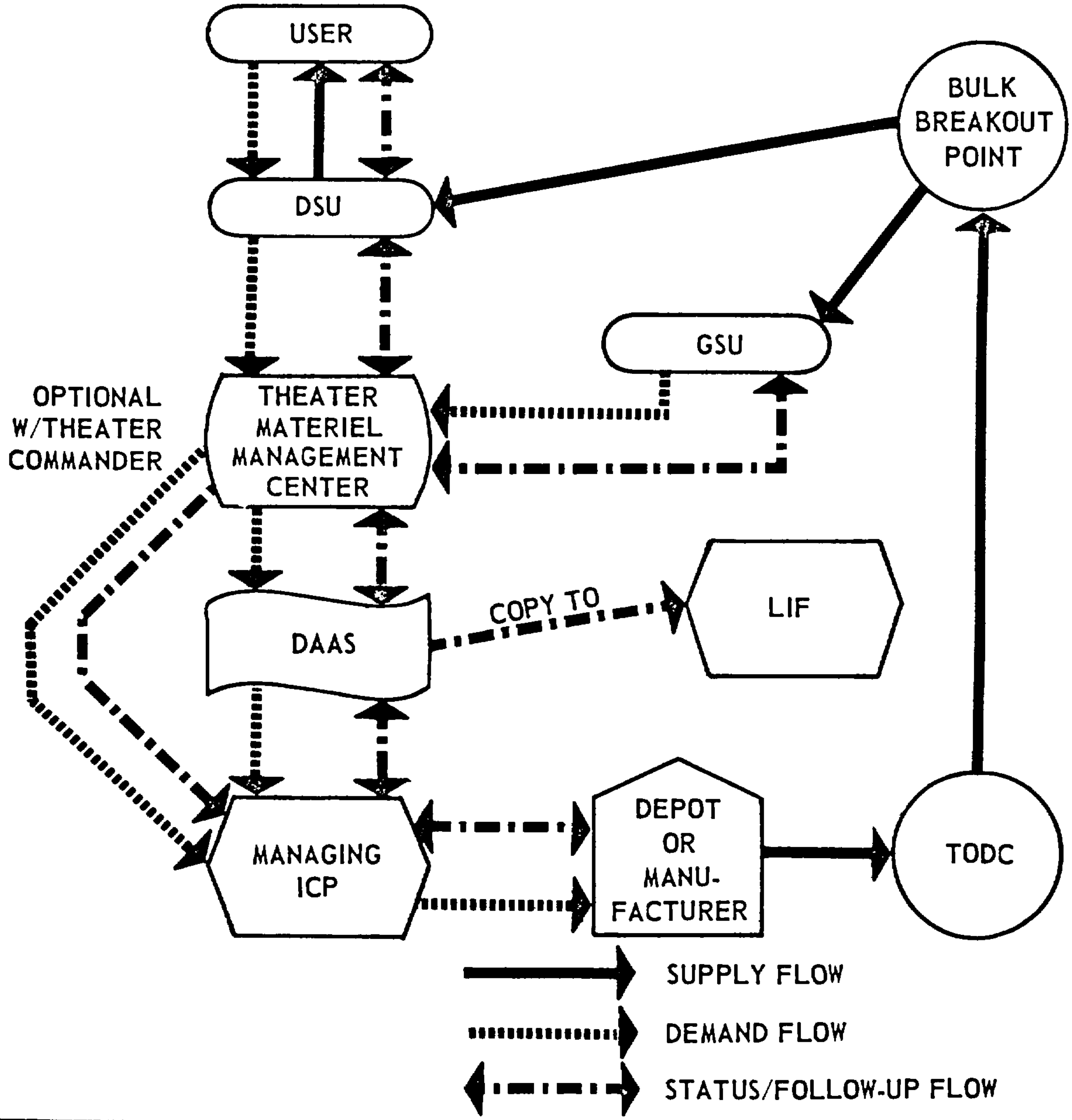
W ---Reserved (DA)

X---Reserved (DA)

Y --US Army Tank-Automotive Commands
Warren, MI 48090

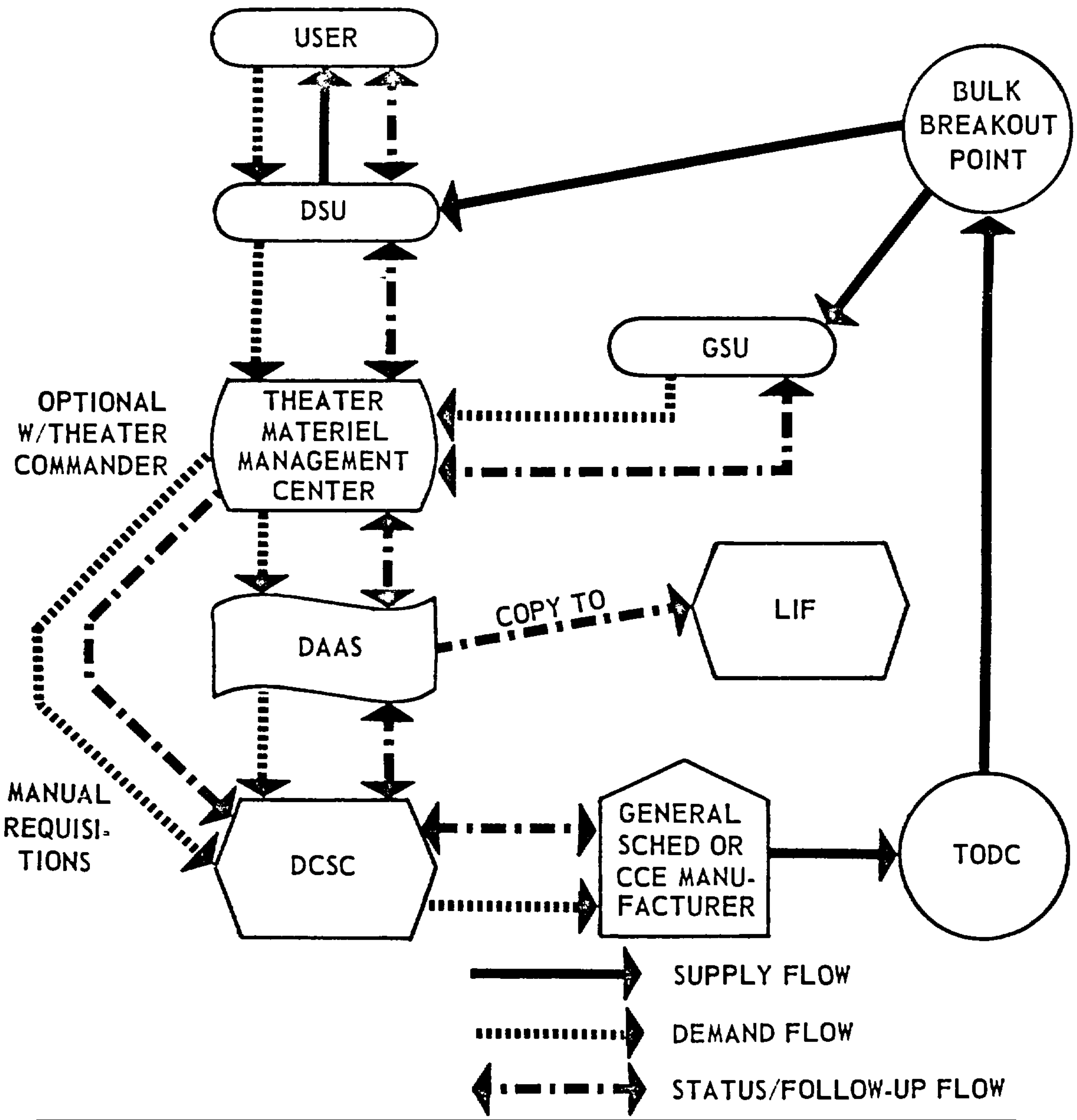
Z---Directorate for Inventory Control
US Army Medical Materiel Center, Europe
Einseidlerhof, Germany
APO New York 09227

FLOW OF REQUISITIONS AND MATERIEL
CCE PARTS (NSN)



TA 126332

FLOW OF REQUISITIONS AND MATERIEL
CCE PARTS (NON-NSN)

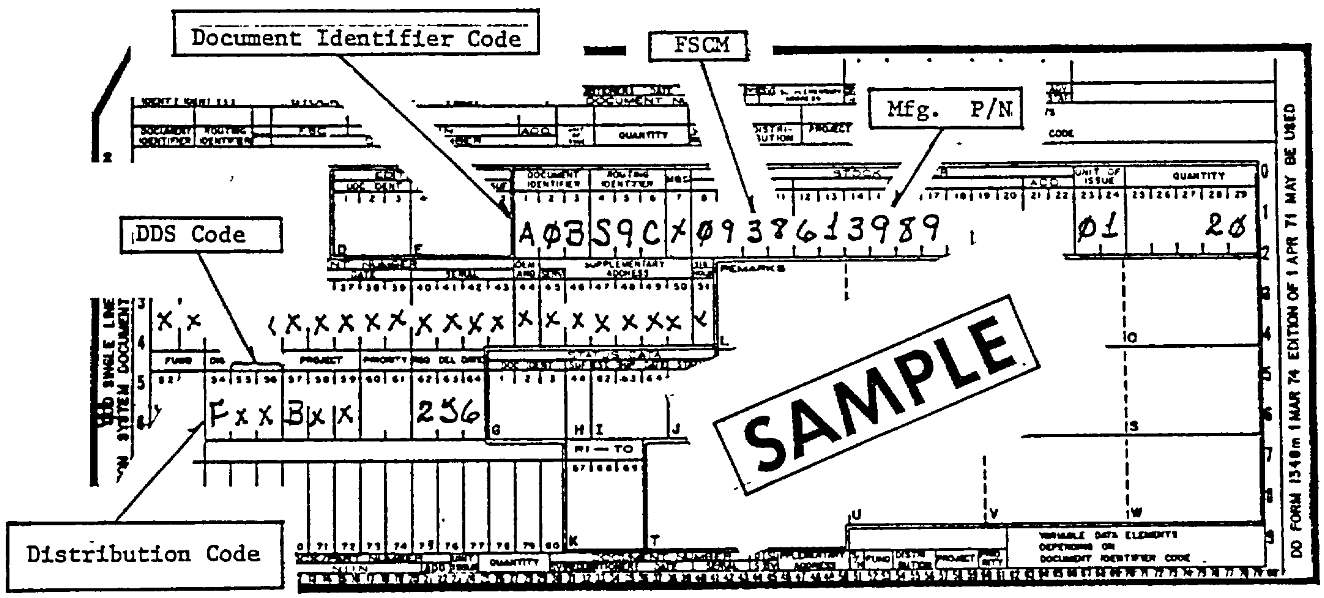


TA 126333

APPENDIX K

SAMPLE REQUISITIONING FORMATS

SAMPLE FORMAT - MILSTRIP REQUISITION FOR CCE (NON-NSN)

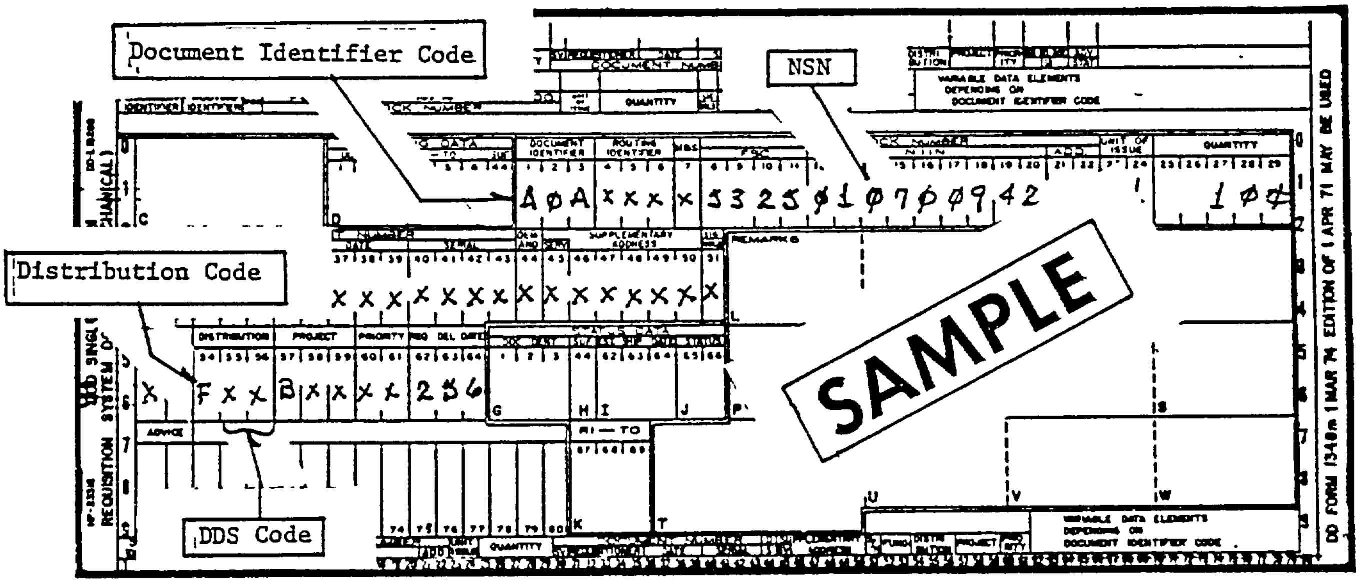


CARD COLUMN	DESCRIPTION OF DATA		MANDATORY ENTRY FOR CCE
1-3	Document Identifier Code		A0B - CONUS A02 - Overseas
4-6	Routing Identifier Code		Always S9C
7	Media/Status Code		
8-22	FSCM and Part Number		
23-24	Unit of Issue		
25-29	Quantity		
30-43	Document Number		
44	Demand Code		
45-50	Supplementary Address		
51	Signal Code		
52-53	Fund Code		
54-56	Distribution Code	CC-54	"F" for CONUS; see AR 725-50 for OCONUS
		CC-55-56	Weapon System Code
57-59	Project Code		CCE (DSS) Code
60-61	Priority Code		
62-64	Required Delivery Date		
65-66	Advice Code		

TA 1126335

CARD COLUMN	DESCRIPTION OF DATA	MANDATORY ENTRY FOR CCE/MHE
67-69	Blank	
70	Identification Code Applicable to Entry in cc 71-80 A - Technical Order or Technical Manual B - End Item Identification C - Noun Description D - Drawing or Specification No.	
71-80	Reference Identification	Identification of Reference Specified in cc 70

SAMPLE FORMAT - MILSTRIP REQUISITION FOR CCE (NSN)



CARD COLUMN	DESCRIPTION OF DATA		MANDATORY ENTRY FOR CCE
1-3	Document Identifier Code		A∅A - CONUS A∅1 - Overseas
4-6	Routing Identifier Code		
7	Media/Status Code		
8-22	NSN		
23-24	Unit of Issue		
25-29	Quantity		
30-43	Document Number		
44	Demand Code		
45-50	Supplementary Address		
51	Signal Code		
52-53	Fund Code		
54-56	Distribution Code	CC-54	"F" for CONUS; see AR 725-50 for OCONUS
		CC-55-56	Weapon System Code
57-59	Project Code		(DSS) Code
60-61	Priority Code		
62-64	Required Delivery Date		
65-66	Advice Code		

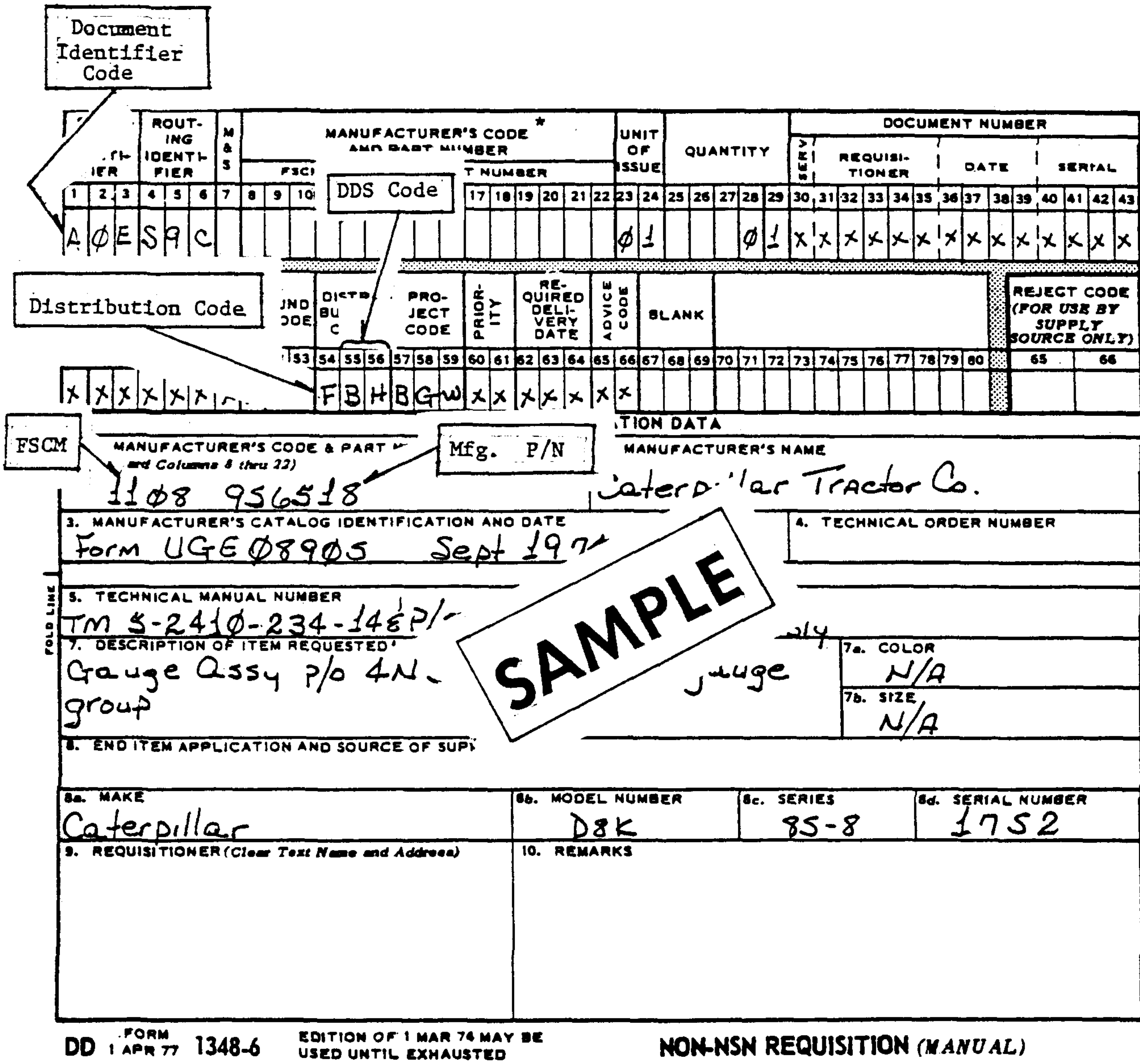
TA 126334

CARD COLUMN	DESCRIPTION OF DATA	MANDATORY ENTRY FOR CCE
67-69	Blank	
70	Identification Code Applicable to Entry in cc 71-80 A - Technical Order or Technical Manual B - End Item Identification C - Noun Description D - Drawing or Specification No.	
71-80	Reference Identification	Identification of Reference Specified in cc 70

SAMPLE FORMAT - MILSTRIP REQUISITION

FOR

CCE (NON-NSN) (MANUAL)



TA 126336

INSTRUCTIONS

This form will only be used in those cases where the manufacturer's code and part number exceed the spaces allocated in card columns 8 - 22 of the requisition.

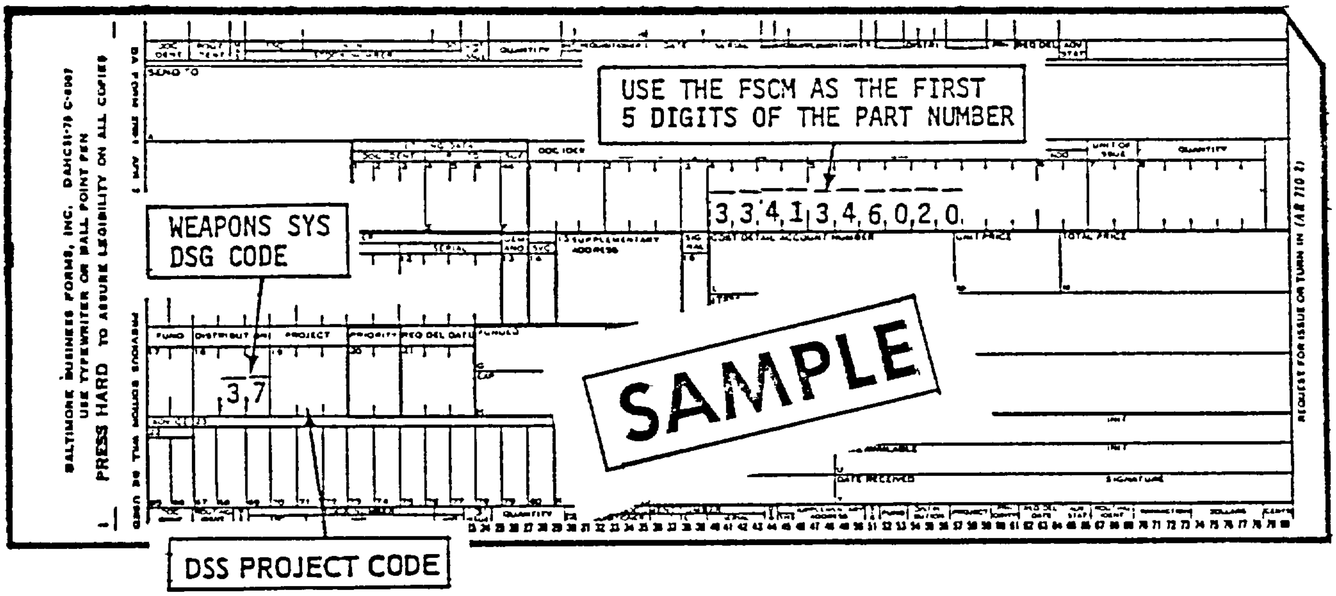
CARD COLUMN	DESCRIPTION OF DATA		MANDATORY ENTRY FOR CCE/MHE
1-3	Document Identifier Code		AØE - CONUS AØ5 - OVERSEAS
4-6	Routing Identifier Code		Always S9C
7	Media Status Code		
8-22	FSCM and Part Number		Leave Blank Enter in Block 1 Under Identification Data
23-24	Unit of Issue		
25-29	Quantity		
30-43	Document Number		
44	Demand Code		
45-50	Supplementary Address		
51	Signal Code		
52-53	Fund Code		
54-56	Distribution Code CC 54	 CC-55-56-	"F" for CONUS. (See AR 725-50 for OVERSEAS. Leave Blank
57-59	Project Code		CONUS - BGX OCONUS - JJZM
60-61	Priority Code		
62-64	Required Delivery Date		
65-66	Advice Code		
67-80	Blank		

IDENTIFICATION DATA - Lower half of CD Form 1348-6, complete blocks 1 thru 9.

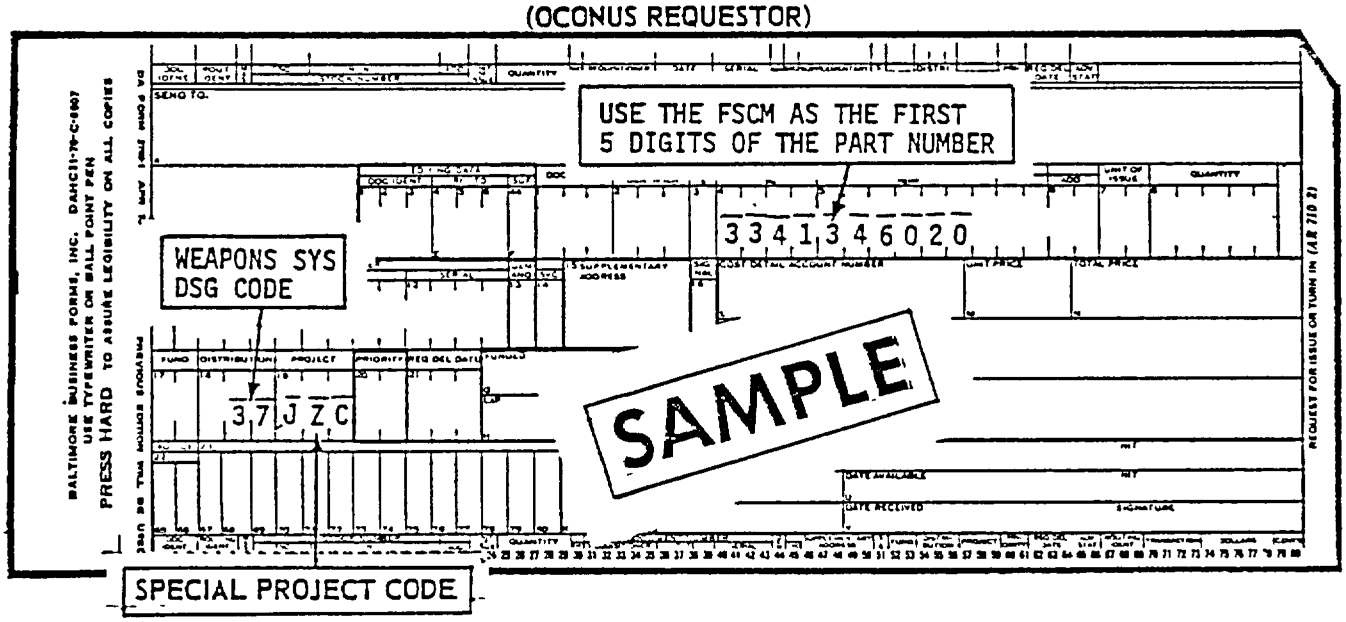
SAMPLE FORMAT

DA FORM 2765 PART NUMBER REQUEST

(CONUS REQUESTOR)



(OCONUS REQUESTOR)



TA 126340

By Order of the Secretary of the Army:

E. C. MEYER
General, United State Army
Chief of Staff

Official:

ROBERT M. JOYCE
Brigadier General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-254, Operator maintenance requirements for Truck, Fork Lift, Rough Terrain.

☆ U.S. GOVERNMENT PRINTING OFFICE : 1997 O - 418-292 (70589)

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

FROM (PRINT YOUR UNIT'S COMPLETE ADDRESS)
Your mailing address

DATE SENT
Date you filled out this form

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 10-3930-645-14&P	20 October 1981	Truck, Fork Lift

BE EXACT PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	
3-109	D			The last sentence in this paragraph is incomplete. It should read, "Install new replacement gaskets."

SAMPLE

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE
Michael P. Heimke, SFC, 555-8367	Michael P. Heimke

DA FORM 1 JUL 79 2028-2 PREVIOUS EDITIONS ARE OBSOLETE.

P S--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS

TEAR ALONG PERFORATED LINE

REVERSE OF DA FORM 2028-2

TEAR ALONG PERFORATED LINE

FILL IN YOUR UNIT'S ADDRESS

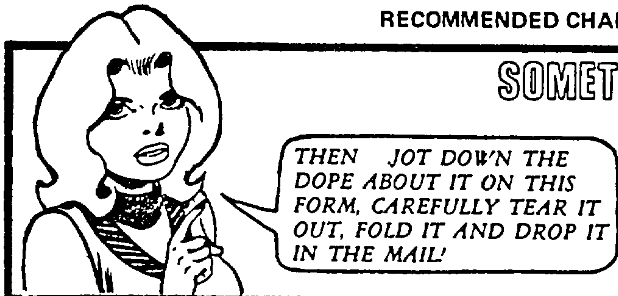
FOLD BACK

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS

Commander
US Army Tank-Automotive Command
ATTN: DRSTA-MBS
Warren, Michigan 48090

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



SOMETHING WRONG WITH THIS PUBLICATION?

FROM (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 10-3930-645-14&P	20 October 1981	Truck, Fork Lift

BE EXACT PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE

TEAR ALONG PERFORATED LINE

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE.

P S --IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS

REVERSE OF DA FORM 2028-2

TEAR ALONG PERFORATED LINE

FILL IN YOUR UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS

Commander
US Army Tank-Automotive Command
ATTN: DRSTA-MBS
Warren, Michigan 48090

THE METRIC SYSTEM AND EQUIVALENTS

LINEAR MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

WEIGHTS

1 Gram = 0 001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 Lb
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq Centimeter = 100 Sq. Millimeters = 0.155 Sq Inches
1 Sq. Meter = 10,000 Sq Centimeters = 10.76 Sq Feet
1 Sq Kilometer = 1,000,000 Sq Meters = 0.386 Sq Miles

CUBIC MEASURE

1 Cu Centimeter = 1000 Cu Millimeters = 0 06 Cu Inches
1 Cu Meter = 1,000,000 Cu Centimeters = 35 31 Cu. Feet

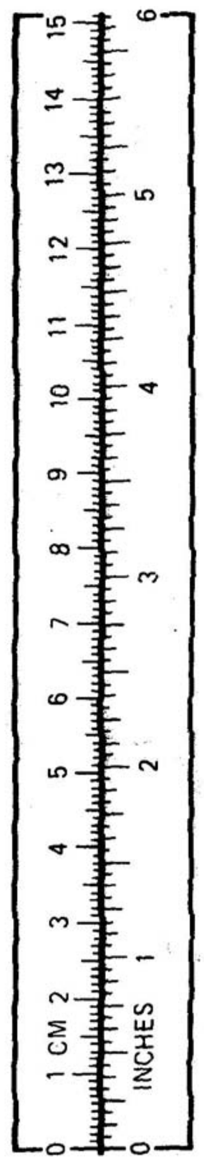
TEMPERATURE

5/9 (°F - 32) = °C
212° Fahrenheit is equivalent to 100° Celsius
90° Fahrenheit is equivalent to 32 2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5 °C + 32 = °F

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid	Ounces Milliliters	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Quarts.	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.45
Short Tons	Metric Tons	0.0907
Pound-Feet	Newton-Meters	1.356
Pounds per Square	Inch Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0 155
Square Meters	Square Feet .	10.764
Square Meters	Square Yards	1.195
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters Fluid	Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2 205
Metric Tons	Short Tons	1.102
Newton-Meters	Pound-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
Kilometers per Liter	Miles per Gallon	2.354
Kilometers per Hour	Miles per Hour	0.621



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