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

AUGER, EARTH, SKID MOUNTED, TYPE I
REED TOOL COMPANY
TEXOMA MODEL 254-9
(NSN 3820-01-068-4078)

HEADQUARTERS, DEPARTMENT OF THE ARMY

14 MARCH 1980

CHANGE

No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington D.C., *30 September 1991*

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT

AND GENERAL SUPPORT MAINTENANCE MANUAL

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AUGER, EARTH, SKID MOUNTED, TYPE I

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TEXOMA® MODEL 254-9

(NSN 3820-01-068-4078)

Current as of 1 November 1988

TM 5-3820-254-14&P, 14 March 1980, is changed as follows:

Title page. Reporting of Errors is superseded as follows:

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.

Page 1-1, paragraph 1-2 is superseded as follows:

1-2. Maintenance Forms and Records

Maintenance forms and records that you are required to use are explained in DA Pam 738-750.

Page 1-1, paragraph 1-3 is superseded as follows:

1-3. 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.

NOTE

The following pages are located in "Operator and Maintenance Instructions."

Page 2-2, Section II. The title of Section II is changed to read as follows: "Section II. MOVEMENT OF AUGER".

Page 2-2, paragraph 2-2.1 is added as follows:

2-2.1. Movement to New Digging Spot, Same Worksite

a. Raise the auger.

CAUTION

Before and during lowering of the feed ram, line up the dotted line on frame ring to marker on the right angle drive to prevent feed ram from damaging engine and acoustical panel.

b. Line up the dotted line on frame ring to marker on the right angle and lower the feed ram to traveling position.

c. Raise support jack and stop engine.

d. Move to new digging spot.

Page 2-2, paragraph 2-3. Title is changed as follows: "2-3. Movement to a New Worksite".

Page 2-3, paragraph 2-10*b*(1). Add the following NOTE before Step (1):

NOTE

Make sure the digging clutch is disengaged before starting engine.

Page 2-3, paragraph 2-10*c*(2). After last sentence, add the following:

The selection of the proper gear is very important to the digging operation and the life of the digger. The gears should be selected with regard to the size of the auger and digging conditions. Larger diameter augers and hard digging conditions require slower operating speeds. Therefore, you should start in the highest gear usable without stalling the torque converter or lugging the engine.

CAUTION

Low gear or reverse should never be used with engine at full power. If more auger speed is required, use 2nd gear and control the speed with the engine RPM.

Page 2-3, paragraph 2-10*c*(3). After last sentence, add the following:

During all operations, except actual digging, the engine should be run as low RPM as possible. Raising the feed ram, leveling, and the smallest accessories should all be operated as close to engine idle as possible. Only the winch should have the full power of the engine applied.

Page 2-6, paragraph 2-10*c*(7). Caution and note are added before (7), as follows:

CAUTION

When returning into the hole, do not allow the auger to turn. This and insufficient down pressure will cause chatter and excessive vibration and may cause damage to the drive train.

NOTE

When returning into the hole, do not hold auger bar control valve open after the auger hits bottom. This will raise the auger and may shift it off the hole.

Page 2-6, paragraph 2-10*c*. Add the following:

(8) When digging with extra-depth diggers, dig the first three to five feet slowly, then continue at normal speed. This helps stabilize the auger and bar, thus eliminating bar slap inside the barrel.

(9) In the event the auger gets overloaded and it cannot be lifted with the auger bar control, disengage clutch, shift the transmission into reverse, and reengage the clutch. This will back the auger out of the hole. Use the auger bar control to pull up at the same time. When the auger is clear, disengage the clutch and shift the transmission back to forward and continue digging.

(10) If for some reason the hydraulic system should fail while the auger is in the hole, place the transmission in reverse, shovel dirt into the hole, pull control marked auger bar, engage clutch and the auger will back itself off. When the auger reaches the top of the hole, push the elevating cylinder control, move the auger forward slowly, and the barrel will lower. By using the control valve , lower the barrel to travel position.

(11) For efficient digging, the bit point and cutting teeth should be kept sharp at all times. If hard digging is encountered, such as sandstone, limestone, frozen ground, etc., the auger speed should be reduced and a slight down pressure put on the auger to allow the auger to cut its way.

CAUTION

Excessive speeds and down pressure cause undue wear on auger teeth and may damage the drive train if the auger should hang up.

Page 2-6, paragraph 2-10*d*. Add the following: (3) When setting and pulling poles or using the winch for any type of heavy work, position the kelly bar vertical, place the auger with bit on the ground and apply some down pressure. Jacks should be used, if so equipped.

WARNING

NEVER SUSPEND A POLE OR HEAVY OBJECT WITH THE WINCH AND THEN MOVE THE TRUCK. ALWAYS KEEP THE BOOM VERTICAL AND THE AUGER ON THE GROUND.

(4) When using the winch to drag an object to the digger from a distance, use the snatch block provided at the top of the final drive. The polesetter boom should be used as a crane.

Page 2-6, paragraph 2-10*f* is added

f. Use and Stowage of Support Jacks. (PAGE 63, Sheet 1 of 1)

(1) Position truck where hole will be dug.

CAUTION

Do not try to lift the rear wheels off the ground with the auger unit.

(2) Extend auger against ground and lift rear section of truck to where the weight is off truck springs.

(3) Pin upper and lower tubes together using pin (6). Secure pin with clip (15).

(4) Release hydraulic pressure from auger to allow weight to rest on support jacks.

(5) After digging is complete, raise rear of truck so that the support jacks are not supporting the truck. Remove pins.

(6) Determine where next digging job will be.

(7) If job is complete, remove auger unit from truck. Remove entire assembly including brackets. Store brackets with auger.

(8) If job is short distance away, raise jack pads so that jacks are in the shortest position and reinsert pins. Drive to next hole location.

(9) If job is long distance away, remove capscrew (10) and store support jacks with the auger unit. Tie pin (6) so that it will not be broken off the chain (13).

Page 3-1, Table 3-1 is superseded as follows:

Table 3-1. Preventive Maintenance Checks and Services

Item Number	Interval: Operator Daily B	D	A	W	Org M	Q	Item to be inspected	Procedure	References
							B – Before operation, D – During operaton	A – After operation, W – Weekly	M – Monthly, Q – Quarterly
1	X						Muffler and Pipes	Visually inspect exhaust system for leakage due to cracks, breaks, corrosion, loose or missing clamps or caps, or damaged gaskets. Refer to organizational maintenance.	(para. 4-31)
2	X						Radiator	Check radiator and hoses for leaks. Check coolant level. Fill to 2 inches below filler neck.	(para. 3-8)
3	X						Fan Belt	Inspect for frayed or damaged edges. Check for proper adjustment. Adjustment should be 1/2 -inch deflection between pulleys. Refer to organizational maintenance.	(para. 4-15a.)
4	X						Air Cleaner and Hoses	Inspect for air leaks due to loose connections or breakage. Tighten loose connections. Refer to organizational maintenance for repair.	
5	X	X					Fuel System	Inspect fuel tank, lines, and hoses for leaks due to loose connections. Make sure all caps are on tight. Inspect tank for physical damage that could cause leakage.	(para. 3-9)
6	X						Transmission	Inspect for signs of leakage. Check oil level and service as required.	(para. 3-10)
7	X						Electrical System	Inspect all electrical wiring for cracks, breaks, or other signs of damage. Check for loose connections and signs of scorching which could indicate overheating or short circuit.	
8	X						Alternator	Visually inspect alternator for cracks, breaks, or other physical damage. Ensure alternator is securely fastened.	
9	X						Hydraulic Reservoir	Inspect for breaks, bends or other physical damage. Inspect for leaks and be sure reservoir is full.	(para. 4-24)
10	X						Hydraulic Pump	Inspect pump for damage or leakage.	(para. 4-21)
11	X						Converter and Shut-Tie	Inspect for leakage and proper oil level.	

Table 3-1. Preventive Maintenance Checks and Services — Continued

Item Number	Interval: Operator Daily B	D	A	W	Org M	Q	Item to be inspected	Procedure	References
	B – Before operation; D – During operaton						A – After operation; W – Weekly	M – Monthly; Q – Quarterly	
12	X						Right Angle Drive	Inspect for signs of leakage and proper oil level.	
13	X						Final Drive	Inspect for signs of leakage and proper oil level.	
14	X						Feed Ram	Inspect upper and lower packing for proper oil seepage.	
15	X						Instrument Panel Gages	Inspect gages for loose wires and broken glass.	
16	X						Auger	Make sure auger is properly lubricated	(para 4-30)
17	X						Auger	Make a thorough visual inspection of the auger and see that it is in good working condition. Look for loose, missing or damaged parts.	(page 4-28)

Page 4-25, add paragraph 4-37.1 as follows:

4-37.1. Feed Ram Assembly Maintenance

a. Removal.

(1) If machine is equipped with a polesetter attachment, it will be necessary to remove polesetter before proceeding to remove the feed ram assembly.

(2) Loosen the clamping bolt and nut in the lower packing nut. This nut has left-hand threads and can be removed with a chain wrench.

(3) Slide nut and lower gland off end of kelly bar.

(4) Loosen the set screw that locks upper packing nut in place. This nut has left-hand threads and may be removed with a chain wrench even though the amount of working room is limited.

(5) Allow nut and upper gland to slide down main drive until they rest against main drive housing.

(6) Start digger engine and very slowly actuate the kelly bar valve handle as to apply up-pressure to the assembly. This will force both the upper packing set and the lower packing set out into the open except for possibly the last packing in each set, which can easily be removed by hand.

(7) Disconnect all hydraulic hose connections at feed ram assembly. Remove all bolts, washers, and nuts around base of lower support.

(8) Remove capscrews and nut from shaft that secures the elevating cylinder assembly to the saddle assembly. Remove shaft using a hammer and a soft punch.

(9) Remove feed ram assembly by lifting it out of headache rack and towards front of truck or backing truck away from it, depending on type of hoist setup available. Once the kelly bar is slid partially out 4 of main drive brass, it may be necessary to clamp kelly bar to the barrel assembly to keep the bar from sliding out.

b. Disassembly. (PAGE 37, Sheet 1 of 2 and Sheet 2 of 2)

(1) Set feed ram assembly on some type of rack to provide a good working height.

(2) Remove transfer tube clamps, split flange clamp halves and transfer tube assembly. Remove 0-Ring located in tip end of transfer tube assembly.

(3) Remove the 12 capscrews from the feed ram cap. Slide cap off end of barrel. Remove O-Ring and backup ring located inside cap. Remove lock ring by lifting the ring end up with a screwdriver and coiling it out of the ring groove and off end of barrel. Slide retainer off end of barrel.

(4) Loosen nuts on saddle and slide saddle off end of barrel.

(5) Remove all bolts and nuts from working barrel braces and remove braces.

(6) Remove barrel support from barrel by turning support counterclockwise. Remove O-Ring and backup ring as located inside support.

(7) Push on auger end of kelly bar until piston at tip end is exposed. Continue pushing bar until approximately 8 inches of kelly bar is exposed.

(8) Remove piston rings with a ring expander tool.

(9) Locate the piston pin in top end of piston. Head of pin will be flush with O.D. of piston, but can usually be located by discoloration. The general location will be marked by a center punch mark on the top end of the position. Drill down through wall of piston plug. This will cause an internal pressure leak if plug is reused.

Drill only deep enough to remove pin. Screw piston plug out of piston.

(10) Using a plastic or rawhide hammer, knock piston back toward auger end of bar until it slides off the bearing assembly.

NOTE

Wrap the bar end that will be rubbing the I.D. of the barrel while being removed to protect barrel wall from possible damage. Pick up the exposed end of bar slightly during removal to relieve the heavy metal-to-metal contact between kelly bar corners and barrel wall.

(11) Remove cotter pin and piston nut. Remove piston bearing and bearing cup with a bearing puller. Slide piston off end of kelly bar. Pull bar out either end of barrel.

c. Assembly.

(1) Clean all parts thoroughly. Insert O-Ring (29) and backup ring into O-Ring groove inside working barrel support (30) with backup ring on top of O-Ring. Lubricate O-Ring backup ring, inside threads in support and threads on barrel. Screw support on barrel until it is tight.

(2) Place barrel braces on barrel. Place bolts and nuts in the barrel braces and leave loose. Aline holes in braces with holes in support and place all bolts through holes and screw on nuts. Torque all barrel brace nuts to 10 lb.-ft. maximum.

(3) Slide saddle over end of barrel to approximate location.

(4) With machined end of kelly bar (40) wrapped, slide bar into barrel starting through barrel support end of assembly. The wrapping around the machined end of the bar will prevent damage to the wall of the barrel while bar is being pushed through. Allow machined end of bar to extend approximately 2 feet out top end of barrel.

(5) Remove wrappings on end of bar and slide piston past machined area with I.D. threads toward end of bar.

(6) Drive one of the bearing cones on bearing journal until it contacts shoulder. Place bearing cup on cone, and drive other bearing cone into cup. Screw kelly bar nut on bar until bearing assembly shows no play, but still turns freely. If cotter pin hole does not line up with slots in nut, it will be necessary to redrill bar to 1/4 inch diameter. Install cotter pin.

(7) Heat top end of piston (26) (low temperature) with a torch, and with a plastic or rawhide hammer, drive piston over bearing assembly until shoulder in piston contacts rear of bearing cup.

(8) Screw piston plug into piston until it contacts front edge of bearing cup tight. If hole in plug is out of line with hole in piston, it will be necessary to redrill through piston and into plug approximately 3/16 inch. Drive pin through piston and into plug until it swells and locks in place. File down portion of pin protruding out of piston.

(9) Place piston rings into piston ring grooves with a ring expander tool. Check rings to be sure that they function freely in grooves.

(10) Lubricate piston and rings, and secure ring compressor tightly over assembly. Insert a round rod through auger pin hole in bar and pull piston into barrel.

(11) Slide retainer over top end of barrel and past groove in barrel with relieved slide of retainer facing end of barrel. Place lock ring into groove starting with one end and coiling it into place. Install new 0Ring and backup ring in cap, slide cap into place, over end of barrel and align holes with the holes in the retainer. <u>Screw capscrews into cap and torque to 67 lb.ft</u>

(12) Place O-Ring into top end of transfer tube. Install all clamps on barrel loosely, leaving top bolt out of each clamp. Set transfer tube in clamps and slide against cap. Place split flanges around top end of transfer tube and align holes with the holes in the cap. Screw bolts into cap tight. Replace remaining bolts in clamps and tighten all nuts. Do not tighten to the point of distorting tube.

d. Installation.

(1) Reverse removal procedure.

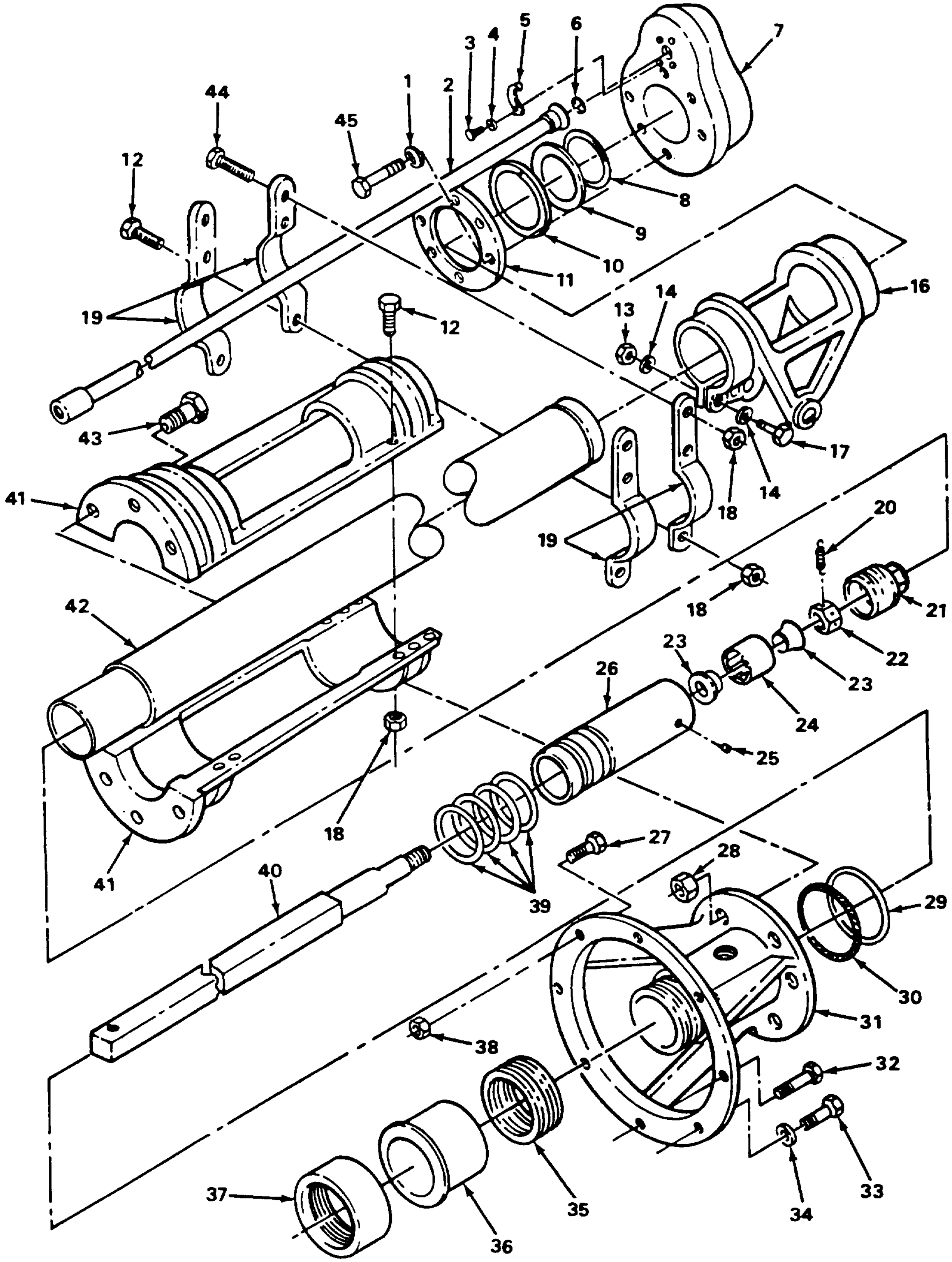
(2) After feed ram assembly has been installed on digger, <u>torque nuts on elevating cylinder saddle clamp to 60 lb.-ft. maximum. all other clamps torque to 10 lb.-ft, maximum</u>.

(3) After replacing the upper and lower packing, adjust upper packing to allow a very slight seepage of oil to ensure proper lubrication of main brass drive. The lower packing should be adjusted to allow an oil film to be present on the kelly bar at all times to ensure maximum packing life.

Page I-1. Add "Feed ram assembly maintenance" after "Fan bracket and pulley, removal and installation".

NOTE
The following pages are located in "Repair Parts and Special Tools List".

Page 37, Sheet 1 of 2 is superseded as follows:



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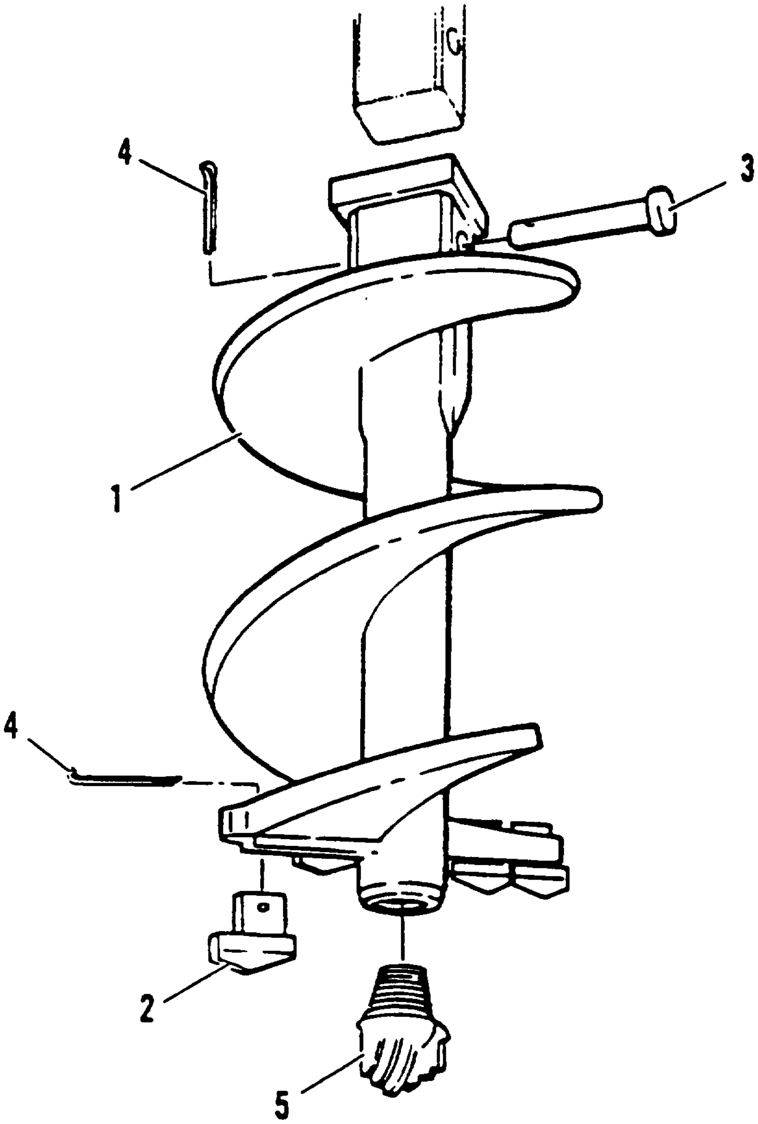
Page 38, Sheet 2 of 2 is superseded as follows:

ASSEMBLY 32251

ITEM	PART NO.	QTY	DESCRIPTION
1	5962	12	WASHER - LOCK - INTERNAL 3/8 IN
2	32229	1	TUBE - TRANSFER
3	7784	4	CAPSCREW - HEX HD - 7/16 - 14 NC X 1 1/ 2 LG - GRD 5
4	5959	4	WASHER - LOCK 7/16 IN
5	16628	2	FLANGE - SPLIT - HALF - 1 1/4 IN
6	16600	1	O-RING - 1 1/2 I.D. X 1 3/4 O.D. X 1/8 DIA.
7	16444	1	CAP - END - BARREL - FEED RAM
8	16701	1	O-RING - 4 1/4 I.D. X 4 5/8 O.D X 3/16 DIA.
9	16700	1	RING - BACKUP 4 1/4 I.D. X 4 5/8 O.D X 3/16 WIDE
10	16699	1	RING - LOCK - 4 1/4 O.D. - BARREL - FEED RAM
11	16698	1	RETAINER - CAP - FEED RAM - 4 1/4 O.D.
12	S 90725-116	12	CAPSCREW - HEX HD - 1/2 - 13 NC X 2 1/4 LG - GRD 5
13	S 51967-14	10	NUT - HEX - 1/2 - 13 NC
14	S 27183-17	20	WASHER - HARDEN - 1/2 IN
15	----	--	DELETED
16	11574	1	SADDLE - BARREL - FEED RAM
17	MS 90725-112	10	CAPSCREW - HEX HD - 1/2 - 13 NC X 1 3/4 LG - GRD 5
18	6291	18	NUT - ELASTIC STOP - 1/2 - 13 NC
19	16251	4	CLAMP - TRANSFER TUBE - HALF
20	5941	1	PIN - COTTER - 1/4 DIA. X 2 1/2 LG
21	4238	1	PLUG - PISTON
22	4283	1	NUT - CASTELLATED - THIN - 1 3/8 - 12 N F
23	6125	2	BEARING - CONE - 1.500 I.D.
24	6124	1	BEARING - CUP - 3.151 O.D.
25	11744	1	PIN - PISTON PLUG
26	11146	1	PISTON - FEED RAM - 3 3/4 O.D.
27	6414	2	CAPSCREW - HEX HD - 5/8 - 11 NC X 2 3/4 LG - GRD 5
28	42606	6	NUT - ELASTIC STOP - 3/4 - 10 NC
29	16696	1	RING - BACKUP - 4 1/8 I.D. X 4 1/2 O.D. X 3/16 WIDE
30	16695	1	O-RING - 4 1/8 I.D. X 4 1/2 O.D. X 3/16 DIA.
31	16694	1	SUPPORT - FEED RAM
32	42705	4	CAPSCREW - HEX HD - 5/8 - 11 NC X 2 1/4 LG - GRD 5
33	42821	2	CAPSCREW - HEX HD - 5/8 - 11 NC X 2 3/4 LG - GRD 5
34	5984	2	WASHER - LOCK - CUT - 5/8 IN
35	16758	1	PACKING SET - UPPER FEED RAM
36	3589	1	GLAND - PACKING - UPPER
37	3588	1	NUT - UPPER PACKING
38	6716	6	NUT - ELASTIC STOP - 5/8 -11 NC
39	11136	4	RING - PISTON - 3 3/4 O.D.
40	32232	1	KELLY - 2 1/2 SQ
41	11450	2	BRACE - BARREL - FEED RAM
42	32233	1	BARREL - FEED RAM - 3 3/4 I.D.
43	7807	6	CAPSCREW - HEX HD - 3/4 - 10 NC X 2 1/2 LG - GRD 5
44	6368	4	CAPSCREW - HEX HD - 1/2 - 13 NC X 2 3/4 LG - GRD 5
45	42724	12	CAPSCREW - HEX HD - 3/8 - 16 NC X 1 1/2 LG - GRD 5
46	42827	1	SCREW - SET SQ HD - 3/8 - 16 NC X 3 (NOT SHOWN)
47	4193	8	PACKING - LOW FEED RAM (NOT SHOWN)
48	16174	1	GLAND - PACKING - LOWER (NOT SHOWN)

Page 71. Immediately following page 71, add page 72, Sheet 1 of 1, Publication Drawing Number PM-45-051, Auger Equipment.

TITLE AUGER EQUIPMENT



ITEM	PART NO.	QTY.	DESCRIPTION
	29131	1	AUGER, 9 INCH
1	29242	1	AUGER, 12INCH
	29311	1	AUGER, 16 INCH
	29009	1	AUGER, 24 INCH
2	16844	13	BIT, ROCK
	17318	26	BIT, DIRT
3	11581	1	PIN, AUGER
4	MS24665-625	40	PIN, COTTER
5	16845	1	POINT, PILOT

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NOTE

The following pages are located in "Supplemental Operating, Maintenance and Repair Parts Instructions."

Page 12, paragraph 2-17, Change "(see Appendix H)." To read "(see Appendix G).".

Paragraph 2-18. Change "(see Appendix G)." To read "(see Appendix F).".

Paragraph 2-19. Change "(see Appendix L)." To read "(see Appendix K).".

By Order of the Secretary of the Army:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official:

PATRICIA P. HICKERSON
Brigadier General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-25-E, Block 0238, Operator, Unit, Direct Support and Maintenance Requirements for TM 5-3830-254-14&P.

Distribution:

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No 5-3820-254-14&P

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 14 March 1980

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AND GENERAL SUPPORT MAINTENANCE MANUAL

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MAINTENANCE AND REPAIR PARTS INSTRUCTIONS)

AUGER, EARTH, SKID MOUNTED, TYPE I
REED TOOL COMPANY

TEXOMA® MODEL 254-9
(NSN 3820-01-068-4078)

REPORTING OF ERRORS

You can help improve this manual by calling attention to errors and by recommending improvements and by stating your reasons for the recommendations. Your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms),,should be mailed directly to Commander, US Army Tank-Automotive Materiel Readiness Command, ATTN: DRSTA-MBS , Warren, MI, 48090. A reply will be furnished direct to you. For your convenience, preaddressed DA Forms 2028 are included as final pages of this manual.

Current as of 30 November 1979

CONTENTS

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

REED TOOL COMPANY
Drilling Machinery Division

Sherman, Texas

EARTH BORING MACHINE

NEW MACHINE WARRANTY

REED TOOL COMPANY warranty each new machine manufactured by it to be free from defects in material and workmanship for 1 year from the date of delivery to the original purchaser.

The company's obligations shall be limited to replacing any part or parts manufactured only by REED TOOL COMPANY, and found, upon examination at our factory to be defective due to materials or workmanship. Freight, express and/or installation charges shall be borne by the purchaser. Provided further, that the machine was properly cared for and operated under normal conditions.

REED TOOL COMPANY will not warrant any part that has failed as a result of abuse, negligence, misuse, accident or damaged caused by overloading, improper application or installation made by others, nor, to any part made inoperative because of wear occasioned by use, nor any machine which has been altered in any way so in our judgment effects its operation or reliability.

REED TOOL COMPANY will not be liable for loss of time to the purchaser while the machine is out of service nor for any labor or other expense, damage or loss, statutory or otherwise, occasioned, or claimed to be occasioned, by such defective parts or failure. The correction of such defects by repair or replacement shall constitute a fulfillment of all the Company's obligation to the purchaser.

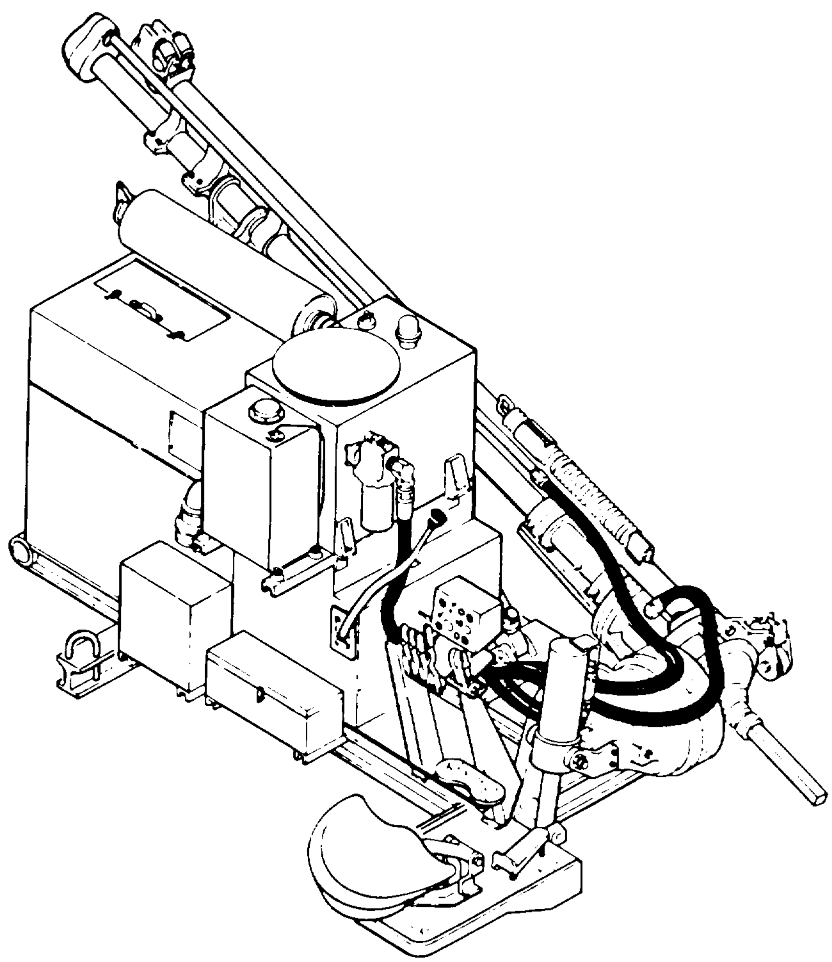
No employee, agent, distributor, or dealer of REED TOOL COMPANY shall have the right to modify or change this warranty without written authorization signed by an officer of REED TOOL COMPANY.

This warranty is in lieu of all other warranties, express or implied, and any and all other obligations or liabilities on its part contractual or otherwise.

REED TOOL COMPANY reserves the right to make changes in the design of and other changes in its products at any time and from time to time without notice and without incurring any obligation with respect to any product theretofore ordered from it or sold or shipped by it or otherwise.

OPERATOR
AND
MAINTENANCE
INSTRUCTIONS

EARTH AUGER
TEXOMA® MODEL 254-9



OPERATOR INSTRUCTIONS AND MAINTENANCE MANUAL

AUGER, EARTH, SKID MOUNTED
TEXOMA ® MODEL 254-9

LIST OF ILLUSTRATIONS

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1-1. Scope

a. This manual contains instructions for use by personnel to whom the Texoma Inc. Earth Auger, Model 254-9, is issued. It provides instructions on the operation and the operator and organizational maintenance of the equipment. Also included are descriptions of major components and their functions in relationship to other components.

b. Appendix A contains a list of publications applicable to this manual. Appendix B contains the maintenance allocation chart. Appendix C contains the troop installed items.

1-2. Forms and Records

Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

1-3. Reporting of Errors

Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on VA Form 2028, (Recommended Changes to DA Publications), and forwarded direct to Commanding General, U.S. Army Tank-Automotive Material Readiness Command. Warren,Michigan,48090.

1-4. Destruction of Army Material to Prevent Enemy Use and Administrative Storage

Instructions regarding destruction of Army material to prevent enemy use are provided in TM 750-244-3. Instructions for administrative storage are provided in TM 740-90-1.

Section II. DESCRIPTION AND DATA

1-5. Description

a. General. The Texoma Incorporated Earth Auger Model 254-9, illustrated in figures 1-1 and 1-2, is a self-contained, skid mounted, earth boring assembly driven by a gasoline engine, Ford Model 2004GF6006E). All operations of the boring assembly are controlled by a hydraulic system. The auger is capable of boring holes 9 to 24 inches in diameter and to a depth of 9 feet. The boring assembly can be operated from vertical downward to 60c away from truck, 450 to the right or left of truck, or 100 toward the truck.

b. Engine. The engine is a Ford Motor Company Model200GF-6006E in-line, 6 cylinder, pressure lubricated, gasoline engine.

c. Transmission. The transmission is a Funk Manufacturing Company Model4050A055BP, with four speeds forward and reverse.

d. Auger Assembly. The auger assembly consists of the auger, kelly bar, final drive assembly, and right angle drive assembly. Operation of the auger assembly is controlled by the shuttle control and the hand or foot operated throttle control. The shuttle is used to engage and disengage the drive assembly.

e. Warning/Safety Devices.

(1) The hydraulic system incorporates load lock valves on both the elevating and leveling cylinders. These valves prevent the cylinders from retracting in event of hydraulic system pressure loss.

1-6. Identification and Tabulated Data

a. Identification. The earth auger has three identification plates.

(1) *Manufacturer's nameplate*. Mounted on the rear of the skid, specifies model number, capacity, FSN, auger serial number, engine serial number, and contractor number.

(2) *Shipping data plate*. Mounted on the front left side of the accoustical panel; it gives model number, information concerning lifting points and lift eye capacity.

(3) *Operational procedures data plate.* Located on the rear of the accoustical panel directly below the hydraulic filter. Provides data for operating auger controls. Also gives instructions concerning strainer, filters, and packing nuts.

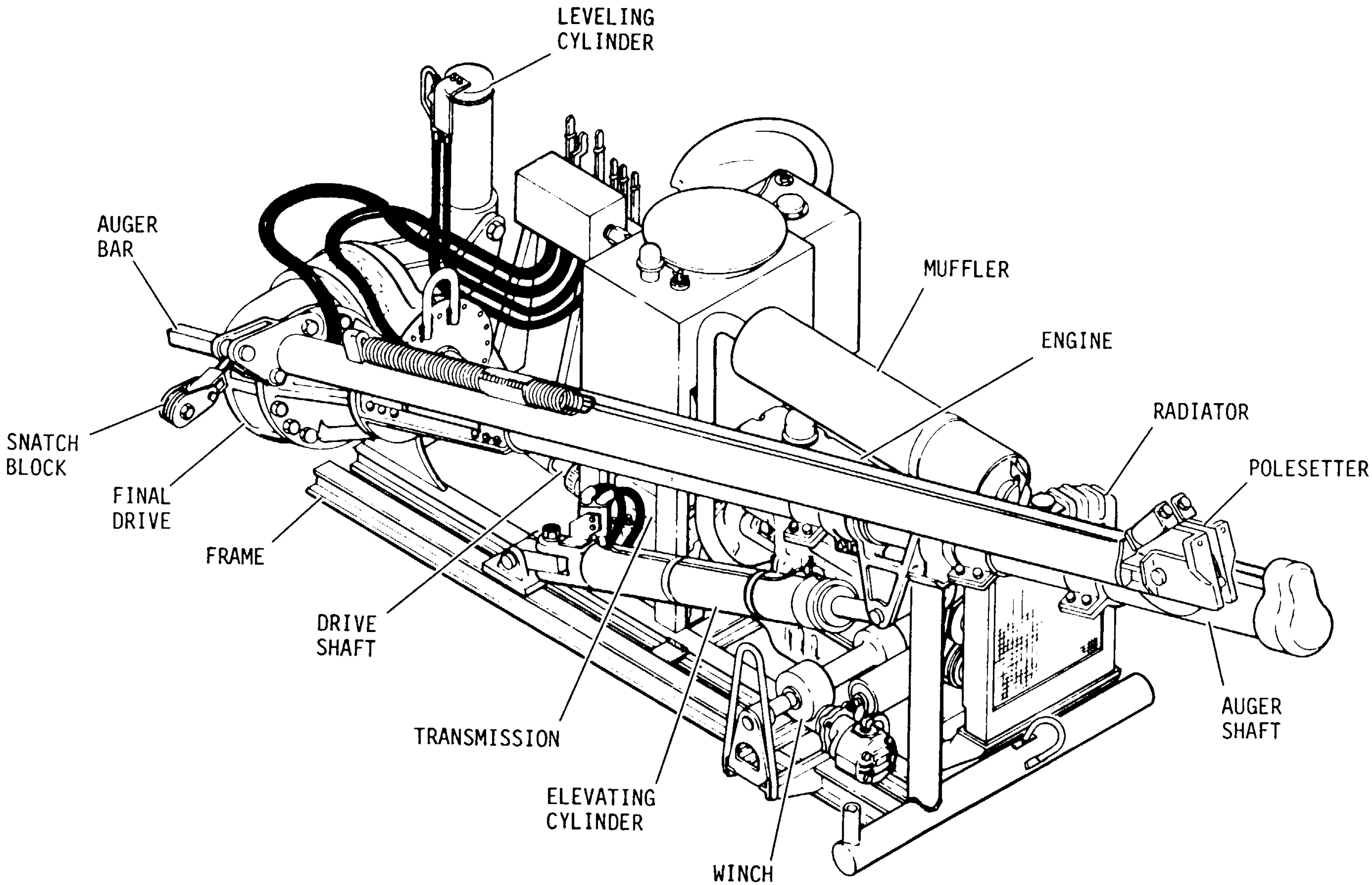


Figure 1-1. Earth auger, right front view (accoustical panels removed).

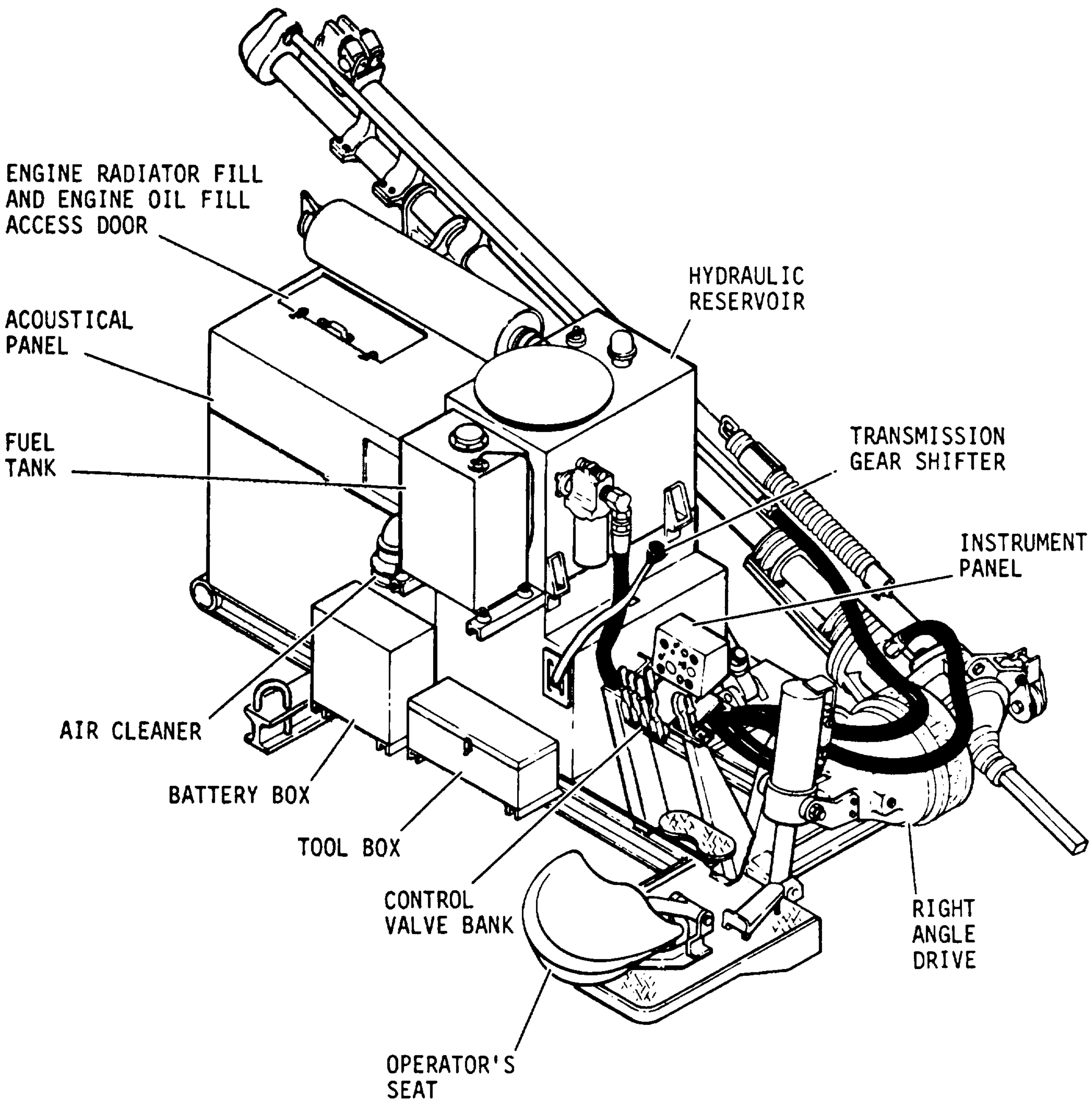


Figure 1-2. Earth auger, left rear view (accoustical panels installed).

(4) *Engine identification plate*. Mounted on the Upper Left-hand side of the engine also gives the serial number, type, and options.

b. Tabulated Data.

(1) Auger assembly.

Manufacturer........................ Reed Tool Company
Model 254-9

(2) Engine.

Manufacturer........................ Ford Motor Company
Model 200GF-6006E
Type .... Gasoline
Number of cylinders............. 6
Cooling .... Liquid
Electrical system.................. 12 volts
Batteries required................. 1 (12 volts)
Ground .... Negative

(3) Oil Filter.

Manufacturer........................ Motorcraft
Model FL-1
Type .... Spin-off

(4) Transmission.

Manufacturer........................ Funk Manufacturing Company
Model .... 4050A055 BP
Number of speeds................ 4 forward, 4 reverse
Filter manufacturer............... AC
Filter model.......................... PF-2
Filter type............................. Spin-off

(5) Adjustments.

Fan belt deflection................ ½ inch (between pulleys)

(6) Dimensions and weights.

Overall length .... 182 in.
Overall width........................ 90 in.
Overall height .... 68 in.
Shipping weight................... 6000 lb.

(7) Capacities.

Fuel tank.............................. 20 gallons
Cooling system .... 17 quarts
Engine crankcase................. 4.5 quarts
Transmission........................ 13 quarts
Right-angle drive.................. 3 quarts
Final drive .... 3 ½ quarts
Hydraulic system.................. 65 gallons
Air cleaner............................ 2/3 quart
Oil filter .... 1 quart

(8) Performances.

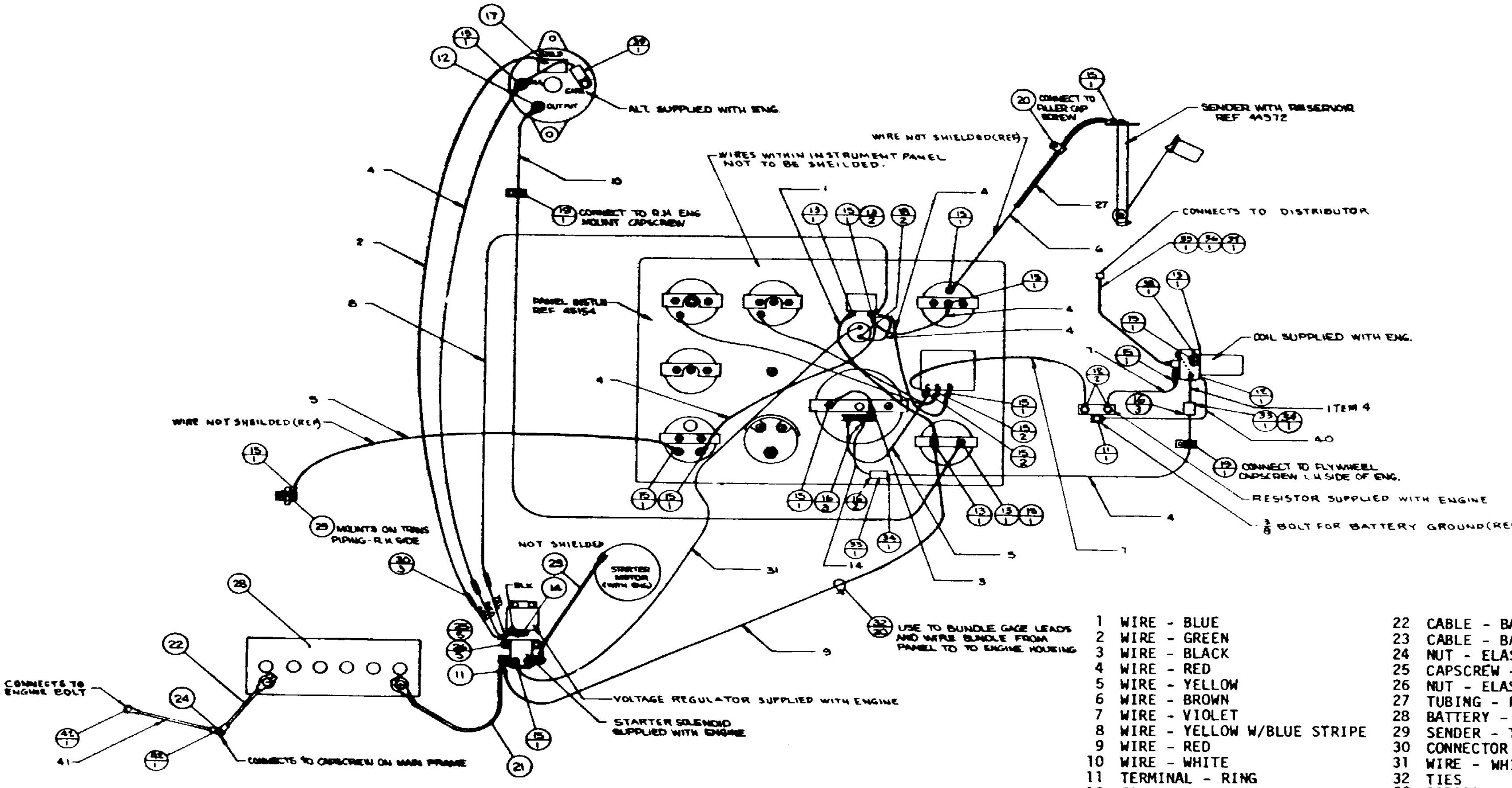
Diameter hole .... Maximum depth
9 in. .... 9 feet
12 in. .... 9 feet
16 in. .... 6 feet
24 in. .... 9 feet
Drilling angle .... 60° away from truck
(from vertical) .... 10° toward truck
45° to right or left

(9) Wiring diagram. See figure 1-3.

(10) Hydraulic diagram. See figure 1-4.

1-7. Difference Between Models

This manual covers only the Reed Tool Company Earth Auger, Model 254-9.



NOTE: ITEM 40 SHEILDING TO BE INSTALLED ON ALL WIRES EXCEPT AS NOTED. (BATTERY CABLES NOT TO BE SHEILDED)

1 WIRE - BLUE
2 WIRE - GREEN
3 WIRE - BLACK
4 WIRE - RED
5 WIRE - YELLOW
6 WIRE - BROWN
7 WIRE - VIOLET
8 WIRE - YELLOW W/BLUE STRIPE
9 WIRE - RED
10 WIRE - WHITE
11 TERMINAL - RING
12 TERMINAL - RING
13 TERMINAL - RING
14 TERMINAL - RING
15 TERMINAL - RING
16 TERMINAL - SPADE
17 DISCONNECT - F. TAB
18 DISCONNECT - M. PIN
19 CLAMP - HOSE SUPPORT
20 CLAMP - CONDUIT - 1/4
21 CABLE - BATTERY - POSITIVE
22 CABLE - BATTERY - NEGATIVE
23 CABLE - BATTERY - EYE TO EYE
24 NUT - ELASTIC STOP
25 CAPSCREW - HEX HD.
26 NUT - ELASTIC STOP
27 TUBING - RD - PLASTIC
28 BATTERY - 12 V - 55 AMP
29 SENDER - TEMP
30 CONNECTOR - BUTT
31 WIRE - WHITE
32 TIES
33 CAPACITOR
34 MOUNT-CAPACITOR
35 CABLE-COAXIAL
36 CONNECTOR
37 CONNECTOR
38 GASKET
39 CONDENSER
40 SHEILDING
41 CABLE-BATTERY
42 EYE-BATTERY

Figure 1-3. Wiring diagram.

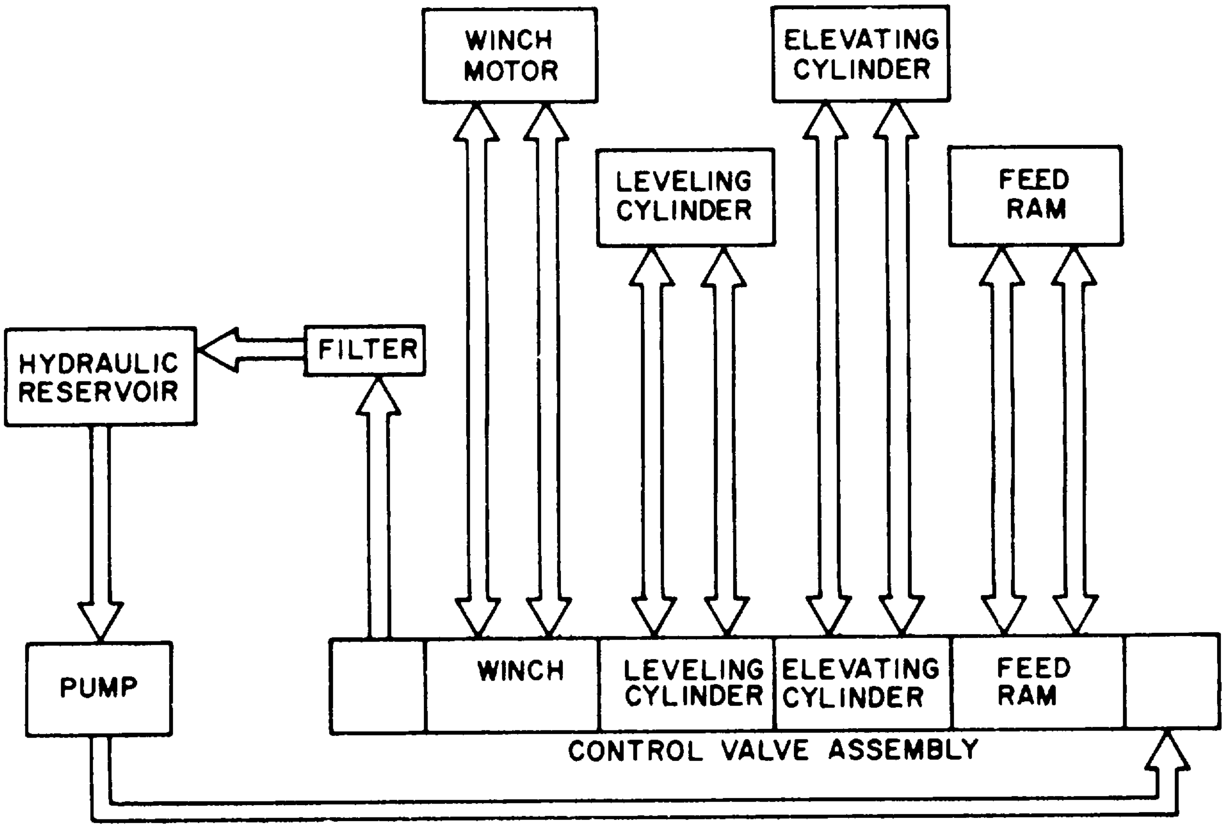


Figure 1-4. Hydraulic diagram

CHAPTER 2

OPERATING INSTRUCTIONS

HIS EQUIPMENT MUST BE INSTALLED INTO PROPER TRUCK CHASIS FOR SAFE OPERATION BOTH ON AND OFF ROAD,

USE; TRUCK, CARGO, 5 TON, 6 X 6 SMA2 W/W (NATIONAL STOCK NO. 2320-00-055-9265)

Section I. SERVICE UPON RECEIPT OF MATERIAL

2-1. Inspecting and Servicing the Earth Auger

NOTE

Make certain the earth auger is completely depreserved before operating. Make sure preservatives have been removed from the crankcase and fuel tank.

a. Inspection.

(1) Visually inspect the earth auger for loss of parts or damage which may have occurred during loading, shipping, or unloading.

(2) Check earth auger identification plate for positive identification of earth auger.

b. Service.

(1) Open the battery box lid. Refer to Ford Maintenance and Operator's Manual Page 12, 13/22 and Service the battery.

(2) Fill the radiator with coolant.

(3) Fill the fuel tank with gasoline.

(4) Lubricate according to Lube diagram .

*2-2. Installation of Auger onto Carrier

WARNING

Do not use a lifting device with less than 15,000 pound capacity.

a. Attach suitable lifting device to three lifting eyes on auger.

b. Position auger over carrier.

c. Slowly lower the auger to the carrier and mount as shown in figure 2-1.

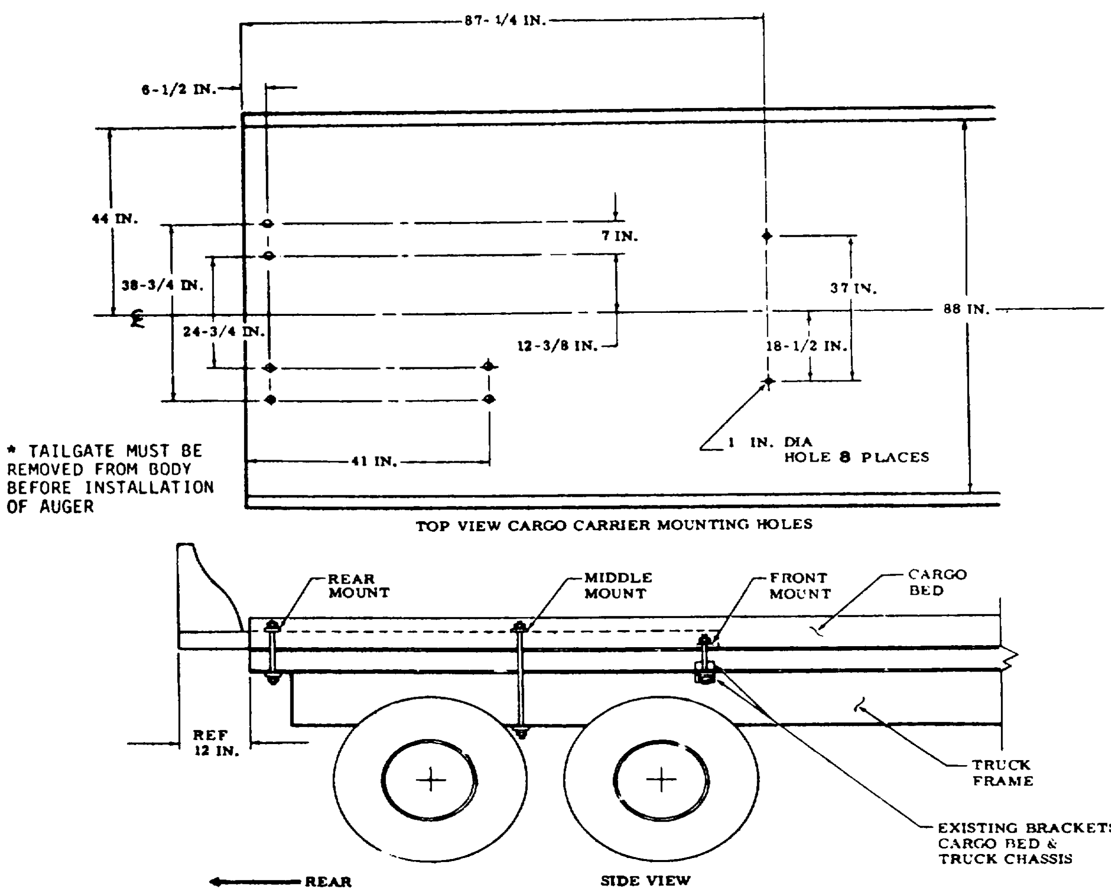


Figure 2-1. Auger assembly base pan.

2-3. Dismantling for Movement

a. Short Distance Movement.

(1) If the earth auger is to be moved only a short distance, it will be moved on it's carrier.

(2) Refer to figure 2-2 and remove the auger from the auger shaft.

(3) Stow the auger, all equipment and tools on the carrier.

(4) Move the unit to the new worksite.

b. Long Distance Movement.

NOTE

If the auger Is to remain on the carrier, it can also be moved a long distance as outlined in paragraph *a* above

(1) Refer to figure 2-2 and remove the auger from the auger shaft.

(2) Drain the auger engine fuel tank.

(3) Refer to figure 2-1 and remove the front, center, and rear mounting hardware securing the auger assembly to the truck frame.

(4) Use a suitable lifting device with at least 15,000 pounds capacity and lift the auger assembly from the truck frame.

(5) Refer to TM 38-230-2 and prepare the auger assembly for shipment to the new worksite.

2-4. Reinstallation After Movement

a. Remove all packaging and preservation tape from the auger assembly.

b. Reinstall the auger assembly on the carrier frame (para 2-2).

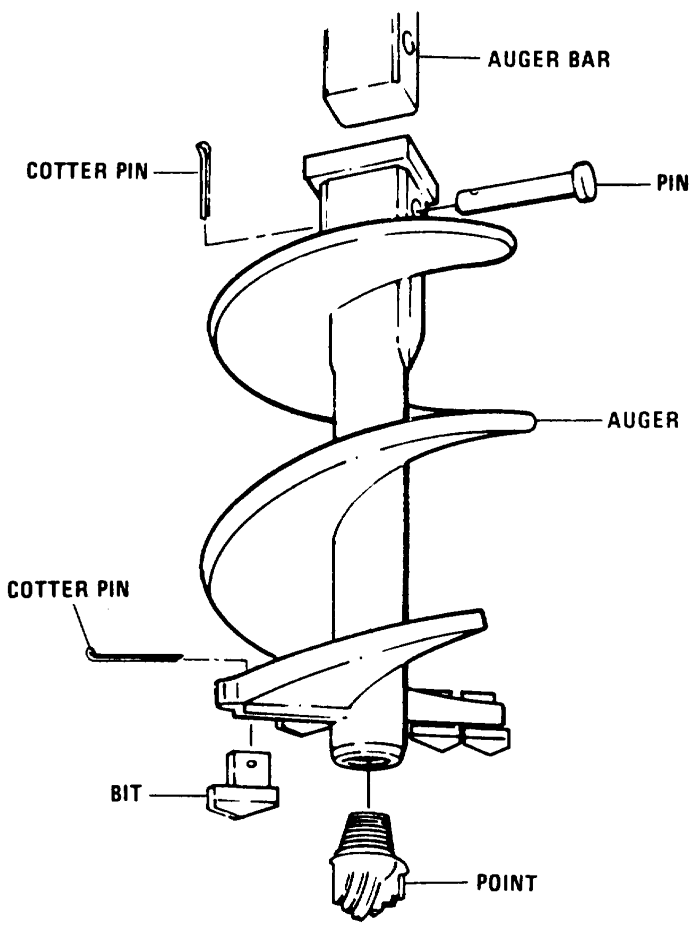


Figure 2-2. Auger. bits, and point, removal and installation

Section III. CONTROLS AND INSTRUMENTS

2-5. General

This section describes the various controls and instruments and provides the operator or crew sufficient information to insure proper operation of the earth auger.

2-6. Controls and Instruments

The purpose. location, and use of the controls and normal readings of the instruments and gauges are illustrated in figure 2-3.

Section IV. OPERATION UNDER USUAL CONDITIONS

2-7. General

a. The instructions in this section are for the information and guidance of personnel responsible for operation of the earth auger.

b. The operator must know how to perform every operation of which the earth auger is capable. This section contains instructions on starting and stopping the earth auger, on operation on the earth auger, and on coordinating the basic motions to perform the specific tasks for which the equipment is designed. Since nearly every job presents a different problem, the operator may have to vary given procedures to fit the individual job.

2-8. Starting the Earth Auger Engine

a. Preparation for Starting.

(1) Perform the preventive maintenance service (para 3-5).

(2) Place all controls in neutral position (fig. 2-3).

(3) Open the fuel shut-off valve on the fuel strainer beneath the fuel tank.

b. Starting (fig. 2-3).

(1) Pull ignition switch out.

(2) Pull the choke out half way. If engine is cold, pull choke out all the way.

(3) Depress the starter button and start engine.

CAUTION

If engine fails to start after 30 seconds cranking, release starter button and allow starter to cool for at least two minutes. Then attempt starting procedures again. If engine still will not start, stop the starting procedures and determine the cause and correct before making another attempt.

(4) Allow engine to warm up for about ten minutes.

(5) Slowly return choke to the "in" position.

2-9. Stopping the Earth Auger Engine

a. Check that all controls are in the center position.

b. Stop the earth auger engine as follows:

(1) Lower the engine speed to idle.

(2) Turn off the ignition switch. If the engine has been running hot, let it run at fast idle speed a few minutes to dissipate the excess heat.

c. Close the fuel shut-off valve on fuel strainer beneath the fuel tank.

2-10. Operation of Equipment

a. General. The auger is designed for use in boring holes in the earth for construction purposes such as fence, power line. anchor post holes, or for explosives.

b. Preparation for Operation.

(1) Start the engine (para 2-8) and operate at idle speed until engine reaches normal operating temperature.

(2) Elevate the auger shaft as instructed in figure 2-4. Pull the elevating cylinder control valve lever to raise the auger shaft.

(3) Level the auger shaft as instructed in figure 2-4. The leveling cylinder positions the auger shaft vertically from left to right. Push the control valve lever to go right, pull for left.

(4) Shift the transmission to first gear, engage shuttle. and allow auger bar to rotate for approximately five minutes to allow lubricant to reach all gears.

NOTE

Do not run the engine faster than idle speed during this operation (5) Disengage shuttle.

c. Operation of Earth Auger.

(1) Position the auger shaft to elevation required by use of elevating and leveling control levers (fig. 2-4).

(2) Shift the transmission to gear required. Shift shuttle to forward position.

(3) Depress accelerator to increase engine speed.

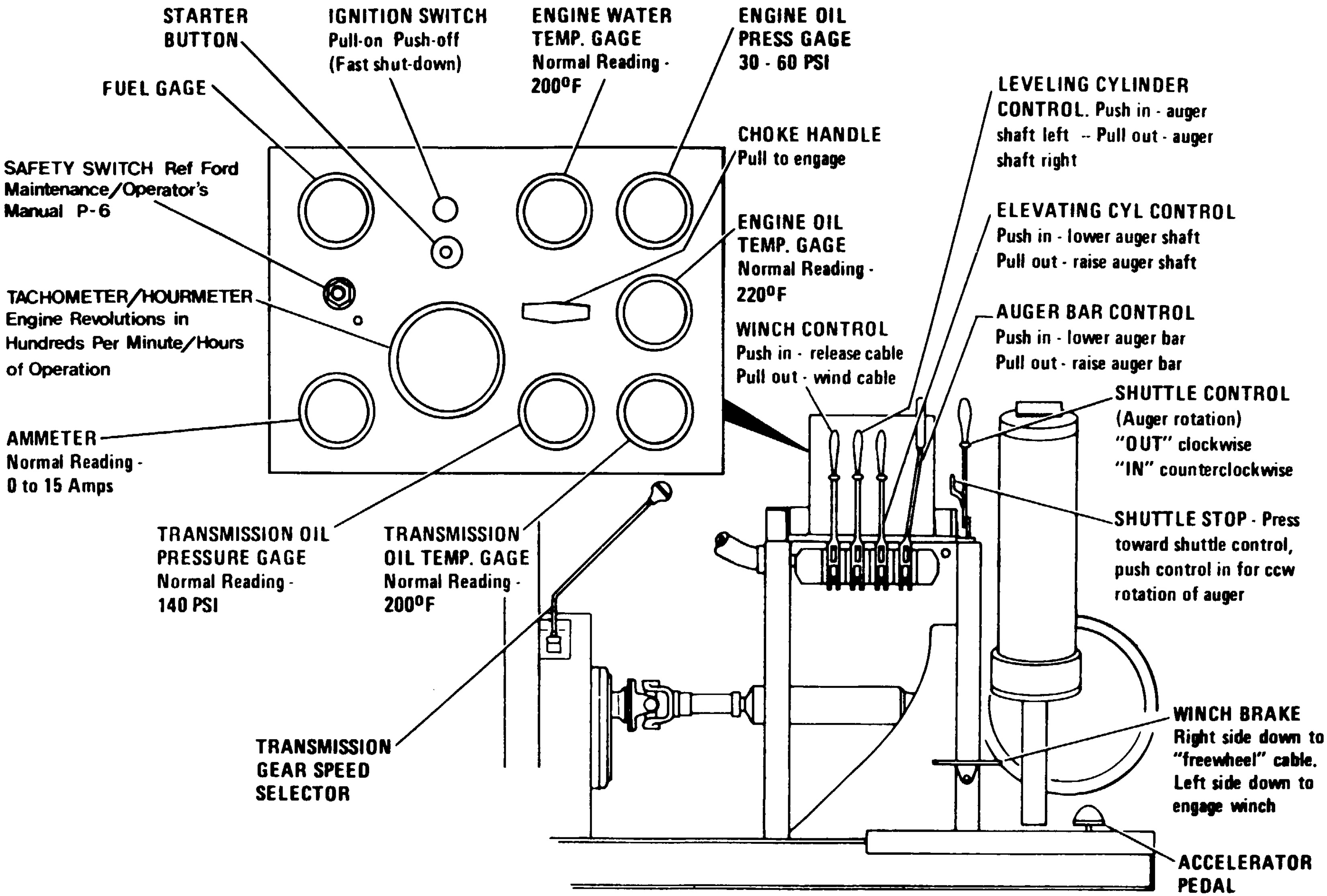


Figure 2-3. Controls and instruments.

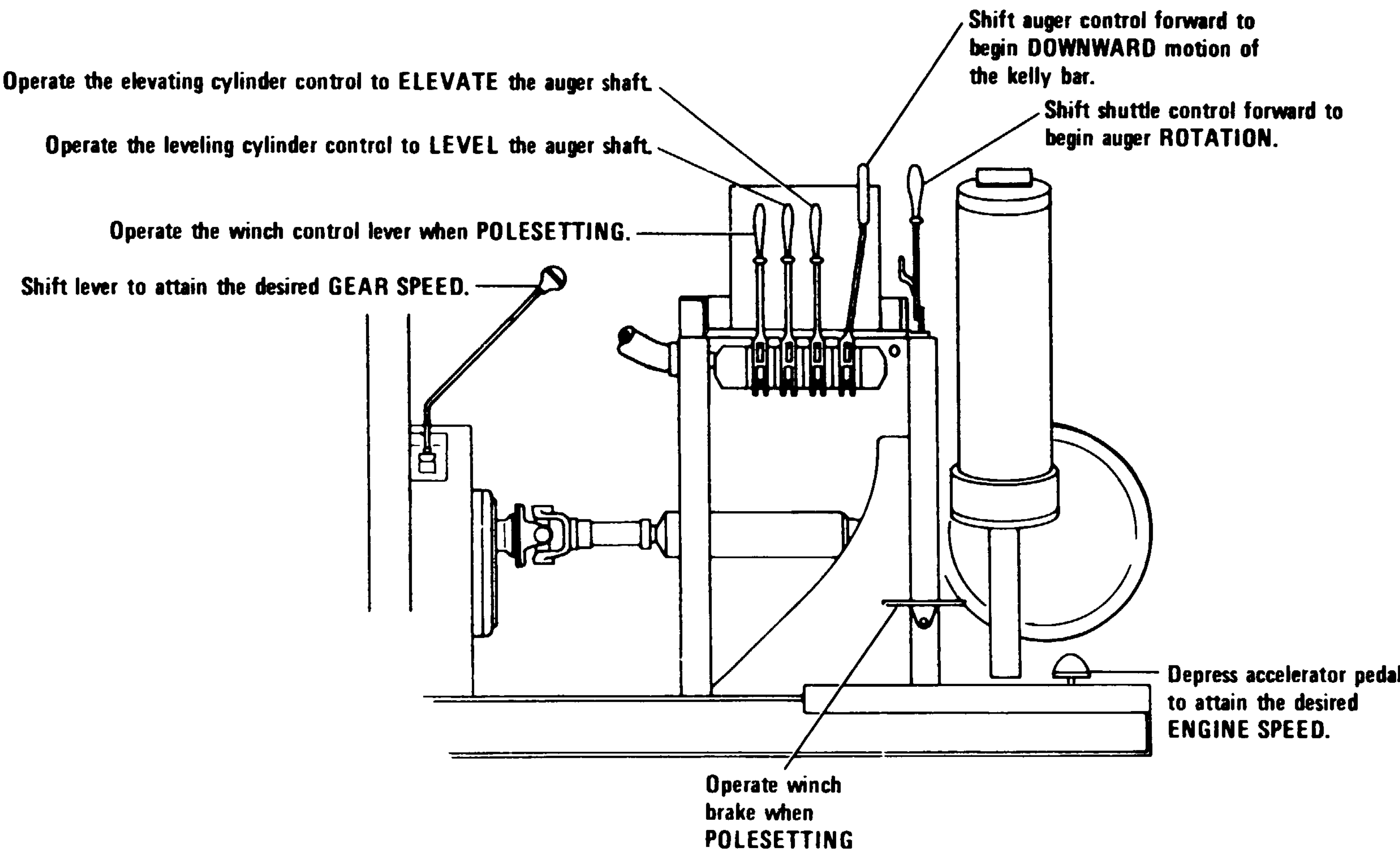


Figure 2-4. Auger operation

CAUTION

Do not overspeed auger. Run engine at slow speed until type and texture of earth can be determined.

(4) Push kelly bar lever (fig. 2-4) forward to lower auger and begin earth boring operation.

(5) When auger is deep enough in earth to be loaded with dirt, disengage shuttle and raise auger from hole by pulling kelly bar lever.

(6) With auger clear of hole, engage shuttle. Rotation will clean auger.

(7) Repeat steps (4), (5), and (6) until hole is to desired depth.

d. Operating for Collapsible Wire Reel.

(1) The wire reel is designed to be mounted onto the end of the winch assembly shaft. It must be secured to the winch shaft using the clevis pin and hair pin provided for this purpose.

(2) With the wire reel mounted horizontally onto the winch shaft, position the handle in the horizontal position to wind cable. To remove cable, position handle perpendicular to the winch shaft.

e. Lowering Auger Shaft. A pointer is welded onto the right angle drive housing and must point to the mark on the right angle drive mount before the auger shaft is lowered. To align the pointer, operate the leveling cylinder. This procedure is necessary to lower the auger shaft to the transport position

Section V. OPERATION UNDER UNUSUAL CONDITIONS.

2-11. Operation in Extreme Cold (Below O' F)

a. Inspect radiator to be sure that antifreeze is correct for the lowest possible temperature expected.

b. Inspect the cooling system and report any leaks to direct support maintenance.

c. Keep battery fully charged. After adding water, run the engine for at least one hour.

d. Keep fuel tank as full as possible to prevent condensation.

e. Drain and service fuel strainers frequently.

f: Before applying load, allow engine to reach normal operating temperature.

g. Lubricate as specified in Lubrication diagram this manual.

2-12. Operation in Extreme Heat

a. Cooling System.

(1) Check the coolant level frequently. Clean and flush the cooling system frequently.

(2) Make sure the fan belts are in good condition and that the' tension is adjusted properly. Make sure that the thermostat is in proper working condition.

(3) Clean between the fins of the radiator core frequently to get the best possible cooling. Use compressed air if available to blow all dust and dirt out of the core. Avoid using water that contains substances likely to cause excessive scale and rust.

b. Lubrication System. Lubricate the unit for hot weather operation in accordance with Lubrication diagram this manual.

c. Fuel System.

(1) Clean the fuel strainer frequently and check the fuel filters.

(2) Check the air cleaner. Keep it clean and free from foreign matter.

(3) Be sure the tank vents in the fuel system are open.

d. Electrical System. Check the electrolyte level in the battery daily, and fill to three-eights inch above the plates with distilled water, if available. Clean, mineral free water may be used.

2-13. Operation in Dusty or Sandy Areas

a. Cooling System.

(1) Keep the radiator core free of dust, sand, or foreign matter to avoid overheating of the engine.

(2) Keep dust and sand from entering the radiator by wiping dust or sand from the cap before adding coolant.

b. Lubrication System.

(1) Lubricate the unit in accordance with Lubrication diagram this manual.

(2) Keep all lubrication points clean and avoid spilling oil on the unit as it will collect dust and sand.

(3) Clean and replace filters more often than in normal operation.

c. Fuel System.

(1) Take all precautions necessary to keep dirt or other foreign material out of the fuel tanks and fuel system. Clean the fuel strainer and water trap frequently.

(2) Check and service the air cleaner as necessary.

d. Electrical System.

(1) Service the batteries frequently and keep battery box cover securely fastened.

(2) If any of the instrument gauges have loosefitting glass, use a sealer or tape to keep dust or sand from entering.

2-14. Operation Under Rainy or Humid Conditions

a. Lubrication System.

(1) Lubricate the unit in accordance with Lubrication diagram this manual

(2) Keep the fillet caps and plugs tight to prevent water from entering the lubrication system.

b. Fuel System.

(1) Keep fuel tank full when not in operation to prevent condensation and keep fill caps tight.

(2) Inspect fuel strainer for accumulated water more often than is required for normal operation.

c. Electrical System.

(1) Check wiring for cracked or frayed insulation. See that wiring is kept dry and water-proofed.

(2) Coat the battery terminals with grease and keep the battery box secured.

2-15. Operation in Salt Water Areas

a. Lubrication System.

(1) Keep oil filler caps and plugs tight.

(2) Be sure to clean and dry all fittings before lubricating.

b. Cooling System. Be sure the water in the cooling system is free from salt or alkali. Use an approved rust inhibitor to prevent the formation of rust or scale in the cooling system.

CAUTION

The cooling system is not intended for use with salt water. However, salt water may be used in extreme emergencies. Drain, flush, and refill the cooling system as soon as possible after using this expedient.

c. Electrical System.

(1) Clean electrical connections and keep them dry.

(2) Coat the battery terminals with grease and secure battery box cover.

d. Protection.

(1) Wash the unit frequently with clean, fresh water.

(2) Remove corrosion from any unpainted surface. Report areas in need of painting to organizational maintenance.

2-16. Operation at High Altitudes

a. The engine in this unit is designed to operate under normal conditions up to 5,000 feet above sea level without special service or adjustment.

b. Above 5,000 feet the engine efficiency will be reduced. This is a normal condition which cannot be prevented, but maximum performance can be maintained by following all service instructions carefully. Be sure air cleaners are clean and free of objects that might restrict flow of air to the unit.

c. Be alert for pressure leaks that allow the coolant to boil with resultant loss of coolant. Inspect the radiator cap and gasket frequently for tight sealing.

Section I. BASIC ISSUE ITEMS LIST AND ITEMS TROOP INSTALLED OR AUTHORIZED

3-1. Basic Issue Items and Troop Installed Items

Basic issue items list and items troop installed or authorized are not applicable.

Section II. LUBRICATION INSTRUCTIONS

3-2. Detailed Lubrication Information

a. *General*. Keep all lubricants in closed containers and store in a clean dry place away from external heat. Allow no dust or other foreign material to mix with the lubricants. Keep all lubrication equipment clean and ready for use.

b. *Cleaning*. Keep all external parts not requiring lubrication clean of lubricants. Before lubricating the equipment, wipe all lubrication points free of dirt and grease. Clean all lubrication points after lubricating to prevent accumulation of foreign matter.

3-3. Points of Lubrication

Service the lubrication points at proper intervals as specified in Lubrication diagram this manual

Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

3-4. General

To insure that the earth auger is ready for operation at all times. it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. The necessary checks and services to be performed are listed as described in paragraph 3-5. The item numbers indicate the sequence of minimum inspection requirements. Defects discovered during operation of the unit will be noted for future correction to be made as soon as operating has ceased. Stop operation immediately if a deficiency is noted during operation which would damage the equipment if operation were continued. All deficiencies and shortcomings will be recorded together with the corrective action taken on DA Form 2404, Equipment Inspection and Maintenance Worksheet, at the earliest possible opportunity.

3-5. Preventive Maintenance Checks and Services

Preventive maintenance checks and services to be performed by the operator are listed in table 3-1.

Table 3-1. Preventive Maintenance Checks and Services

Item Number	Interval						B – Before operation A – After operation M – Monthly D – During operaton W – Weekly Q – Quarterly		
	Operator				Org				
	Daily				M	Q	Item to be inspected	Procedure	References
	B	D	A	W					
1	X						Muffler and pipes	Visually inspect for exhaust leakage due to corrosion, loose clamps, or damaged gaskets Refer damage to organizational maintenance.	(fig 4-24)
2	X						Radiator	Check coolant level. Fill to 2 inches below filler neck.	(para 3-8)
3	X						Fan belt	Inspect for frayed or damaged edges Check for proper adjustment. Adjust-ment should be 1/2 inch deflection between pulleys Refer to organizational maintenance.	(para 4-15*a*.)

Item Number	Interval: Operator, Daily: B	D	A	W	Org: M	Q	Item to be inspected	Procedure	References
							B – Before operation; D – During operaton	A – After operation; W – Weekly	M – Monthly; Q – Quarterly
4	X						Air cleaner hoses	Inspect for loose connections or breakage in hose. Tighten any loose connections, and, if breakage is detected, refer to organizational maintenance for repair.	(fig. 4-11)
5	X	X					Fuel lines and tank	Inspect fuel hose for leaks. Inspect and service fuel tank.	(para 3-9)
6	X						Transmission	Check oil level and service as required.	(para 3-10)

Section IV. TROUBLESHOOTING

3-6. General

This section contains information useful to the operator in diagnosing and correcting unsatisfactory operation or failure of the earth auger Malfunctions which may occur are listed in table 3-2 Each malfunction stated is follow by a list of probable causes of the trouble The corrective action recommended is described opposite the probable cause.

Table 3-2. Troubleshooting

Malfunction	Probable cause	Corrective action
1. Engine hard to start or fails to start.	a. Fuel tank empty.	a. Fill the fuel tank (para 3-9).
	b. Fuel valve closed.	b Open fuel valve on fuel line under fuel tank.
	c. Fuel contaminated.	c. Drain fuel tank and fill with clean fuel (para 3-9).
2. Engine misses or runs erratically.	Contaminated fuel.	Drain and refill fuel tank (para 3-9).
3. Engine stops suddenly.	a Fuel tank empty.	a. Service the fuel tank (para 3-9).
	b. Water or dirt in fuel.	b Drain and refill fuel tank (para 3-9).
	c. Fuel line broken.	c Inspect fuel line and report any discrepancies to organizational maintenance.
4. Engine overheats.	a. Fan belt loose or broken.	a. Check and adjust fan belt (para 4-15). Proper adjustment is 1/2 inch deflection between pulleys. Refer broken belt condition to organizational maintenance.
	b. Coolant level low.	b. Add coolant (para 3-8).
	c Clogged radiator cooling fins.	c Clean radiator exterior cooling fins with a soft brush or wisk broom.
5. Engine oil pressure low.	Crankcase oil level low.	Fill to correct level (Lube diagram).
6. Engine knocks or develops excessive noise.	a. Crankcase oil level low.	a. Fill to correct level (Lube diagram).
	b. Excessive load on gear train.	b. Reduce load or change gears.
7. Engine exhaust smoky.	a. Crankcase oil level too high.	a. Drain crankcase to proper level (Lube
a. Mostly blue color diagram).		
b. Mostly black color	b. Engine cold causing poor combustion.	b. Allow engine sufficient time to warm up.
	c. Choke not open.	c. Open choke.
8.		
9. Excessive leakage of hydraulic fluid from the lower packing nut.	Loose packing.	Tighten packing nut (para 3-12).

3-7. General

This section contains maintenance instructions that are to be performed by the operator.

3-8. Cooling System

a. Remove the radiator cap and check the level of coolant.

b. Add coolant until level is approximately one inch below neck of radiator.

c. If there are signs of dirt or rust in the coolant, drain and flush the cooling system as follows:

(1) Remove the radiator cap to facilitate drainage.

(2) Open the coolant drain cock at the bottom of the radiator and allow the coolant to drain into a suitable container.

(3) Fill the radiator with coolant as required for lowest expected temperatures and attach a tag specifying the coolant used.

(4) Refer to paragraph 2-8 and start the engine and allow it to operate until normal operating temperature is reached

(5) Refer to paragraph 2-9 and stop engine.

(6) Check coolant level. Add coolant as necessary.

d. In cold weather operation, test the specific gravity of anti-freeze. Add anti-freeze as required for lowest temperature expected.

e. If loss of coolant occurs, check for any leaks and refer findings to higher level of maintenance for repair.

3-9. Fuel System

a. Remove fuel tank cap. Inspect vent hole and remove any obstructions.

b. Fill fuel tank to capacity.

c. If evidence of fuel contamination is observed, drain and refill the fuel tank. Check for any obstructions in fuel lines.

3-10. Transmission

a. Check level of lubricant in transmission by removing cap level indicator located on the transmission.

b. If level indicates low, add lubricant per Lube diagram until the level reaches full.

c. Always use clean fluid and clean containers.

d. Do not overfill.

e. If the oil appears contaminated, remove the drain plug and drain the oil. Refill with clean fluid.

f. If the fluid has become contaminated with metal particles, do not operate the equipment.. Refer to higher level of maintenance.

NOTE

Stop engine before checking or adding fluid Drain dirty fluid while unit is still warm

3-11. Engine

a. Check crankcase oil level on indicator.

b. If oil level is low, add oil specified in Lube diagram to full level. If there are signs of oil leakage or excessive oil consumption, refer to higher level of maintenance.

3-12. Kelly Bar (Lower) Packing Nut

a. After initial operation, the kelly bar packing nut will tend to leak somewhat. Therefore, the nut must be tightened in such a manner that the "leakage" leave only a "film" of hydraulic oil on the kelly bar. The nut must not be tightened to the extent that the kelly bar is dry

**b*. To tighten the packing nut, refer to figure 3-1.

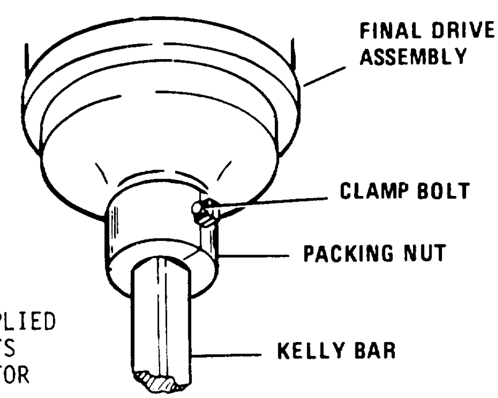


Figure 3-1. Tightening kelly bar (lower) packing Unit

CHAPTER 4
ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIAL

4-1. General

In addition to the performance of inspections and services by the operator as described in paragraph 2-1, the earth auger must be depreserved and serviced by organizational maintenance personnel as follows:

a Clean hydraulic tank strainer and breather. Install filters. Refer to paragraph 4-24. Check o-rings and gaskets. Replace if necessary. Service the hydraulic tank.

b. Visually inspect the unit for loss of parts, or damage which may have resulted during shipping, loading, or unloading.

c. Remove all preservatives used for shipping.

d. Service the engine crankcase.

e. Service the air cleaner.

Section II. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

4-2. Special Tools and Equipment

There are no special tools or equipment required by organizational maintenance.

4-3. Maintenance Repair Parts

Repair parts and equipment are listed and illustrated in the Renewal Parts Manual, Ford Manuals and Funk Manual.

Section III. LUBRICATION INSTRUCTIONS

4-4. General

This section contains lubrication instructions which are supplemental to, and are not specifically covered, in the Lube diagram. Refer to Lubrication diagram this manual,

4-5. Detailed Lubrication Information

a. General. Keep all lubricants in closed containers and store in clean dry place away from extreme heat. Do not allow dust or other foreign particles to mix with lubricants. Keep all lubrication equipment clean and ready to use.

b. Cleaning. Keep all external parts not requiring lubrication free of lubricants. Wipe all lubrication points free of dirt and grease before lubricating equipment. Clean all lubrication points after lubricating to prevent accumulation of foreign matter.

c. Engine Lubrication System.

(1) Remove oil drain plug from oil pan on engine and allow oil to drain completely. Clean any foreign matter from magnetic drain plug and inspect plug gasket to insure proper sealing and prevent leakage. Replace drain plug.

NOTE

Drain oil from engine while warm Check all dirty oil for contamination of metal particles Metal particles In the oil may indicate failure of some part Refer to higher level of maintenance for repair

(2) Remove oil filter located on the side of the engine. Thoroughly clean filter mounting area and install a new filter.

d. Transmission Service.

(1) To change fluid in the transmission, the shuttle and four speed transmission sections must be drained separately. Clean magnetic drain plugs before replacing.

NOTE

Drain oil from transmission while warm Check all dirty oil for contamination of metal particles Metal particles in the oil mav indicate failure of some part Refer findings to higher level of maintenance for defect interpretation

(2) Replace fluid filter located on top of the shuttle transmission.

(3) Refill the entire unit through the single fill location positioned on the side of the shuttle transmission.

Section IV. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

4-6. General

To insure that the earth auger is ready for operation at all times, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure The necessary preventive maintenance checks and services to be performed are listed as described in paragraph 4-7. Defects discovered during operation of the earth auger will be noted for future correction, to be made as soon as operation has ceased. Stop operation immediately if a deficiency is noted during operation which would damage the equipment if operation were continued. All deficiencies and shortcomings will be recorded, together with the corrective action taken. on DA Form 2404 (Equipment Inspection and Maintenance Worksheet) at the earliest possible opportunity.

4-7. Preventive Maintenance Checks and Services

Preventive maintenance checks and services are listed and described in table 4-1.

Table 4-1. Preventive Maintenance Checks and Services

Item Number	Interval						B – Before operation D – During operaton	A – After operation W – Weekly	M – Monthly Q – Quarterly
	Operator				Org				
	Daily								
	B	D	A	W	M	Q	Item to be inspected	Procedure	References
1					X		Muffler & pipes	Replace exhaust pipe and/or muffler if there are signs of corrosion or excessive rust.	(para 4-31)
2					X		Cooling system	Test radiator cap pressure. If cap pressure is below recommended pressure, replace cap. Test thermostat.	(para 4-14)
						X		Replace it' faulty. Inspect thermostat housing for leaks. Replace gasket If required. Inspect all coolant hoses	(para 4-1 7)
					X			for leaks.	
3	,				X		Fan belt	Inspect fan belt. Replace badly worn or frayed belt. Adjust as required.	(para 4-15)
4						X	Fan blade	Inspect for damage. If there are signs of damage, replace the fan blade.	(para4-16)
5					X		Hydraulic system	Inspect and service strainer and filter. Replace it' necessary. Inspect all hydraulic hoses. Replace any worn or broken hoses.	(para 4-24)
6						X	Hydraulic pump	Inspect pump. Replace pump if inoperative or it' it produces insufficient results.	(para 4-21)
7						X	Control valve	Inspect and adjust control valve. Replace if necessary	(para 4-20)
8						X	Hydraulic motor	Inspect motor for defective condition or unsatisfactory operation. Replace defective motor.	(para 4-22)
9					X		Hydraulic reservoir	Inspect for insecure mounting. Inspect tank for damage or deterioration. Service breather cap. Replace tank or cap It' necessary.	(para 4-24)
10					X		Engine	Inspect engine for damage. leaks, or unsatisfactory conditions. Service as required. Inspect engine support for insecure mounting. Inspect crankcase breather or cap. Replace if defective.	(4-31, Also Ford Maintenance/Service Manuals)
11						X	Valves and cover	Inspect valve cover for damage or leaks Replace if not serviceable. Check gasket for cracks or breaks.. Replace if defective. If noisy or loss of power is noticed, make valve adjustments in accordance with (Ford Maintenance /Service Manuals).	(Ref. Ford Maintenance /Service Manuals)

Table 4-1. Preventive Maintenance Checks and Services - Continued

Item Number	Interval: Operator Daily B	D	A	W	Org M	Q	Item to be inspected	Procedure	References
							B – Before operation A – After operation M – Monthly D – During operaton W – Weekly Q – Quarterly		
12						X	Fuel System	Adjust the carburetor if required. Replace unserviceable carburetor.	(Ref. Ford Manuals)
13						X		Check fuel pump for insecure mountings, cracks, or leaks. Check gaskets. Replace if defective.	(Ref. Ford Manuals)
14					X			Service the air cleaner. Tighten all loose connections. Replace defective hoses.	(Ref. Ford Manuals)
15						X		Inspect fuel tank mounting. Replace damaged or defective tank. Check all fuel lines. Replace if defective.	(para 4-26)
16						X		Adjust governor as required. Replace if inoperative.	(Ref. Ford Manuals)
17					X			Service and adjust throttle and choke controls. Replace any defective parts.	(Ref. Ford Manuals)
18						X		Replace fuel filter.	(Ref. Ford Manuals)
19						X		Spark plugs Inspect spark plugs for breaks and inspect for improper gap Replace worn or damaged plugs.	(Ref. Ford Manuals)
20					X		Gages and	Check for broken glass or defective condition. Replace if broken or defective.	(para 4-30)
21					X		Battery	Check electrolyte level and service. Test battery for proper voltage. Replace defective battery.	(para 4-29c)
22						X	Shielding system	Inspect electrical leads. Test filter capacitor. Replace defective parts.	(para 4-9 thru para 4-12)
23						X	Winch	Inspect and adjust winch. Inspect wire reel. Repair defects In reel. Replace.	(para 4-36)
24						X	Polesetter	Inspect polesetter.	
25						X	Auger, and points.	Replace it' excessively worn.	(para 4-37)
26						X	Feed ram and cylinder	Inspect feed ram and leveling cylinder. Check hydraulic connections for leaks.	(para 4-23)
27						X	Control handles	Inspect hand controls.	(para. 4-20c)

Table 4-2. TROUBLESHOOTING

Malfunction	Probable cause	Corrective action
1. Starter will not crank engine	a. Battery leads loose or terminals corroded	a. Clean and tighten battery terminals (para 4-29a)
	b. Battery defective or too weak lt, .rank engine	b. Check electrolyte level and service as necessary Replace defective battery (para 4-29a).
	c. Starter defective	c. Replace starter (Ref. Ford Manuals)
2. Engine hard to start or fails to start (Ref. Ford Maintenance/Service Manuals)	a. Fuel sediment bowl clogged	a. Service the Fuel sediment bowl (para 4-27)
	b. Intake air restricted	b. Service the air cleaner
	c. Starter switch detective	c. Replace switch
	d. Carburetor Improperly adjusted or defective	d. Adjust or replace carburetor
	c. Ignition or spark plug wires loose or defective	e. Tighten loose .connection or replace wire
	f. Spark plugs defective	f. Clean, regap, or replace spark plugs
	g. Detective points and/or condenser	g. Replace points and condenser
3. Engine misses or runs erratically (Ref. Ford Maintenance/Service Manuals)	a. Carburetor Improperly adjusted or detective	a. Adjust or replace carburetor
	b. Valves require adjustment.	b. Adjust valves
	c. Spark plugs defective.	c. Clean, regap, or replace spark plugs

Table 4-2. TROLBLESHOOTING – Continued

Malfunction	Probable cause	Corrective action
	d. Ignition or spark plug fires loose or defective.	d. Tighten loose connections or replace wires
	e. Governor out of adjustment.	e. Adjust governor in accordance with manual specifications
	f. Air cleaner intake restricted.	f. Service the air cleaner
	g. Fuel sediment bowl dirty.	g. Service fuel sediment bowl (para 4-27)
4. Engine stops suddenly (Ref. Ford Maintenance/Service Manuals)	a. Air cleaner clogged.	a. Service the air cleaner
	b. Ignition wire faulty.	b. Inspect wire for a ground between ignition switch and distributor
	c. Clogged fuel filter or line.	c. Replace fuel filter. Clean line.
5. Engine overheats (Ref. Ford Maintenance/Service Manuals)	a. Ventilation insufficient.	a. Provide proper ventilation.
	b. Radiator clogged or leaking.	b. Clean or replace radiator (para 4-13).
	c. Water pump or thermostat defective.	c. Test thermostat. Replace if defective (para 4-17). Replace water pump (para 4-18)
	d. Low coolant level.	d. Refill radiator (para 3-8).
	c. Fan belt loose or slipping.	e. Adjust fan belt to correct tension (para 4-15*a*.).
6. Engine oil pressure low	a. Oil pressure gauge defective.	a. Replace oil pressure gauge (para 4-30)
	b. Low oil level in crankcase.	b. Refill crankcase (Lube diagram).
7. Engine lacks power (Ref. Ford Maintenance/Service Manuals) defective.	a. Valve lifter clearance incorrect.	a. Adjust the valves
	b. Carburetor improperly adjusted or	b. Adjust or replace carburetor
	c. Governor out of adjustment.	c. Adjust governor
	d. Ignition timing out of adjustment.	d. Retime the engine
8. Engine knocks or develops excessive noise (Ref. Ford Maintenance/Service Manuals)	a. Air leak in intake manifold.	A. Replace gasket or manifold as required
	b. Improper ignition timing.	b. Retime engine
	c. Governor out of adjustment or defective.	c. Adjust governor or linkage, replace if defective
9. Engine will not idle smoothly (Ref. Ford Maintenance/Service Manuals)	a. Carburetor improperly adjusted.	a. Adjust the carburetor
	b. Spark plug gap improper.	b. Inspect and reset spark plug gap
	c. Improper distributor point gap.	c. Adjust points
10. Engine exhaust smoky mostly black smoke closed choke valve. (Ref. Ford Maintenance/Service Manuals)	a. Carburetor improperly adjusted or	a. Adjust the carburetor or open choke valve
	b. Carburetor defective.	b. Replace the carburetor
	c. Air intake restricted.	c. Service air cleaner
11. Electrical starter fails to operate	a. Starter defective.	a. Replace the starter (Ford Manuals)
	b. Defective battery.	b. Replace the battery (para 4-29)
	c. Battery cables defective.	c. Replace cables (para 4-29a)
	d. Starter switch defective.	d. Replace switch (para 4-30)
12. Ammeter shows improper charge	a. Voltage regulator faulty.	a. Replace regulator (-Ford Manuals)
	b. Defective battery cell.	b. Replace battery (para 4-29)
	c. Ammeter defective.	c. Replace ammeter (para 4-30)
	d. Alternator defective.	d. Replace alternator (para 4-28)
13. Alternator does not charge	a. Regulator defective.	a. Replace regulator (Ford Manuals)
	b. Sulfated battery.	b. Replace battery (para 4-29)
	c. Alternator defective.	c. Replace alternator (para 4-28)
	d. Fan belt out of adjustment.	d. Adjust the fan belt (para 4-15).
14. Transmission gears difficult to shift in accordance with (Lube diagram).	a. Incorrect lubricant.	a. Drain and refill with proper lubricant
	b. Insufficient lubricant.	b. Refill transmission in accordance with (Lube diagram).
15. Hydraulic cylinders operate slowly or fail to operate at all	a. Insufficient hydraulic oil in the system.	a. Inspect the level of the hydraulic oil In the tank and fill as required. (Lube diagram).
	b. Leak in pressure lines.	b. Inspect the pressure lines for leaks or loose connections. Correct this condition (para 4-23).
	c. Clogged oil filter element.	c. Replace filter element (para 4-24).
16. Hydraulic pump does not operate or build up system.	a. Insufficient hydraulic oil In the	a. Inspect the level of hydraulic oil in the tank and add oil as necessary. (Lube diagram
	b. Clogged hydraulic line strainer or filter.	b. Remove and clean the hydraulic strainer and replace filter (para 4-24*b*.).

Malfunction	Probable cause	Corrective action
	c. Hydraulic pump defective.	c. Replace pump (para 4-21).
	d. Leak in pressure line.	d. Tighten connections (para 4-21).
17. Elevating cylinder will not operate correctly	a. Hydraulic shut-off valve not open	a. Open the hydraulic shutoff valve.
	b. Clogged hydraulic line strainer	b. Remove and clean the hydraulic strainer (para 4-24*b*.).
18. Hydraulic oil leaks at elevating and leveling cylinders	Packing worn or defective.	Replace a defective cylinder (para 4-23).
19. Hydraulic filter warning light illuminates	Filters dirty	Replace filters (para 4-24*c*.).
20. Hydraulic noise excessive	a. Pump bearings worn excessively	a. Replace hydraulic pump (para 4-21).
	b. Hydraulic line strainer clogged	b. Remove and clean strainer (para 4-24*b*.).
21. Final drive assembly leaks	a. Loose or missing hardware	a. Inspect all hardware. Tighten or replace.
	b. Oil level too high	b. Drain oil to proper level (Lube diagram)
22. Auger bores holes at incorrect angles	a. Elevating and/or leveling cylinders inoperative.	a. Replace the elevating or leveling cylinder (para 4-23).
	b. Hydraulic pump leaking	b. Replace the hydraulic pump (para 4-21).
	c. Carrier hold-down bolts loose	c. Tighten carrier hold-down bolts (para 2-3).
23. Auger jumps or bucks excessively	a. Defective hydraulic pump	a. Replace the pump (para 4-21).
	b. Defective leveling or elevating cylinder	b. Replace defective cylinder (para 4-23).
	c. Carrier hold-down bolts loose	c. Tighten hold-down bolts (para 2-3).
24. Auger does not evacuate material	a. Loss of hydraulic pressure	a. Inspect all lines and fittings 'or leaks or seepage) oil. Tighten fittings. Replace defective lines.
	b. Load on auger too heavy.	b. Raise kelly bar lever sufficiently to ease load on auger (para 2-10*c*.).

Section V. TROUBLESHOOTING

4-8. General

This section provides information useful for organizational maintenance in diagnosing and correcting unsatisfactory operation or failure of the earth auger. Malfunctions which may occur are listed in table 4-2. Each malfunction stated is followed by a list of probable causes of the trouble. The corrective action recommended is described opposite the probable cause.

4-9. General

Essentially, suppression is attained by providing a low resistance path to ground for stray' currents. The methods used include shielding the ignition and high frequency wires, grounding the frame with bonding straps, and using capacitors and resistors.

4-10. Interference Suppression Components

a. Primary Suppression components. The primary suppression components are those whose primary function is to suppress radio interference. These components are illustrated in figure 4-1.

b. Secondary Suppression Components. These components have radio interference suppression functions which are incidental or secondary to their primary function. These components are illustrated in figure 4-1.

4-11. Inspection, Removal and Installation of Interference Components

Inspect all components for damage and secure installation Replace a defective component. Refer to figure 4-1 for removal and installation.

4-12. Testing of Radio Interference Suppression Components

If interference is indicated, isolate the cause of interference by using the appropriate frequency/audio meter if available If not available, use the trial and error method of replacing each component in turn until the cause of interference is located and eliminated.

Remove coil wire and spark plug wires by unscrewing fittings
Remove the plug shields by removing entire assembly from cylinder head then separate cap from body of plug shields.
Remove distributor shield and cap by releasing the two clamps. Remove two screws from the shield to separate the distributor cap from the shield.
Remove coil shield by removing two screws.

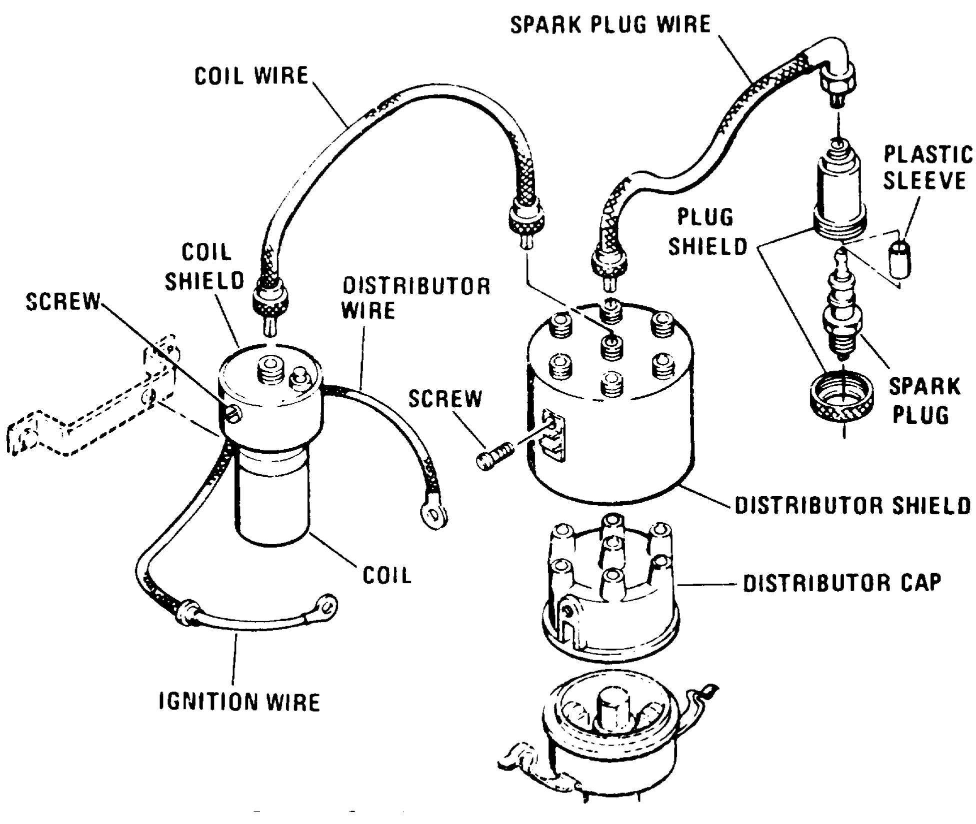


Figure 4-1. Radio interference suppression Components

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4-13. Radiator Removal and Installation

a. Remove acoustical panels necessary for access to radiator. Refer to paragraph 4-50.

b. Remove radiator cap (14,fig. 4-2) by turning it in a counterclockwise direction and lifting straight upward. If engine is hot, turn the cap slowly to first stop and allow pressure to escape completely. Then turn cap again slowly counterclockwise to remove.

c. Drain the radiator by opening the drain cock (16)on the lower part of the radiator. After draining, remove the clamp(19),drain hose E8) and drain cock (16).

d. Loosen the clamps (8) on the upper hose (9) and lower hose(lo)and disconnect hoses from radiator.

e. Remove the nut (4) and washer (5) from Engine to remove the radiator brace (7).

f. Remove the screw and washer assemblies (11) to remove the fan shroud (12).

g. Remove the nuts (4), And Pads (2) attaching the radiator (1) to the support and remove radiator (1).

i. To install the radiator, reverse the procedures given in paragraphs *a.* through *g*. Replenish coolant following installation (para 3-8).

4-14. Radiator Cap

a. Remove radiator cap(14,fig. 4-2) by slowly turning the cap in a counterclockwise direction to the first stop.

b. Allow pressure to escape completely.

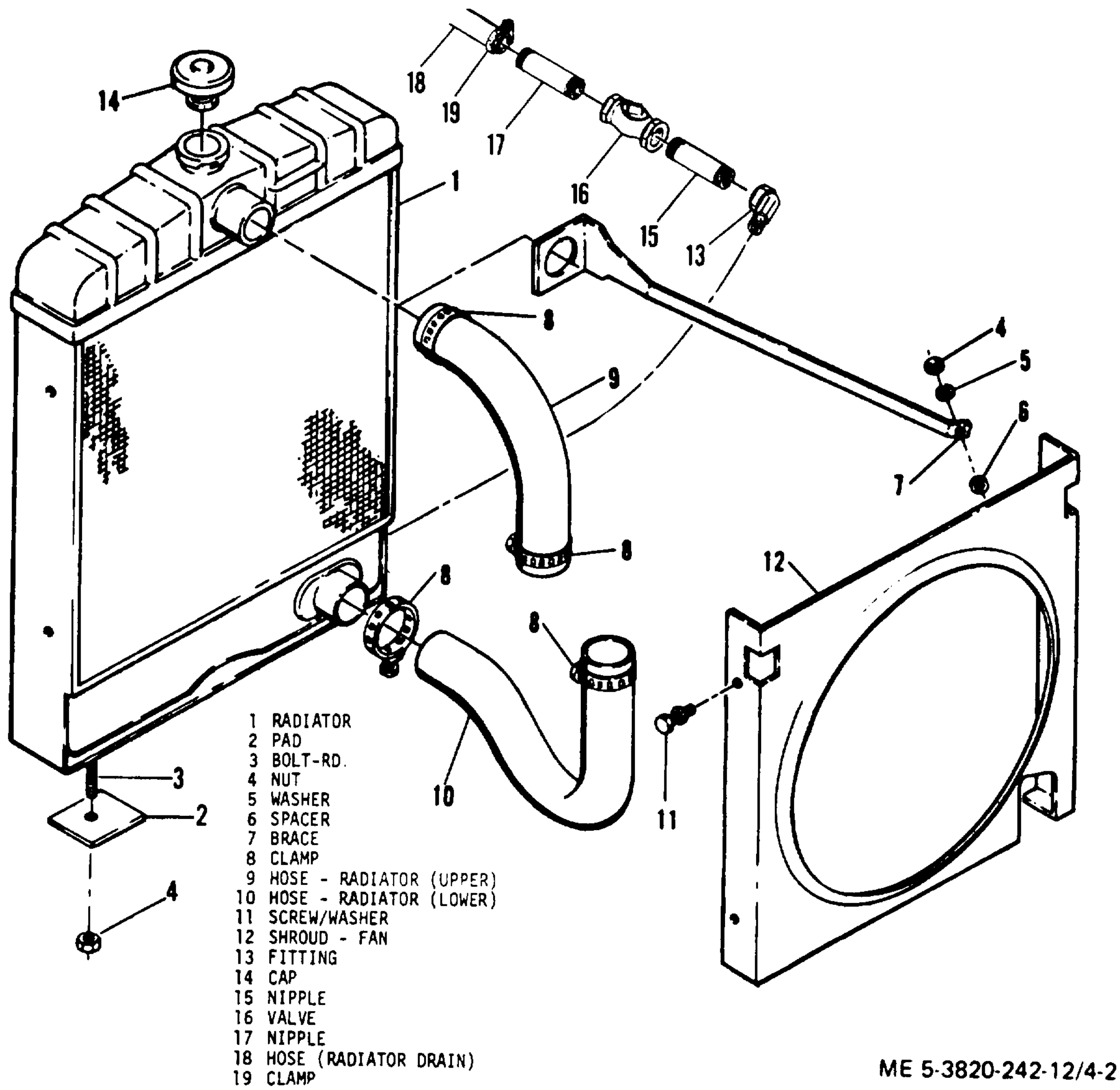


Figure 4-2. Radiator, exploded view.

c. Continue turning cap counterclockwise and remove the cap from the radiator.

d. Test the radiator cap with a radiator cap tester. The radiator cap should open when the pressure as indicated on the tester dial shows 7 psi. If the cap opens at a pressure reading one PSI above or below the correct reading, or if the cap will not maintain a 7 pound pressure for one minute, the cap must be replaced e. Install cap and tighten in a clockwise direction

4-15. Fan Belt and Water Pump Drive Belt

a. *Fan Belt Adjustment (4, fig. 4-3)*. To adjust the fan belt tension, loosen the two nuts (4) securing fan bracket (7) to the outlet connection (15). Tighten the fan belt tension by lifting up on the fan bracket and retighten the two nuts Proper tension is 1/2 inch deflection between pulleys.

b. Fan Belt Removal and Installation (fig 9. 4-3)

(1) Loosen the two nuts (4) securing the fan bracket (7) to the outlet connection (15) and relieve the belt tension by lowering the fan bracket.

(2) Remove the belt (6) from the fan bracket and pulley (7) and the crankshaft pulley.

(3) Lift the belt (6) over the fan blade (3) to remove

(4) Install belt (6) by reversing removal procedures outlined above.

c. Water Pump Drive Belt Adjustment (fig. 4-11) To adjust the belt tension, loosen the alternator mounting bolt and alternator adjusting arm bolt. The belt tension is adjusted by moving the alternator in a direction outward from the engine to tighten, or toward the engine to lessen the tension. Holding alternator in position, tighten the adjusting arm bolt, then the alternator mounting bolt. Proper tension is 1/2 inch deflection between pulleys.

d. Water Pump Drive Belt Removal and Installation.

(1) Remove the fan belt (refer to para *b*. above)

(2) Loosen the alternator mounting bolt and adjusting arm bolt. Move the alternator toward the engine (fig. 4-11).

(3) Remove the belt from the alternator pulley, water pump pulley, and crankshaft pulley.

(4) Install belt by reversing the removal procedures outlined above.

4-16. Fan Blade and Bracket and Pulley Assembly

a. Fan Blade Removal and Installation.

(1) Remove the four bolts (1, fig. 4-3) and lockwashers (2) attaching the blade assembly (3) to the bracket and pulley (7).

(2) Remove the blade assembly (3).

(3) Installation is opposite of removal. Torque bolts to 12-15 ft-lbs.

b. Fan Bracket and Pulley Removal and Installation

(1) Remove the fan blade (para *a* above).

(2) Remove two nuts (4, fig. 4-3) and lockwashers (5) attaching the bracket and pulley (7) to the water outlet connection (15)

(3) Remove the fan belt (6).

(4) Remove the bracket and pulley (7).

(5) Install by reversing removal procedures (paragraph (1) through (4) above).

4-17. Water Outlet Connection and Thermostat

a. Water Outlet Connection Removal and Installation

(1) Drain the radiator so that the coolant level is below the thermostat.

(2) Remove the fan blade and bracket and pulley assembly (para 4-16)

(3) Loosen the hose clamp (8, fig 4-31 and remove the hose (9) from the top of water outlet connection.

(4) Remove the four bolts (13) and lockwashers (14) attaching the outlet connection to the cylinder head and remove the outlet connection (15) and gasket (16).

(5) Install water outlet connection by reversing removal procedures Torque attaching bolts (13) to 12-15 ft-lbs.

b. Thermostat.

(1) Removal and installation.

(a) Remove the water outlet connection (paragraph *a* above).

(b) Remove the thermostat (17, fig 4-3) from the cylinder head.

(c) To install the thermostat, position the thermostat in the cylinder head with the copper pellet, or element, toward the engine and the thermostat flange in the recess.

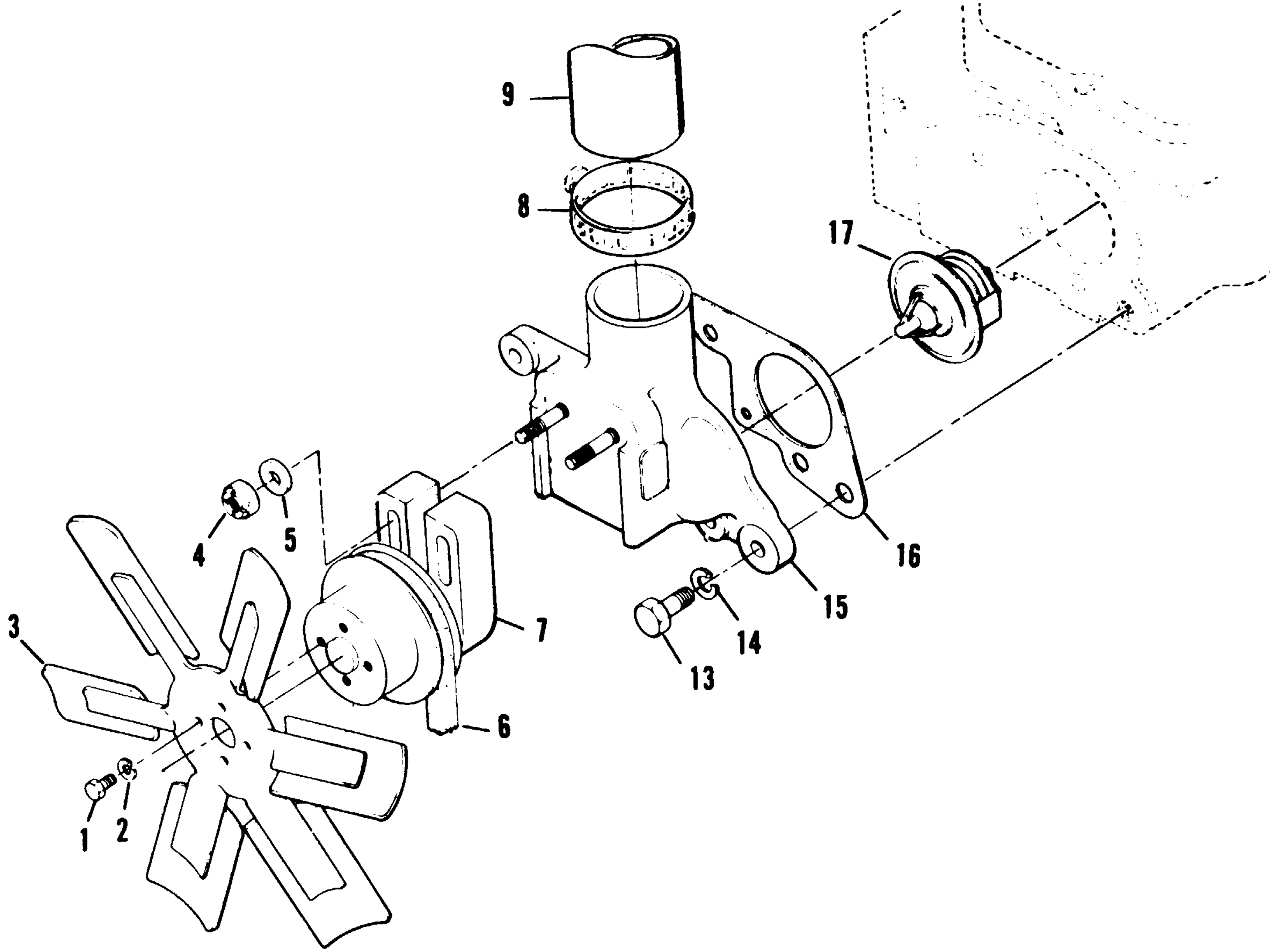
(d) Install the water outlet connection (para *a*. above). Fill the cooling system. Start the engine and check for leaks.

(2) Testing.

(a) Remove the thermostat from the engine.

(b) To test the thermostat, insert a piece of .003 inch feeler stock 1/8 inch wide under the valve sleeve. Suspend the thermostat by the feeler stock, in a large container of water so that it is completely submerged, and 1 to 2 inches from the bottom.

(c) If the thermostat does not hold fast to the feeler stock when it is first inserted, replace the thermostat.



1. Bolt
2. Lockwasher
3. Fan blade assy
4. Nut
5. Washer
6. Fan belt
7. Bracket and pulley
8. Hose clamp
9. Hose
10. ---
11. ---
12. ---
13. Bolt
14. Lockwasher
15. Water outlet connection
16 Gasket
17. Thermostat

Figure 4-3. Thermostat housing and fan, exploded view.

(d) Suspend a thermometer in the water so that the bulb is at the same level as the thermostat element. Heat the water slowly and stir to normalize the temperature. When the thermostat drops off the feeler stock, note the temperature on the thermometer.

(e) If the valve opens at a temperature more than 5 below the start-to-open specification (157 162) or valve does not open at a temperature of more than 5 above the start-to-open specification, replace the thermostat. In boiling water the thermostat should open to a minimum of 0.26 inch. If the valve does not open this far, replace the thermostat.

(f) To install the thermostat, clean the gasket surface, coat new gasket with water resistant sealer and position the gasket on the cylinder head. Position the thermostat with the copper pellet or element toward the engine and the thermostat flange in the recess

(g) Install the housing and radiator hose.

(h) Fill the cooling system. Start the engine and check for leaks.

4-18. Water Pump and Pulley

a. Water Pump Pulley Removal and Installation (fig.4-11)

(1) Remove the water pump drive belt (para 4-15*d.*).

(2) Remove the four bolts attaching the water pump pulley

(3) Remove the pulley.

(4) Install pulley by reversing procedures used for removal.

b. Water Pump Removal and Installation n (fig. 4-11).

(1) Drain the cooling system by opening the drain cock on the radiator.

(2) Remove the water pump pulley (para *a* above).

(3) Loosen the clamp and remove the lower radiator hose from the water pump.

(4) Remove the four bolts attaching the water pump to the cylinder block.

(5) Remove the water pump and gasket.

(6) Install water pump by reversing procedures used for removal Torque attaching bolts to 12-15 ft-lbs.

4-19. Hoses

a. Inspection. Inspect all cooling system hoses for cracks or breaks. Replace a defective hose.

b. Removal and Installation. All of the hoses are attached with clamps. To remove a hose, first drain the cooling system. then loosen the clamps at each end of the hose. Remove the hose. Install clamps on new hose; install the hose; tighten the clamps.

Section VIII. MAINTENANCE OF HYDRAULIC SYSTEM

4-20. Control Valve

a. Adjustment. (Remove Item 12,13 Insert Gauge)

(1) Loosen adjusting screw lock nut (14, fig. 4-4).

(2) Turn adjusting screw(15)until pressure gauge indicates 1450 PSI with engine running at governed speed.

(3) Tighten lock nut and recheck pressure gauge.

b. Removal and Installation

(1) Remove cotter pins (1) and clevis pins (2) attaching handles and remove handles (3,4).

(2) Remove cotter pins (1) and clevis pins (6) attaching handle links. Remove links (5,7)

(3) Disconnect hydraulic lines and hoses from control valve.

(4) Remove the mounting screws (10) and nuts (9)

(5) the hydraulic valve bank (11).

(6) Install the valve bank by reversing the procedures used for removal.

c. Control Handles. Inspect control handles for cracks, breaks, or weakened areas. Replace handle if any defects are observed.

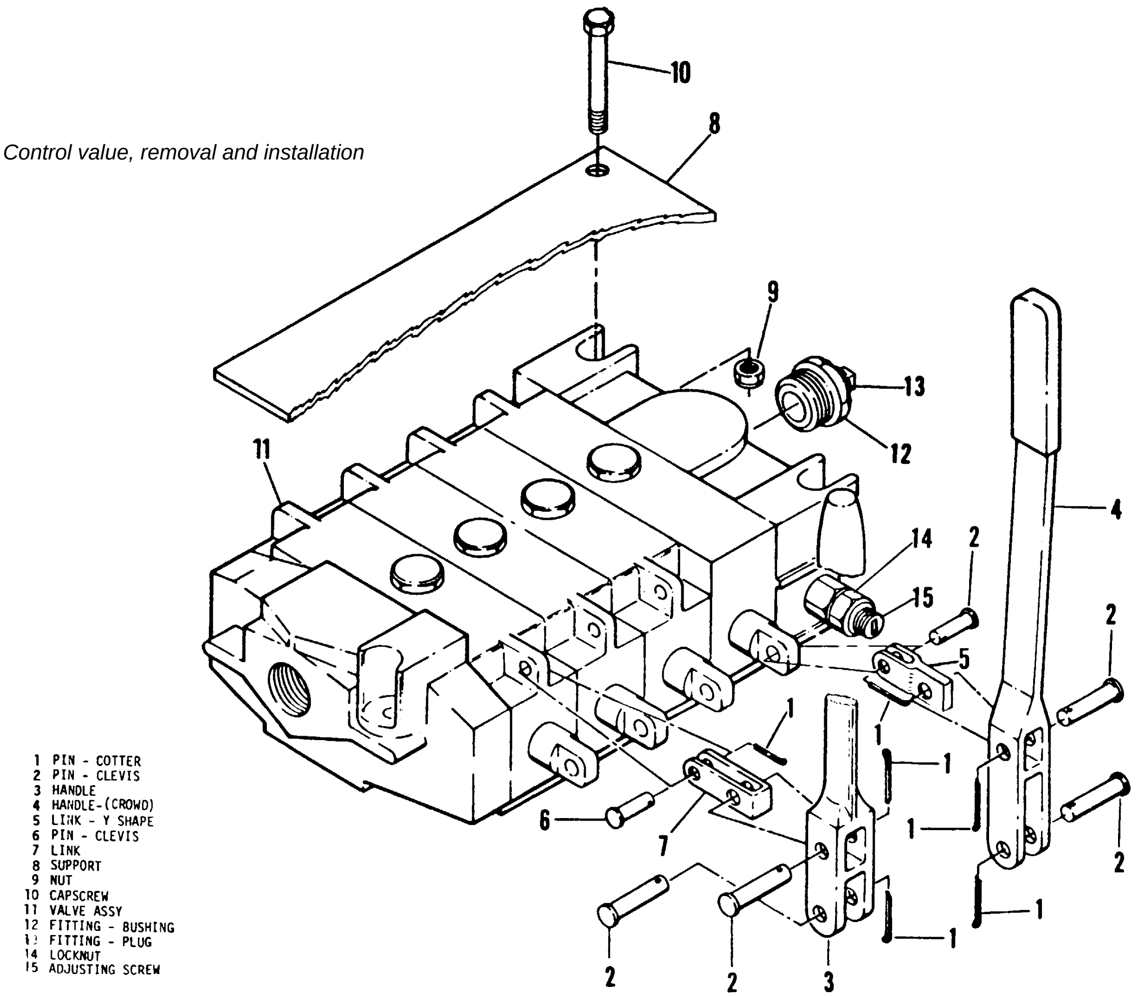
4-21. Hydraulic Pump and Hose

a. General. The hydraulic pump is mounted to the auxiliary drive located on the side of the shuttle transmission. If any defects or shortcomings are evident, the pump should be replaced.

b. Removal. Remove the hydraulic pump and hoses as instructed in figure 4-5.

c. Installation. Install the hydraulic pump and hoses by reversing the instructions for removal.

Figure 4-4. Control value, removal and installation



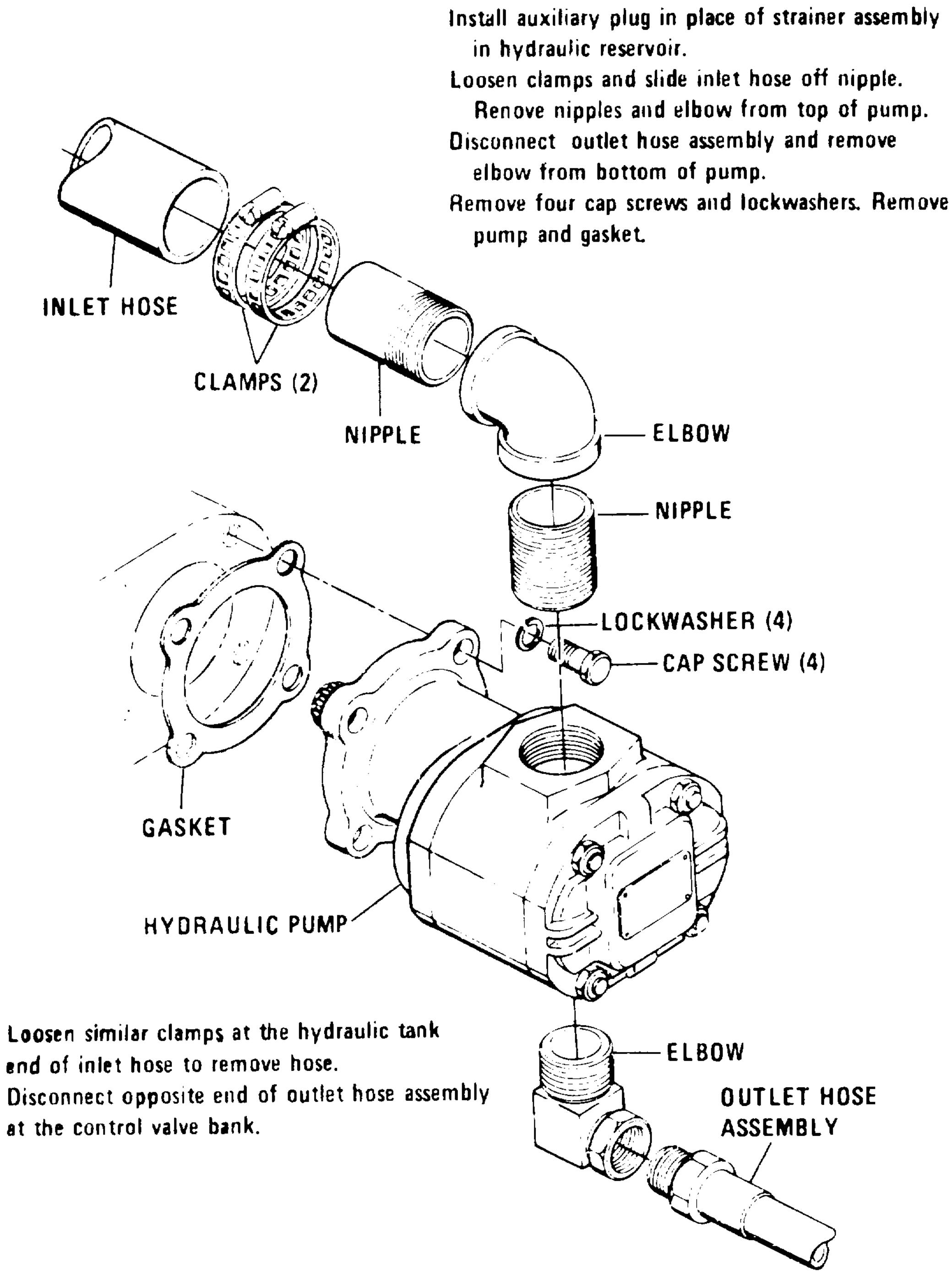


Figure 4-5. Hydraulic pump and hoses, removal and installation.

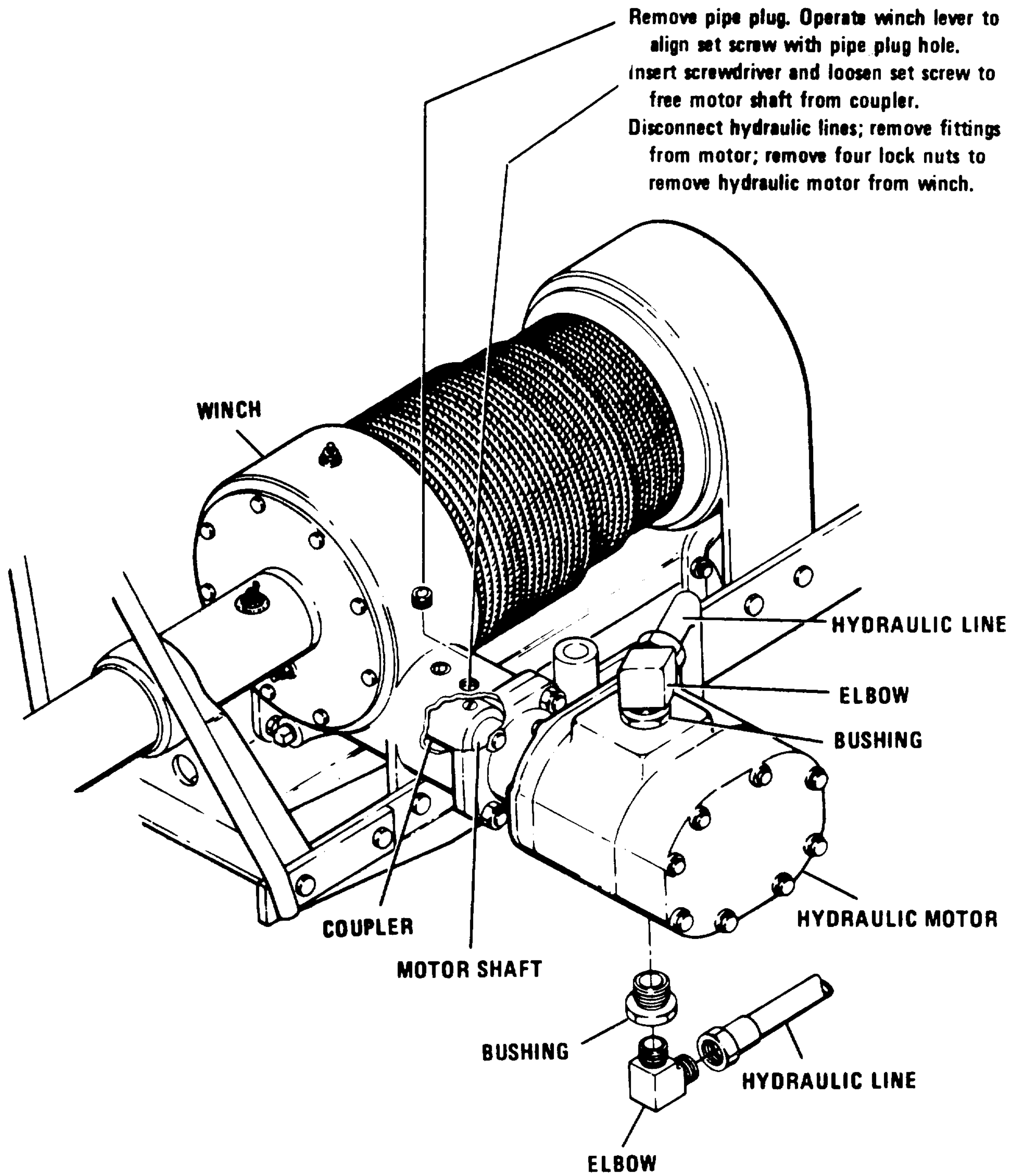


Figure 4-6. Hydraulic motor, removal and installation.

4-22. Hydraulic Motor

a. Inspection. Visually inspect the motor for any cracks in housing or other damage Replace a damaged motor.

b. Removal. Remove the hydraulic motor as instructed in figure 4-6. Operate winch lever to align set screw with pipe plug lever.

c. Installation. Install the hydraulic motor by reversing the procedures given for removal.

4-23. Hydraulic Cylinders

a. Elevating Cylinder.

(1) Inspection. Check the elevating cylinder for any cracks and leaks. Replace a damaged cylinder.

(2) Removal. Remove elevating cylinder as instructed in figure 4-7.

(3) Installation. Installation is reverse of removal.

b. Leveling, Cylinder.

(1) *Inspection*. Check the leveling cylinder for any cracks or leaks. Replace a damaged cylinder.

(2) *Removal*. Remove leveling cylinder as instructed in figure 4-8.

(3) *Installation*. Installation is reverse of removal.

4-24. Hydraulic Tank

a. Breather Cap.

(1) *Removal and installation*. Remove the breather cap (1, fig. 4-9) from the top of the hydraulic reservoir by rotating the cap counterclockwise and removing. Installation is opposite of removal.

(2) *Servicing*. Clean the breather cap in an approved cleaning solvent and dry with compressed air. Inspect cap for damage. Replace a damaged cap.

DISCONNECT HYDRAULIC LINES AT THE BOTTOM OF THE ELEVATING CYLINDER.

REMOVE THE UPPER LOCKNUT WASHERS. PROVIDE A SUPPORT TO HOLD THE ELEVATING CYLINDER'; THEN REMOVE THE CAPSCREW FROM THE CYLINDER AND THE AUGER. REMOVE THE LOCKNUT AND CAPSCREW AT THE BOTTOM TO REMOVE THE ELEVATING CYLINDER.

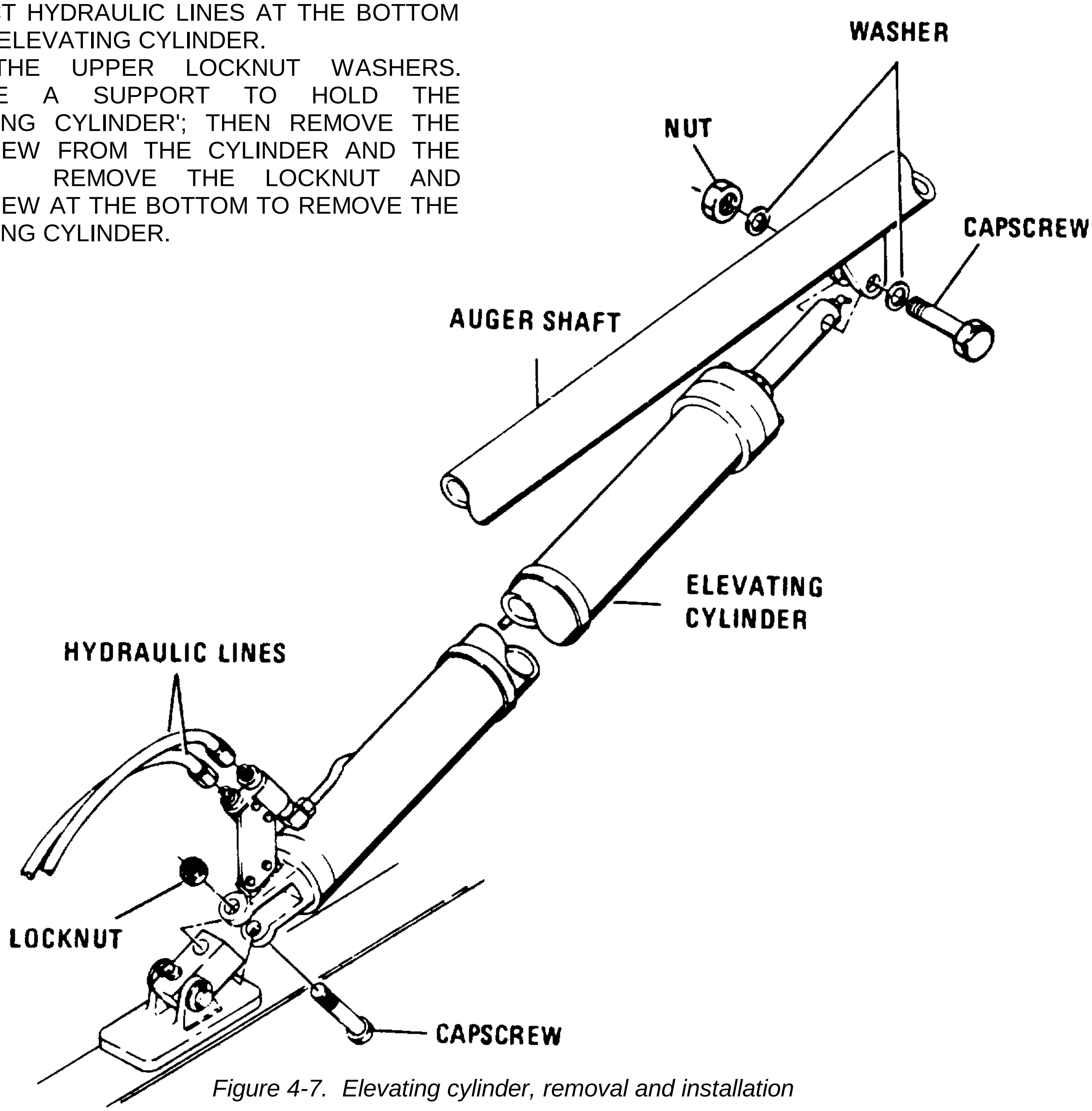


Figure 4-7. Elevating cylinder, removal and installation

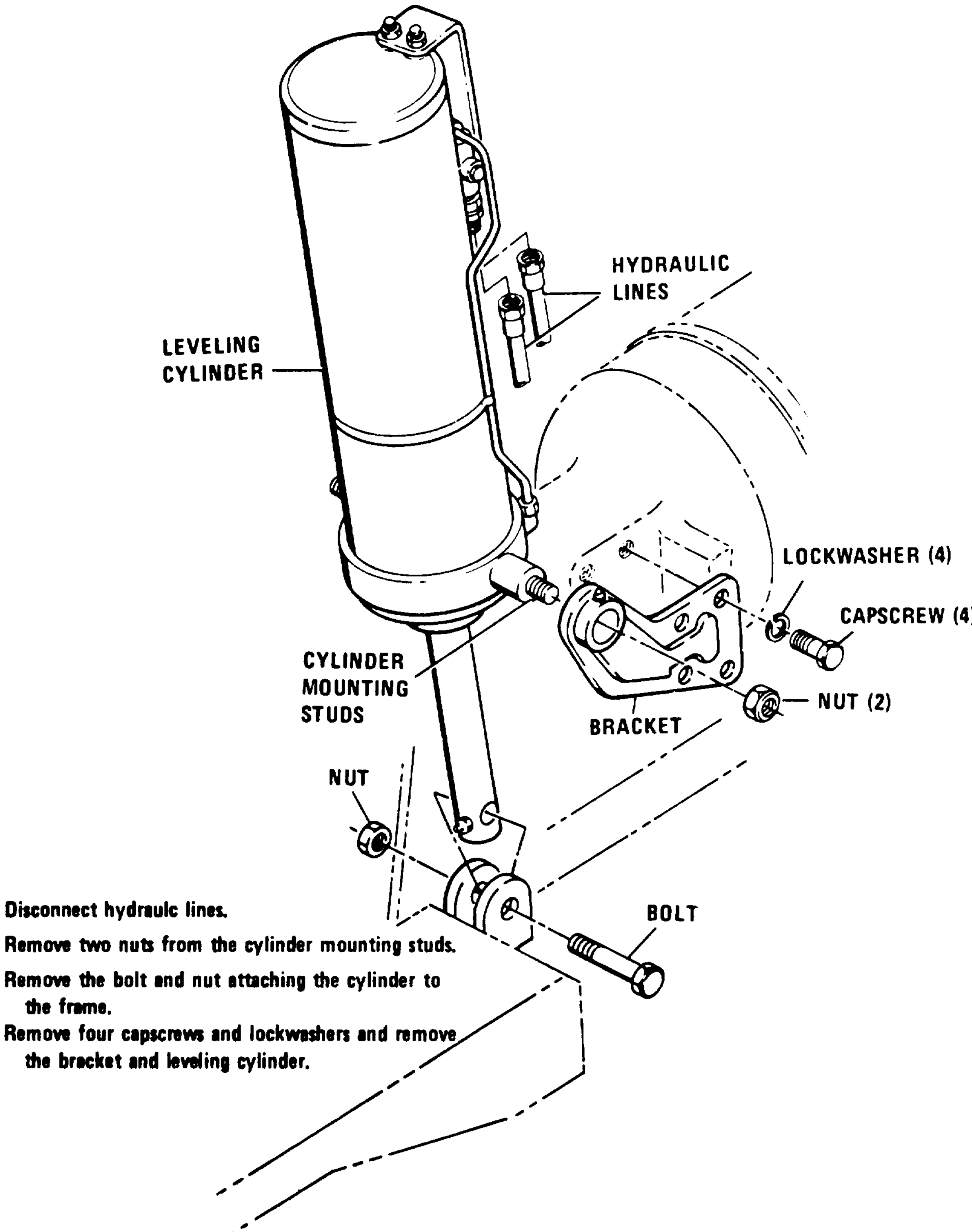
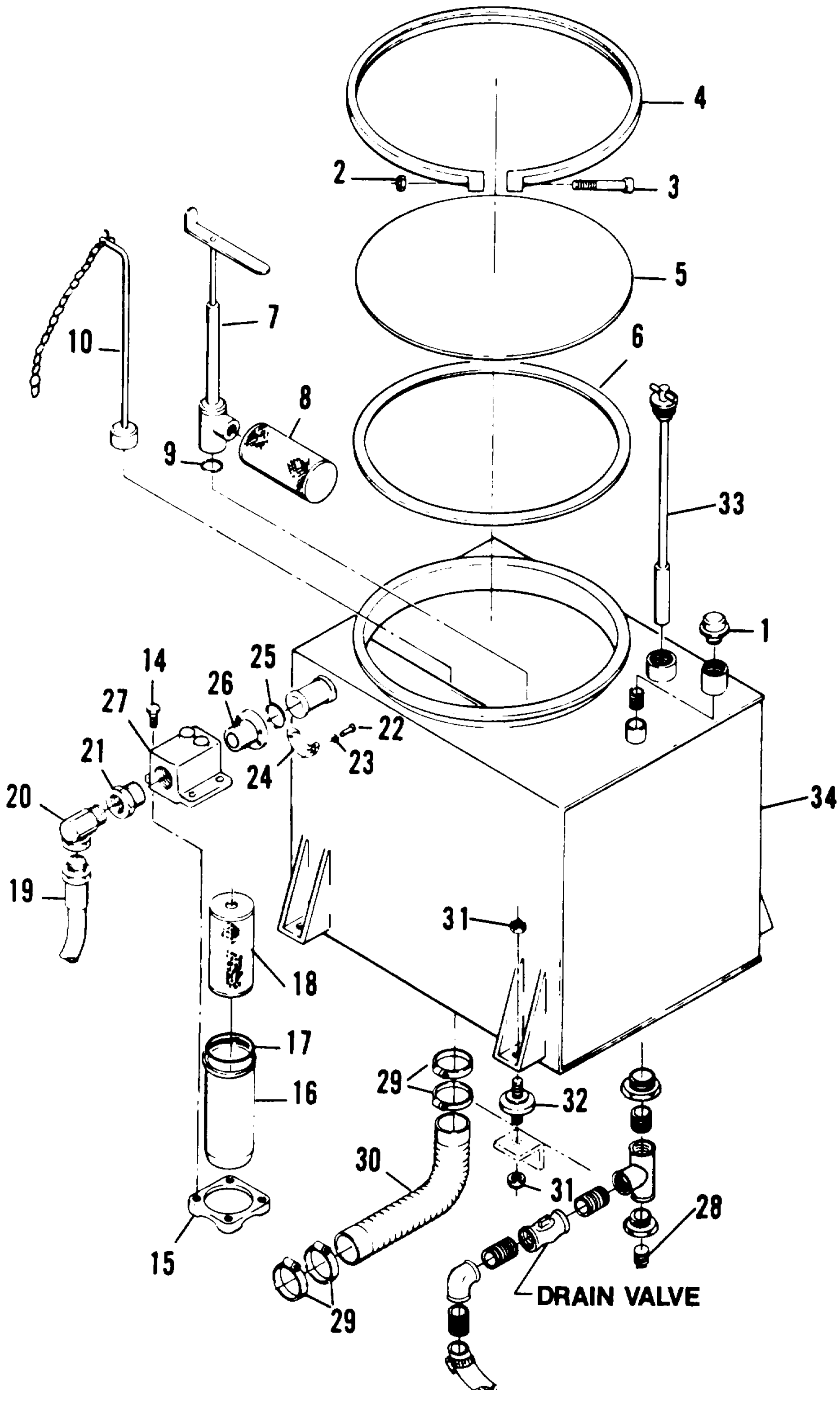


Figure 4-8. Elevating cylinder. removal and installation



1. Breather cap
2. Nut
3. Bolt
4. Clamp
5. Cover
6. Gasket
7. Adapter
8. Strainer
9. O-ring
10. Auxiliary plug
11. - - -
12. - - -
13. - - -
14. Bolt
15. Flange
16. Housing
17. Gasket
18. Filter element
19. Hose
20. Elbow
21. Adapter
22. Nut
23. Lockwasher
24. Clamp half
25. O-ring
26. Flange
27. Filter head
28. Drain plug
29. Clamp
30. Hose
31. Nut
32. Mount
33. Oil level gauge
34. Hydraulic reservoir

Figure 4-9. Hydraulic reservoir, exploded view.

b. Oil Strainer.

(1) *Removal*.

(a) Loosen the nut (2, fig. 4-9) and bolt (3) and remove the clamp (4) retaining the hydraulic tank cover and remove the tank cover (5) and gasket (6).

(b) Remove suction adapter (7) and install auxiliary plug (10) in place of adapter.

(c) Remove strainer (8) from suction adapter. Remove o-ring (9) from adapter.

(2) *Servicing and inspection*. Clean the strainer with an approved cleaning solution and allow to dry. Inspect the strainer for holes in filter screen or any other damage. Replace a damaged strainer.

(3) *Installation*. Install strainer and cover by reversing removal procedures.

c. Filter.

(1) *Removal*.

(a) Remove the four bolts (14) retaining the flange (15) and filter housing and remove the housing (16) and gasket (17).

(b) Remove the filter element (18).

(2) *Servicing*. Clean the filter housing with an approved cleaning solvent and dry thoroughly. Old filters and gaskets shall be discarded and replaced with new filters and gasket.

(3) *Installation*. Install the filter by reversing the procedures used for removal.

d. Reservoir.

(1) *Removal*.

(a) Drain reservoir by removing drain plug (28, fig. 4-9). or open drain valve above plug.

(b) Remove breather cap, oil strainer, and filter (para *a., b.*, and *c.* above).

(c) Disconnect hose (19), remove elbow (20) and adapter (21). Remove four nuts (22) and lockwashers (23) and two clamp halves (24). Remove 0ring (25); then unscrew flange (26) from filter head (27). Loosen clamps (29) and remove the hose (30). Remove eight nuts (31) and four mounts (32). Remove oil level gauge (33) from hydraulic reservoir (34).

(2) *Cleaning and inspection.*

(a) Clean the reservoir with an approved solvent and dry thoroughly.

(b) Inspect for cracks, dents, or other damage.

(3) *Repair and replacement*. Minor dents in the reservoir may be repaired using simple shop repair methods. Major damage will necessitate the replacement of the reservoir. Use replacement parts in lieu of worn or damaged parts.

(4) *Installation*. Install the reservoir and associated parts by reversing the removal procedures. After installation, service the hydraulic reservoir as instructed in Lubrication diagram this manual

4-25. Hydraulic Hoses

a. Inspection. Inspect all hoses for cracks, breaks, damaged or loose fittings. Tighten loose fittings. Replace damaged or defective hose.

b. Removal and Installation

(1) Remove cover from hydraulic reservoir.

(2) Remove suction adapter and install auxiliary plug in place of adapter.

(3) Unscrew hose (19, fig. 4-9) from reservoir and from control valve. Loosen clamps (29) and remove hose (30) at reservoir and at hydraulic pump.

(4) Install new hoses and replace suction adapter and reservoir cover.

4-26. Fuel Tank

a. Removal (fig. 4-10)

(1) Remove plug drain the fuel from tank into a suitable container.

(2) Disconnect fuel line at shutoff valve (11) on bottom of tank.

(3) Disconnect the wire from the fuel gauge send or(8) on top of tank.

(4) Remove the four nuts (18,fig. 4-10), four fuel tank mounts(17)and ground strap (12) and remove fuel tank assemblage.

b. Disassembly.

(1) Unscrew fuel sediment bowl (1_fig. 4-10) from tank; Remove drain plug (1) from bottom of tank.

(2) Remove the cap (3) and chain from filler neck(5 Remove six screws(4)and remove filler neck (5) and gasket (6). Discard gasket.

(3) Remove the five screws (7) to remove fuel gauge sender (8) from tank (2).

c. Repair. Repair at the organizational level is restricted to the replacement of defective or damaged parts with the exception of the fuel sediment bowl. For fuel sediment bowl service, refer to paragraph 4-27.

d. Assembly. Assembly is the reversal of disassembly procedures. Refer to paragraph *b*. above and reverse the procedures.

e. Installation.

(1) Position the four fuel tank mounts (2, fig. 4-17) onto the mounting brackets; then place the fuel tank assemblage over the mounts, installing ground strap (14) and secure it using the eight nuts (1).

(2) Connect the wire to the fuel gauge sender on top of tank.

(3) Connect the fuel line to the shutoff valve on bottom of tank.

4-27. Fuel Sediment Bowl Service (fig 4-10).

a. Close fuel valve on sediment bowl body.

b. Loosen the bail nut on bottom of bail and swing bail sideways while holding bowl.

c. Remove bowl, gasket, and element.

d. Clean the bowl and the element. Install element, bowl and a new gasket. Position bail and tighten bail nut.

e. Open the fuel valve on sediment bowl body and check for any leaks. If leakage is detected, loosen the bail nut and maneuver the bowl and gasket until it seats properly in the bowl body: then retighten bail nut.

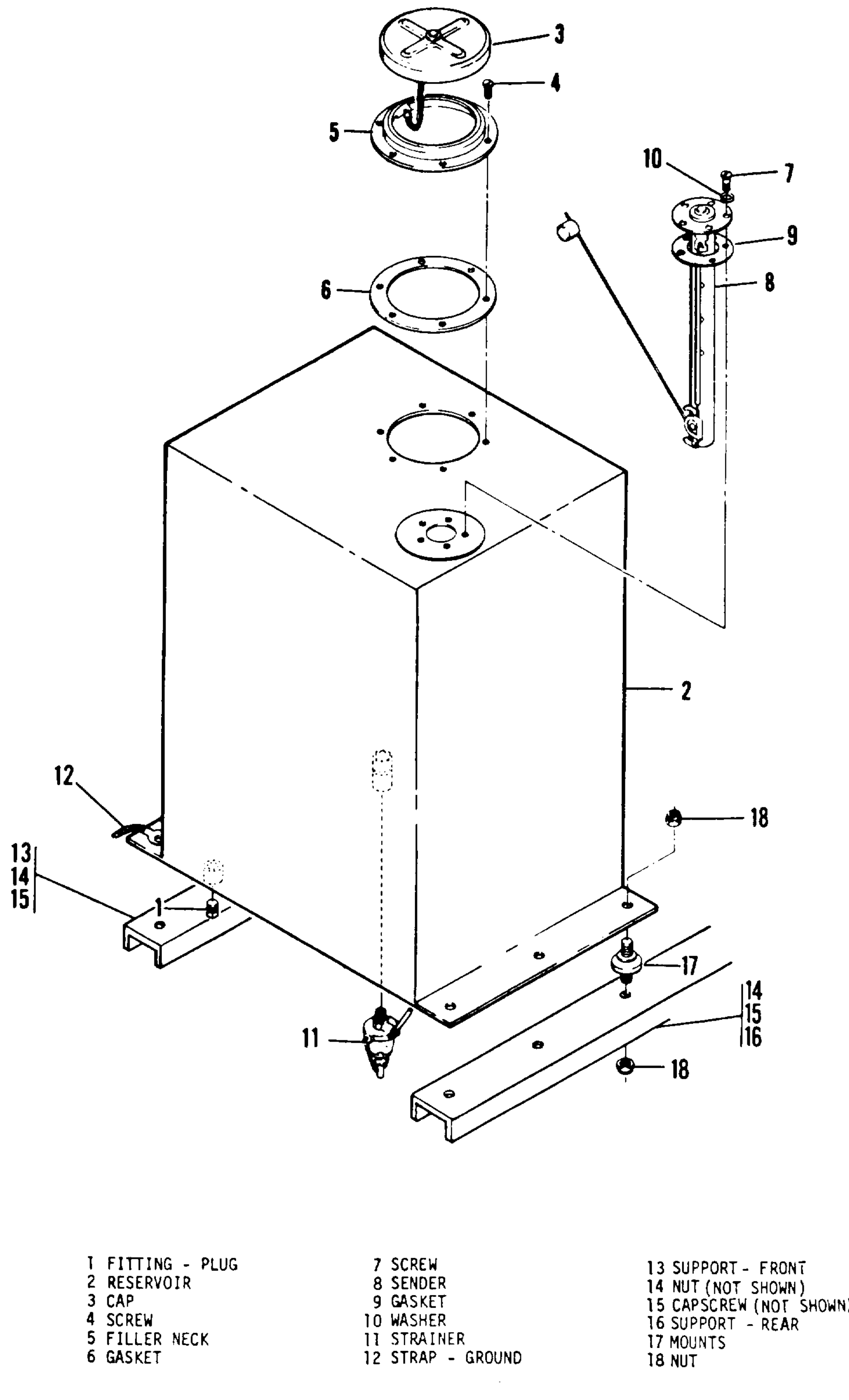
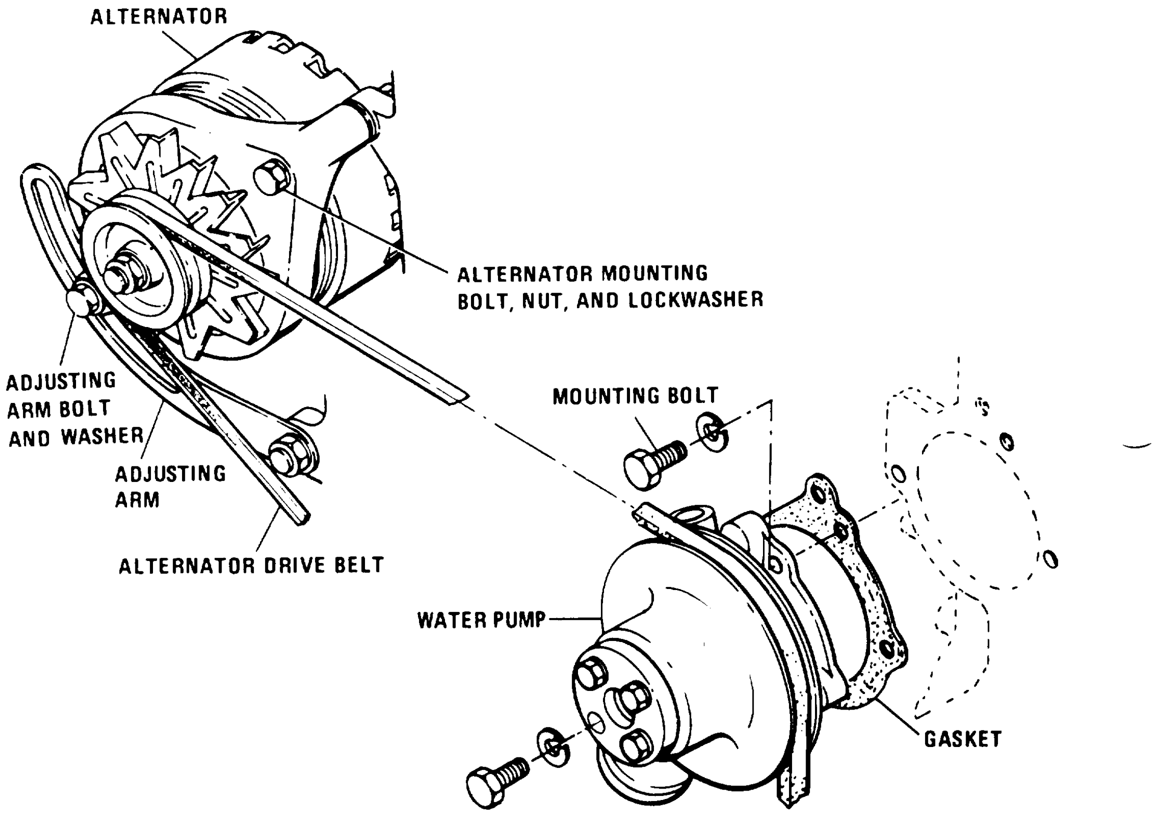


Figure 4-10. Fuel tank, exploded view

4-28. Alternator

a. Removal (fig 4-11).



(1) Loosen alternator mounting bolt and adjusting arm bolt. Move alternator toward engine and remove belt from pulley.

(2) Remove nuts and lockwashers from alternator terminals to disconnect electrical wires from the terminals. Mark the wires to be sure of proper connection when alternator is replaced.

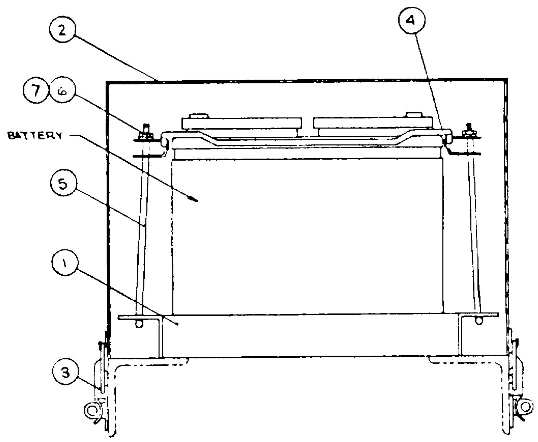
(3) Remove the bolt and washer attaching the alternator to adjusting arm.

(4) Remove the bolt, nut, and lockwasher attaching the alternator to mounting bracket.

(5) Remove the alternator.

b. Installation. Install alternator by reversing removal procedure.

Figure 4-11. Alternator. Removal and installation.



1 BOX
2 COVER
3 CATCH
4 BRACKET
5 ROD
6 NUT
7 WASHER

Figure 4-12. Battery, removal and Installation.

4-29. Battery and Battery Box

a. Removal and Installation

(1) Remove the battery box cover (2, fig. 4-12).

(2) Loosen and remove the two battery cable

(3) Remove the two holddown nuts(6)and Washer (7) and remove the brackets

(4) Remove the battery and Rod

(5) from battery box(l) (4) Install the battery box and battery by reversing removal procedures.

b. Testing. The state of charge of the battery is indicated by the specific gravity of the battery solution. Check the specific gravity with a hydrometer to determine the condition of the battery. If specific gravity is less than 1.280, the battery should be recharged. If the battery does not hold a charge it should be replaced. If the difference is specific gravity between cells is more than 20-25% the battery should be replaced.

c. Service. Fill the battery to the ring with distilled water or clean rain water. The battery terminals should be kept tight and free of corrosion. A solution of two tablespoons of baking soda to a pint of water makes an excellent cleaning agent for corroded battery terminals and a dirty battery case. Apply the solution with a paint brush or whisk broom and thoroughly flush the outside of the battery with clean water when finished. Coat the battery terminals with a light grease or petroleum jelly to inhibit corrosion.

CAUTION

Do not allow the soda solution to enter the battery cells. It may cause the battery to be neutralized.

d. Inspection and Repair. Inspect the box and fastening hardware for damage. Use replacement fasteners as needed. Straighten any dents using simple shop repair methods.

4-30. Instrument Panel

a. Disassembly

(1) Remove nut, capscrew and clamp (8,9,10, fig. 4-13) on back of instrument panel assembly.

(2) Remove two capscrews (20) and lock washers (21)to remove the cover from the instrument panel.

(3) Disconnect the engine oil pressure line from the back of the gauge (3) and disconnect the Transmission oil pressure line from the back of the gauge (25).Tag the electrical wires for identification purposes, on the back of the gauges. Remove nuts and washers to remove electrical leads. Remove nuts and washers (22, 23) from the CLAMPS (24)thereby enabling each of the gauges (1,2,3,4,5,15, 16,25) to be removed from the panel.

(4) Tag electrical wires and disconnect same from on-off switch (13) starter button (14) and safety switch (6). Unscrew the knob and nut on front of panel to remove the on-off switch (13). Pull the spring loaded starter button(14)straight out to remove it from panel. Unscrew nut and remove plate and safety switch (6) from instrument panel.

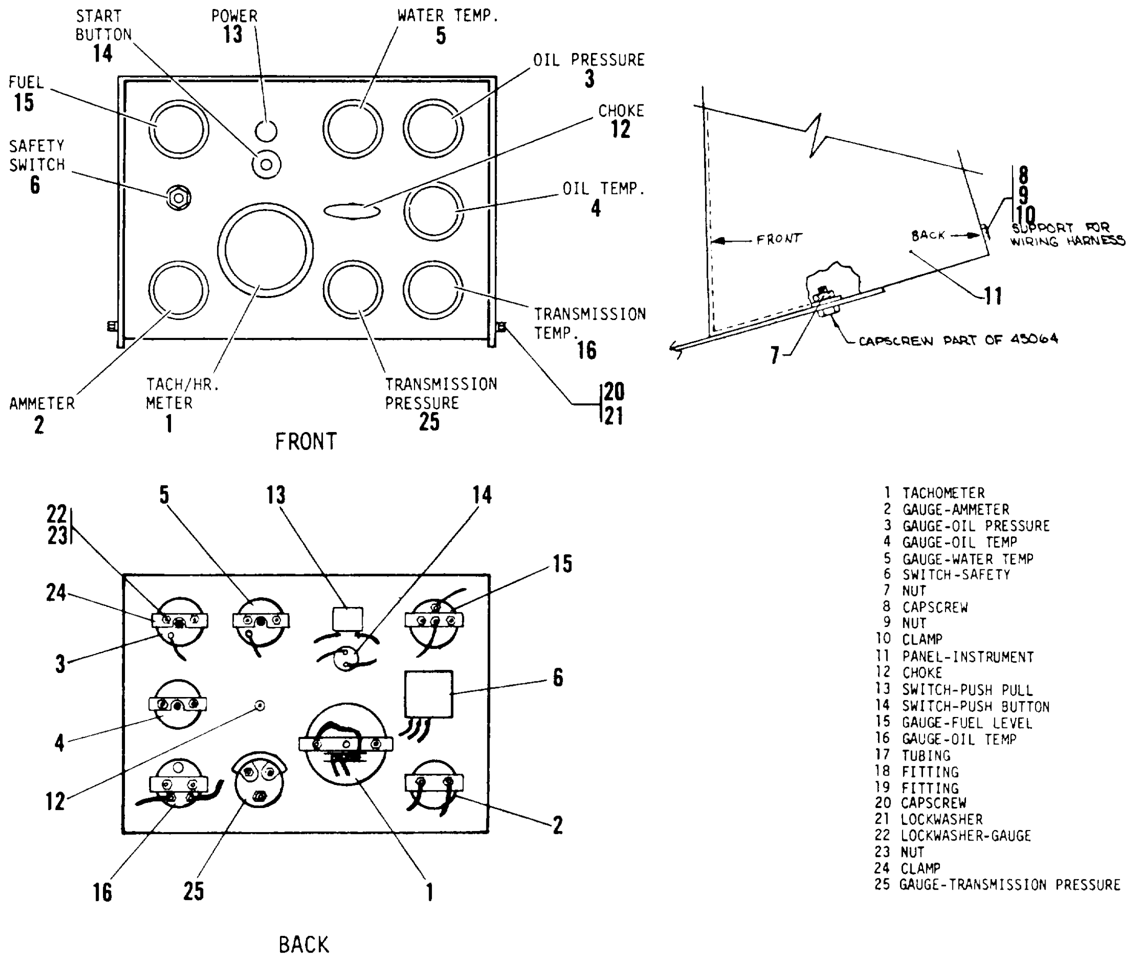


Figure 4-13. Instrument panel.

(5) Disconnect choke cable at the carburetor and relieve any holddown clamps so as to free the cable for removal. Unscrew the nut to remove washer and choke control (12) from instrument panel.

b. Inspection and Replacement.

(1) Inspect all gauges for broken glass, damaged or bent indicators or other damage. Inspect fastening hardware for stripped, crossed, or otherwise damaged the reads.

(2) Use replacement parts in lieu of damaged or inoperative parts.

c. Installation. Install instrument panel components by reversing the procedures used to disassemble.

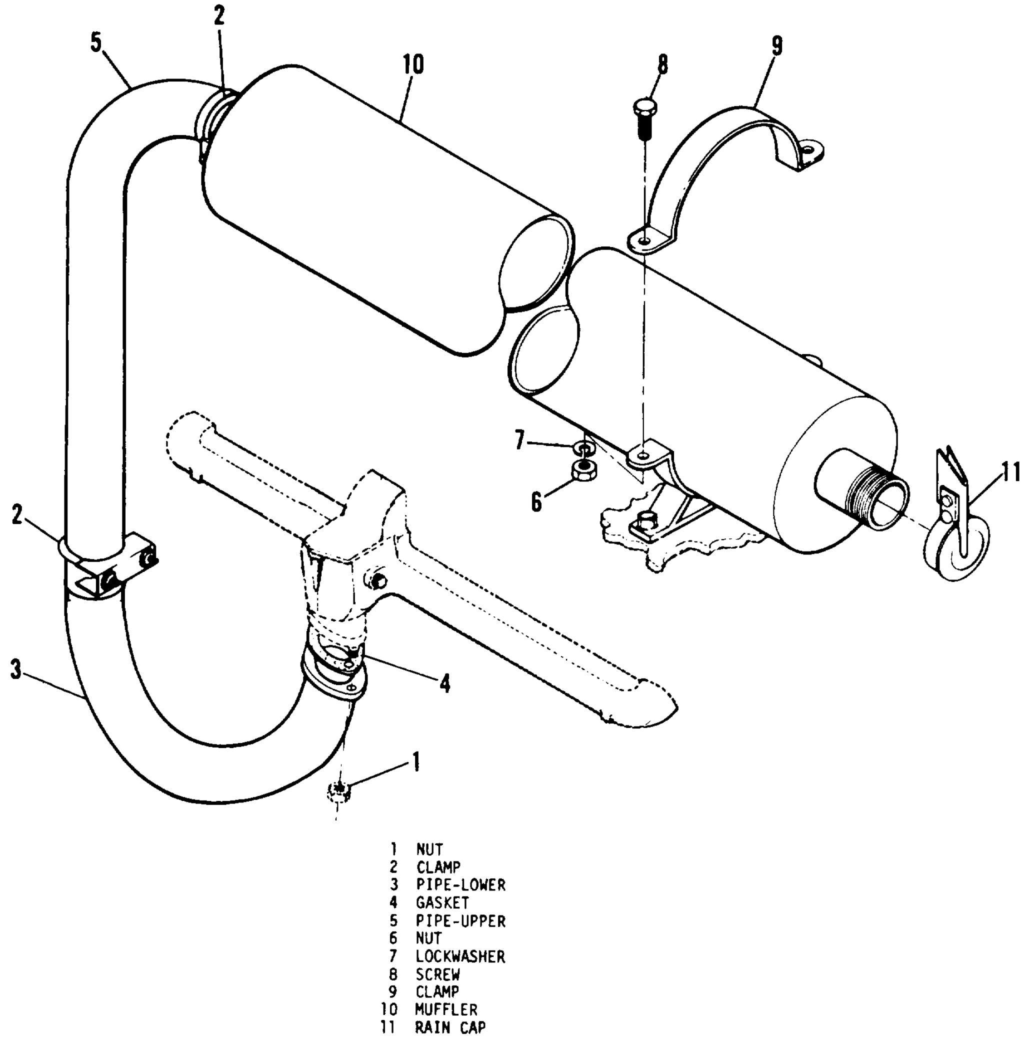


Figure 4-14. muffler, and exhaust pipe

4-31. Muffler, and Exhaust Pipe

NOTE

Remove acoustical panels as necessary for access to engine component

a. Removal. Remove the muffler, and the exhaust pipe by removing parts in order of ascending numeric sequence of numbers (1 through 11) assigned to figure 4-14

b. Inspection and Repair. Inspect the manifolds, muffler. and exhaust pipe for extensive corrosion. cracks, or other damage. Inspect the fastening hardware for stripped, crossed, peened or otherwise damaged threads. Any damaged parts must be replaced.

c. Installation. Install the muffler and exhaust pipe by reversing the procedure used at removal.

4-32. Seat Assembly (fig. 4-15)

a. Inspection. The seat assembly may be inspected in the assembled state. Inspect the seat pan for cracks, or breaks. Inspect the spring and the shock absorber for collapsed conditions. All defective parts must be replaced.

b. Removal and Disassembly. Remove and disassemble the seat components by removing parts in ascending numeric sequence of index numbers (1 through 16) assigned to figure 4-15.

c. Installation. Install the seat components by reversing the procedures used to remove and disassemble the seat.

4-33. Tool Box

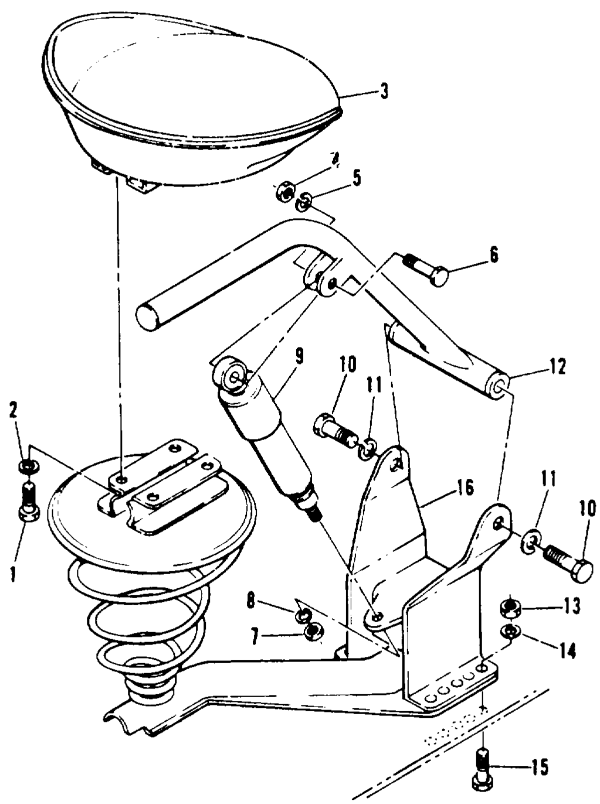
a. Inspect the tool box for any defects or damage. Replace if necessary.

b. Remove the four capscrews and lock nuts attaching the tool box to the frame. Remove the tool box.

4-34. Main Frame and Data Plates

a. Frame. Thoroughly inspect the main frame for any cracks, breaks, or bends in the frame. Refer any defects to general support maintenance.

b. Data Plates. There are three data plates located on the earth auger (para 1-6). Inspect the data plates to assure legibility. Replace a damaged data plate. All data plates are attached with drive screws and are not readily replaced.



1. Bolt
2. Lockwasher
3. Seat pan
4. Nut
5. Lockwasher
6. Bolt
7. Nut
8. Lockwasher
9. Shock absorber
10. Bolt
11. Lockwasher
12. Support
13. Nut
14. Lockwasher
15. Bolt
16. Bracket assembly

Figure 4-15. Seat assembly, exploded view

4-35. Collapsible Wire Reel

a. Removal and Disassembly. Remove and disassemble the collapsible wire reel by following the sequence of index number (1 through 30) assigned to figure 4-16.

b. Inspection and Repair.

(1) Inspect all parts for visible signs of wear or damage.

(2) Repair by using replacement parts in lieu of worn or damaged parts.

c. Installation. Install the wire reel by reversing the procedures used to remove and disassemble the reel.

4-36. Winch

a. Removal.

(1) Remove wire reel (para 4-35*a*).

(2) Remove hydraulic motor (para 4-22).

(3) Remove the winch as instructed in figure 4-17.

b Installation. Reverse the removal procedures to install the winch.

c Winch Brake.4djustmentt (fig. 4-17)

(1) Loosen adjusting screw lock nut

(2) Turn adjusting screw clockwise to increase brake tension or counterclockwise to decrease tension. Turn the adjusting screw only 1/2 turn at a time until proper adjustment is achieved.

(3) Retighten adjusting screw lock nut after correct tension is acquired.

4-37. Augers, Bits, and Points

a Inspection. Check augers, bits and points for excessive wear or defects. Replace as necessary.

b Removal and Installation. Installation instructions are given in figure 2-2. Removal is accomplished by reversing the installation instructions.

1. Hair pin retainer
2. Clevis pin
3. Nut
4. Bolt
5. Nut
6. Bolt
7. Nut
8. Bolt
9. Shaft
10. Fitting
11. Bracket
12. Cotter pin
13. Clevis pin
14. Link
15. Saddle
16. Nut
17. Bolt
18. Spider
19. Spider
20. Nut
21. Setscrew
22. Nut
23. Bolt
24. Lever cap
25. O-ring
26. Shaft
27. Setscrew
28. Pin
29. Link
30. Handle

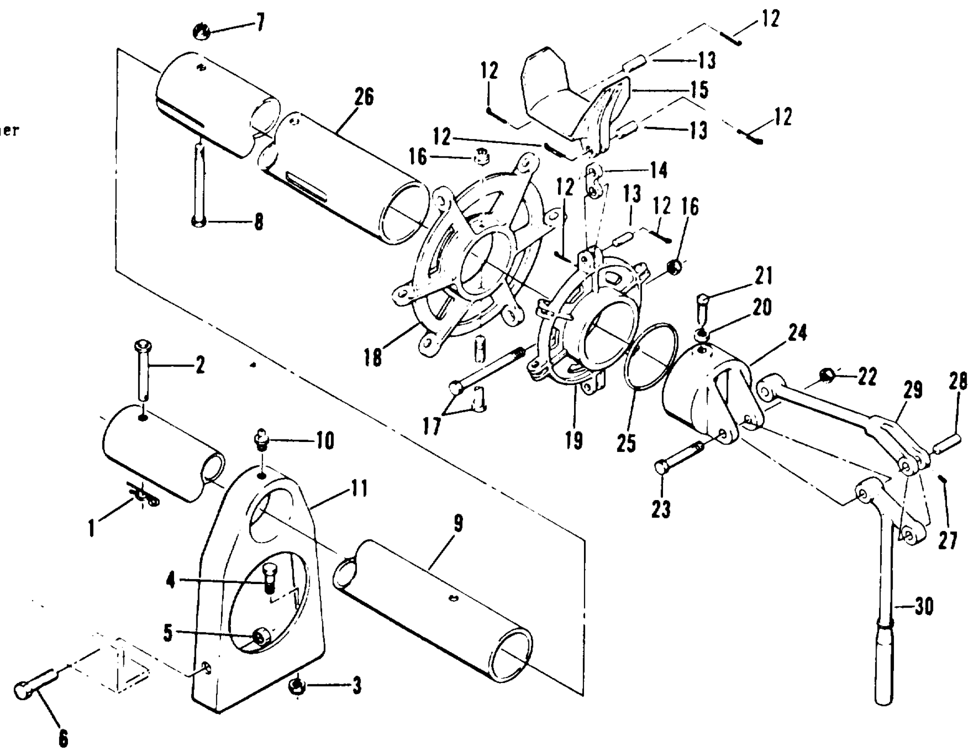


Figure 4-16. Collapsible reel. exploded view.

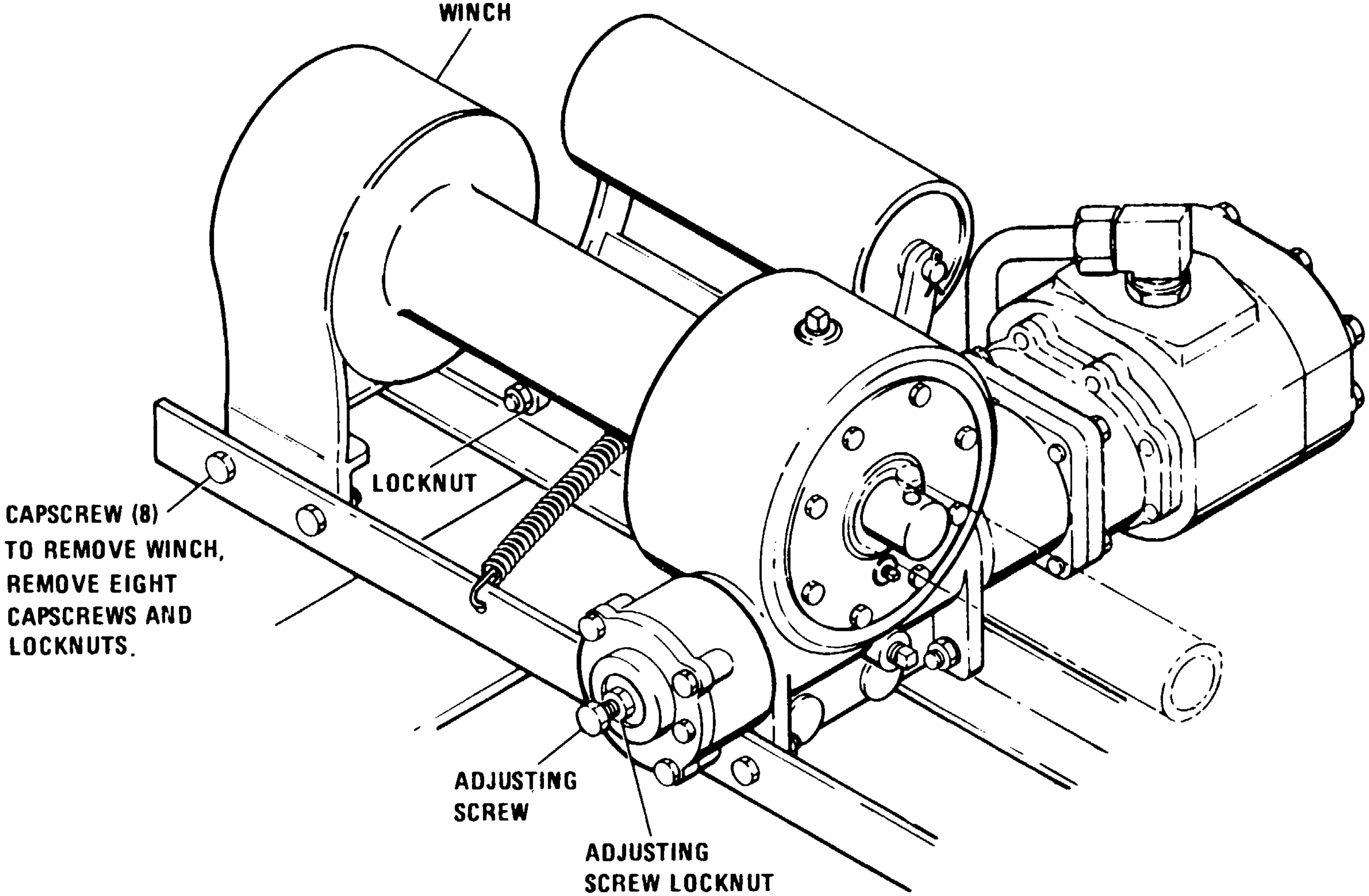


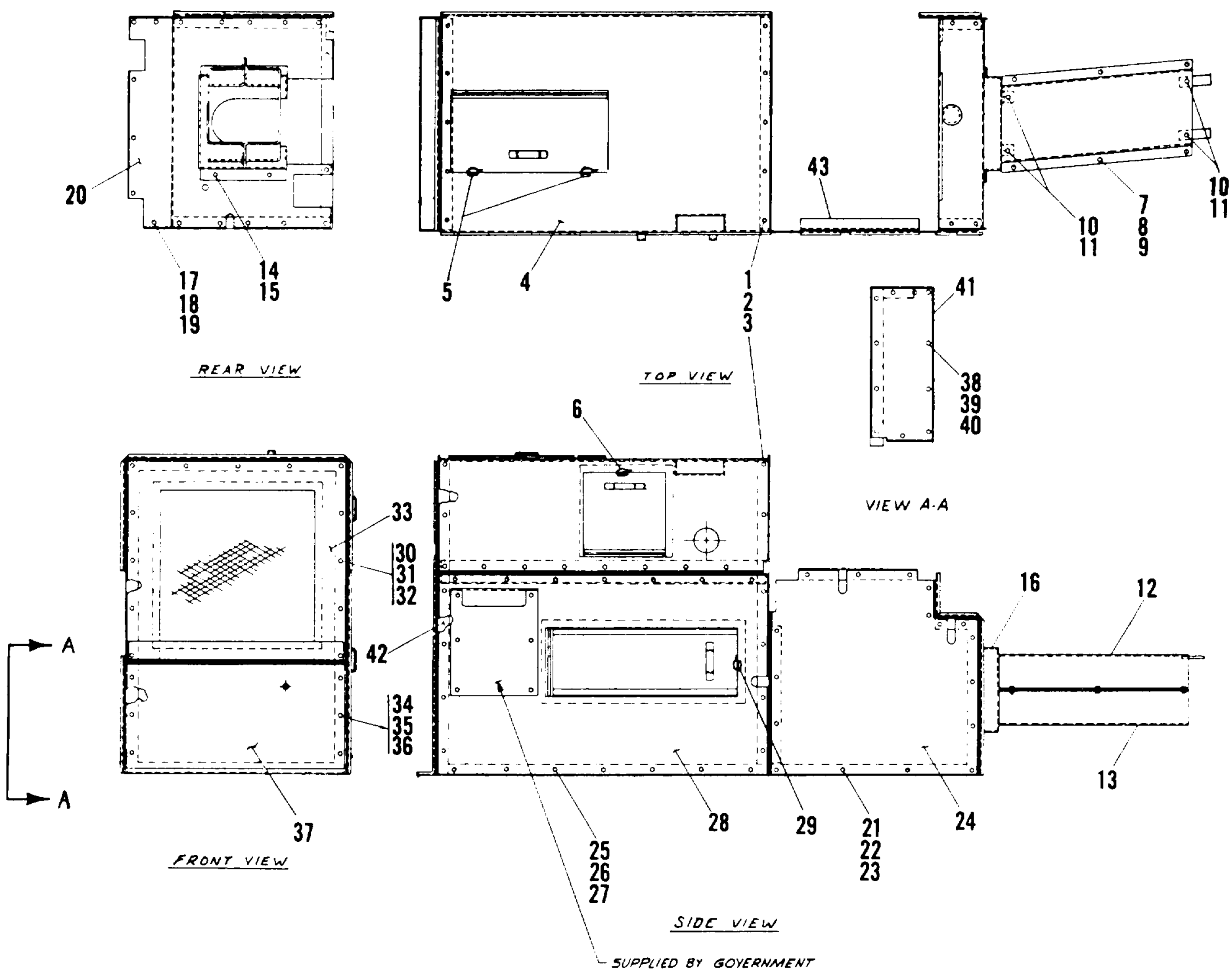
Figure 4 -17. Winch, removal and installation.

4-38. Acoustical Panels

a. General. The exclusive purpose of the acoustical panels is to control the sound level of the operation of the earth auger, and do not contribute to the operation. Maintenance of most components requires the removal of one or more panels for accessibility.

b. Removal. Remove the acoustical panels by following the sequence of index numbers (1 through 43) assigned to figure 4-18.

c. Installation. Install the panels by reversing the instructions used for removal.



1. RIVNUT
2. CAPSCREW
3. LOCKWASHER
4. PANEL - HOOD - ENGINE
5. DOOR LATCH
6. DOOR LATCH
7. CAPSCREW
8. NUT
9. LOCKWASHER
10. CAPSCREW
11. LOCKWASHER
12. PANEL - TOP DRIVE LINE
13. PANEL - LOWER DRIVE LINE
14. CAPSCREW
15. LOCKWASHER
16. PANEL - FRONT DRIVE LINE
17. RIVNUT
18. CAPSCREW
19. LOCKWASHER
20. PANEL - TRANSMISSION
21. RIVNUT
22. CAPSCREW
23. LOCKWASHER
24. PANEL - TANK SUPPORTS
25. RIVNUT
26. CAPSCREW
27. LOCKWASHER
28. PANEL - LOWER - ENGINE
29. ACCESS DOOR LATCH
30. RIVNUT
31. CAPSCREW
32. LOCKWASHER
33. GRILL - RADIATOR
34. RIVNUT
35. CAPSCREW
36. LOCKWASHER
37. PANEL - LOWER - ENGINE - FRONT
38. RIVNUT
39. CAPSCREW
40. LOCKWASHER
41. PANEL - AIR OUTLET
42. FRAME
43. ANGLE - STL

Figure 4-18. Acoustical panels

Section XV. LUBRICATION DIAGRAM

LUBRICATION DIAGRAM				AUGER, EARTH: SKID MOUNTED, GASOLINE ENGINE DRIVEN REED TOOL COMPANY MODEL 254-9		
INTERVAL HOURS	*MAN HOURS	REF. NO.	IDENTIFICATION	SERVICE	LUBRICANT	NO. OF SERVICE POINTS
10	2.3	28	WINCH SHAFT BEARINGS	LUBE	GAA	2
		12	CRANKCASE OIL LEVEL GAGE	CHECK LEVEL	OE/HDO	1
		30	UPPER MAST SHEAVE	LUBE	GAA	1
		18	LOWER MAST SHEAVE	LUBE	GAA	1
		4	RIGHT ANGLE DRIVE PINION CARRIER	LUBE (SPARINGLY)	GAA	4
		2	LEVELING CYLINDER SUPPORT	LUBE (SPARINGLY)	GAA	2
		3	LEVELING CYLINDER	LUBE	GAA	1
		17	SNATCH BLOCK	LUBE	GAA	1
		15	FINAL DRIVE PINION CARRIER	LUBE	GAA	4
		10	AIR CLEANER	(REFILL OIL RESERVOIR TO LEVEL MARK; EVERY 50 HOURS DISASSEMBLE ENTIRE UNIT, CLEAN, REOIL, AND REASSEMBLE)	OE/HDO	1
		24	ELEVATING CYLINDER UPPER	LUBE (SPARINGLY)	GAA	1
		20	ELEVATING CYLINDER LOWER	LUBE (SPARINGLY)	GAA	2
50	2.0	7	TRANSMISSION FILL AND LEVEL	CHECK LEVEL	OE	1
		1	RIGHT ANGLE DRIVE FILL AND LEVEL GAGE	CHECK LEVEL (SEE KEY)	GO	1
		26	WINCH LEVEL PLUG	CHECK LEVEL	GO	1
		25	WINCH FILL PLUG	FILL (SEE KEY)	GO	1
		23	HYDRAULIC TANK FILL AND LEVEL	CHECK LEVEL	OE/HDO	1
		9	*HYDRAULIC OIL STRAINER - T*	*CLEAN OR REPLACE*	---	1
		16	FINAL DRIVE FILL AND LEVEL GAGE	CHECK LEVEL (RAISE ELEVATOR TO VERTICAL POSITION TO CHECK LEVEL)	GO	1
100	0.9	11	CRANKCASE OIL DRAIN	DRAIN AND REFILL	OE/HDO	1
		13	OIL FILTER (ENGINE)	REMOVE, INSTALL NEW FILTER (SEE NOTE 2)	OE/HDO	1
		29	CRANKCASE FILL AND BREATHERS	FILL AND CLEAN BREATHERS	OE/HDO	2
250	0.5	5	UNIVERSAL JOINT	LUBE (SPARINGLY)	GAA	3
		21	HYDRAULIC FILTER	REMOVE, CLEAN HOUSING, ADD NEW FILTER ELEMENT, REIN-STALL	OE/HDO	1
500	0.6	6	TRANSMISSION DRAIN	DRAIN AND REFILL	OE	1
		8	TRANSMISSION OIL FILTER	REMOVE, INSTALL NEW FILTER	OE	1
1000	1.3	27	WINCH DRAIN PLUG	DRAIN AND REFILL	GO	1
		19	RIGHT ANGLE DRIVE DRAIN PLUG	DRAIN AND REFILL (SEE KEY)	GO	1
		22	HYDRAULIC TANK DRAIN	DRAIN AND REFILL	OE/HDO	1
		14	FINAL DRIVE DRAIN PLUG	DRAIN AND REFILL	GO	1

* THE TIME SPECIFIED IS THE TIME REQUIRED TO PERFORM ALL SERVICES AT THE PARTICULAR INTERVAL

Intervals are based on normal operations. Adjust to compensate for abnormal operations and severe conditions. During inactive periods sufficient lubrication must be performed for adequate preservation.

Clean fittings before lubrication.

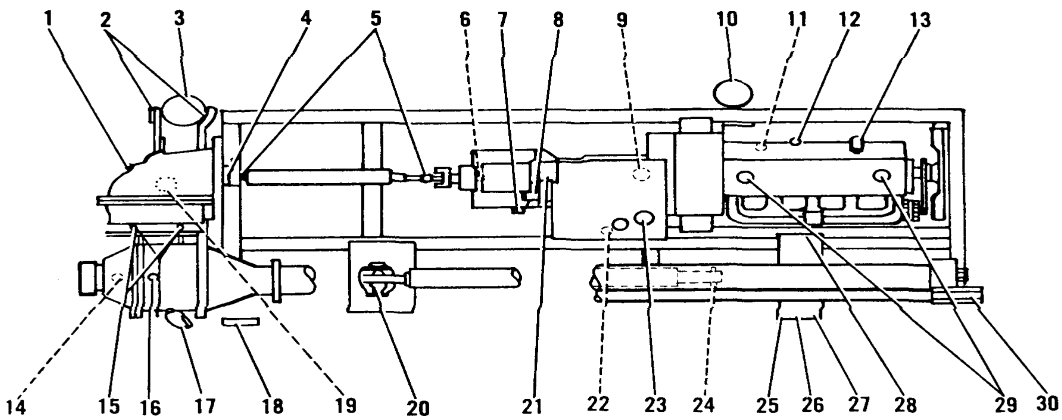
Relubricate after washing or fording.

A dotted circle indicates a drain below.

Clean parts with SOLVENT, dry-cleaning Type II (SD-2). Dry before lubricating.

Drain gear grease when hot. Fill and check level.

LUBRICATION DIAGRAM



KEY

LUBRICANTS	CAPACITY	EXPECTED TEMPERATURES ABOVE +32°F	+40°F to -10°F	0°F to -65°F	INTERVALS
OE/HDO OIL, Lubricating Oil, Engine					
Engine Crankcase	4.5 qt.	OE/HDO 30	OE/HDO 10	OES	
Air Cleaner	2/3 qt.				
Hydraulic Tank	260 qt.	OE/HDO 10			
GO - LUBRICATING OIL, Gear					
Right Angle Drive	3 qt.	GO90	GO90	GOS	
Final Drive	3-1/2 qt				
Winch	1 qt.				
Transmission	13 qt.	OE SAE10 MIL-L-2104		OES	
OES-OIL, Engine Subzero					
GOS - LUBRICATING OIL, Gear					
GAA - GREASE, Automotive & Artillery		ALL TEMPERATURES			

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.

2. OIL FILTER. After installing new filter, fill crankcase, operate engine 5 minutes, check for leaks, check crankcase oil level and bring to full mark.

3. LUBRICANTS. The following is a list of lubricants with the Military symbols and applicable specification numbers.

OE/HDO - MIL-L-2104
OES- MIL-L-10295
GAA - MIL-G-23827
GO - MIL-L-2105
GOS - MIL-L-10324

Copy of this Lubrication Diagram will remain with the equipment at all times; instructions herein are mandatory.

APPENDIX A
REFERENCES

A-1. LUBRICATION

Page, 4-28 This Manual	Lubrication Diagram

A-2. RADIO SUPPRESSION

Page, 4-6 This Manual	Radio Interference Suppression

A-3. SHIPMENT AND STORAGE

TM 740-90-1	Administrative Storage of Equipment

A-4. DESTRUCTION TO PREVENT ENEMY USE

TM 750-244-3	Procedures for Destruction of Equipment to Prevent Enemy Use.

50000 SERIES

FUNK
reversOmatic®
DRIVES

FUNK Manufacturing Co.

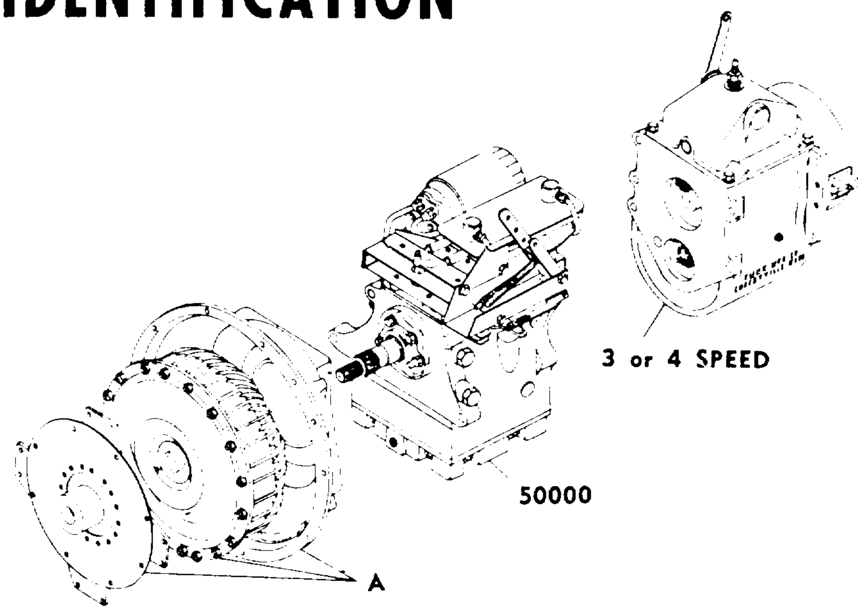
Division of Gardner-Denver
P.O. Box 577 Coffeyville, Kans. 67337

model 50A055BP spec 7837

Funk
MFG. CO.

parts list and instruction manual

MODEL IDENTIFICATION



A—This part is the Drive Plate, Torque Converter, and Converter Housing.

50000—This is the Hydraulic Reversing Section called the Revers-O-Matic.

3 or 4 SPEED—This is the Selective Speed Transmission available in four models.

50000 SERIES REVERS-O-MATIC MODEL NO. CODE

1. The model number will consist of ten digits, as shown in the following example:

   Example:

4	050	A	O	OO	A	O
A	B	C	D	E	F	G

   The model number to contain seven sections as shown above.
   Explanation of each section is as follows:
2. "A"—In this section the first digit will always be "4" which designates Funk Division of Gardner-Denver.
3. "B"—In this section the second, third, and fourth digit designates the model series number, which in this case is the 50000 series, and in this model the number will always be 050.
4. "C"—In this section the fifth digit will designate whether the unit has converter housing and converter. The letter "A" will designate with converter housing and converter. The letter "O" will designate without housing and converter.
5. "O"—In this section the sixth digit will indicate whether the input shaft has 17 tooth or 29 tooth spline. The letter "O" will indicate 17 tooth spline. The letter "S" will indicate 29 tooth spline.
6. "E"—In this section the seventh and eighth digit will indicate the type of (or lack of) transmission to be attached.

   The letter code and indicated transmission are as follows:

"OO"	No transmission	($1\frac{3}{8}$-10 spline shaft only)	"21" = Funk 23121	(3 speed, 3.17 Second & 6.3 Low)
"09"	= Warner T9	(4 speed)	"50" = Funk 23150	(4 speed)
"98"	= Warner T98	(4 speed synchronized)	"16" = Funk D16	(Right Angle Drive)
"10"	= Funk 23110	(3 speed lo ratio)	"33" = Funk 33000	(Drop box)
"20"	= Funk 23120	(3 speed hi ratio)	"FS" = Funk Special	(In this case refer to specification sheet for description of transmission arrangement.)

7. "F"—In this section the ninth digit indicates type of clutches used. The letter "A" will indicate standard clutches. The letter "B" will indicate step clutches.
8. "G"—In this section the tenth digit indicates governor drive or P.T.O. used. The letter "G" will indicate governor drive. The letter "P" will indicate P.T.O. The letter "O" will indicate neither.
9. Several specific examples and explanations are as follows:

4 050 A O 20 A G
- G — With Governor Drive
- A — Std. Clutches
- 20 — 23120 Transmission
- O — 17 Tooth Input Shaft
- A — With Converter Housing
- 050 — 50000 Series Revers-O-Matic
- 4 — Funk Div. of Gardner-Denver Co.

4 050 O O OO B P
- P — With P.T.O.
- B — Step Clutches
- OO — No Transmission
- O — 17 Tooth Input Spline
- O — No Converter Housing
- 050 — 50000 Series Revers-O-Matic
- 4 — Funk Div. of Gardner-Denver Co.

DESCRIPTION

The Revers-O-Matic Drive consists of a pair of hydraulically actuated multiple disc clutches When the front clutch is engaged, the output shaft turns engine-wise and in most applications this produces forward motion The rear clutch is driven by a simple gear train, and its rotation is opposite to the front clutch Therefore, when the rear clutch is engaged, the output shaft turns anti-enginewise and in most applications this produces rearward motion.

The power Is transmitted from the engine to the Revers-O-Matic Drive through a torque converter The use of a torque converter, has two distinct advantages First, the converter is essentially a fluid drive, there being no direct mechanical connection through it This feature creates a very smooth and shock-free drive with the elimination of engine stalling and lugging Secondly, the converter multiplies torque, but only during heavy pull-down loads When loads are light, the converter transmits the engine power directly at almost engine speed and there is rno torque multiplication The net result is an action like a transmission, with infinitely variable and automatic speed ratios The need for shifting gears, although present, is greatly reduced.

The Revers-O-Matic Drive is controlled by (1) one of (4) four control systems

The standard control (40RC7824) is a very unique system, thus being a device that sorts out motions from a single hand lever that FIRST engages one of the clutches and then accelerates the engine as the lever is moved further. Therefore, it is a unified control that regulates both the direction of travel and the speed of travel Movement of the lever from a neutral position In one direction produces forward motion, and opposite movement of the lever produces rearward motion The optional 40RC7818 control is basically the same type as the 40RC7824 standard control, except that it is actuated by foot pedals instead of a hand lever. The action of the foot pedal is essentially the some, except that one pedal produces forward motion and the other, rearward motion

The optional control system (40RC7812) is designed to accommodate the system requiring a self centering control valve, it also features the synchronized characteristic of engaging the clutches before accelerating the engine The optional control system (40RC7804) is designed to accommodate the system requiring a 3 pos. Valve and a separate accelerator device.

CAUTION

The clutches are not power absorbing members and must not be subjected to slippage under power.

The clutch must be engaged prior to accelerating the engine when the vehicle Is to be moved or direction changed.

The clutches are hydraulically applied and spring released. Each clutch has six friction plates which have sintered bronze facings and six reaction plates of polished steel Because the clutches are hydraulically controlled, there is automatic compensation for normal wear - no adjustment is necessary

SPECIFICATIONS AND APPLICATION DATA

Speed and Input Torque	Input r.p.m. (maximum): 2800 Input torque (maximum): 200 ft. lbs. gas engine, 150 ft. lbs. diesel, plus, subject to our Engineering Department approval of application.
Converters	11¾" converter - 2.12 (Max.) Torque Multiplication. 11¾" Hi-K Converter - 2.54 (Max.) Torque Multiplication. 12" Converter - 2.15 (Max.) Torque Multiplication.
Oil System	Clutch Operating Pressure 160 P.S.I. Conv. Charge Pressure 80 P.S.I. Converter "Out" Pressure 10 P.S.I. Oil Capacity With selective speed approx. 14 qts. Type oil: Dexron or Dexron II specifications. Oil Temp: (Max.) 250° F.
Oil Cooler	Type - Oil To Water Oil Cooler Capacity 300 B. T. U. Per Minute

Gear Ratios

3 speed (Non-Synchronized) Transmission

GEAR RATIOS

Model	Low	2nd	High
4050211	3.74 to 1	1.9 to 1	1 to 1
4050212	6.63 to 1	2.54 to 1	1 to 1
4050213	6.63 to 1	3.17 to 1	1 to 1

4 Speed Transmission (Non-Synchronized)

GEAR RATIOS

Model	Low	2nd	3rd	4th
4050214	6.63 to 1	3.17-1	1.72-1	1-1

These standard transmissions do not have towable features.

Shuttle Transmission
Revers-O-Matic Only
Direct 1.00 - 1
(Forward and Reverse)

OPERATION

Like all mechanical equipment, the Revers-O-Matic cnd attached transmission will need attention and servicing Routine checks will help prevent down-time. The operator can aid in preventive maintenance by keeping a watchful eye, reporting weak or borderline malfunctioning

Because the unit operates "in" oil and "by" oil, most of the maintenance is concerned with oil replenishment and oil cleanliness

RULES OF OPERATION

1. Check oil level daily, stopping engine before check Make sure area around oil fill is clean before removing dip stick.
2. Always shift the Revers-O-Matic to neutral before starting the engine, or when the vehicle is parked and the engine is running. To move the vehicle, select the speed range desired by shifting the transmission behind the shuttle box and then engage the directional clutch (forward or reverse) In the Revers-O-Matic
3. Engage forward and reverse clutches at idle speed only The clutches are not power absorbing members and must not be subjected to slippage under pressure.
4. Use brakes to slow motion or stop before applying the opposite clutch
5. If the oil temperature gauge which is the converter ofl "Out" temperature rises above 250'F or the warning light comes on, stop the vehicle immediately Shift Revers-O-Matic to neutral and run the engine at 1000-1200 R.P.M The temperature should drop rapidly to the engine water temperature !within minutes) If the temperature does not drop, trouble is indicated The cause of trouble should be determined before further operation of the vehicle, refer to "TROUBLE SHOOTING" Instructions to be found elsewhere in this manual. Generally when overheating does occur, It is due to ra 0 r-everseis In the higher gear ratios Shifting to a lower gear will help eliminate overheating due to this cause
6. Do not shut off the engine when the unit is overheated.
7. The drive shaft should be disconnected If the vehicle is to be towed.

SERVICE

THE FUNK MFG. COMPANY recommends the use of type Dexron or Dexron II fluid or equivalent In the Revers-O-Matic Drive, Torque Converter and Attached Transmissions.

The type of service and the operating conditions will determine the maintenance interval However as stated above, It is recommended that the oil level be checked daily, at the same time checking for oil leaks.

Because the hydraulic system Is the heart of the transmission, It is especially Important that the oil be kept clean.

All models of the unit have a common oil fill This means the entire unit may be filled with lubricating oil from one oil fill location, positioned on the side of the Revers-O-Matic (shuttle) transmission.

When draining for an oil change, the Revers-O-Matic and ALL variable speed transmissions must be drained separately.

NOTE

ANY REFERENCE AS TO THE LEFT OR RIGHT HAND SIDE OF THE MODEL 50000 WITH ATTACHED IS MADE FROM THE REAR OF THE UNIT LOOKING FORWARD TOWARD THE ENGINE.

When servicing your unit for the first time, fill the Revers-O-Matic Drive to the overflow level with the recommended lubricant This will take approximately 9 quarts. Start engine and run at Idle speed for one minute. Stop engine and add 4 more quarts of fluid, some of the original fluid being required to fill the converter Check the oil level with the dipstick, adding oil if necessary to bring the level up to the low mark when unit is cold, or the full mark when unit is worm Run the engine for at least five minutes and recheck the oil level.

SERVICE PROCEDURE AND RECOMMENDATIONS

1. Stop engine before checking or adding oil
2. Always check the oil level of the Revers-O-Matic Drive immediately after stopping the engine
3. Clean around oil fill before checking or adding oil
4. It is recommended that all lubricating oil and oil filter be changed after the first 20 hours of operation and/or after overhaul
5. Thereafter and under normal operating conditions, it Is recommended that all lubricating oil and oil filters be changed after every 500 hours of operation The oil In the system must be changed whenever the oil shows traces of dirt or the effects of high operating temperature evidenced by discoloration or strong odor. If the oil in the system has become contaminated with metal particles, ALL the components of the hydraulic system (oil tubes, oil pump, oil filter, control valve, converter, clutches, heat exchanger, sump) must be thoroughly cleaned Generally this means a tear-down of the units Metal particles in the oil Is evidence of failure of some part.
6. Drain dirty oil while unit Is still warm, examining for contamination as described above
7. Clean all magnetic drain plugs before replacing
8. Replace oil filter element Use AC TYPE PF-2 which is generally available at most gas stations.
9. Always use clean oil and clean containers.
10. Do not overfill
11. Keep all joints In the shuttle box and transmission controls properly lubricated with heavy grease
12. If radiator on the vehicle is drained during winter storage, the heat exchanger on the transmission must also be drained.

TROUBLE SHOOTING

The diagnosis of trouble in the transmission always should start by making certain preliminary checks before It is assumed that the transmission is at fault, cr bef re carrming out any other trouble shooting procedures.

1. Check the coolant level in the engine radiator.
2. Check the oil level in the transmission A low oil level can effect the operation of the transmission, and may indicate fluid leaks that could cause transmission damage A high oil level can cause foaming of the oil which in turn may result In clutch slippage or leakage at the breather or filler tube
3. Check the adjustment of the control and governor linkages Make sure that the engine starts to rev up immediately after the pedal or lever leaves the neutral zone, and that the governor is being held wide open with pedal or lever in the full throttle position All Interferences that limit top R.P.M should be remedied.

JERKING STARTS

If unit starts with a jerk, check the engine idle speed which is recommended at 450 to 550 R.P.M If idle speed is lower than this, unit will die too easily in rapid reversals, and If higher than this, the converter will transmit too much torque for smooth starts Maladjustment of the control system caused by excessive friction or external interference may cause the clutches to engage after the engine has started to accelerate The control valve should be completely open before the engine starts to rev up This is mandatory for smooth starts.

SLUGGISHNESS

Check engine for proper operating performance (refer to the performance check on Page 7). Adjust the rod from the control system to the governor so that the engine starts to rev up immediately after the control valve is opened. All interferences that limit top R.P.M. should be remedied.

CLUTCH SLIPPAGE

Inspect the control valve and linkage for possible malfunction Check the regulator valve for proper operating pressures as instructed under the performance check on Page 7. If the readings ore other than normal, check for broken pressure regulator springs, make certain the valves are clean. Internally, Inspect the clutch affected for possible damage Check the oil pump for damage and improper performance

CLUTCH FAILING TO RELEASE

First check for high oil level. Internally, inspect the clutch affected for burned, damaged or worn parts and replace as necessary. Check the alignment of the missing teeth on the separator plates with the oil drain holes In the clutch cylinder, making sure the drain holes are not clogged If the output shaft exerts a turning force of 30 Inch pounds of torque or more with the unit in neutral, corrective measures should be taken and this would require disassembly of the unit and inspection of all parts

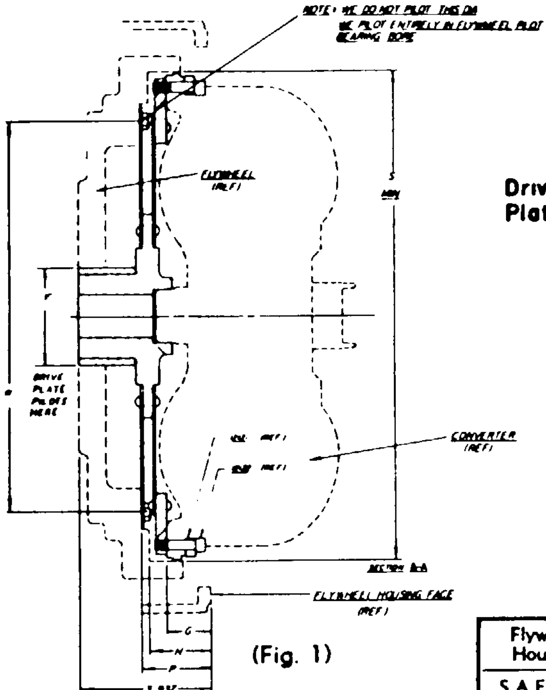
OVERHEATING

First, check for high oil level Shifting to a lower gear will help eliminate the tendency to overheat. Inspect the heat exchanger and oil filter lines for obstructions and clean or replace as necessary The possibility of Insufficient oil flow to the heat exchanger caused by a worn or damaged oil pump should be checked. Inspect the oil filter for clogging

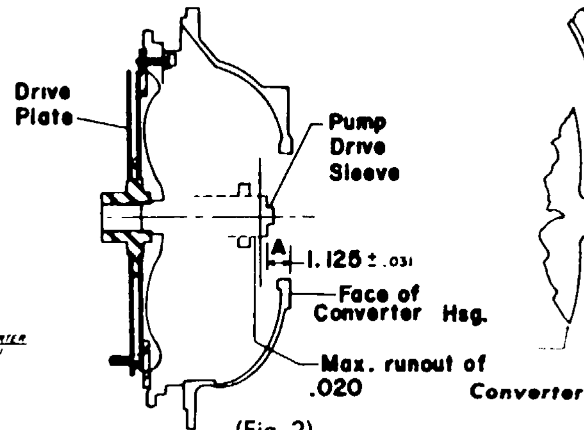
NOISY CONVERTER

First, check for low oil level. Inspect the converter for worn or damaged parts, check for damaged oil pump and replace If necessary.

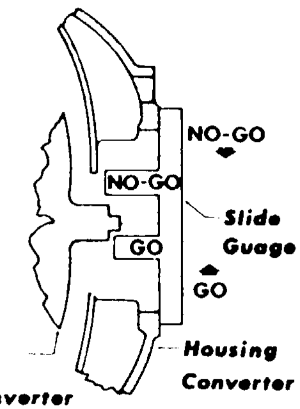
TORQUE CONVERTER INSTALLATION DATA



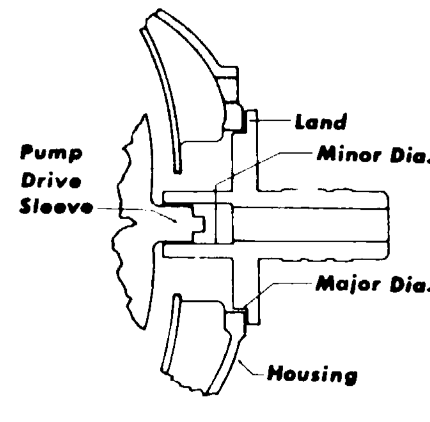
(Fig. 1)



(Fig. 2)



(Fig. 3)



(Fig. 4)

The 2 Drive Plate Assemblies Listed Below are Standards

Flywheel Housing	Flywheel	Converter	Y	Drive Plate Ass'y. No.	W	S	H	P	G	P. G
S.A.E. No. 2, 3, 4	S.A.E. 10"	12"	2.440 or 2.835 With Sleeve	12101	11.625	14½	1 15/16	2⅛	1⅜	¾
S.A.E. No. 2, 3, 4	S.A.E. 10"	11¾	2.440 or 2.835 With Sleeve	12101-K	11.625	14 5/16	1 15/16	2⅛	1⅜	¾

1. Preliminary checks should be made for the dimensions shown In Fig No. 1, also the following must be within SAE tolerances before starting converter Installation
   A. Engine flywheel face runout.
   B. Engine flywheel housing pilot bore runout, and parallelism of mounting face in relation to flywheel.
2. Attach the converter drive plate assembly to the engine flywheel with the #F10030-12 capscrew (3/8 x 3/4) and the #F16202 lockwasher supplied with the assembly. If the drive hub sleeve is required, it should be installed at this time.
3. Attach the torque converter to the converter drive plate with the #F1 1004-20NY socket head capscrew (5/16 x 1 1/4) and the #4012121 half round washer supplied with the assembly. Be sure the converter is positioned so that the drain plugs #45015 on the front side of the converter do not interfere with the drive plate.
4. Remove the converter housing from the Revers-O-Matic and attach this to the engine flywheel housing The capscrews and lockwashers for this are not ordinarily supplied
5. The location of the pump drive end of the torque converter (shown cs dimension "A" Fig #2) must be checked on all installations Due to the flexibility of the drive plate allowing the converter to tilt slightly, it will be necessary to hold the converter hub In the center position
6. The dimension "A" Is to be 1/8" plus or minus 1/32" and may be checked with a depth mike, a closely graduated scale rule and a straight edge, or the #CDG-1 "Go" and "No-Go" gauge (see Fig -3) is available for this check The dimension "A" Is to be checked at the end of the pump drive sleeve and not at the ends of the two driving lugs. (see Fig. #2)

7. If dimension "A" is less than 1 /8" minus 1/32" or If the "Go" side of the -CDG-1 :gauge will not slide by the end of the pump drive sleeve, It will be necessary to remove the converter housing and check for interference of the torque converter, converter drive plate, and engine flywheel for possible damaged or deformed drive plate. If no Interference is found, the thickness of the flywheel must be reduced, or metal shims may be Installed between the converter housing and the Revers-O-Matic drive
8. If dimension "A" is more than 1 1/8" plus 1/32", or the "No-Go" side of the #CDG 1 gauge will slide by the pump drive sleeve, shims may be Installed between the engine flywheel and the converter drive plate Plain washers not more than 1/16" thick may be used for this purpose
9. The runout of the pump drive sleeve, which is not to exceed .020" max., is checked by using the #CRG-1 gauge (Fig. #4), which also checks for converter housing misalignment The use of this gauge depends on a sense of feel The #CRG 1 gauge slips over the pump drive sleeve and into the converter housing bore, this may require a slight lifting because the flexibility of the converter drive plate may allow the torque converter to tilt slightly. The gauge is then turned as the engine is turned over slowly If the gauge turns freely through a full turn of the crankshaft, the converter and converter housing are in satisfactory alignment If the gauge will not enter the converter housing bore, or the gauge does not turn freely as the engine is turned over, It will be necessary to recheck the tolerances noted in paragraph # 1, as this would Indicate the runout is In excess of the .020" limit.
10. Attach the Revers-O-Matic Drive to the converter housing with the #F10040-32 capscrews (7/16 x 2") and #F16203 lockwashers, checking first that the oil pump drive lugs are set at right angles to the drive lugs on the converter pump drive sleeve The full weight of the Revers-O-Matic must be suspended during Installation to prevent damage to the oil seal at the front of the oil pump The Revers-O-Matic should be rotated a few degrees each way during installation to mesh the spline connections Inside the converter.

NOTE

The Revers-O-Matic must be filled with oil per service Instructions on page 4 before engine is started

11. Installation with reference to 40RC7866 control assembly is shown on page D 12 Connect the throttle rod between the throttle lever (point "E" page 5) and the governor spring Throttle rod length is adjusted so that the engine begins to rev up when the lever has left stop "A" by riot more than 1/16" The rod from the operator's control is connected to the bell crank (point "D"), being sure that the operator can articulate the bellcrank thru 45° each way, or until stop "C" closes.

PERFORMANCE CHECK

Attach a tachometer to the engine with the transmission in neutral Holding the forward pedal or lever wide open, the engine should turn up to the top governor R.P.M as shown on the specification sheet. If the R.P.M is less than this, check the control and governor linkage to make sure that the governor is being held wide open, or tune up the engine. Check the R.P.M. with the reverse pedal or lever fully depressed. The engine speed should be the same as above.

Next, place the transmission in high gear and lock the brakes. Holding the forward pedal or lever wide open, the engine should turn up to the minimum static R.P.M. as shown on the specification sheet If the R.P.M. is less than this, tune up the engine If the engine speed is over the maximum static R.P.M as shown on the specification sheet, the torque converter or the hydraulic clutches in the Revers-O-Matic are slipping. Repeat the some test, using the reverse pedal or lever.

If a check indicates that the converter or the Revers-O-Matic are at fault, first check the oil level of the unit as described under "Service" on Page 4 Next, check the control oil pressures. Install a 200# pressure gauge in the pipe fitting located on top of the control valve and at the front end of the Revers-O-Matic Drive With the engine turning approximately 1500 R.P.M. the pressure should read 150 P.S.I. minimum If less than this, remove and clean the pressure regulator valves as follows'

1. Remove the upper regulator cop on the left hand side of the unit near the front end of the case Remove the spring, valve, and guide pin. Thoroughly clean the valve port as well as the various parts of the valve. Set the parts of the upper regulator valve aside so that they will not be mixed up with other parts later on.
2. Install the upper regulator cap only in the upper regulator valve port.
3. Remove the lower regulator cap, spring, valve and guide pin. Thoroughly clean the valve port as well as the various ports of the valve.
4. Reassemble the lower regulator valve complete, being sure that the valve slides freely in the valve port
5. A pressure reading can now be taken on the lower regulator valve, using the gage previously Installed The lower regulator should be set at 75 to 80 P.S.I.
6. The pressure of the regulators can be adjusted by adding or removing washers under the springs in the regulator caps
7. Remove the upper regulator cop and reassemble the upper regulator valve complete, being sure that the valve slides freely in the valve port.
8. The upper regulator valve should now be set so as to read 160 to 170 P.S.I at 1800 R.P.M. in neutral, However, the pressure will drop momentarily below 100 P.S.I. when the clutches are engaged. With the engine idling, the regulator should read approximately 100 P.S.I.
9. With new oil In the unit, the pressure regulator valves may buzz. This is due to a foaming of the oil Do not read the pressure gage when the regulator valves are buzzing Idle the engine for several minutes, then rev up and read the pressure gage.
10. The 10# pressure regulator valve located on the right hand side of the unit is rarely a source of service problems. However, if the valve should require cleaning, follow the steps described above for the other two regulator valves.

COMPANY SAE #3 17T, STEP CLUTCHES 11 3/4

CONVERTER 4 SPEED TRANSMISSION W/PUMP DRIVE ASM.

FUNK MFG. CO.

COFFEYVILLE, KANSAS

SPEC. 7837 SH 1 OF 1

ASSEMBLY NO. 50A055BP

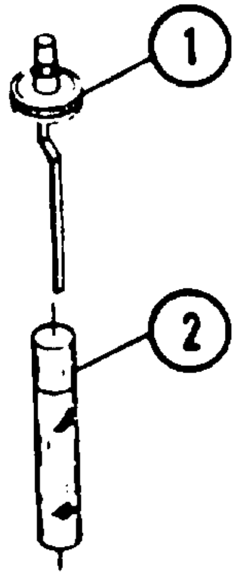
DATE WRITTEN

DWG REF NO	NAME OF PART	PART NO.	NO REQ'D	MATERIAL DESCRIPTION	DWG SIZE
	ASM. TRANSMISSION	50A055BP	1	WITH FOLLOWING OPTIONS:	
	OIL FILL GROUP	40RC7779	1		
	VALVE CONTROL	4TRCC7200	1		
	CONTROL SYSTEM ASM.	40RC7866	1		
	OIL LINES GROUP	40RC7847	1		
	ASM. SHIFT CAP	4023402A	1	L.H.	
	HOUSING CONVERTER	4TRCA75013	1		
	ASM. CONVERTER	4045022	1		
	ASM. DRIVE PLATE	40121189	1		
	OIL PRESSURE LINE	4012548	1		
	OIL PRESSURE GAUGE	4012546	1		
	PUMP DRIVE ASM.	4036000	1		
	HEAT EXCHANGER	4TRCA7230	1		
	SHUTTLE ASM.	4050250	1		
	OIL FILTER GROUP	4TRC7240	1		
	ASM. CASE AND GEAR	4050286	1		
	FITTINGS, CONVERTER ATTACH	40121191	1		
	TAG GROUP	4050400	1		

WRITTEN BY

SPEC SH OF

40RC7779
OIL FILLER GROUP

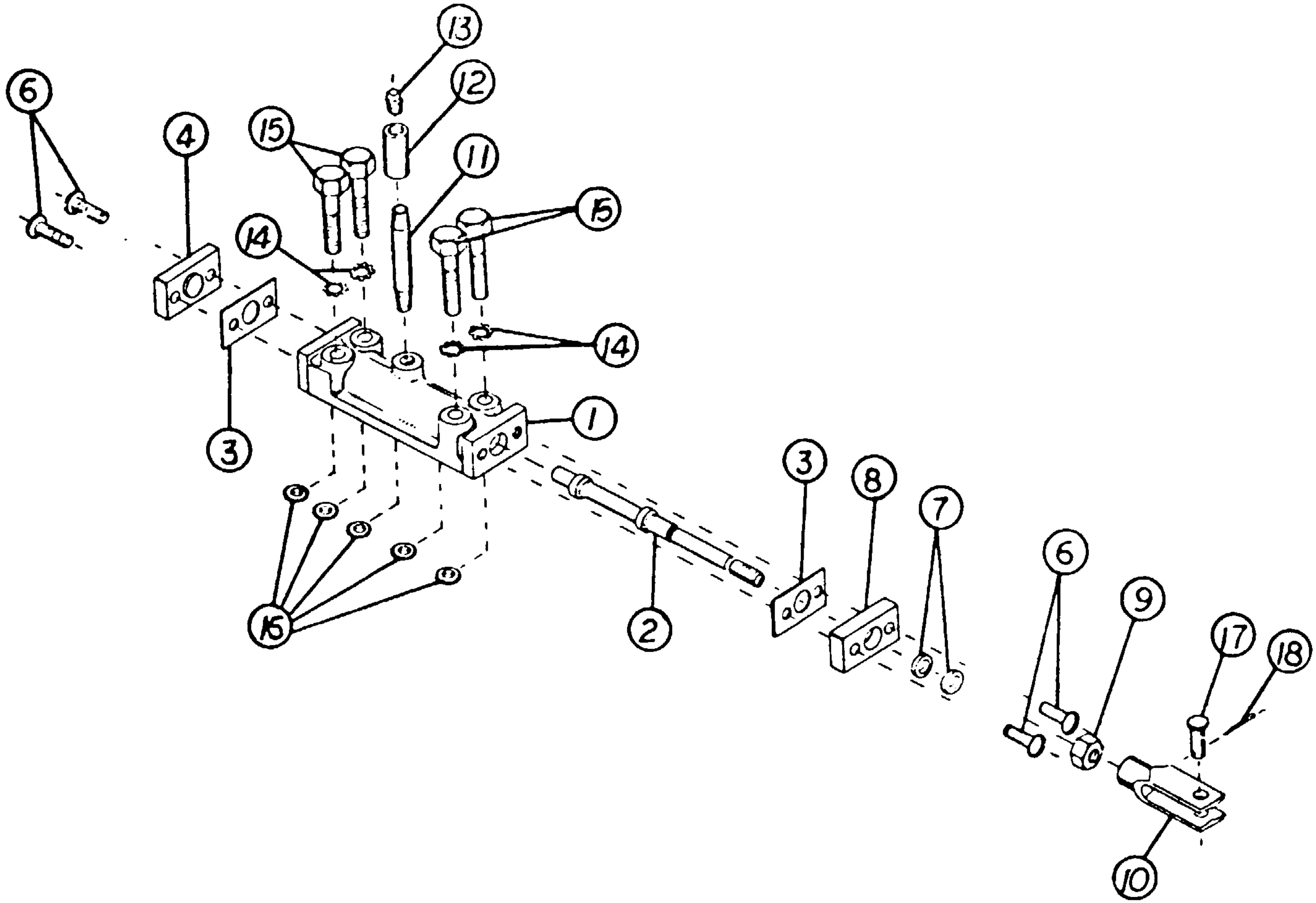


REF. NO	PART. NO.	DESCRIPTION	NO. REQ.
1	40RC7892	DIPSTICK	1
2	40RC7904	ASM. FILLER NECK	1
*3	40RC7722	PLUG, CAP OIL FILLER HOSE	1

* NOTE: ITEM REF. NO. 3 NOT SHOWN ON DRAWING

REV. LETTER "A"
REV. DATE 2-14-74

VALVE CONTROL GROUP
4TRCC7200



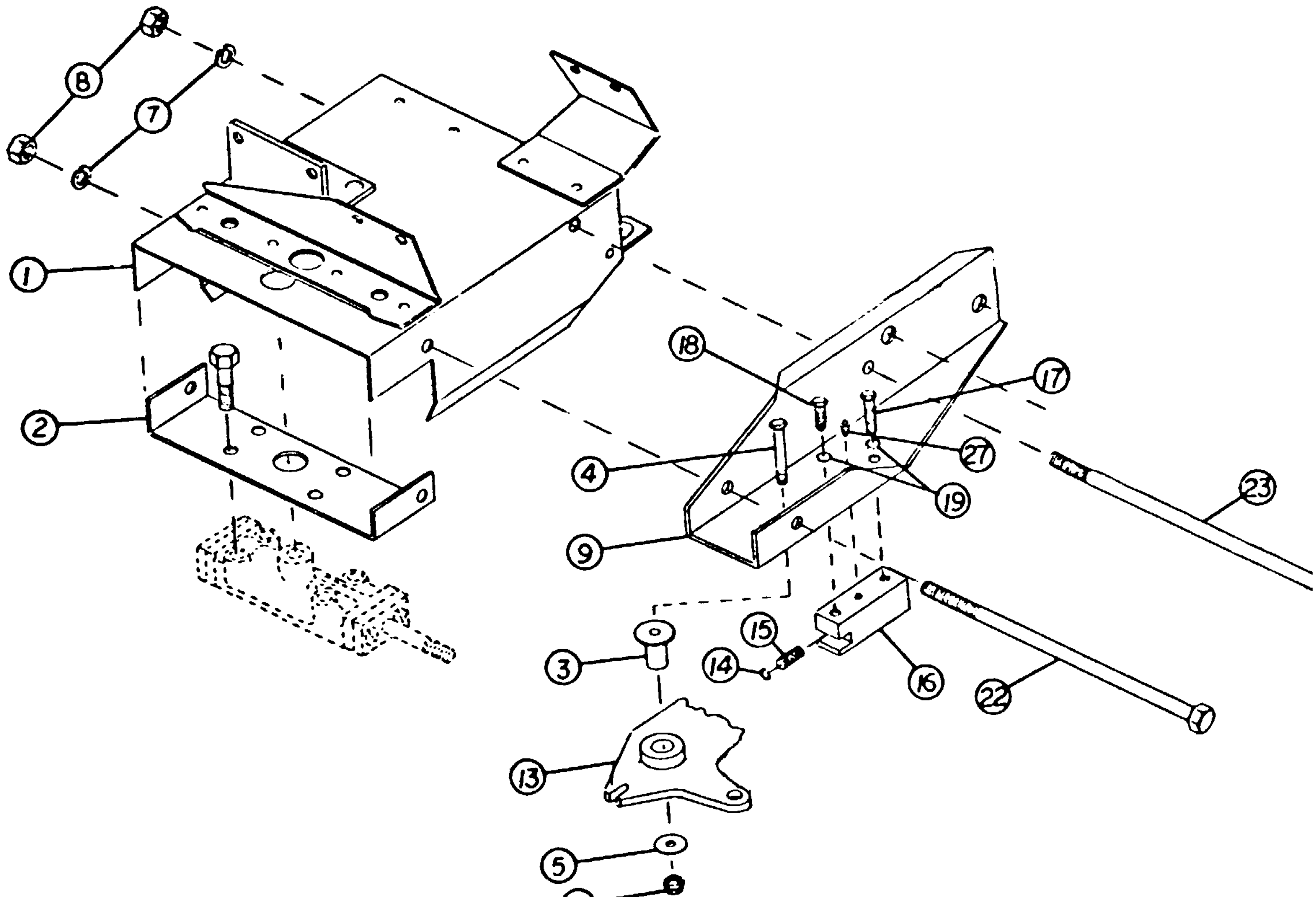
4TRCC7200
VALVE CONTROL GROUP

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
1	4TRC7202	BODY VALVE	1
2	4TRC7201	VALVE, CONTROL	1
3	4TRC7205	GASKETS, VALVE CAPS	2
4	4TRC7203	CAP, VALVE CLOSED	1
6	F7781612	CAPSCREW	4
7	F65133	SEAL, OIL	2
8	4TRC7204	CAP, VALVE, OPEN (TAKES OIL SEAL	1
9	F79103	NUT	1
10	4TRC7251A	YOKE	1
11	F3261016	NIPPLE, PIPE	1
12	F327202	COUPLING	1
13	F190012	PLUG	1
14	F15002	WASHER	4
15	F1002024	CAPSCREW	4
16	F37010012	"O" RING	5
17	F2400223	CLEVIS PIN	1
18	F260038	COTTER PIN	1

REV. LETTER "A"
REV. DATE 6-3-70

40RC7866

LEFT HAND ASM. CONTROL W/O THROTTLE ARM

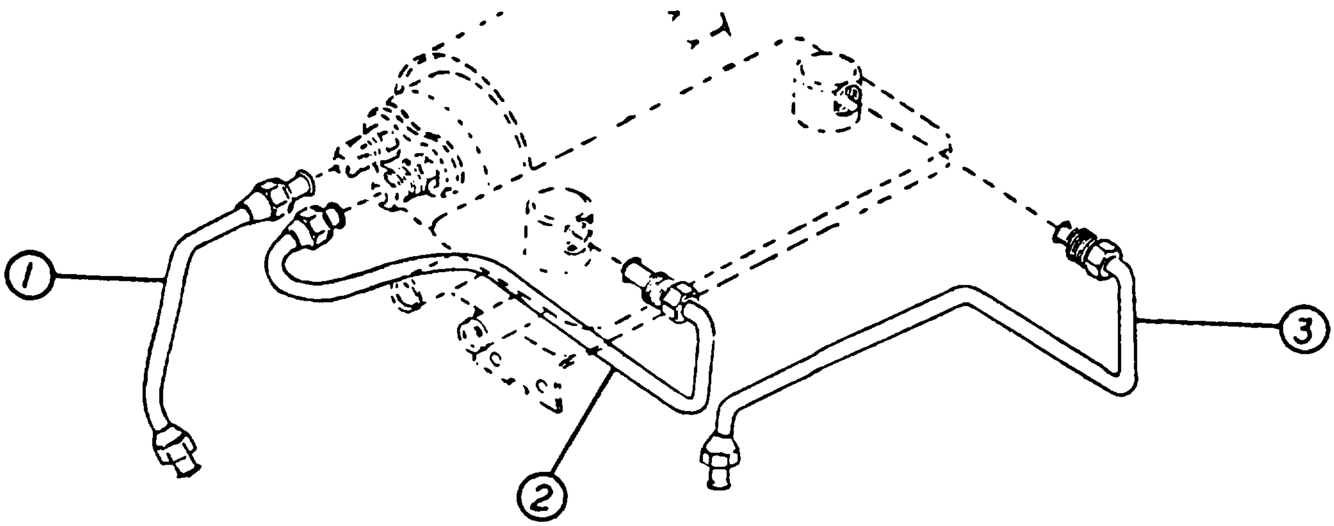


40RC7866
LEFT HAND ASM. CONTROL W/O THROTTLE ARM

REF. NO	PART NO.	DESCRIPTION	NO. REQ.
1	4000726	ASM. CONTROL SUPPORT	1
2	4TRC7269	BASE	1
3	4TRC7262	BUSHING-BELLCRANK	1
4	F1020116	BOLT	1
5	F17001W	WASHER	1
6	F7812528B	STOP NUT	1
7	F16202	LOCKWASHER	2
8	F13005000	NUT	2
9	4TRC7268ALH	BRACKET	1
13	40RC7616	BELLCRANK	1
14	F7400012D	BALL	1
15	40TR7204	SPRING	1
16	4TRC7281A	BLOCK, DETENT	1
17	F1002016	CAPSCREW	1
18	F100208	CAPSCREW	1
19	F15002	STARWASHER (EXT.)	2
22	F10030184	TIE BOLT	1
23	F10030144	TIE BOLT	1
27	F66010	GREASE FITTING	1

REV. LETTER "A"
REV. DATE 2-25-77

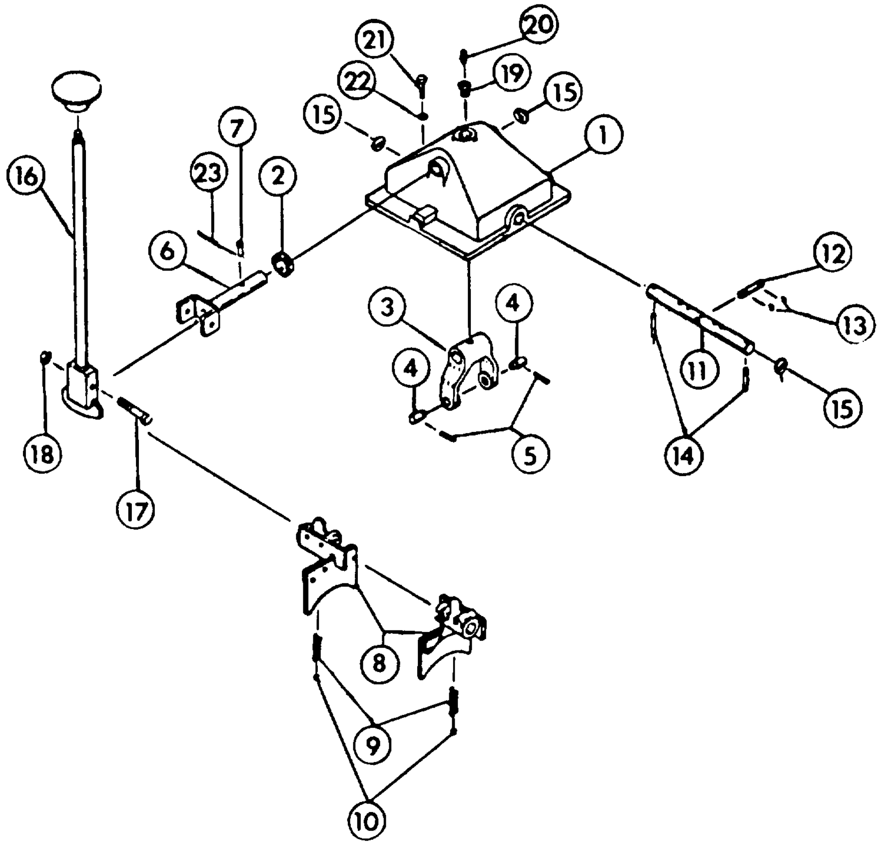
40RC7847
OIL LINE GROUP



REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
1	40RC7839	TUBE, FILTER TO REGULATOR ---------------------------------	1
2	40RC7840	TUBE, FILTER TO HEAT EXCHANGER ------------------------	1
3	40RC7841	TUBE, HEAT EXCHANGER TO CASE --------------------------	1

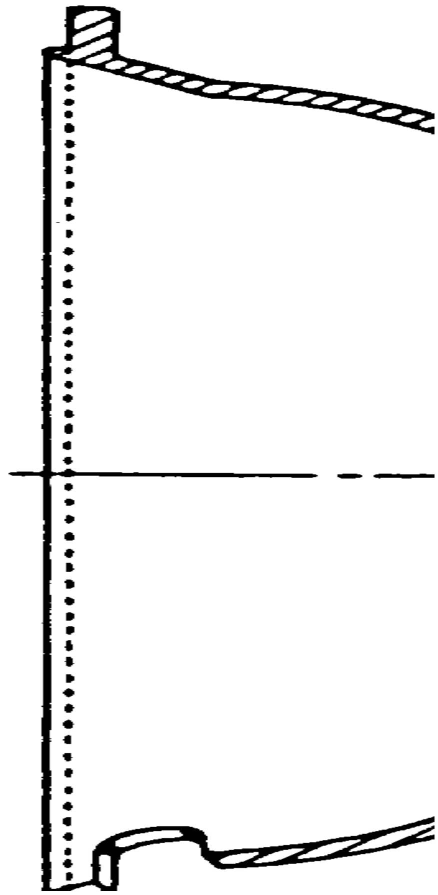
REV. LETTER - -
REV. DATE 3-3-71

4023402A
ASSEMBLY SHIFT CAP



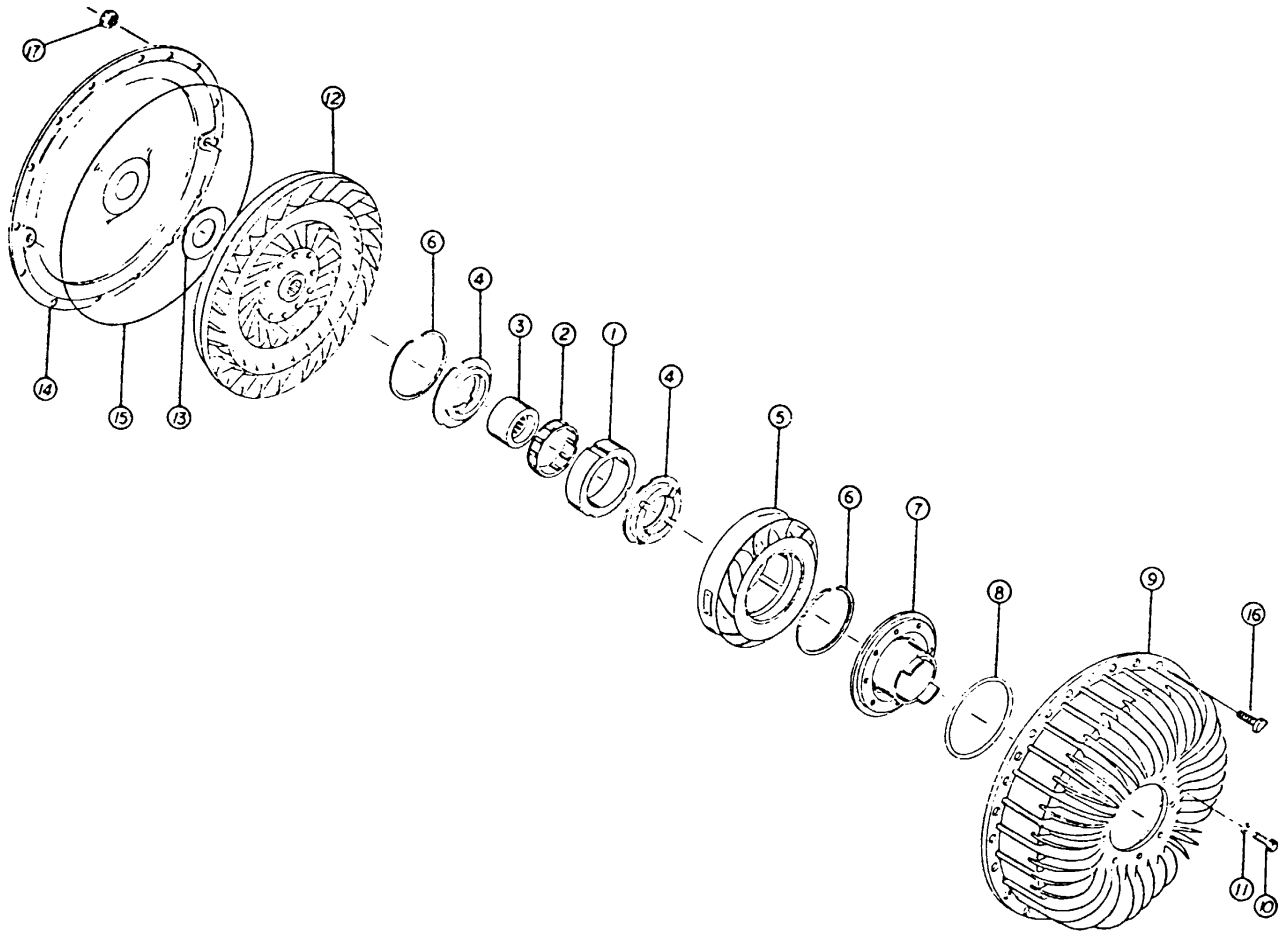
REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
1	4023406	CAP	1
2	F65022	OIL SEAL	1
3	4023456	LEVER	1
4	4023461	PIN	2
5	F2518716	ROLL PIN	2
6	4023463	SHAFT	1
7	F2400347	CLEVIS PIN	1
8	4023424	FORK ASSEMBLY	1
9	4023726	SPRING, DETENT	2
10	F7400012D	BALL, STEEL	2
11	4023413	SHIFT RAIL	1
12	4023451	INHIBITOR PIN	1
13	F3901337	SNAP RING	2
14	F2525022	ROLL PIN	2
15	F22010	EXPANSION PLUG	3
16	4023472	ASM. HAND LEVER	1
17	F1003540	BOLT	1
18	F8203824	LOCKNUT	1
19	F321004	BUSHING, REDUCER	1
20	F68200	BREATHER	1
21	F1003016	CAPSCREW	4
22	F16202	LOCKWASHER	4
23	F260058	COTTER PIN	1

CONVERTER HOUSING
4TRCA75013



REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
1	4TRCA75013	CONVERTER HOUSING ------------------------------- ------------	1
2	F16203	LOCKWASHER ------------------------------- ------------------------	4
3	F1004032	CAPSCREWS ------------------------------- -------------------------	4

CONVERTER ASSEMBLY
4045022

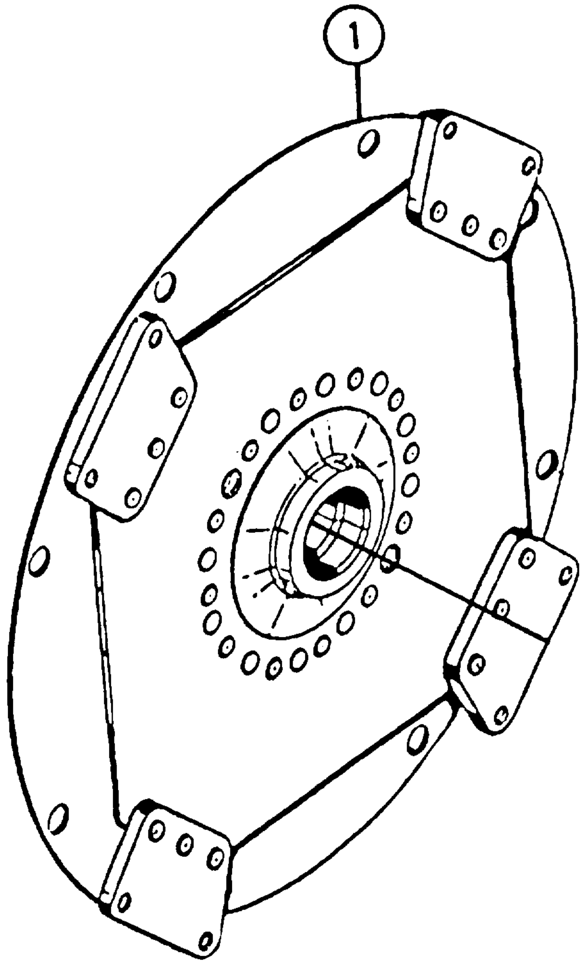


CONVERTER ASSEMBLY
4045022

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
1	4045013	RACE (OUTER)	1
2	4045036	SPRAG (ONE WAY CLUTCH)	1
3	4045012	RACE (INNER)	1
4	4045009	WASHER-STATOR THRUST	2
5	4045025	STATOR ASSEMBLY	1
6	4045011	SNAP RING	2
7	4045003	HUB-IMPELLER	1
8	4045006	GASKET-HUB TO IMPELLER	1
9	4045300	IMPELLER ASSEMBLY	1
10	4045004	CAP SCREW	8
11	4045005	LOCKWASHER	8
12	4045024	TURBINE ASSEMBLY	1
13	4045016	WASHER-TURBINE THRUST	1
14	4045044	COVER ASSEMBLY-FRONT	1
15	4045017	"O" RING GASKET	1
16	4045018	BOLT COVER TO IMPELLER	18
17	4045019	LOCK NUT	18

REV. LETTER "D"
REV. DATE 8-24-77

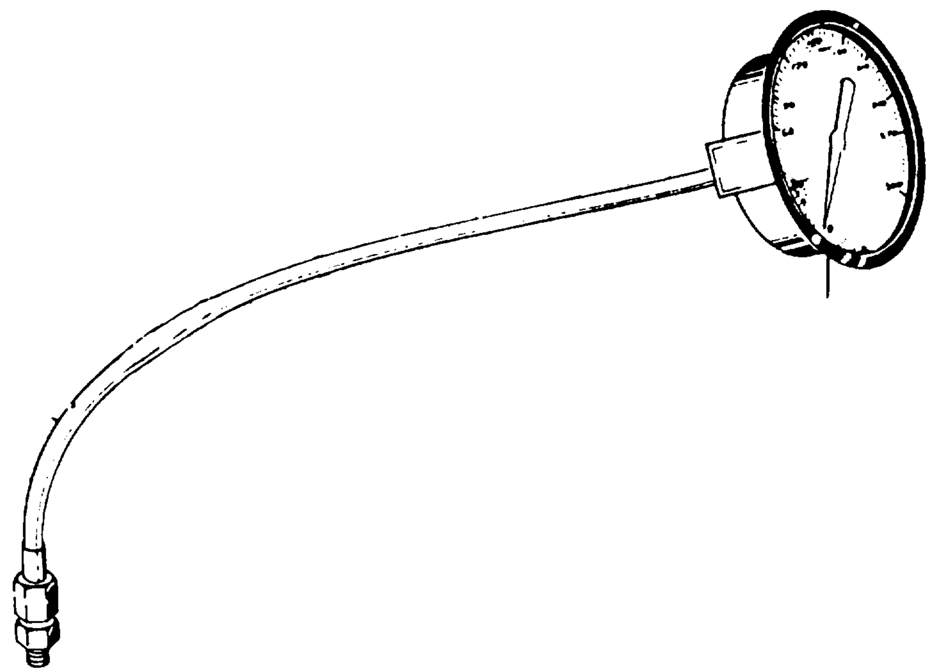
40121189
DRIVE PLATE ASSEMBLY



REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
1	40121189	ASM. DRIVE PLATE ------------------------------ ------------------	1

REV. LETTER: "D"
REV. DATE: 10-13-77

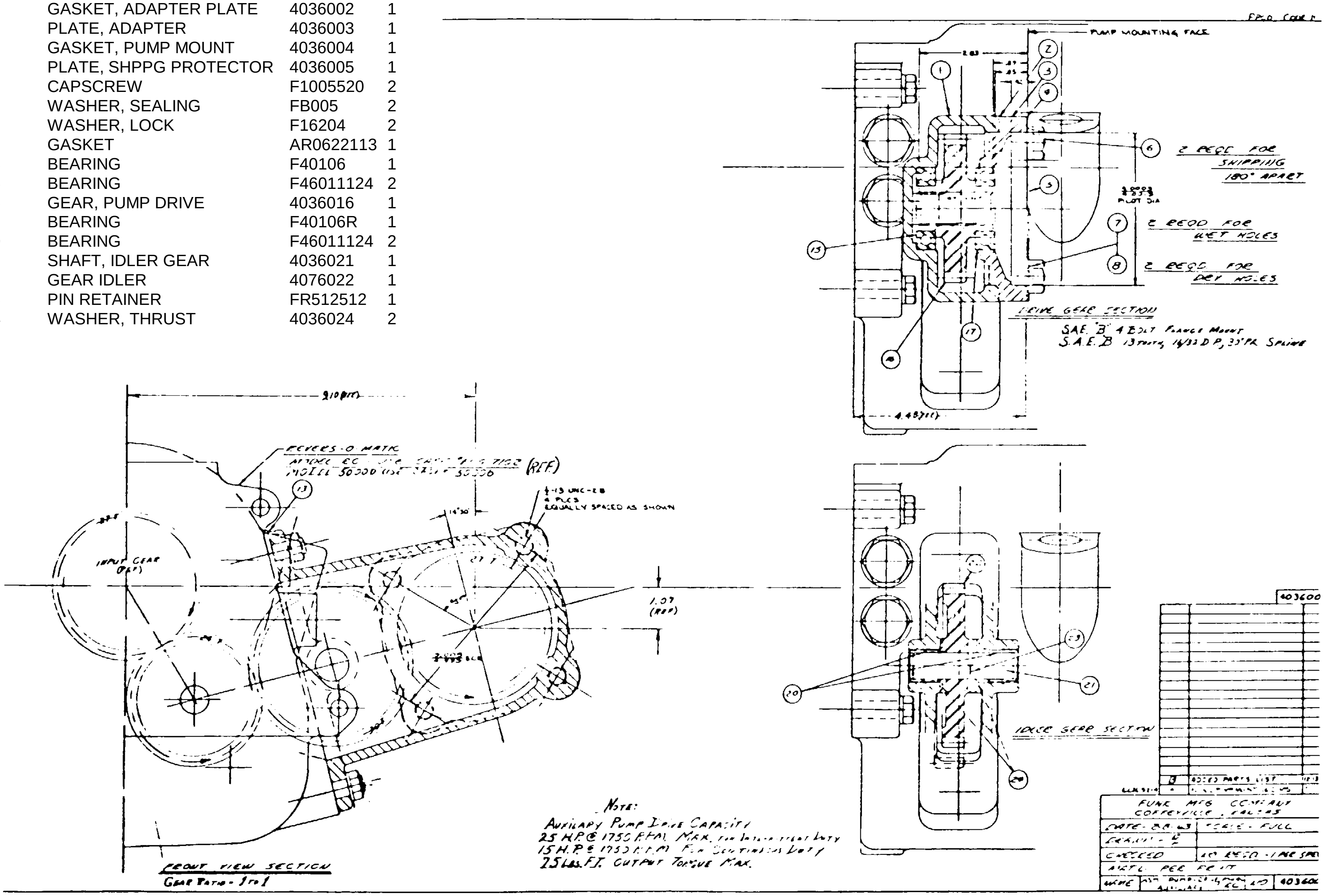
4012546
OIL PRESSURE GAUGE
4012548
OIL LINE ASSM.



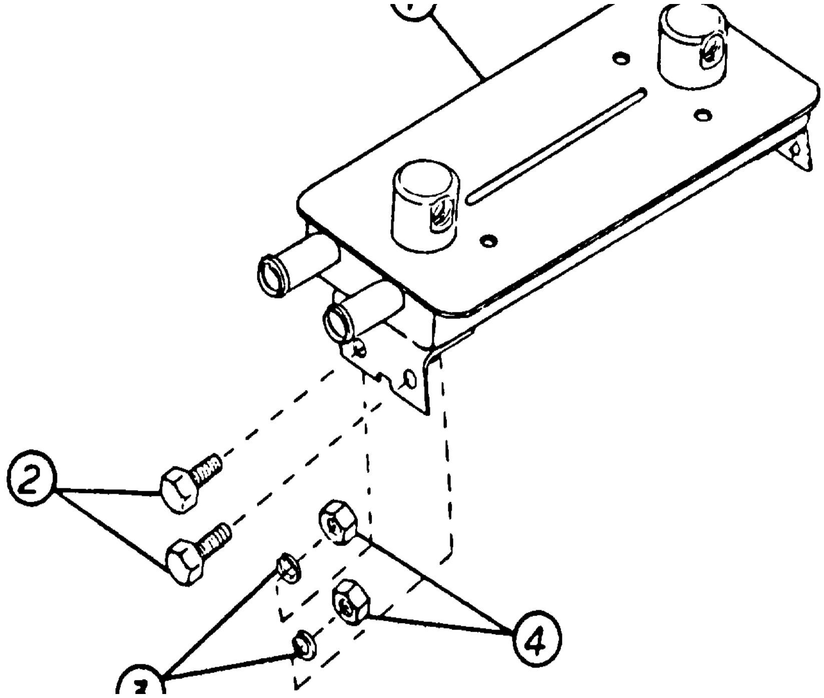
REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
1	4012546	OIL PRESSURE GAUGE------------------------------- ------------	1
2	4012548	OIL LINE ASSEMBLY------------------------------- -----------------	1

REV. LETTER - -
REV. DATE 11-3-77

Fig. No.	Description	Part No.	No. Req.
1	HOUSING, AIR PUMP DRIVE	4036001	1
2	GASKET, ADAPTER PLATE	4036002	1
3	PLATE, ADAPTER	4036003	1
4	GASKET, PUMP MOUNT	4036004	1
5	PLATE, SHPPG PROTECTOR	4036005	1
6	CAPSCREW	F1005520	2
7	WASHER, SEALING	FB005	2
8	WASHER, LOCK	F16204	2
9	GASKET	AR0622113	1
13	BEARING	F40106	1
15	BEARING	F46011124	2
16	GEAR, PUMP DRIVE	4036016	1
17	BEARING	F40106R	1
20	BEARING	F46011124	2
21	SHAFT, IDLER GEAR	4036021	1
22	GEAR IDLER	4076022	1
23	PIN RETAINER	FR512512	1
24	WASHER, THRUST	4036024	2



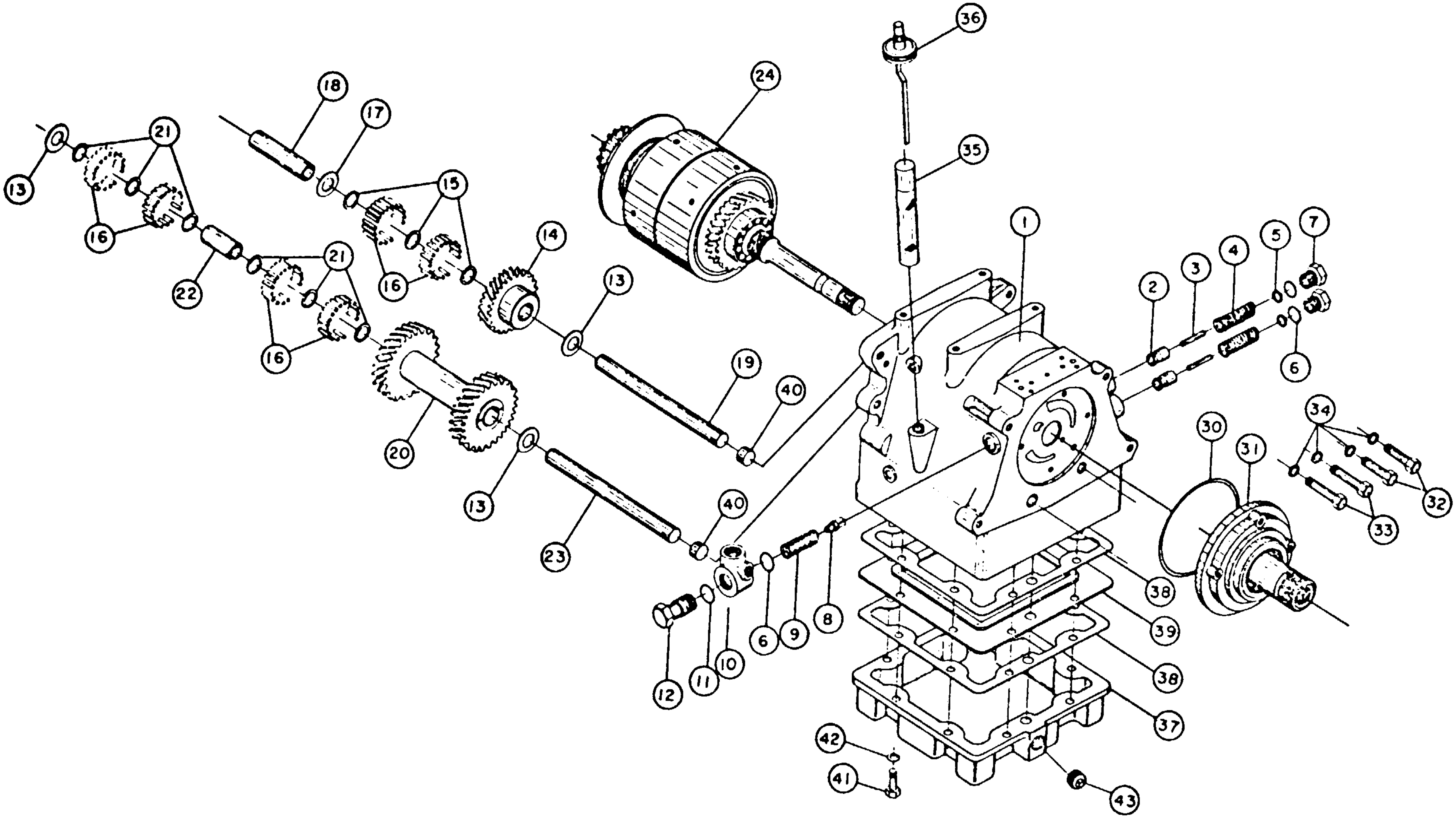
4TRCA7230
HEAT EXCHANGER
GROUP



REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
1	4TRCA7236	HEAT EXCHANGER	1
2	F1115510	CAPSCREW	4
3	F15002	STARWASHER	4
4r	F13003	NUT	4

REV. LETTER
REV. DATE 5-24-72

4050250
SHUTTLE ASSEMBLY

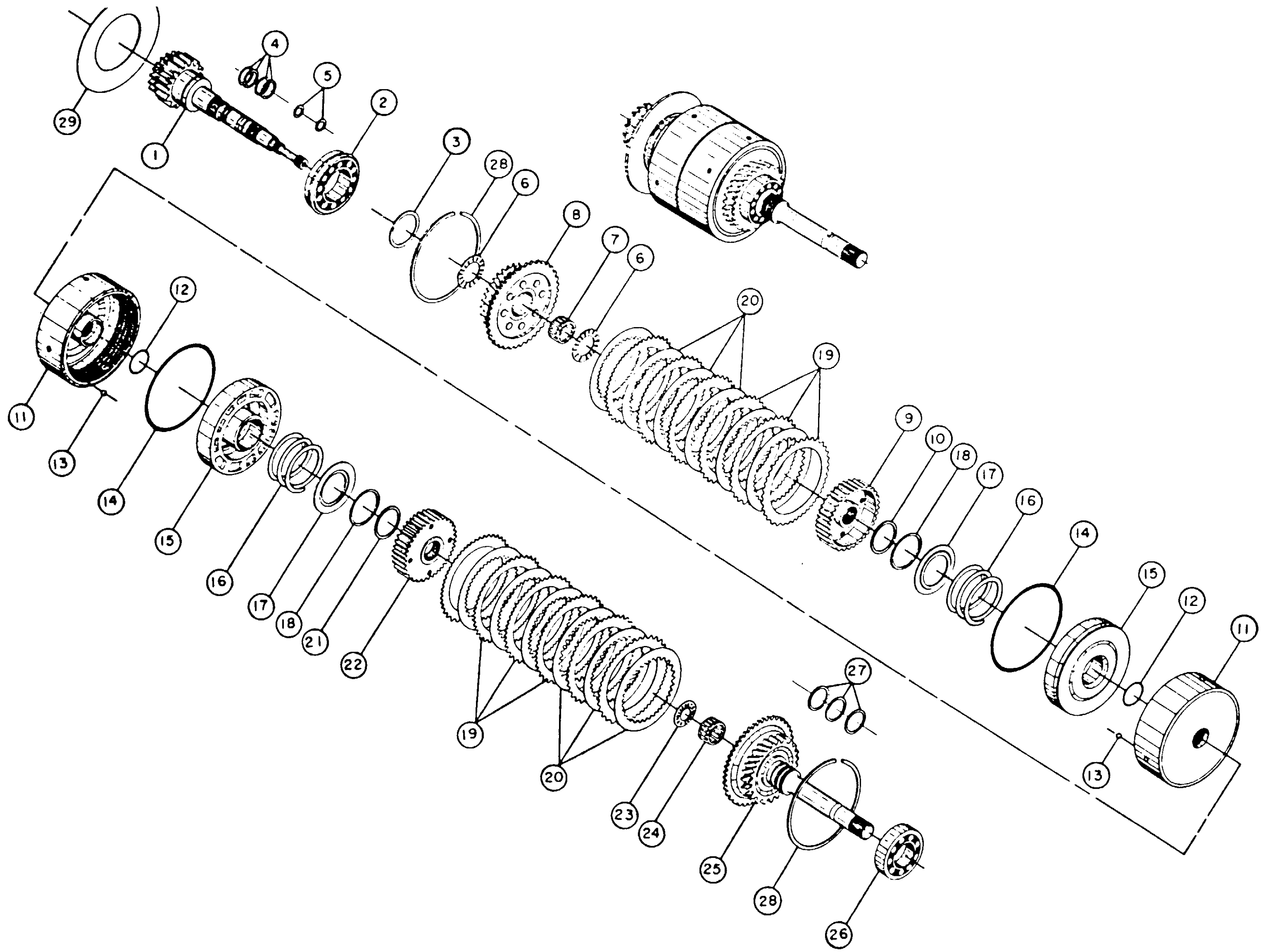


4050250
SHUTTLE ASSEMBLY

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
1	4050006	CASE ASSEMBLY	1
2	4TRC7227C	VALVE REGULATOR	2
3	F56790	PIN-REG. GUIDE	2
4	4TRCB7223	SPRING-REGULATOR	2
5	F17030616	WASHER	0-4
6	F37020116	"O" RING	3
7	4TRC7225	CAP-VALVE REGULATOR	2
8	4TRC7221	VALVE, REGULATOR	1
9	4TRCB7222A	SPRING, REGULATOR VALVE	1
10	40RC7666	BLOCK, REG. VALVE	1
11	F37010020	"O" RING, OUTER	1
12	4TRC7232D	CAP REGULATOR	1
13	40RC7798	WASHER, GEAR THRUST	3
14	4TRC7142G1	GEAR IDLER	1
15	4TRCB71482	WASHER, IDLER GEAR BEARING	3
16	4TRCB7148	ROLLER, COUNTER SHAFT & IDLER GEAR BEARING	100
17	4TRC71432E	WASHER, IDLER GEAR	1
18	4TRC71431E	TUBE SPACER, IDLER GEAR	1
19	4050035	SHAFT, IDLER GEAR	1
20	4TRCB7141D	GEAR, COUNTER SHAFT	1
21	4TRCB71462	WASHER	6
22	4TRCB71461	SPACER, COUNTER SHAFT BEARING	1
23	4050033	SHAFT, COUNTER SHAFT GEAR	1
24	4050191	CLUTCH STACK ASM	1
30	4TRC7009	GASKETS	1
31	40RC7702	ASM. OIL PUMP	1
32	F1002028	CAPSCREW	2
33	F1002032	CAPSCREW	2
34	F18002	WASHER-DYNASEAL	4
35	40RC7904	SCREEN	1
36	40RC7892	ASSEMBLY CAP	1
37	4050297	SUMP, OIL	1
38	4050300	GASKET	2
39	4050301	ASSEMBLY, SCREEN	1
40	F87110	CORK	2
41	F1003012	CAPSCREW	8
42	F16202	WASHER, LOCK	8
43	F1005512	PLUG	1
44	4050304	WASHER OIL DRAIN	1
45	40RC7722	PLUG (Not Shown)	1

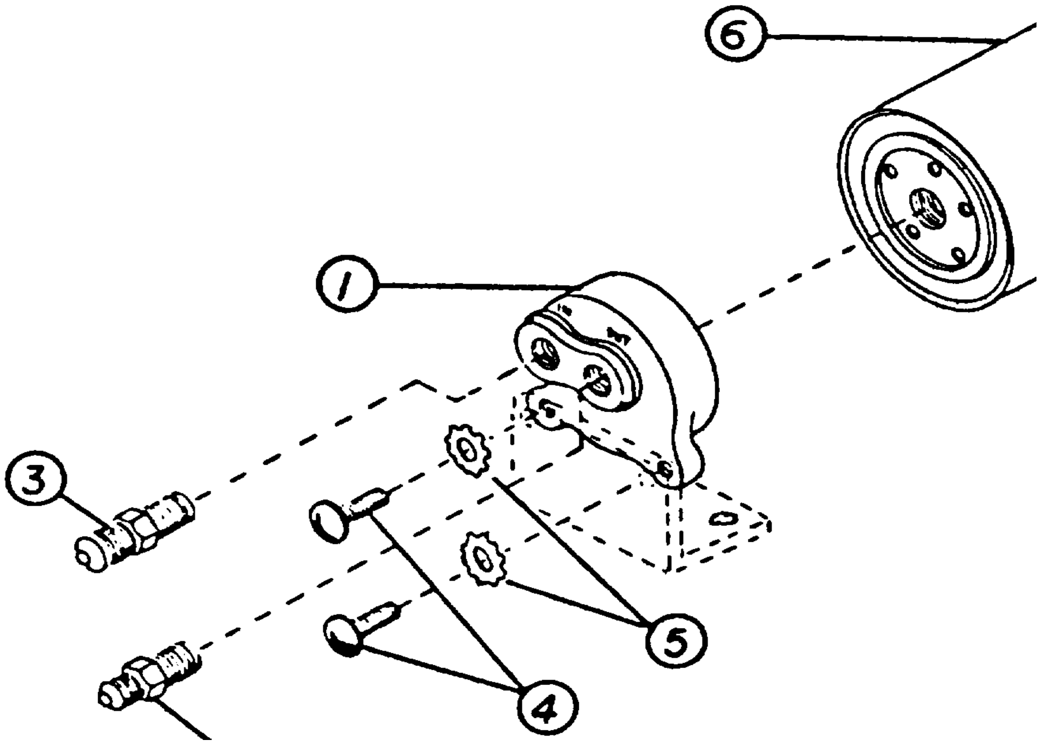
Rev. Letter - -
Rev. Date 2-17-71

CLUTCH STACK ASSEMBLY
4050191



REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
1	4050165	ASM. SHAFT OUTPUT	1
2	F41210RH	BEARING-BALL	1
3	F39010196	SNAP RING	1
4	4TRC7159A	SEAL RING	4
5	4TRC7154	SEAL RING	2
6	F5583047	BEARING-THRUST	2
7	F5593027	BEARING	1
8	4050161	ASM. GEAR OUTPUT	1
9	4050162	HUB, REAR CLUTCH	1
10	F39010106	SNAP RING	1
11	40RC7759	ASM. CYL. CLUTCH (STEP PISTON & CLUTCH	2
12	F37030222	"O" RING	2
14	40RC7167	SEAL	2
15	40RC7647	PISTON-CLUTCH	2
16	40RC7169	SPRING	2
17	40RC7631	RETAINER	2
18	F39010175	SNAP RING	2
19	40RC7727	PLATE-SEPARATOR	12
20	40RC7683	PLATE-CLUTCH	12
21	F39010102	SNAP RING	1
22	4050030	HUB, FRONT CLUTCH	1
23	F5501427	BEARING, THRUST	1
24	F5101416	BEARING, PILOT	1
25	4050010	ASM. SHAFT INPUT	1
26	F41207	BEARING-BALL	1
27	4TRC7136A	RING-SEAL	3
28	4TRC7171	RING-RETAINING	2
29	4023495	RING-CENTERING	1

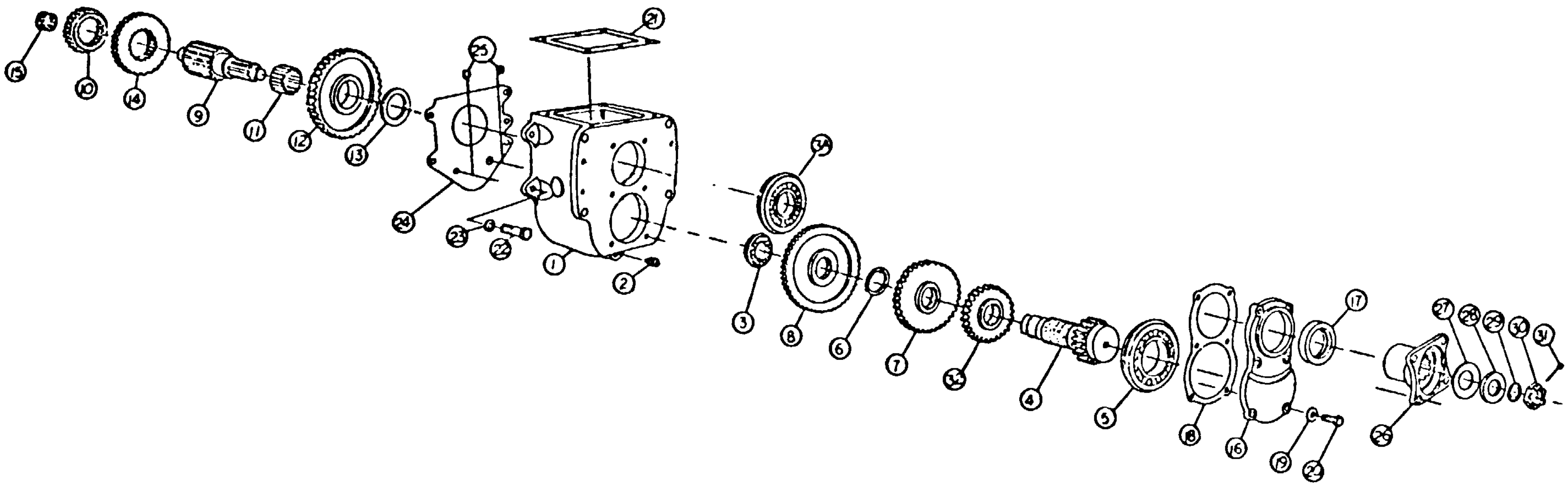
OIL FILTER ASM.
4TRC7240



REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
1	40RC7607	FILTER CAP ASY------------------------------ ----------------------	1
2	F330075A	FITTING ------------------------------ -------------------------------- --	1
3	F330076	FITTING ------------------------------ -------------------------------- --	1
4	F1115516	BUT. SCREW ------------------------------ --------------------------	2
5	F15002	STARWASHER------------------------------ -------------------------	2
6	4TRC7244	OIL FILTER (AC TYPE PF-2 CARTRIDGE --------------------	1

REV. LETTER "A"
REV. DATE 9-15-71

4050286
CASE AND GEAR ASSEMBLY



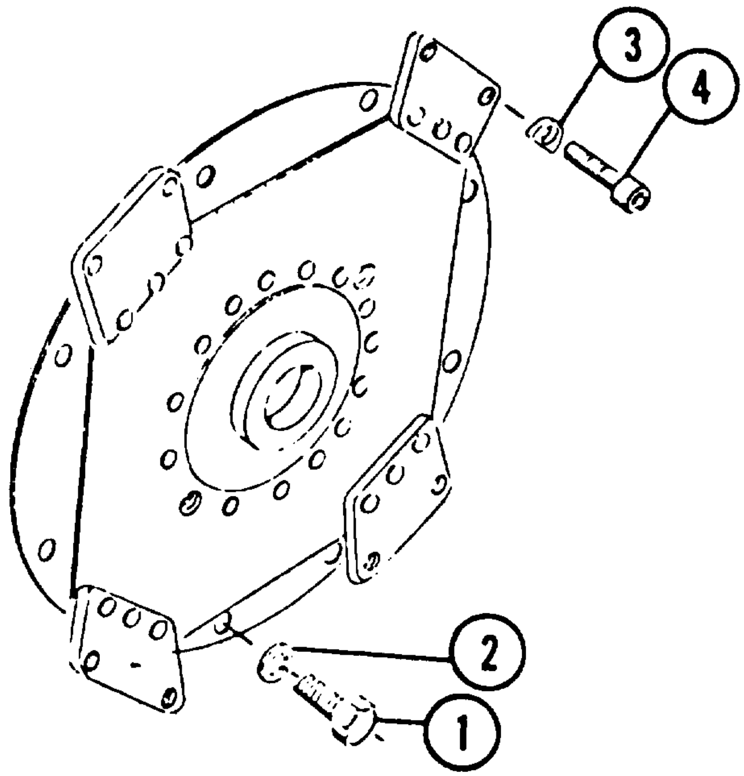
4050286
CASE AND GEAR ASSEMBLY

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
1	4023301B	CASE	1
2	F200002	PLUG, DRAIN	1
3	F40207R	BRG. COUNTER FRONT	1
3A	F40308R	BRG. OUTPUT	1
4	4023543	GEAR, COUNTER LO	1
5	F41211R	BRG. COUNTER REAR	1
6	F39010162	SNAP RING, COUNTER	1
7	4023308	GEAR, COUNTER 3RD	1
8	4023307	GEAR, COUNTER DRIVEN	1
9	4023708	SHAFT, MAIN	1
10	4023710	GEAR, MAIN SHAFT 3RD	1
11	F56720	ROLLER, GEAR BORE	39
12	4023355	GEAR, MAIN SHAFT LO	1
13	4023356	WASHER, LO GEAR	1
14	4023711	GEAR, MAIN SHAFT 2ND	1
15	F5102220	PILOT BEARING	1
16	4023371	COVER, REAR	1
17	F65024	OIL SEAL, REAR	1
18	4023372	GASKET, REAR	1
19	F18003	WASHER, DYNASEAL	6
20	F1003016	CAPSCREW	6
21	4023481	GASKET, CAP	1
22	F1006024	BOLT	5
23	F16205	LOCKWASHER	5
24	4023306	GASKET, FRONT	1
25	4023302	SCREEN PLUG	2
26	4023381	FLANGE BRAKE	1
27	4023488	GASKET, FLANGE	1
28	4000326	WASHER, FLANGE	1
29	F37020118	"0" RING, FLANGE	1
30	F7532014	NUT, FLANGE	1
31	F2600724	COTTER PIN, FLANGE	1
32	4023314	GEAR, COUNTER 2ND	1

REV. LETTER "B"
REV. DATE 6-16-75

40121191
CONVERTER ATTACH FITTINGS

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
1	F1003012	CAPSCREW ------------------------------- ----------------------------	8
2	F16202	WASHER------------------------------- -------------------------------- -	8
3	4012121	WASHER (HALF ROUND ------------------------------- -----------	8
4	F1100420NY	CAPSCREW ------------------------------- ----------------------------	8



KITS AVAILABLE FOR 50000 SERIES REVERS-O-MATIC

4050271--**GASKET KIT** contains:

- 1 Ea. 4TRC7009 Pump Gasket
- 1 Ea. 4023306 Gasket
- 3 Ea. F37020-116 "O" Ring, Regulator Cap
- 1 Ea. F37010-020 "O" Ring, Regulator Block
- 5 Ea. F37010-012 "O" Ring, Under Control Valve
- 2 Ea. F87107 Cork
- 4 Ea. F18002 Washer, Sealing
- 2 Ea. 4050036 Gasket

4000651**--SEAL KIT** contains:

- 1 Ea. F65037 Oil Seal (for pump asm.)
- 2 Ea. 40RC7167 Seal (piston-outer)
- 2 Ea. F37030-222 "O" Ring (piston-inner)
- 2 Ea. 4TRC7154 Steel Seal Ring
- 3 Ea. 4TRC7136A Steel Seal Ring
- 4 Ea. 4TRC7159A Steel Seal Ring
- 2 Ea. 4TRC7205 Gasket, Valve Cap
- 2 Ea. F65133 Oil Seal, Valve Stem

4050272--**GASKET & SEAL KIT** contains:
One of the 4050271 and one of the 4000651 kits-This is the recommended kit for the shuttle unit when used with the three and four speed transmissions of our manufacture.

4000652--**GASKET KIT** contains:

- 1 Ea. 4023481 Gasket
- 1 Ea. 4023372 Gasket
- 1 Ea. 4023488 Gasket
- 1 Ea. F65024 Oil Seal
- 1 Ea. F65022 Oil Seal
- 1 Ea. F37020-118 "O" Ring
- 6 Ea. F18003 Sealing Washers

4050273--**GASKET KIT** contains:
One each of the 4050272 and the 4000652 kits-This one covers everything but the converter.

4050274--**WASHER KIT** contains:

- 6 Ea. F17030-616 Washer, Pressure Regulating
- 3 Ea. 40RC7798 Thrust Washer
- 1 Ea. 4TRC71432E Spacer Washer

4050275**--BEARING KIT** contains:

- 1 Ea. F41207 Ball Bearing, Input Shaft
- 1 Ea. F51014-16 Pilot Bearing, Input Shaft
- 1 Ea. F55014-27 Thrust Bearing, Front
- 2 Ea. F55830-47 Thrust Bearing, Output Gear
- 1 Ea. F55930-27 Thrust Bearing, Output Gear
- 1 Ea. F41210RH Ball Bearing, Output Shaft
- 100 Ea. 4TRCB7148 Loose Rollers, Counter & Idler Gears
- 3 Ea. 4TRCB71482 Washer, Idle Gear Bearings
- 6 Ea. 4TRCB71462 Washer, Counter Gear Bearings

4050276--**BEARING KIT** contains:

- 1 Ea. F40207R Bearing, Counter Front
- 1 Ea. F41211R Bearing, Counter Rear
- 39 Ea. F56720 Loose Roller, Low Gear Bore
- 1 Ea. F40308R Ball Bearing, Rear Main
- 1 Ea. F51022-20 Pilot Bearing, Main Shaft

4TRCB7220--**PRESSURE ADJUSTMENT KIT** contains:

- 4 Ea. F17030-616 Washer, Pressure Adjusting
- 2 Ea. 4TRCB-7223 Spring, Valve Regulator
- 2 Ea. 4TRC7227C Regulator, Valve
- 2 Ea. F56790 Pin, Valve Regulator
- 1 Ea. 4TRCB7222A Spring, Valve Regulator

4050197--**CLUTCH PACK ASSEMBLY** contains:

- 1 Ea. 40RC7160 Cylinder Assembly
- 1 Ea. F37030-222 "O" Ring, Piston
- 1 Ea. F74000-8D Ball
- 6 Ea. 40RC7683 Clutch Plate
- 6 Ea. 40RC7727 Clutch Plate
- 1 Ea. 40RC7165B Piston
- 1 Ea. F80500-175 Snap Ring
- 1 Ea. 40RC7167 Seal, Piston
- 1 Ea. 40RC7169 Spring, Clutch
- 1 Ea. 40RC7172 Retainer, Spring

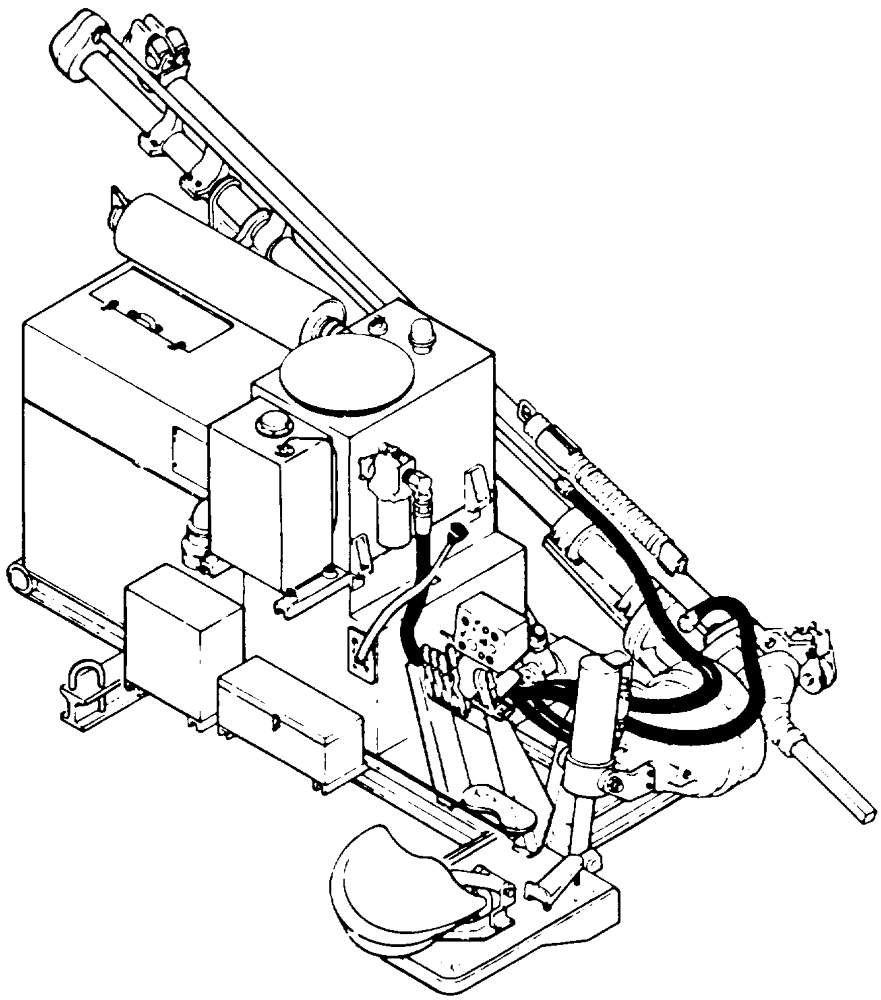
Assembled and ready for quick installation.

If you have ten units or more in field, we recommend stocking a spare pump assembly (part No. 40RC7702 for units with a 17 tooth spline on input shaft and part No. 4000583 for units with 29 tooth spline), a set of clutch plates (12 Ea. 40RC7727 and 12 Ea. 40RC7683) and one 4050165 output shaft assembly. These items in addition to a 4050274 washer kit, a 4050275 bearing kit, and a 4050272 or 4050273 gasket kit will be sufficient to overhaul a 50000 Series Revers-O-Matic in a majority of cases.

INDEX

REPAIR PARTS AND SPECIAL TOOLS LIST

EARTH AUGER
TEXOMA® MODEL 254-9



HOW TO USE
YOUR PARTS
MANUAL

USE THIS SECTION GUIDE TO LOCATE THE ASSEMBLY OR MAJOR COMPONENTS YOU NEED.
USE THE INDEX ON THE

FOLLOWING PAGE TO LOCATE THE ASSEMBLY OR SUB-ASSEMBLY YOU NEED.

THE NUMBERED BLACK TABS CORRESPOND TO THE INDEX SECTION NUMBERS.

REED TOOL COMPANY
DRILLING MACHINERY DIVISION
P O. BOX 998, SHERMAN, TEXAS 75090 (214) 786-2981
TELEX: 73-0357

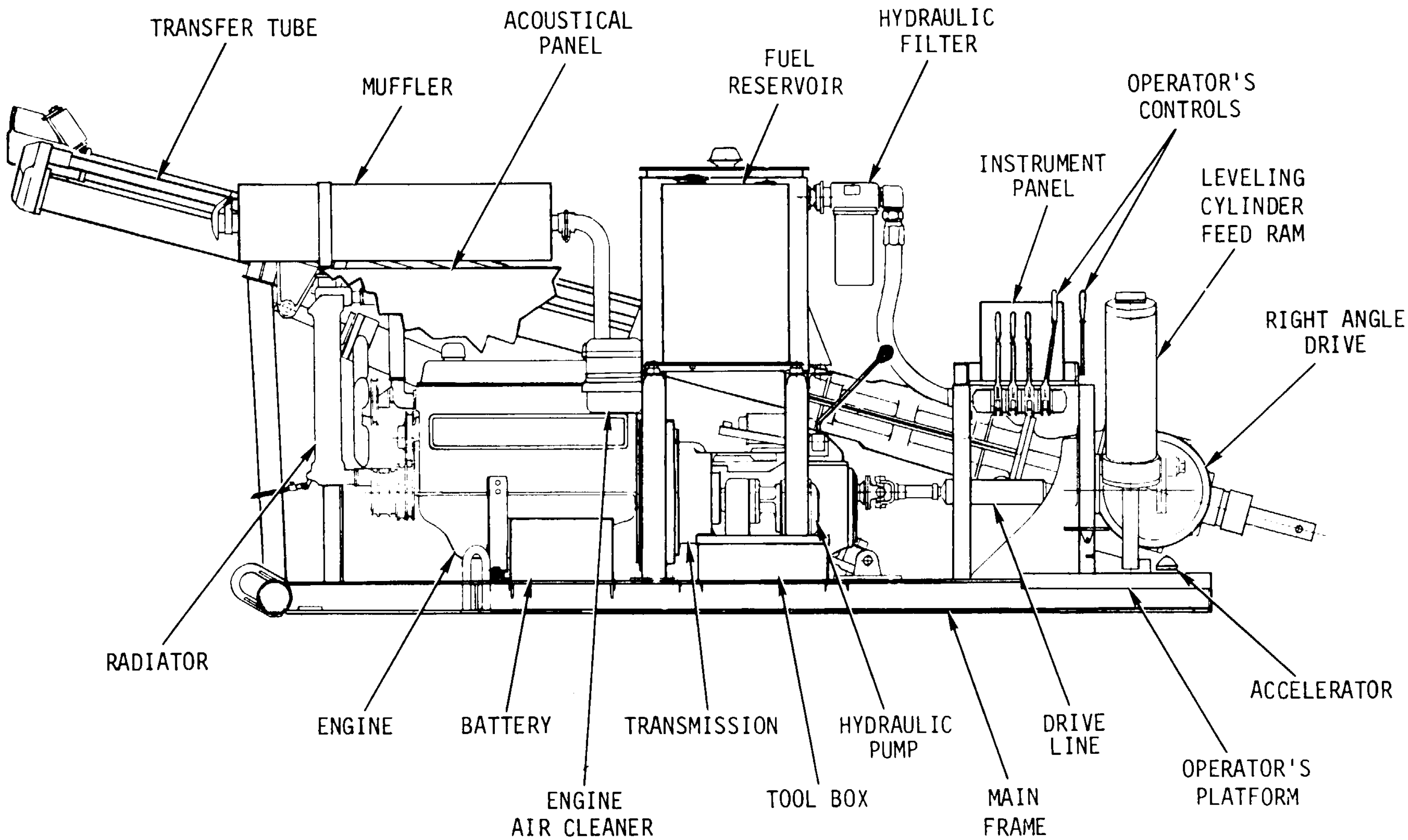
REED TOOL COMPANY
SHERMAN, TEXAS

TITLE
MILITARY INDEX

REVISION | SHEET 1 OF 2 | PUBLICATION DWG. NO. PM-45-001

REED TOOL COMPANY SHERMAN, TEXAS	TITLE MILITARY INDEX

REVISION					SHEET 2 OF 2	PUBLICATION DWG. NO.	PM-45-001



REED TOOL COMPANY
SHERMAN, TEXAS

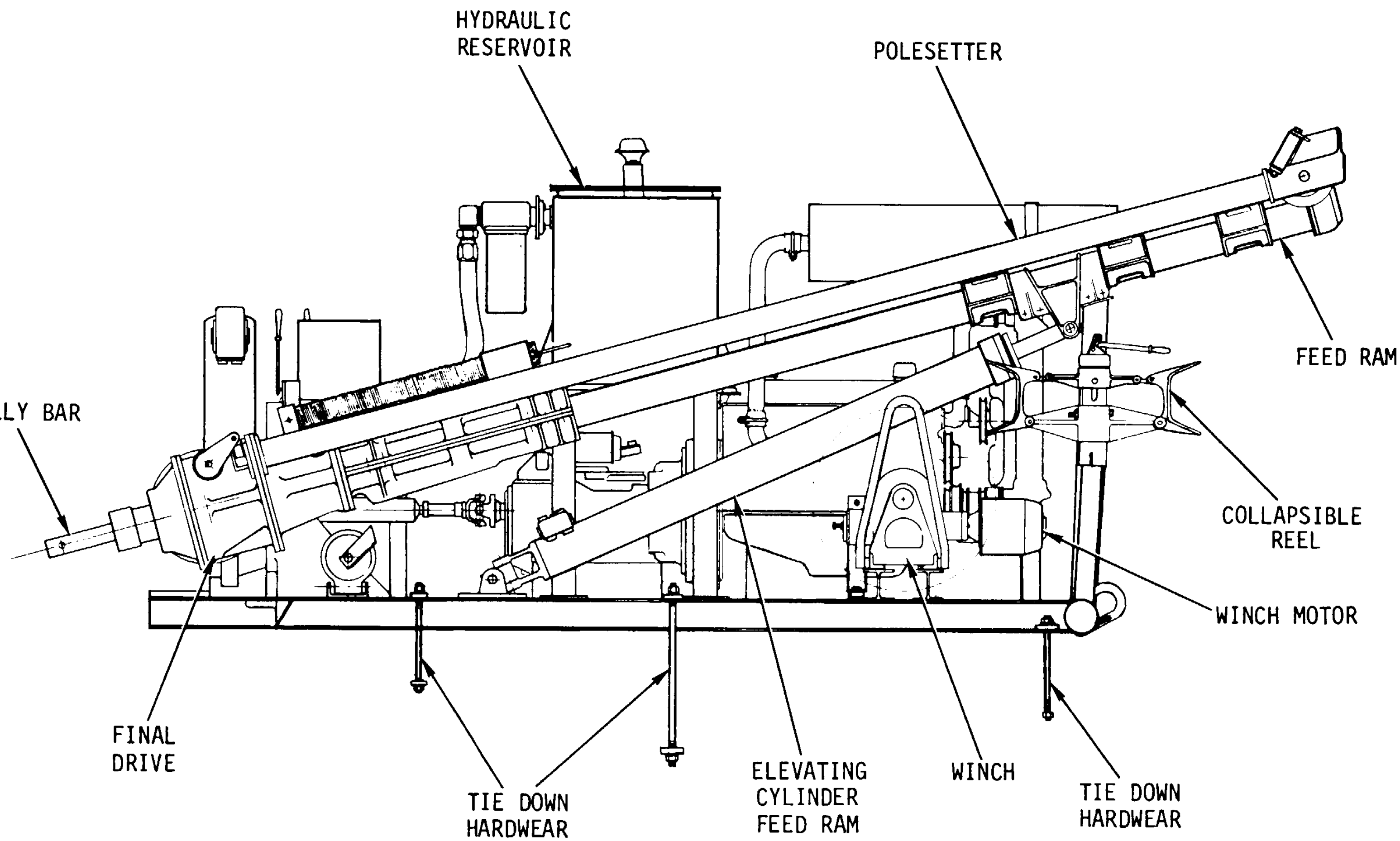
TITLE
254-9 GENERAL ARRANGEMENT/LOCATOR DRAWING

SHEET 1 OF 2

PUBLICATION DWG. NO. PM-45-002

1

001



REED TOOL COMPANY
SHERMAN, TEXAS

TITLE 254-9 GENERAL ARRANGEMENT/LOCATOR DRAWING

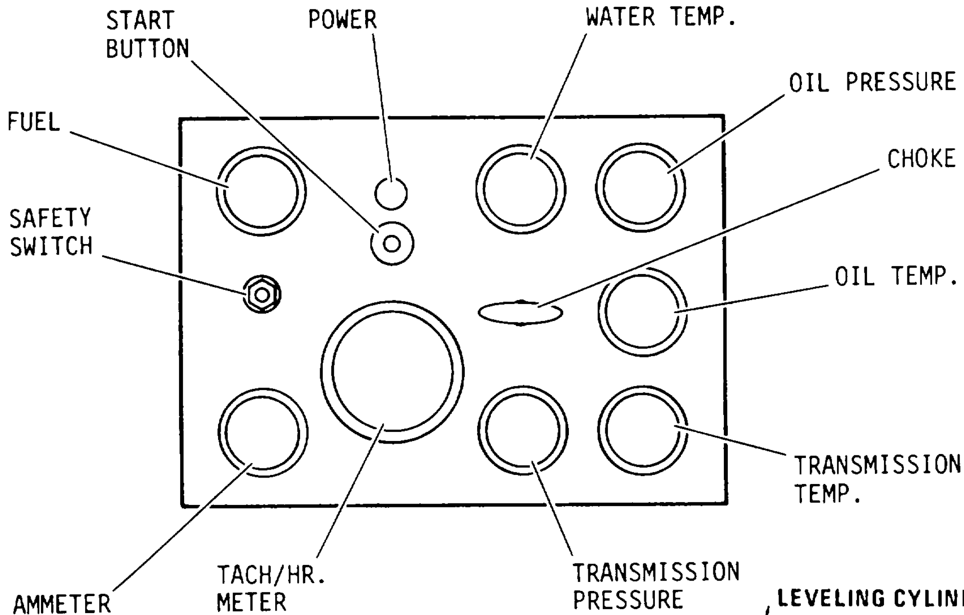
SHEET 2 OF 2

PUBLICATION DWG. NO. PM-45-002

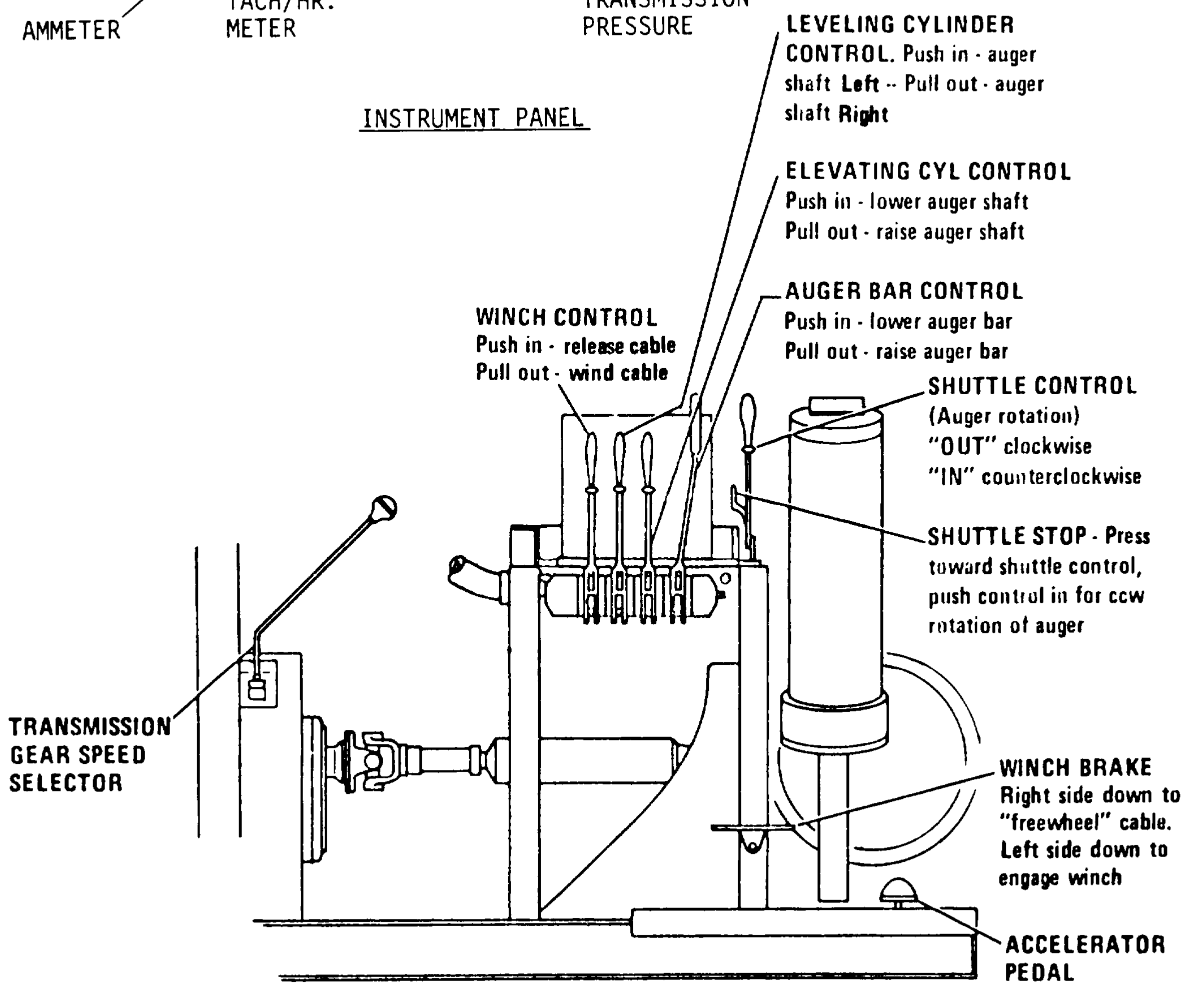
1

REED TOOL COMPANY
SHERMAN, TEXAS

TITLE
OPERATOR'S CONTROLS/INDICATORS LOCATOR



INSTRUMENT PANEL

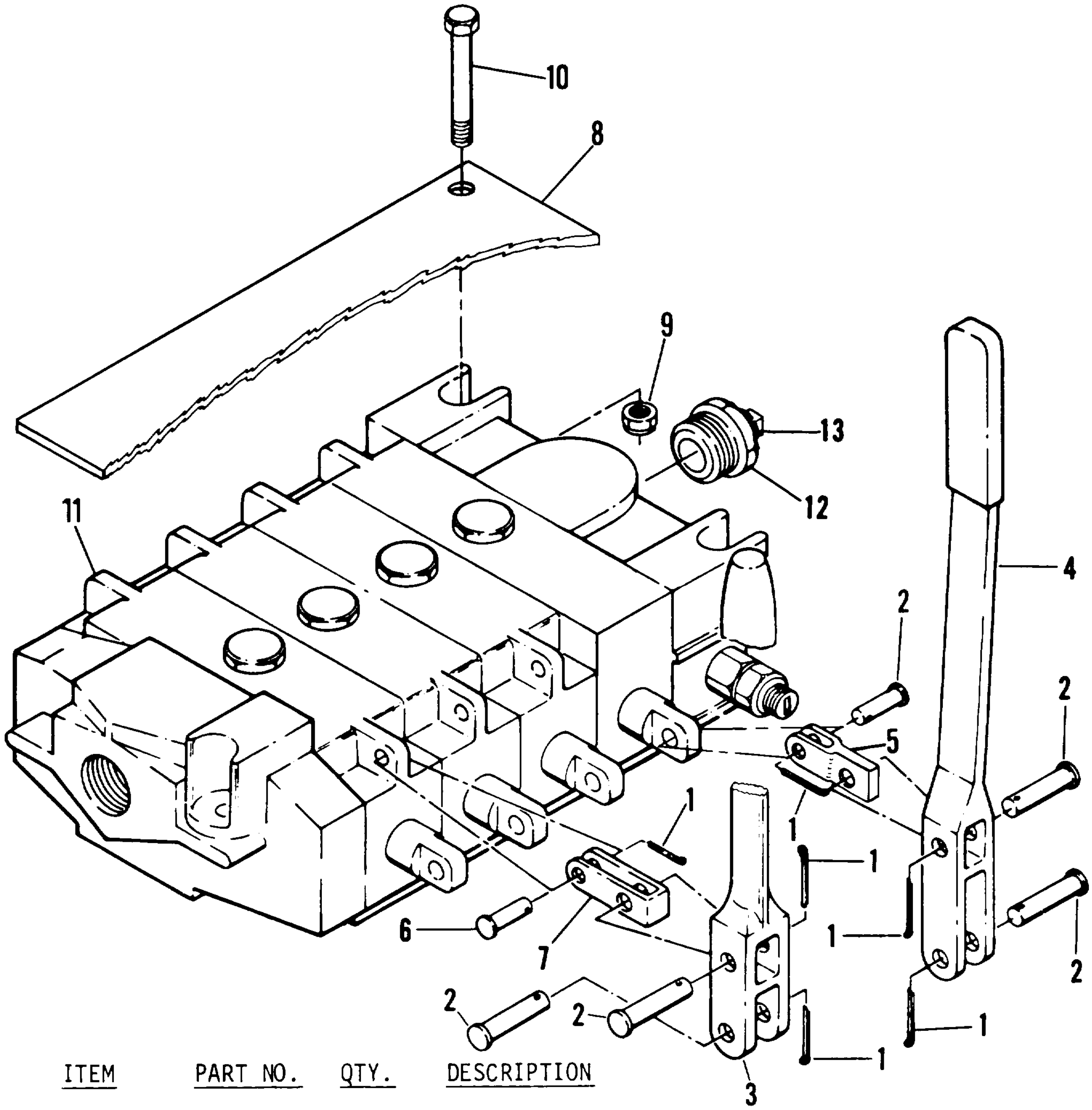


REVISION	SHEET 1 OF 1	PUBLICATION DWG. NO.	PM-45-003

REED TOOL COMPANY
SHERMAN, TEXAS

TITLE

CONTROL VALVE INSTALLATION



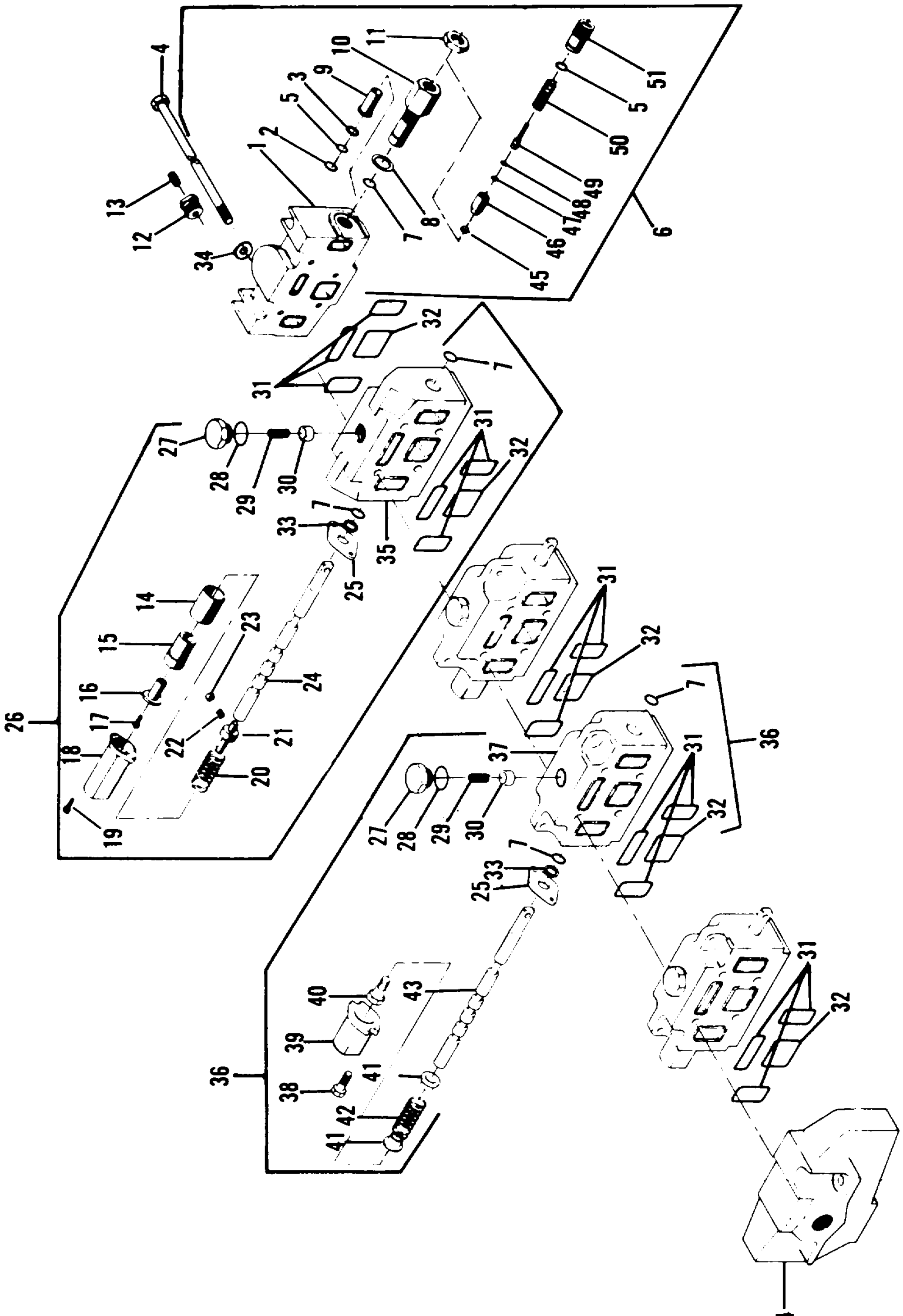
ITEM	PART NO.	QTY.	DESCRIPTION
1	5939	12	PIN - COTTER - 1/8 X1
2	11618	9	PIN - CLEVIS - 1/2 X 1 1/2
3	16095	3	HANDLE - VALVE OPERATING
4	16907	1	HANDLE-VALVE OPERATING - (CROWD)
5	44992	1	LINK - Y SHAPE - CONTROL -(A-35)
6	11495	3	PIN - CLEVIS - 3/8 X 1
7	16099	3	LINK - VALVE HANDLE - FORMED
8	45064	1	SUPPORT - INSTRUMENT
9	6291	3	NUT - ELASTIC STOP - 1/2 - 13 UNC
10	7793	3	CAPSCREW - HEX HD - 1/2 - 13 UNC X 5 - GR 5
11	44989	1	VALVE ASSY - 4 SPOOL
12	17252	1	FITTING - BUSHING - 1 NPT TO 1/4 NPT
13	6161	1	FITTING - PLUG - PIPE - SQ HD - 1/4

REF 44990

SHEET 1 OF 1 | PUBLICATION DWG. NO. PM-45-004

REED TOOL COMPANY SHERMAN, TEXAS	TITLE CONTROL VALVE BANK ASSEMBLY

ASSEMBLY 44989



SHEET	1 OF 2	PUBLICATION DWG. NO.	PM-45-005

REED TOOL COMPANY
SHERMAN, TEXAS

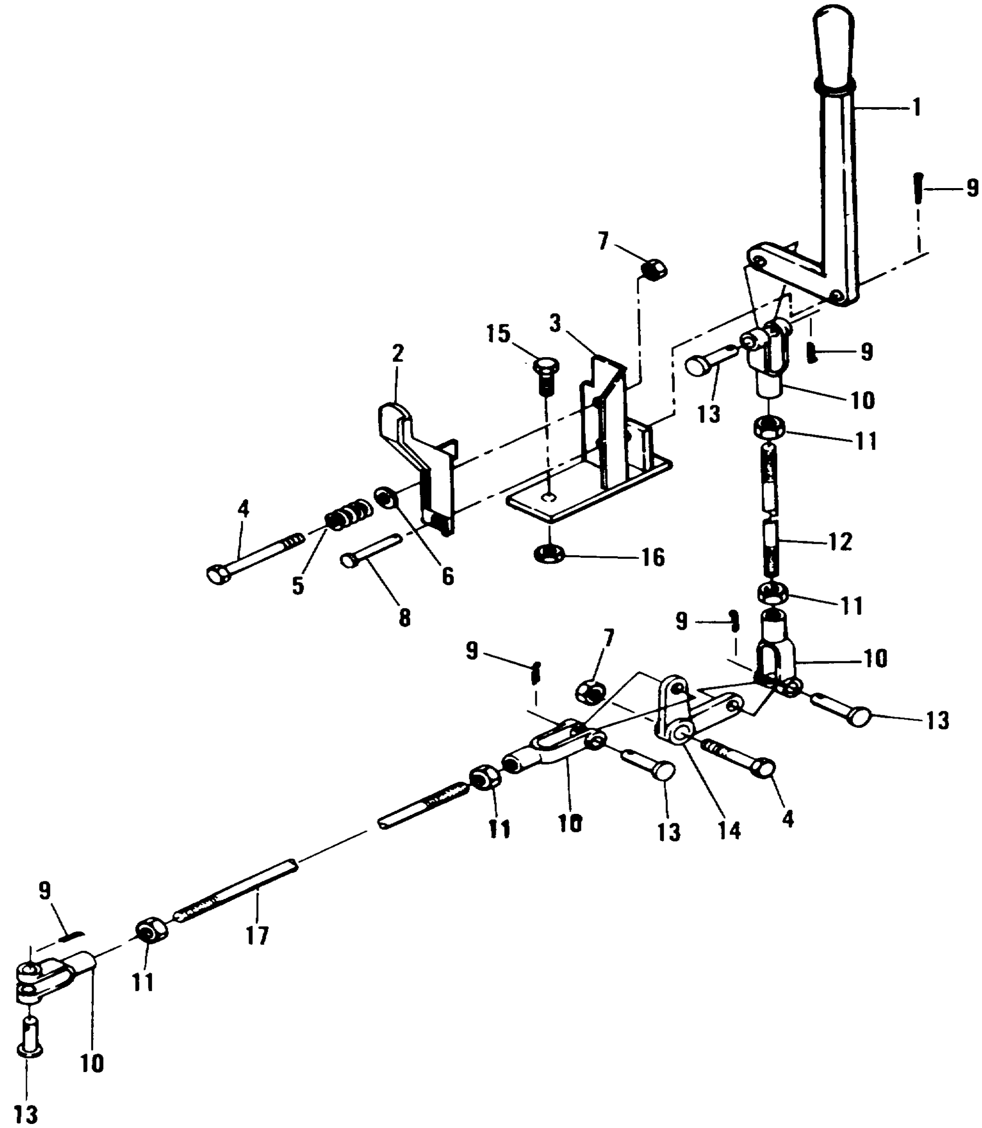
TITLE
CONTROL VALVE BANK ASSEMBLY
ASSEMBLY 44989

ITEM	PART NO.	QTY.	DESCRIPTION
1	16198	1	INLET SECTION HOUSING
2	16202	1	SNAP RING 2
3	16204	1	BACK UP RING
4	19587	4	BOLT-TIE - 1/2 X 11 1/8
5	16203	1	0 RING
6	16197	1	INLET SECTION ASSEMBLY
7	16200	10	0 RING
8	16201	1	WASHER
9	16205	1	POPPET
10	16206	1	CARTRIDGE SHELL
11	16207	1	LOCKNUT
12	17252	1	REDUCING BUSHING
13	6161	1	PLUG
14	16225	1	POPPET SLEEVE
15	16226	1	RETAINER - SPRING #1
16	16227	1	RETAINER - SPRING #2
17	42811	1	SCREW-FILLISTER HD. 3/8 IN. - UNC X 3/8 IN.
18	16229	1	CAP - VALVE SPOOL
19	42810	2	SCREW - FILLESTER HD. 5/16 IN. - UNC X 7/8 IN
20	16224	1	CENTERING SPRING
21	16223	1	POPPET RETAINER
22	16222	1	POPPET - SPRING
23	16221	2	POPPET
24	16220	1*	SPOOL
25	16219	4	RETAINER PLATE
26	16216	1	REGENERATIVE VALVE ASSEMBLY
27	16234	4	CHECK VALVE CAP
28	16233	4	0 RING
29	16232	4	SPRING
30	16231	4	POPPET - CHECK
31	16237	15	0 RING
32	16238	5	0 RING
33	16218	4	BACK UP RING
34	5975	4	WASHER - LOCK - CUT - 1/2
35	16217	1*	REGENERATIVE VALVE HOUSING
36	18451	3	DOUBLE ACTING VALVE ASSEMBLY - 3/4 PORTS
37	37454	3*	VALVE HOUSING - 3/4 PORTS
38	42809	6	FILLISTER HD. CAPSCREW, 5/16 - NC X 3/4
39	16243	3	CAP - VALVE SPOOL
40	16242	3	BOLT - HEX HD. - STRIPPER
41	16240	6	SPRING GUIDE
42	16241	3	SPRING
43	16239	3*	SPOOL
44	16245	1	VALVE - OUTLET PRESS - Z16
45	16208	1	SNUBBER CHECK
46	16209	1	FLOATING SEAT
47	16210	1	O-RING
48	16211	1	BACK UP RING
49	16212	1	DISPLACEMENT PLUNGER
50	16213	1	SPRING
51	16214	1	ADJUSTING SCREW - SPRING

*HOUSING AND SPOOL ARE REPLACED AS PAIRS ONLY

SHEET 2 OF 2 1 | PUBLICATION DWG. NO. PM-45-005

REED TOOL COMPANY SHERMAN, TEXAS	TITLE CONTROL INSTALLATION-SHUTTLE VALVE



REF 32252

							SHEET 1 OF 2	PUBLICATION DWG. NO.	PM-45-006

REED TOOL COMPANY
SHERMAN, TEXAS

TITLE

CONTROL INSTALLATION - SHUTTLE VALVE

ITEM	PART NO.	QTY.	DESCRIPTION
1	11460	1	LEVER - CONTROL
2	17135	1	LEVER - LOCKOUT
3	17136	1	BASE
4	42550	2	CAPSCREW - 1/4 X 2 1/2 NC CLASS 2A - GRADE 5
5	9486	1	SPRING
6	42624	1	WASHER - FLAT - 1/4 CLASS 2B - GRADE 5
7	6293	2	NUT - 1/4 NC
8	11242	1	PIN - CLEVIS - 7/16 X 1 1/2"
9	6718	5	PIN - COTTER - 3/32 X 1 1/4"
10	19023	4	CLEVIS - 5/16" X 24 UNF
11	5999	4	NUT - HEX HEAD - 5/16 X 24 UNF CLASS 2B - GRADE 5
12	32255	1	ROD - 5/16 DIA X 13 1/2
13	11500	4	PIN - CLEVIS - 5/16 X 1
14	34035	1	BELL CRANK - 5/16
15	42574	2	CAPSCREW - 3/8 X 1 1/2 NF CLASS 2A - GRADE 5
16	42642	2	NUT - 3/8 NF CLASS 2B - GRADE 5
17	32253	1	ROD - 5/16 DIA X 39 LG.

REF 32252

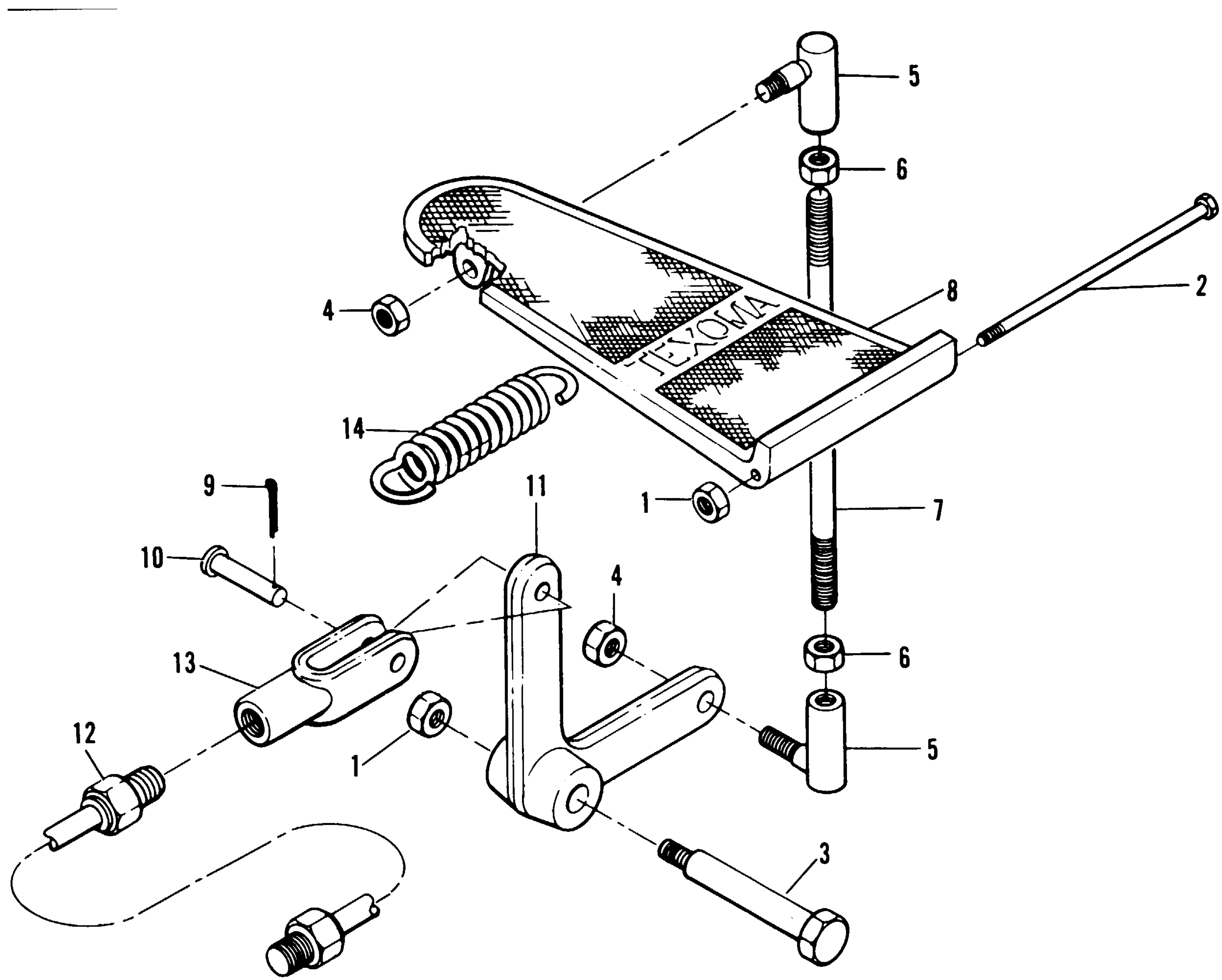
SHEET 2 OF 2

PUBLICATION DWG. NO. PM-45-006

REED TOOL COMPANY
SHERMAN, TEXAS

TITLE

CONTROL INSTALLATION-SHUTTLE VALVE



SHEET 2 OF 2

PUBLICATION DWG. NO. PM-45-006

REED TOOL COMPANY
SHERMAN, TEXAS

TITLE
CONTROL INSTALLATION - SHUTTLE VALVE

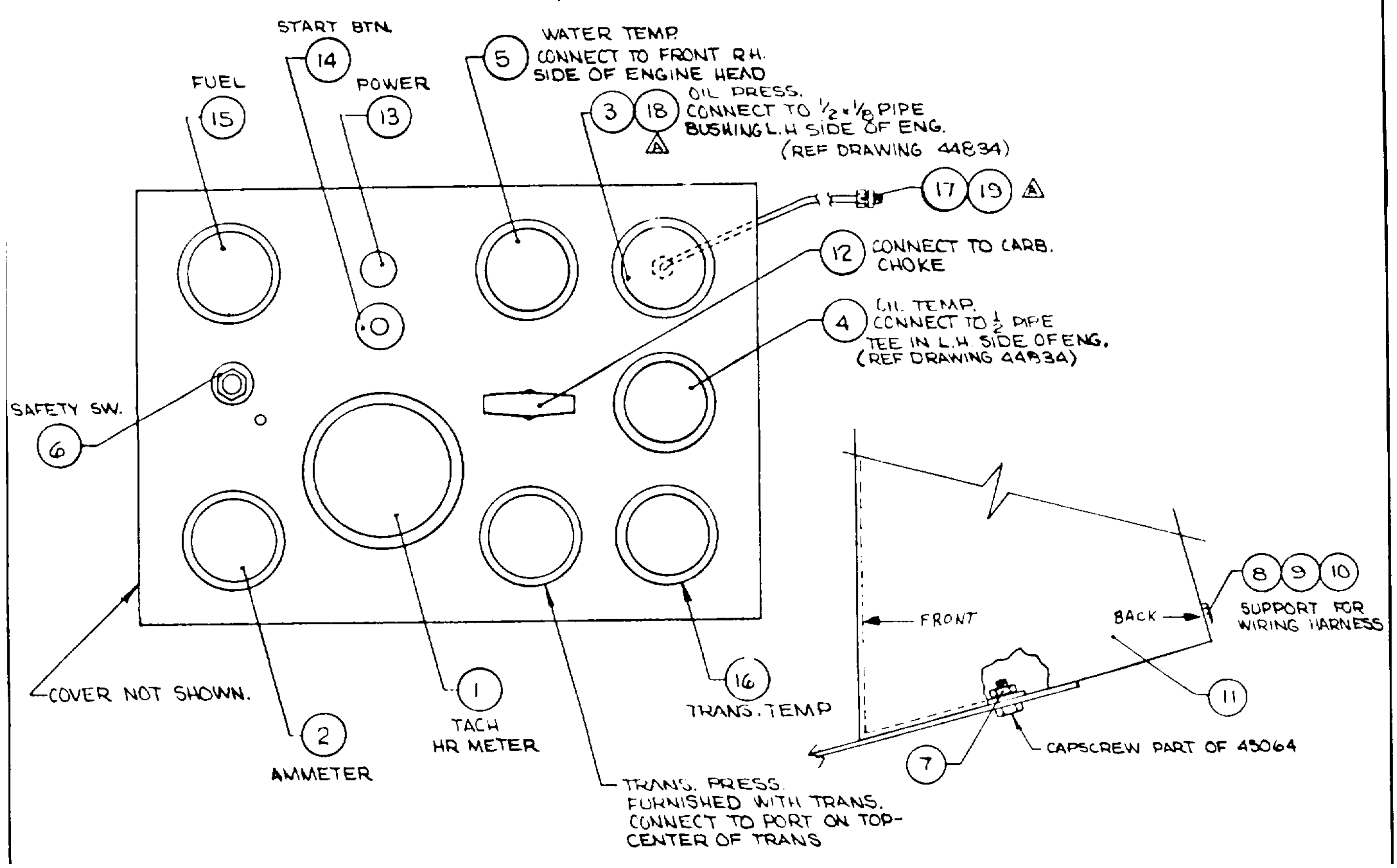
ITEM	PART NO.	QTY.	DESCRIPTION
1	6293	2	NUT - ELASTIC STOP - 1/4 - 20 UNC
2	42562	1	CAPSCREW - HEX HD - 1/4 - 20 UNC X 5 - GR 5
3	42550	1	CAPSCREW - HEX HD - 1/4 - 20 UNC X 2 1/2 GR 5
4	9123	2	NUT - ELASTIC STOP - 1/4 - 28 UNF
5	16727	2	BALL JOINT - 1/4 - 28 UNF
6	6004	2	NUT - HEX - 1/4 - 28 UNF
7	16725	1	ROD - FOOT PEDAL - 1/4 - 28 UNF X 4
8	16716	1	PEDAL - ACCELERATOR
9	6289	1	PIN - COTTER - 1/16 X I
10	7339	1	PIN - CLEVIS - 1/4 X 3/4
11	16717	1	CRANK - BELL
12	18719	1	CABLE - ACCELERATOR - 10 FT.
13	16989	1	CLEVIS - #10 - 32 UNF
14	17951	1	PRING - THROTTLE PEDAL
15	18713	1	BALL JOINT - #10 - 32 (CARBURETOR) (NOT SHOWN)
16	16724	1	HOLDER - FOOT PEDAL (NOT SHOWN)
17	43346	1	BRACKET - THROTTLE - 200 CID (NOT SHOWN)
18	6093	1	CAPSCREW - HEX HD - 5/16 - 18 UNC X 3/4 - GR 5 (NOT SHOWN)
19	6002	1	WASHER - LOCK - CUT - 5/16 (NOT SHOWN)

REF. 44980

SHEET 2 OF 2 PUBLICATION DWG. NO. PM-45-007

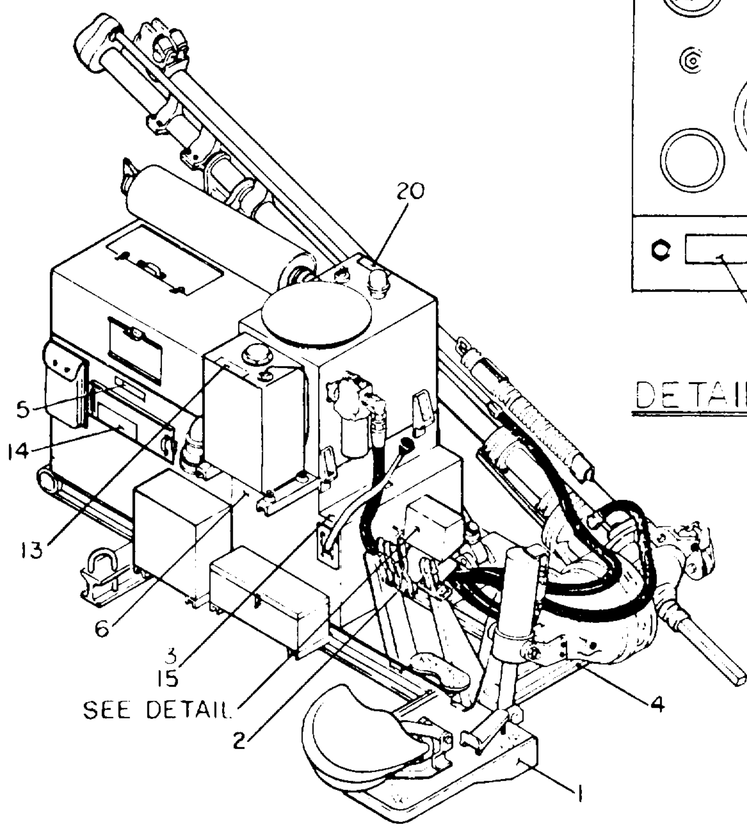
REED TOOL COMPANY
SHERMAN, TEXAS

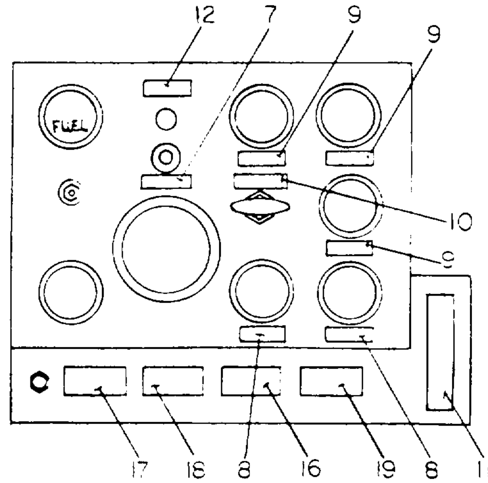
TITLE INSTRUMENT PANEL ASSEMBLY



ITEM	PART NO.	QTY.	DESCRIPTION
1	44926	1	TACHOMETER - O - 4000 RPM - W/HR METER
2	45027	1	GAUGE - AMMETER - 60 - 0 - 60
3	45028	1	GAUGE - OIL PRESSURE - SHUTDOWN - 0 - 75 PSI
4	45029	1	GAUGE - OIL TEM - 8' CPLRY - 1/2NPT - 100° - 250°F
5	45030	1	GAUGE - WATER TEMP-SHUTDOWN - 100-250 °F
6	45031	1	SWITCH - MAGNETIC - GAUGE - SAFETY
7	7972	2	NUT - ELASTIC STOP - 3/8 - 16 UNC
8	6093	1	CAPSCREW - HEX HD - 5/16 - 18 UNC X ¾ - GR 5
9	6292	1	NUT - ELASTIC STOP - 5/16 - 18 UNC
10	37167	1	CLAMP - SUPPORT - HOSE
11	45063	1	PANEL - INSTRUMENT
12	16865	1	CHOKE
13	17154	1	SWITCH - PUSH PULL
14	16866	1	SWITCH - PUSH BUTTON
15	32406	1	GAUGE - FUEL LEVEL - 12V
16	16868	1	GAUGE - OIL TEMP - TORQUE CONV - 140° - 320°F
17	36230	8	TUBING - RD - COPPER - 1/8
18	38560	1	FITTING - BRASS - STR - 1/8 F PIPE X 1/8 TUBE
19	36228	1	FITTING - BRASS - STR - 1/8 M PIPE X 1/8 TUBE

REV | A | SHEET 1OF 1 | PUBLICATION DWG. NO. PM-45-008

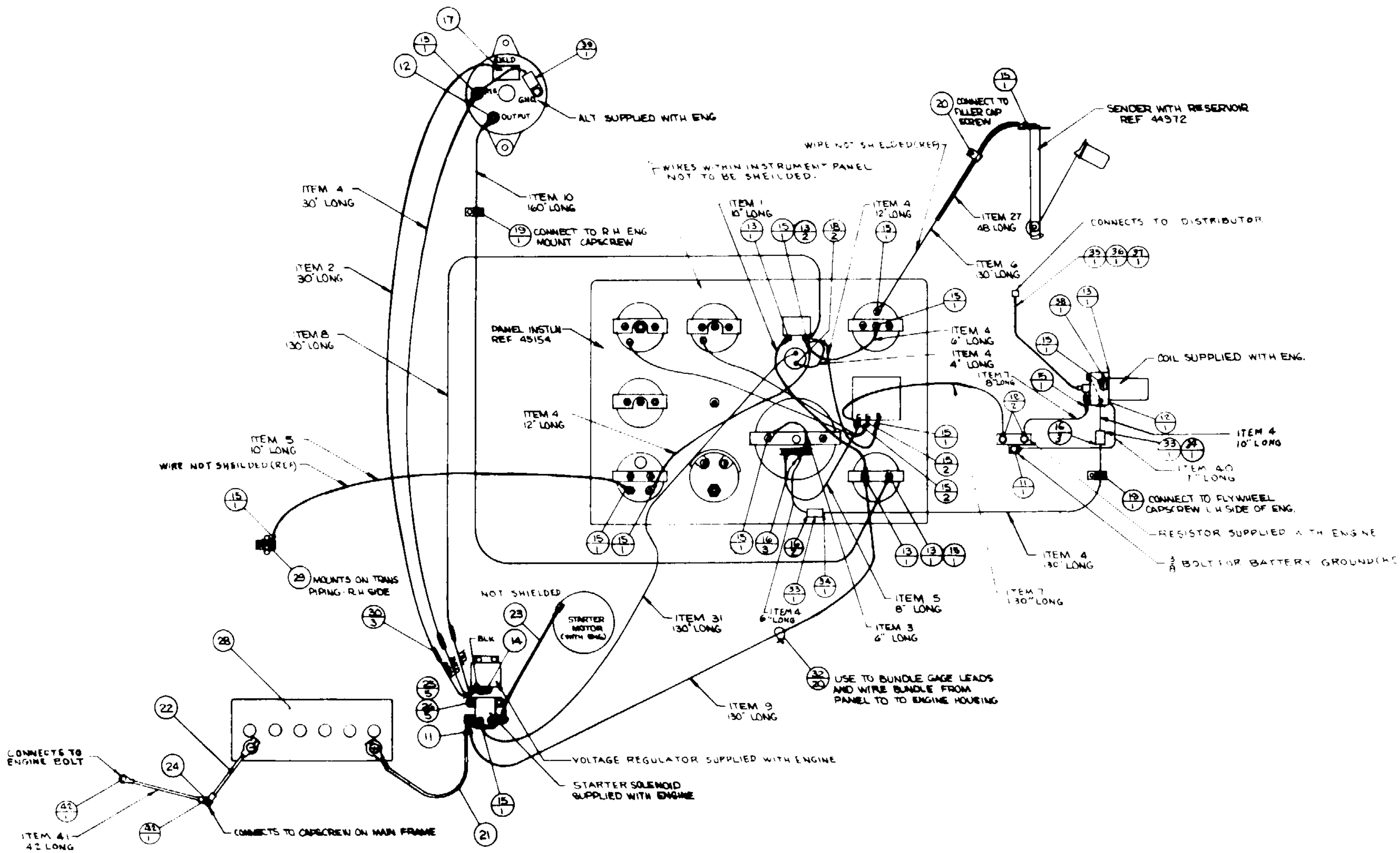




DETAIL OF INSTRUMENT PANEL

ITEM	PART NO.	QTY.	DESCRIPTION
1	32421	1	PLATE - IDENTIFICATION
2	32495	1	DECAL - REMOVE PANEL FOR LUBE POINT
3	32606	1	DECAL - CAUTION
4	34015	1	DECAL - LOWER PACKING
5	34016	1	DECAL - MOUNTING - AUGER
6	34252	1	DECAL - SPECIFICATION - LUBRICATION
7	34254	1	DECAL - STARTER
8	34256	2	DECAL - TRANSMISSION
9	34257	3	DECAL - ENGINE
10	34258	1	DECAL - CHOKE
11	34262	1	DECAL - F - N - R
12	45166	1	DECAL - PULL ON-PUSH OFF
13	31843	1	DECAL - GASOLINE
14	45169	1	DATA PLATE - LIFTING
15	45170	1	DATA PLATE - OPERATIONAL PROCEDURES
16	46923	1	DECAL - ELEVATING CYL.
17	46925	1	DECAL - WINCH MOTOR
18	46925	1	DECAL - LEVELING CYL.
19	46926	1	DECAL - AUGER BAR
20	31842	1	DECAL - HYDRAULIC OIL

REED TOOL COMPANY SHERMAN, TEXAS	TITLE	INSTRUMENT PANEL DECALS



										SHEET 1 OF 2	PUBLICATION DWG. NO.	PM-45-010

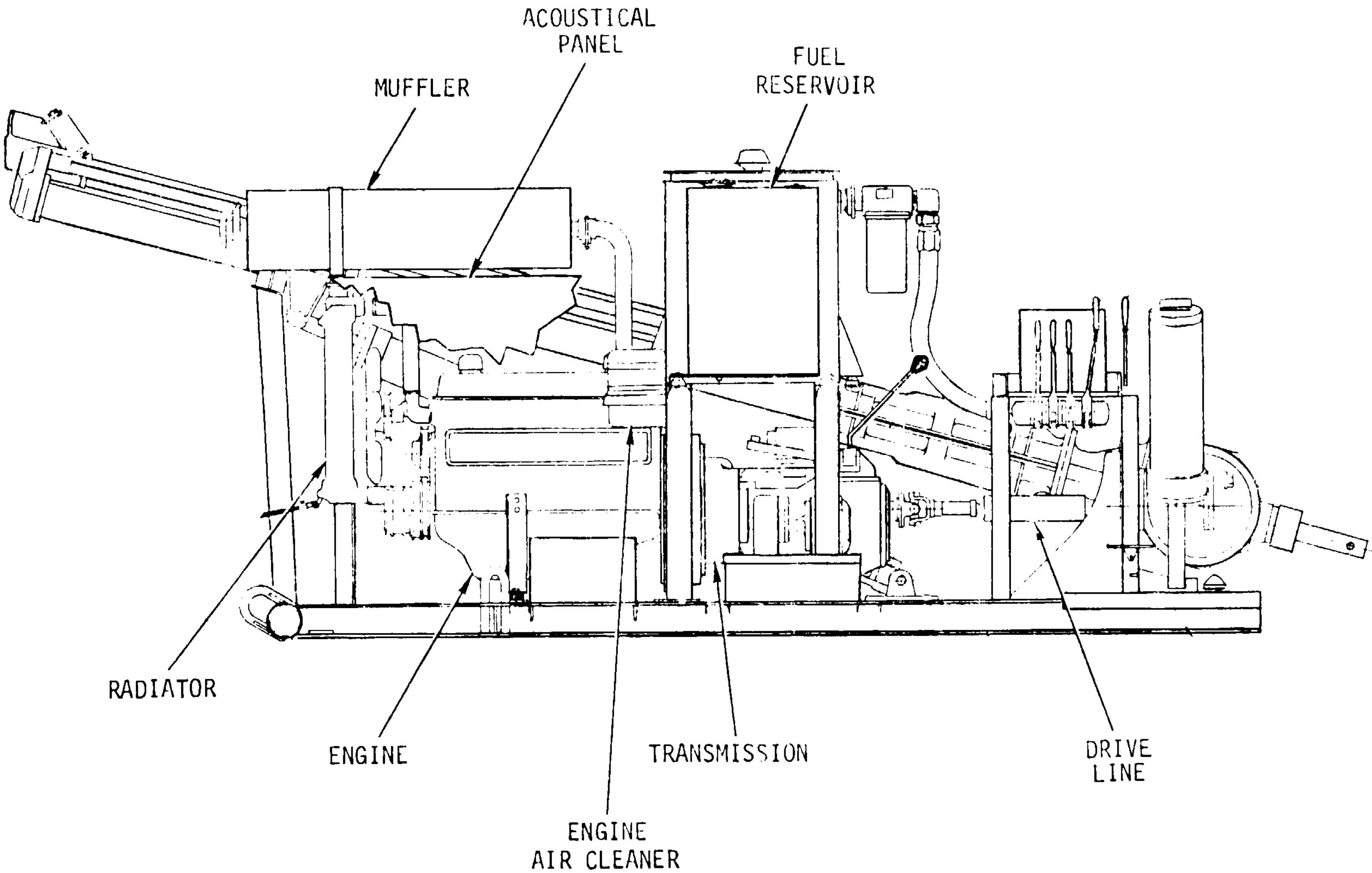
REED TOOL COMPANY SHERMAN, TEXAS	TITLE	ELECTRICAL WIRING INSTALLATION

ITEM	PART NO.	QTY.	DESCRIPTION
1	35399	.84 FT	WIRE - 12 AWG - BLUE 2
	17817	2.50 FT	WIRE - 16 AWG - GREEN
3	17818	.50 FT	WIRE - 16 AWG - BLACK
4	17819	17.5 FT	WIRE - 16 AWG - RED
5	17820	1.50 FT	WIRE - 16 AWG - YELLOW
6	17821	10.84 FT	WIRE - 16 AWG - BROWN
7	44091	10.84 FT	WIRE - 16 AWG - VIOLET
8	44092	10.84 FT	WIRE - 16 AWG - YELLOW W/BLUE STRIPE
9	17824	10.84 FT	WIRE - 10 AWG - RED
10	17825	13.34 FT	WIRE - 10 AWG - WHITE
11	45250	4	TERMINAL - RING - 12/10 - 3/8 STUD
12	45252	1	TERMINAL - RING - 12/10 - 1/4 STUD
13	45253	6	TERMINAL - RING - 12/10 - #10 STUD
14	45256	1	TERMINAL - RING - 16/14 - 1/4 STUD
15	45257	17	TERMINAL - RING - 16/14 - #10 STUD
16	45259	8	TERMINAL - SPADE - 16/14 #10 STUD
17	45265	1	DISCONNECT - F. TAB - 16/14 AWG - .032 X .250
18	43636	2	DISCONNECT - M. PIN - 18/14 AWG - .156
19	35191	2	CLAMP - HOSE SUPPORT
20	17804	1	CLAMP - CONDUIT - 1/4
21	45286	1	CABLE - BATTERY - POSITIVE
22	17827	1	CABLE - BATTERY - NEGATIVE
23	17829	1	CABLE - BATTERY - EYE TO EYE
24	7972	1	NUT - ELASTIC STOP - 3/8 - 16 UNC
25	42538	5	CAPSCREW - HEX HD. - 1/4 - 20 UNC X 3/4 - GR 5
26	6293	5	NUT - ELASTIC STOP - 1/4 - 20 UNC
27	36640	4.00 FT	TUBING - RD - PLASTIC - 1/4 OD
28	36202	1	BATTERY - 12 V - 55 AMP
29	45614	1	SENDER - TEMP - 12 V
30	45261	3	CONNECTOR - BUTT - 16/14 AWG - 16/14 AWG
31	17816	10.83 FT	WIRE - 16 AWG - WHITE
32	43707	2	CAPACITOR
34	17805	2	MOUNT-CAPACITOR
35	46972	1 FT	CABLE-COAXIAL-ESSEX
36	46973	1	CONNECTOR
37	46974	1	CONNECTOR
38	46975	.43 FT	ASKET-WOVEN-METAL-1/8 x5/32 x 5 1/8
39	46976	1	CONDENSER-MOTORCRAFT #C9AZ-12300-A
40	34010	17 FT	SHEILDING-3/8 I. D. BRAIDED
41	17833	3.5 FT	CABLE-BATTERY
42	17830	2	EYE-BATTERY

REF. 45155

SHEET 2 OF 2

PUBLICATION DWG. NO. PM-45-00-10

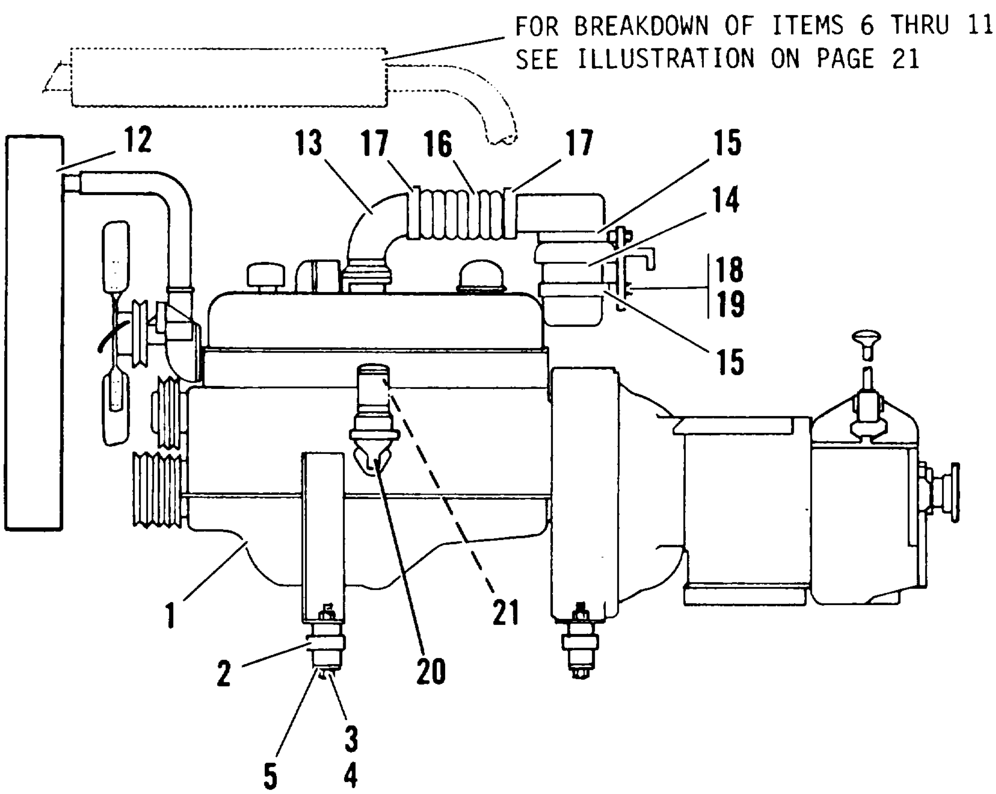


ACOUSTICAL PANEL
FUEL RESERVOIR
MUFFLER
RADIATOR
ENGINE
TRANSMISSION
DRIVE LINE
ENGINE AIR CLEANER

REED TOOL COMPANY
SHERMAN, TEXAS

TITLE

ENGINE AND TRANSMISSION INSTALLATION



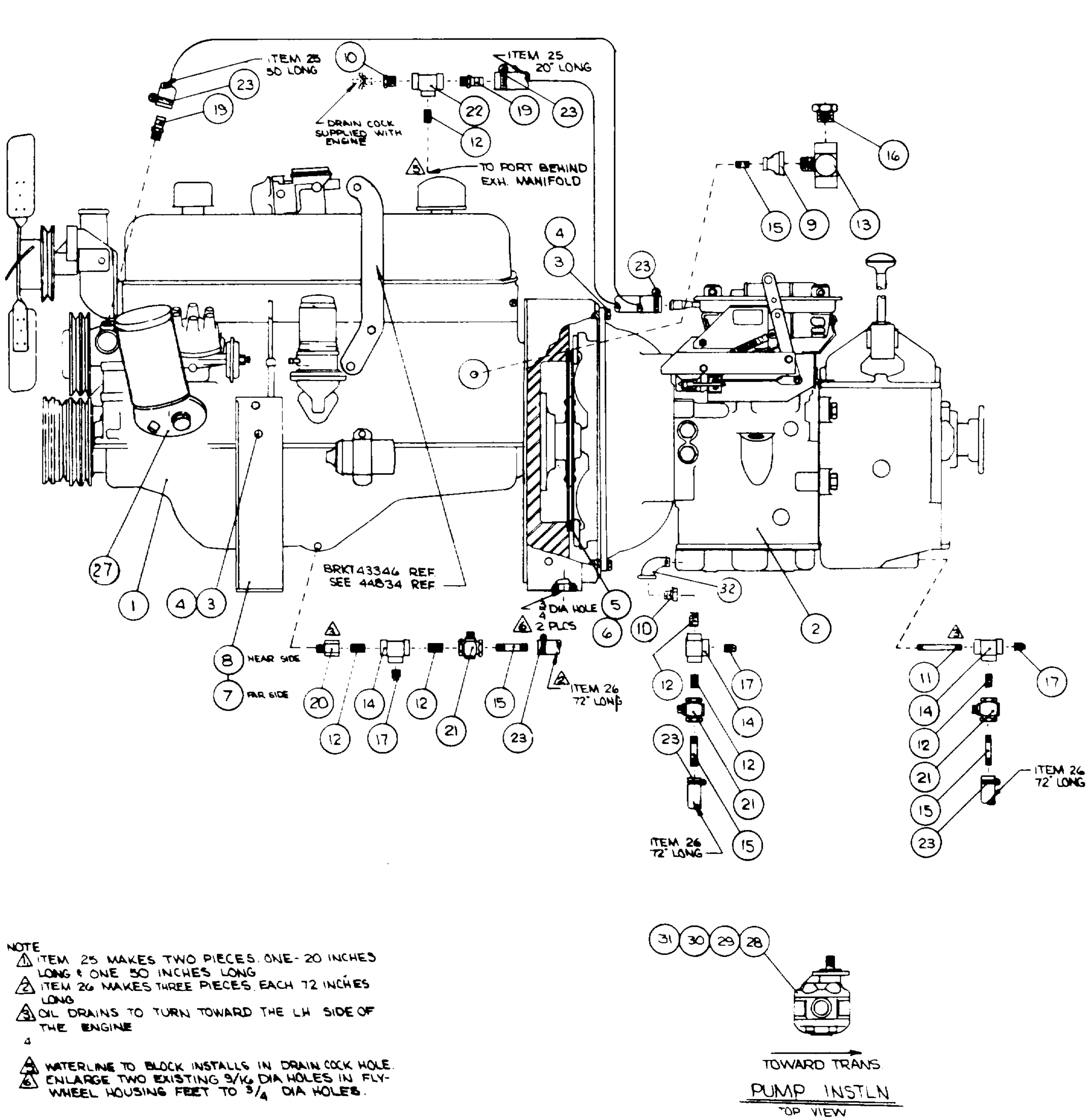
ITEM	PART NO.	QTY.	DESCRIPTION
1	44834	1	ENGINE AND TRANSMISSION ASSY
2	32577	4	ENGINE MOUNTS - BARRY #22003-2
3	5963	4	CAPSCREW - HEX HD - 5/8 - 11 UNC X 4 ½ GR 5
4	6716	4	NUT - ELASTIC STOP - 5/8 - 11 UNC
5	32630	4	SPACER - ENGINE MOUNT RETAINER
6	45156	1	PIPE - EXHAUST - LOWER
7	45157	1	PIPE - EXHAUST - UPPER
8	31883	2	CLAMP - MUFFLER - 2 1/6 - NAPA #35408
9	46279	1	MUFFLER - KITTEL
10	32695	1	BRACKET - MUFFLER
11	17841	1	CAP - RAIN - 3 IN - NAPA #4-3806
12	45129	1	KIT - RADIATOR
13	34136	1	HORN - AIR
14	35832	1	BREATHER
15	36315	2	BRACKET - BREATHER
16	30021	2.00 FT	HOSE BREATHER - 2 5/8 “
17	16894	2	CLAMP - 3” TO 3 ¼”
18	7972	4	NUT - ELASTIC STOP - 3/8 - 16 UNC
19	20998	4	CAPSCREW - HEX HD 3/8 - 16 UNC X 1 GR5
20	--------	1	FUEL PUMP ASSY - FORD # C30z-9350-D (SEE FORD PARTS BOOK, PAGE 27)
21	--------	1	DISPOSABLE FILTER ELEMENT - FORD # 9365 (SEE FORD OPERATOR’S MANUAL, PAGE 24

REF 45236

SHEET 1 OF 1

PUBLICATION DWG. NO. PM-45—012

REED TOOL COMPANY SHERMAN, TEXAS	TITLE ENGINE AND TRANSMISSION INSTALLATION



NOTE
1. ITEM 25 MAKES TWO PIECES. ONE - 20 INCHES LONG & ONE 50 INCHES LONG
2. ITEM 26 MAKES THREE PIECES. EACH 72 INCHES LONG
3. OIL DRAINS TO TURN TOWARD THE LH SIDE OF THE ENGINE
4. WATERLINE TO BLOCK INSTALLS IN DRAIN COCK HOLE.
5. ENLARGE TWO EXISTING 9/16 DIA HOLES IN FLYWHEEL HOUSING FEET TO 3/4 DIA HOLES.

REF. 44834

SHEET 1 OF 1 | PUBLICATION DWG. NO. PM-45—012

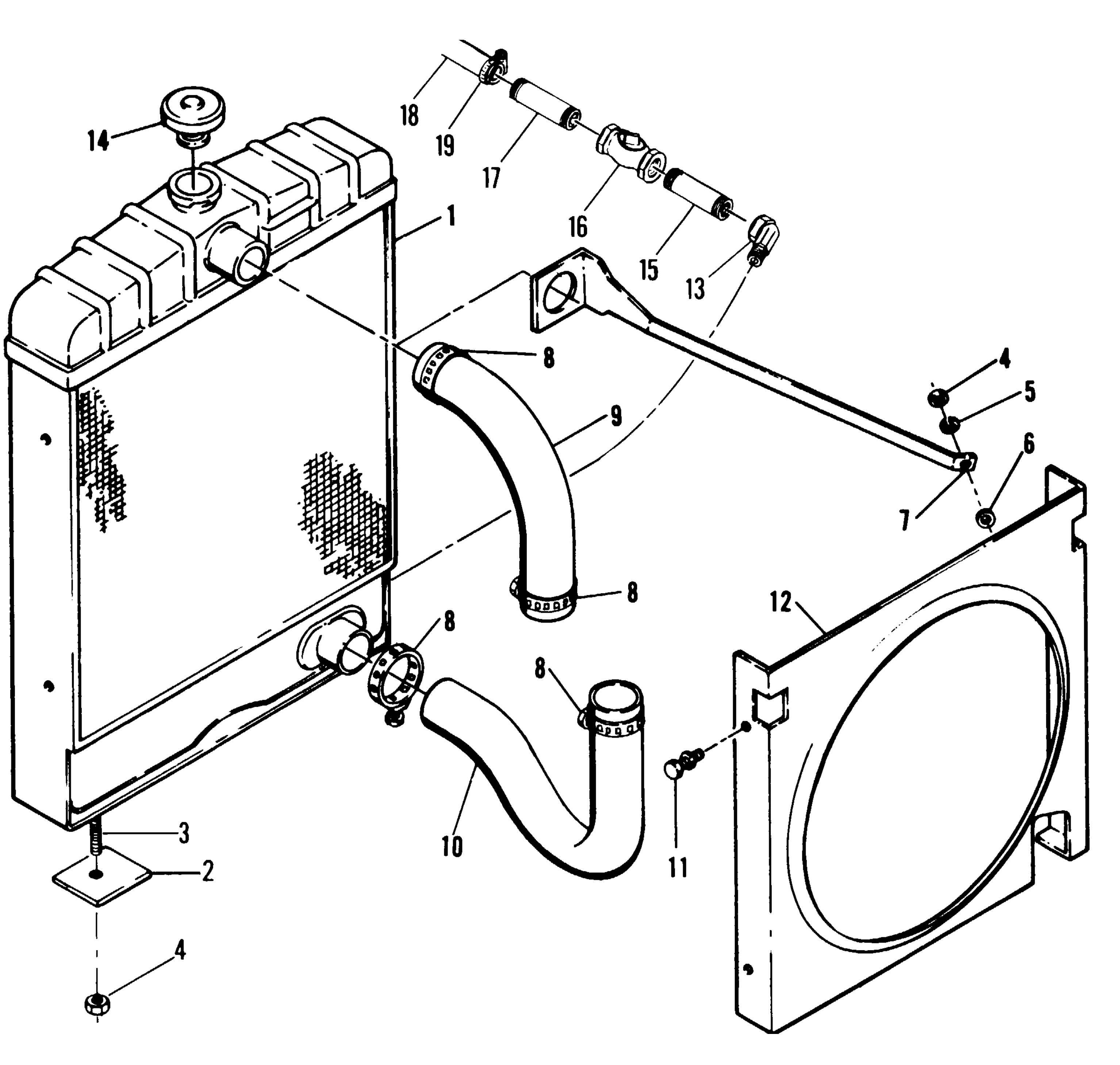
REED TOOL COMPANY
SHERMAN, TEXAS

TITLE ENGINE AND TRANSMISSION ASSEMBLY/PLUMBING

ITEM	PART NO.	QTY.	DESCRIPTION
1	23034	1	ENGINE-FORD 200 CID
2	21064	1	TRANSMISSION - FUNK #4050A055BP SPEC 7837
3	42570	16	CAPSCREW - HEX HD. - 3/8 - 16 UNC X 1 - GR 5
4	5989	16	WASHER - LOCK - CUT - 3/8
5	9134	8	CAPSCREW - SKT. HD - 3/8 - 16 UNC X 3/4 - GR 5
6	5962	8	WASHER - LOCK - INTERNAL - 3/8
7	44796	1	MOUNT - MOTOR - R.H. - FRONT - 200 CID
8	44797	1	MOUNT - MOTOR - L.H. - FRONT - 200 CID
9	17718	1	FITTING - REDUCER - PIPE - BELL - 1/2 X 1/4 XHVY
10	8330	2	FITTING - BUSHING - PIPE - HEX - 3/8 X 1/4
11	17745	1	NIPPLE - STL - SCH 80 - 1/4 X 3 1/4
12	17162	5	NIPPLE - STL - SCH 80 - 1/4 X 7/8 (CLOSE)
13	35120	1	FITTING - HYD - TEE - 1/2 FNPT X 1/2 FNPT X 1/2 MNPT SIDE
14	17728	3	FITTING - TEE - PIPE - 1/4
15	47015	4	FITTING-ADAPTER-1/4 NPT X 3/8 HOSE BARB
16	17703	1	FITTING - BUSHING - PIPE - HEX - 1/2 X 1/8
17	21018	3	FITTING - PLUG - SQ HE - 1/4 - MAGNETIC
18	N/A		
19	32480	2	FITTING - ADAPTER - 3/8 NPT X 5/8 I.D. HOSE
20	33078	1	FITTING - DRAIN - ADAPTER - 1/2 - 20 UNC X 1/4 NPT
21	34053	3	VALVE - GAS SERVICE STOP - 1/4 NPT
22	39447	1	FITTING - TEE - PIPE - 3/8 X 3/8 X SIDE 1/4 - XHVY
23	16888	7	CLAMP - HOSE - 3/4 TO 1 - (MURRAY #H1O)
24	N/A		
25	30211	5.84 FT	HOSE - HEATER - 5/8 I.D.
26	34054	18 FT	HOSE - HEATER - 3/8 I.D.
27	45726	1	ADAPTER-OIL FILTER-1/2 NPT PORTED
28	16780	1	PUMP ASSY - HYDRAULIC - (REF. SECTION 6)
29	5986	4	CAPSCREW - HEX HD. - 1/2 - 13 UNC X 1 3/4 - GR 5
30	5975	4	WASHER - LOCK - CUT - 1/2
31	20323	1	GASKET - PUMP
32	8312	1	ELBOW-STREET-3/8 NPT

REF 44834

SHEET 2 OF 2 PUBLICATION DWG. NO. PM-45-013



REED TOOL COMPANY
SHERMAN, TEXAS

TITLE

ENGINE AND TRANSMISSION ASSEMBLY/PLUMBING

SHEET 2 OF 2

PUBLICATION DWG. NO. PM-45-013

REED TOOL COMPANY
SHERMAN, TEXAS

TITLE RADIATOR ASSEMBLY

ITEM	PART NO.	QTY.	DESCRIPTION
1	*D4JL-8005-F	1	RADIATOR
2	*7C8125A	2	PAD - RADIATOR
3	45151	2	BOLT-RD.HD. SQ NICK - 3/8-16 UNC X 1 1/4
4	7972	3	NUT - ELASTIC STOP - 3/8 - 16 UNC
5	6001	1	WASHER - LOCK
6	*DOJJ8AO45A	1	SPACER
7	*C9JJ8046-A	1	BRACE - RADIATOR
8	*B7A8287B	4	CLAMP - HOSE
9	*C9JJ-8260-B	1	HOSE - RADIATOR (UPPER)
10	*C9JJ-8286-A	1	HOSE - RADIATOR (LOWER)
11	*357622S8	4	SCREW/WASHER
12	*C9JJ-8146-A	1	SHROUD - FAN
13	16665	1	FITTING - HYD - 450- 1/4 F PIPE SWIVEL X 1/4 M PIPE
14	*D4JL-8100-A	1	CAP - RADIATOR
15	45150	1	NIPPLE - STL - SCH 80 - 1/4 X 2 1/2
16	34053	1	VALVE - GAS SERVICE STOP - 1/4 NPT
17	17743	1	NIPPLE - STL - SCH 80 - 1/4 X 2
18	34054	6.0 FT.	HOSE (RADIATOR DRAIN) HEATER 3/8 I.D.
19	16889	1	CLAMP - HOSE - 3/4 TO 1

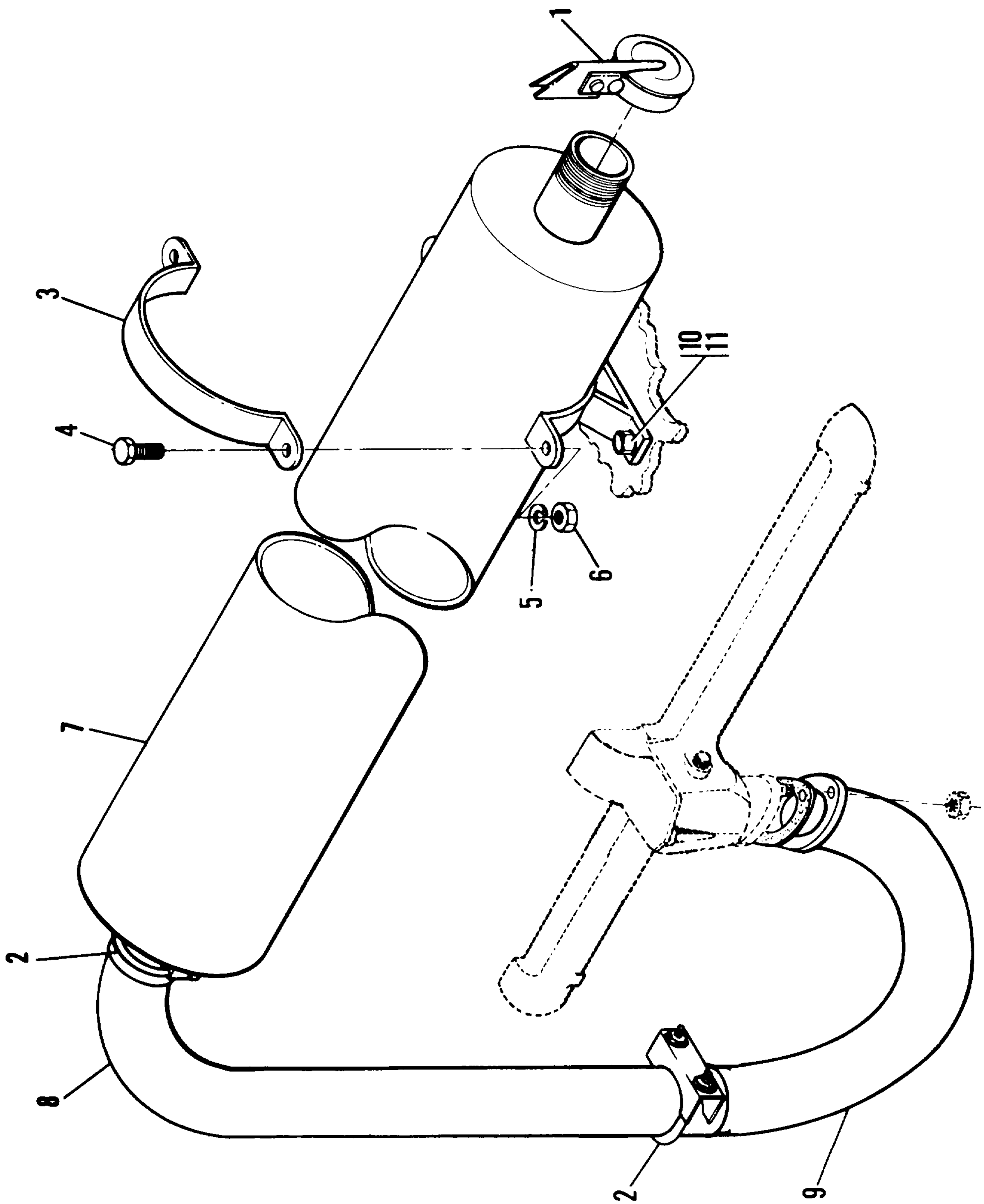
* FORD PART NUMBER

REF 45129

SHEET 2 OF 2

PUBLICATION DWG. NO. PM-45-016

REED TOOL COMPANY **SHERMAN, TEXAS**	**TITLE**	RADIATOR ASSEMBLY



SHEET 1 OF 2	PUBLICATION DWG. NO. PM-45-016

REED TOOL COMPANY
SHERMAN, TEXAS

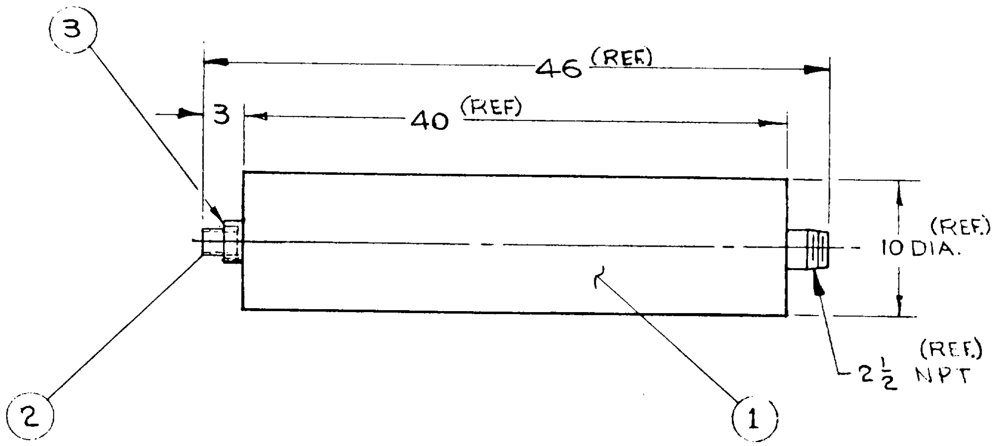
TITLE MUFFLER AND EXHAUST PIPE

ITEM	PART NO.	QTY.	DESCRIPTION
1	17841	1	CAP - RAIN - 3 IN.
2	31883	2	CLAMP - MUFFLER
3	32695	1	BRACKET - MUFFLER
4	42540	2	SCREW
5	5970	2	WASHER - LOCK
6	6293	2	NUT - HEX
7	46279	1	MUFFLER W/ALTERATION
8	45157	1	PIPE - EXHAUST - UPPER
9	45156	1	PIPE - EXHAUST - LOWER
10	45207	2	RIVNUT - 1/4
11	5970	2	WASHER - LOCK - CUT - 1/4

SHEET 2 OF 2

PUBLICATION DWG. NO. PM-45-017

REED TOOL COMPANY **TITLE:**
SHERMAN, TEXAS **MUFFLER W/ALTERATION**

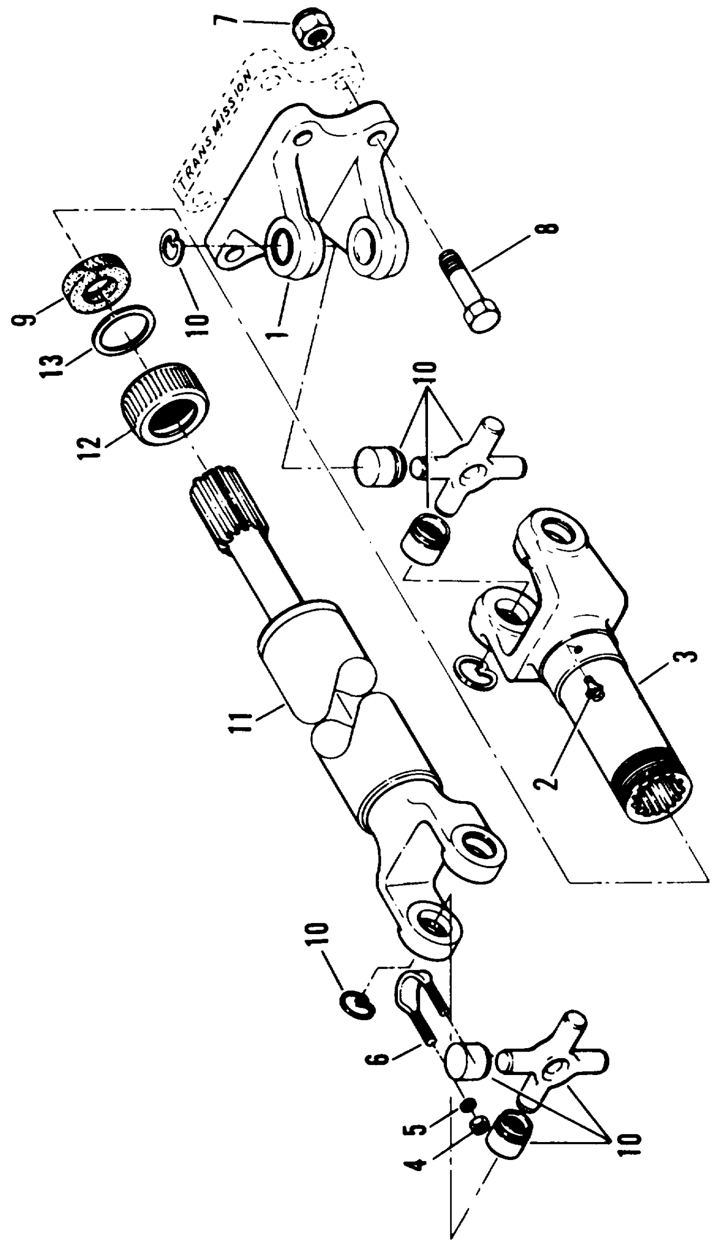


ITEM	PART NO.	QTY.	DESCRIPTION
1	32446	1	MUFFLER-KITTELL #TRU02-5001
2	12159	.22 FT	TUBING- 2 O.D. X .120 W X 2 1/2 LG
3	12139	.09 FT	PIPE- 2 (SCHED. 40) X 1 LG

REVISION SHEET 1 OF 1 REF 46279

TITLE

DRIVE LINE ASSEMBLY



SHEET 1 OF 2

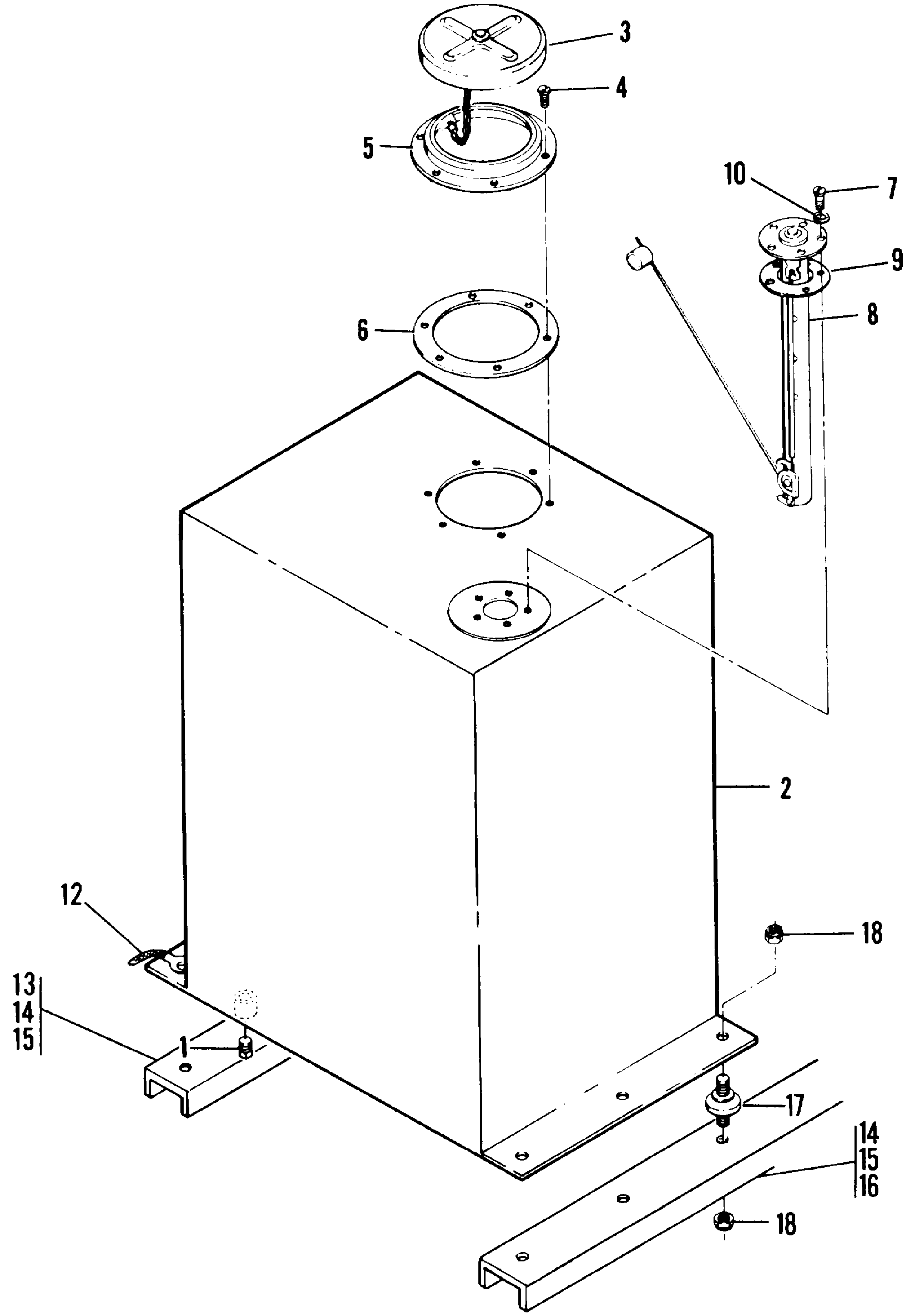
REF 33378
PUBLICATION DWG. NO. PM-45-019

TITLE

DRIVE LINE ASSEMBLY

3

ITEM	PART NO.	QTY.	DESCRIPTION
1	11435	1	YOKE - FLANGE (SPICER #3-2-119)
2	36373	1	FITTING - GREASE - STR - 1/4 NF (ALEMITE #1792)
3	11125	1	YOKE - SLEEVE (SPICER #3-3-598X)
4	5976	4	NUT - HEX - 3/8 NF
5	5989	4	LOCKWASHER - 3/8
6	11131	2	U-BOLT (SPICER #3-94-18X)
7	42644	4	LOCKNUT - 7/16 NC
8	5997	4	CAPSCREW - HEX - HD - 7/16 NC X 1 3/4
9	11672	1	RING - CORK (SPICER #3-16-53)
10	11132	2	BEARING KIT (SPIDER #5-178X)
11	32497	1	SHAFT - DRIVE
12	11670	1	CAP - DUST (SPICER #3 1/2 - 14)
13	11671	1	WASHER (SPICER #3 1/2 - 15 - 53)

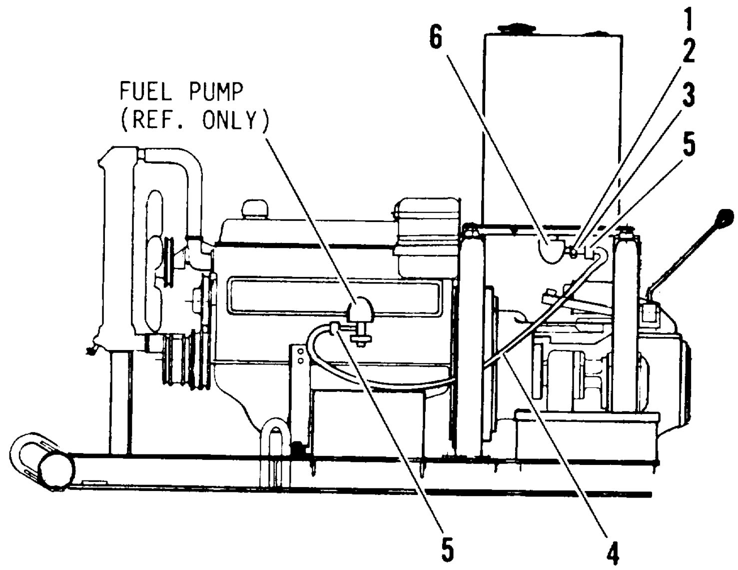


REF. 44972

FUEL RESERVOIR ASSEMBLY

3

ITEM	PART NO.	QTY.	DESCRIPTION
1	21019	1	FITTING - PLUG - PIPE - SQ HD - 3/8 - MAG
2	44940	1	RESERVOIR - FUEL - 20 GAL
3	17153	1	CAP - FILLER NECK - W/CHAIN
4	17159	6	SCREW - SHEET METAL - PAN HD - #8 X 1/2 - TYPE A
5	39878	1	FILLER NECK
6	17149	1	GASKET - VELLUMOID
7	32408	5	SCREW - MACHINE - FILLISTER HD - #10-32 X 1/2
8	32404	1	SENDER - FUEL LEVEL
9	32407	1	GASKET - FUEL LEVEL SENDER
10	32409	5	WASHER - LOCK - CUT #10
11	----------		
12	33379	1	STRAP - GROUND - FUEL RESERVOIR
13	44960	1	SUPPORT - RESERVOIR - FRONT
14	6291	8	NUT - ELASTIC STOP - 1/2 - 13 UNC (NOT SHOWN)
15	5977	8	CAPSCREW - HEX HD - 1/2 - 13 UNC X 1 1/4 - GR 5 (NOT SHOWN)
16	44961	1	SUPPORT - RESERVOIR - REAR
17	40436	4	MOUNTS - FUEL RESERVOIR
18	6292	8	NUT - ELASTIC STOP - 5/16 - 18 UNC



ITEM	PART NO.	QTY.	DESCRIPTION
1	17539	1	FITTING - BRASS - SLEEVE - 5/16 TUBING
2	17609	1	FITTING - BRASS - INV. FLARE - 5/16
3	17809	1	TUBING - COPPER - 5/16 O.D. X 1 1/2 IN. LG.
4	15132	1	HOSE - FUEL LINE - 45 IN LG.
5	16886	2	CLAMP - HOSE - 3/8 TO 7/8
6	16867	1	STRAINER - FUEL

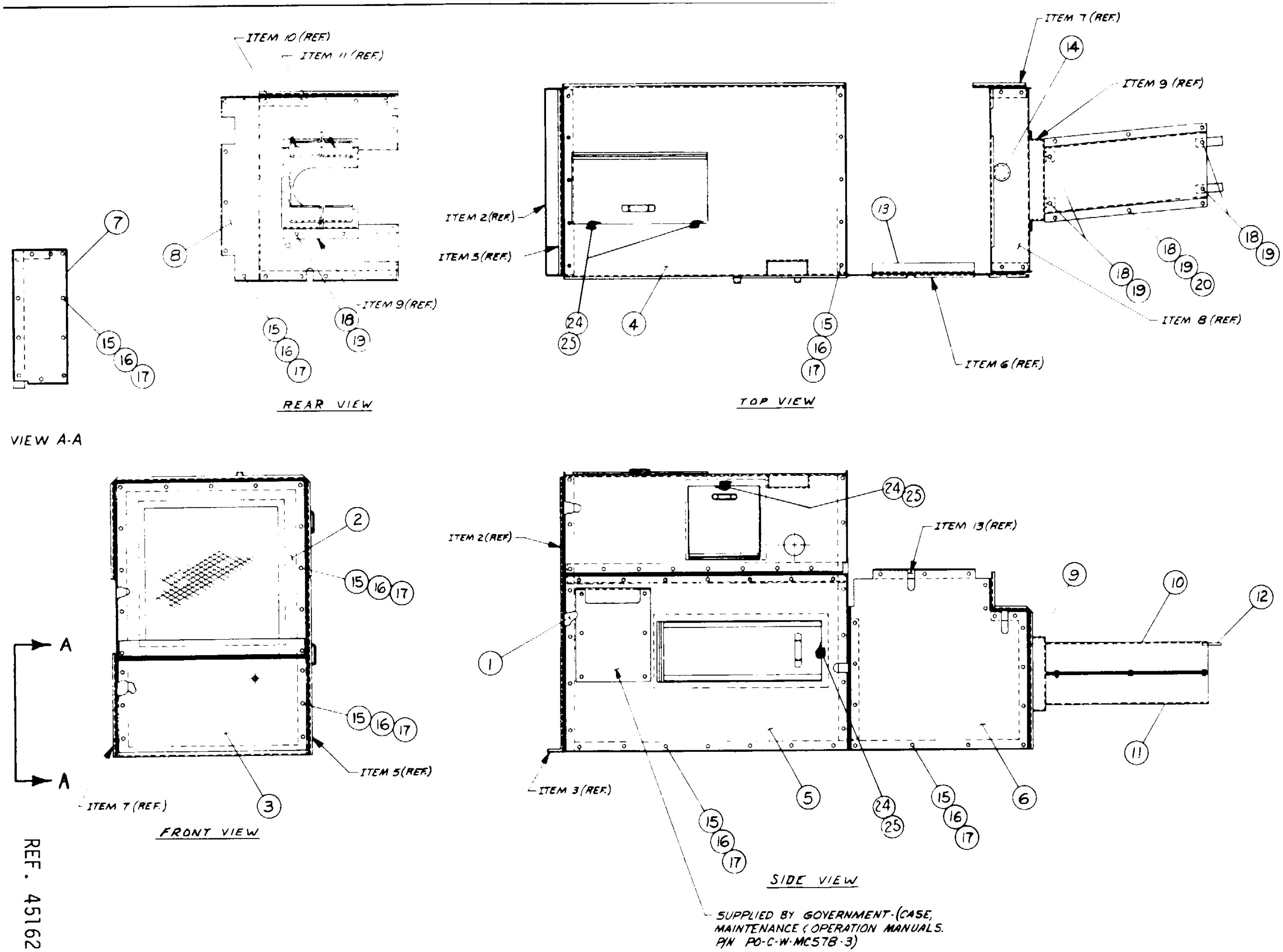
REF. 45198

SHEET 1 OF1 PUBLICATION DWG. NO. PM-45-021

REED TOOL COMPANY
SHERMAN, TEXAS

TITLE

ACCOUSTICAL PANEL INSTALLATION



SHEET 1 OF 2 PUBLICATION DWG. NO. PM-45-022

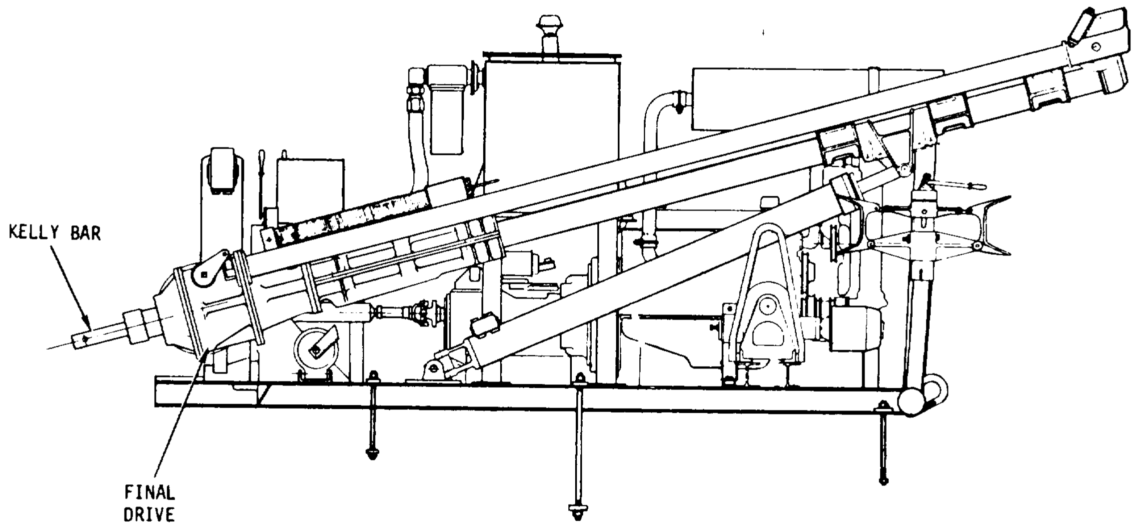
ACCOUSTICAL PANEL INSTALLATION

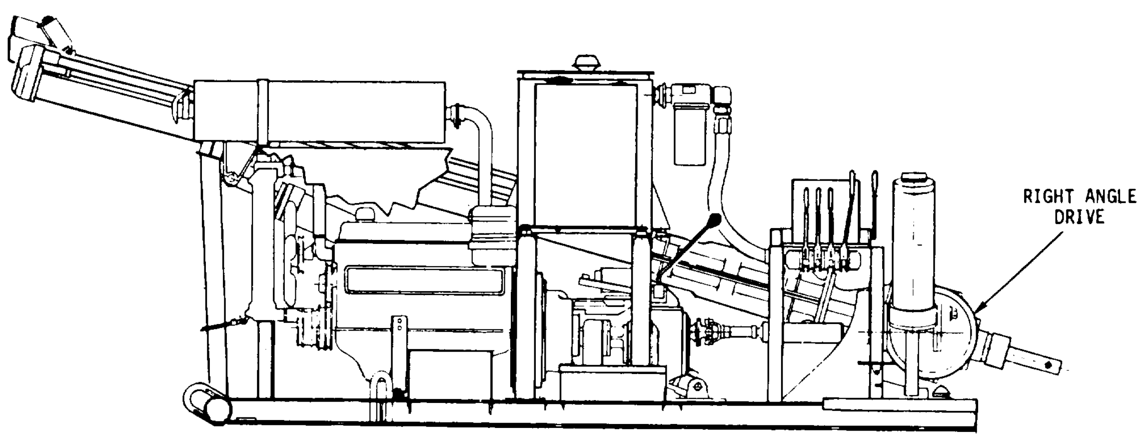
3

ITEM	PART NO.	QTY.	DESCRIPTION
1	45171	1	FRAME - PANEL SUPPORT - ACOUSTICAL
2	45173	1	GRILL - RADIATOR - 254 - MILITARY
3	45172	1	PANEL - LOWER - INSULATION - ENGINE - FRONT
4	45175	1	PANEL - HOOD - INSULATING - ENGINE
5	45174	1	PANEL - LOWER - INSUL. - ENGINE - OPERATORS SIDE
6	45176	1	PANEL - INSUL. - TANK SUPPORTS - OPERATORS SIDE
7	45177	1	PANEL - INSULATING - AIR OUTLET
8	45178	1	PANEL - INSULATING - TRANSMISSION
9	45179	I	PANEL - INSULATING - FRONT - DRIVE LINE
10	45180	1	PANEL - INSULATING - TOP DRIVE LINE
11	45181	1	PANEL - INSULATING - LOWER - DRIVE LINE
12	34078	2	STRAP - MOUNTING - REAR - DRIVE LINE
13	14227	1.26 FT.	ANGLE - STL - 1/8 X 1 1/2 X 1 1/2 X 15 1/8 LG.
14	37456	1	CAP - FILLER - TRANSMISSION
15	45207	125	RIVNUT - 1/4 - 20 UNC
16	5970	125	WASHER - LOCK - CUT - 1/4
17	42540	125	CAPSCREW - HEX HD. - 1/4 UNC X 1 LG. (GR 5)
18	20998	14	CAPSCREW - HEX HD. - 3/8 UNC X 3/4 LG. (GR 5)
19	5989	14	WASHER - LOCK - CUT - 3/8
20	7972	6	NUT - ELASTIC STOP - 3/8 UNC
21	34095	AS REQD	INSULATION - RUBBER - 1/4 X 2
22	34096	AS REQD	INSULATION - BARR. SH (SFB-1, 1.0 LB. SQ FT. LEAD)
23	43620	AS REQD	ADHESIVE - 3M (#EC 1357)
24	33388	4	SASH LOCK (HAGER NO. 1487)
25	45298	32	SCREW - MACH - FLAT HD. - 8 UNC X 1/2 LG.

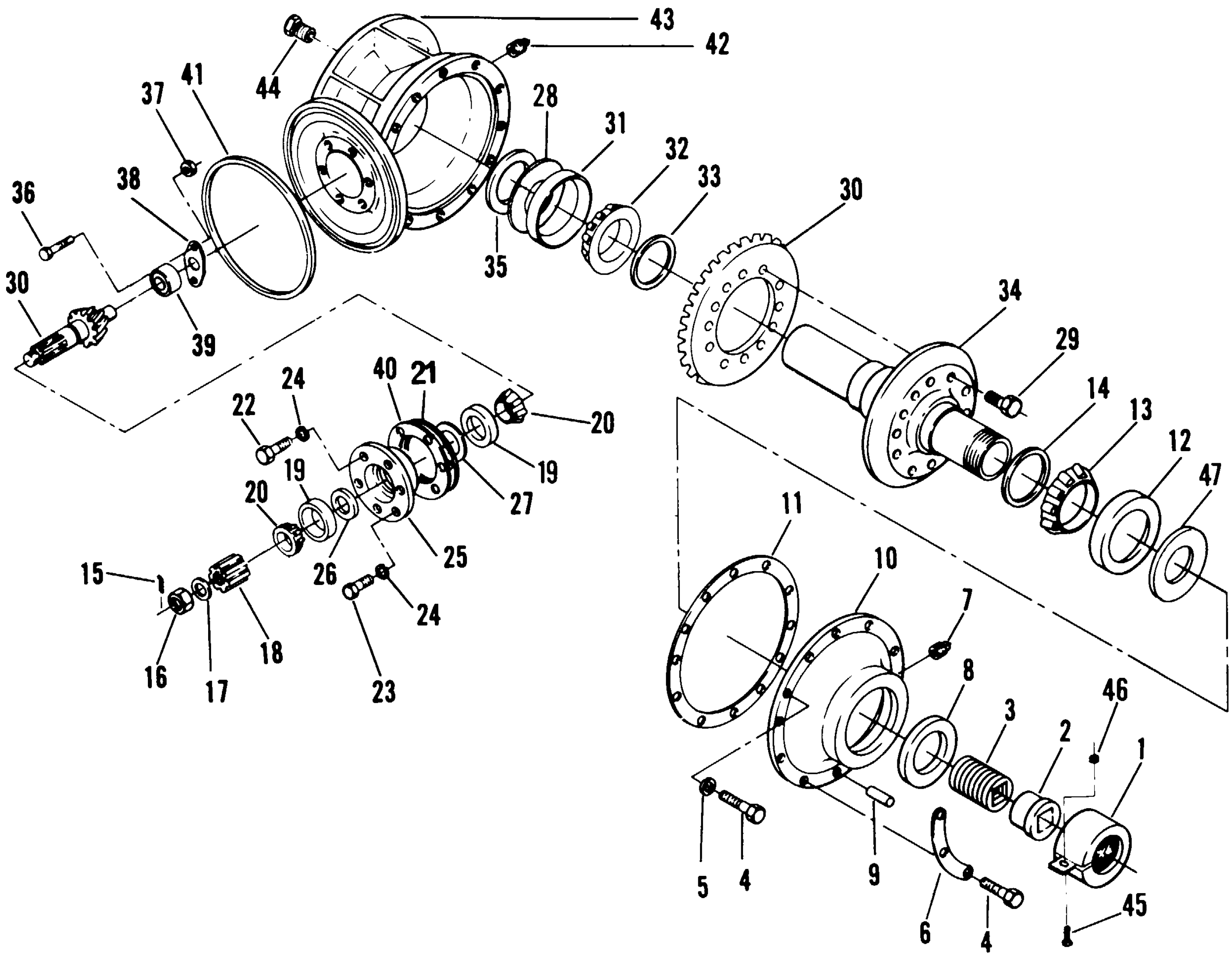
REF. 45162

SHEET 2 OF 2 PUBLICATION DWG. NO. PM-45-022


KELLY BAR
FINAL DRIVE


RIGHT ANGLE DRIVE

ASSEMBLY 44818

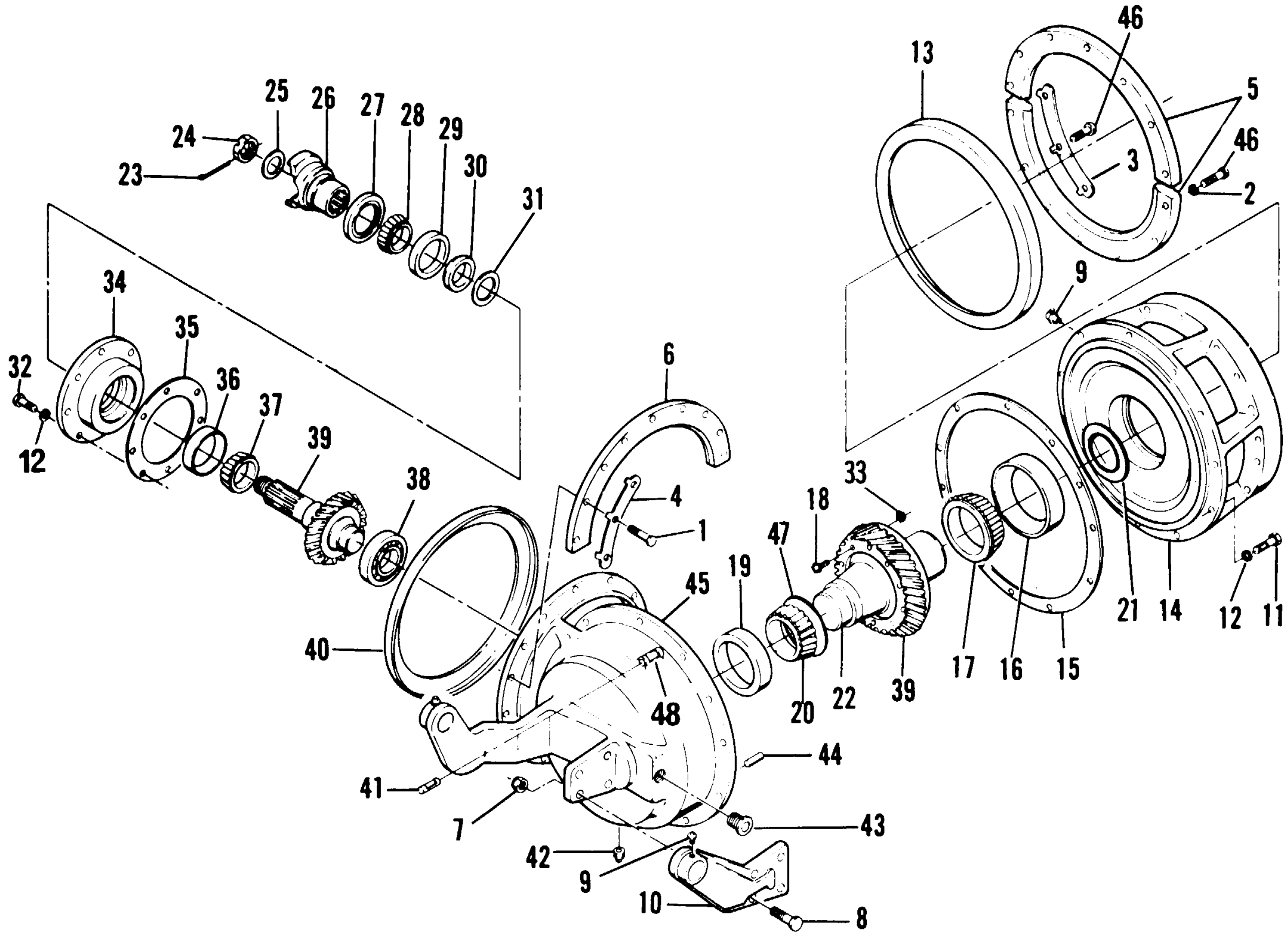


ASSEMBLY 44818

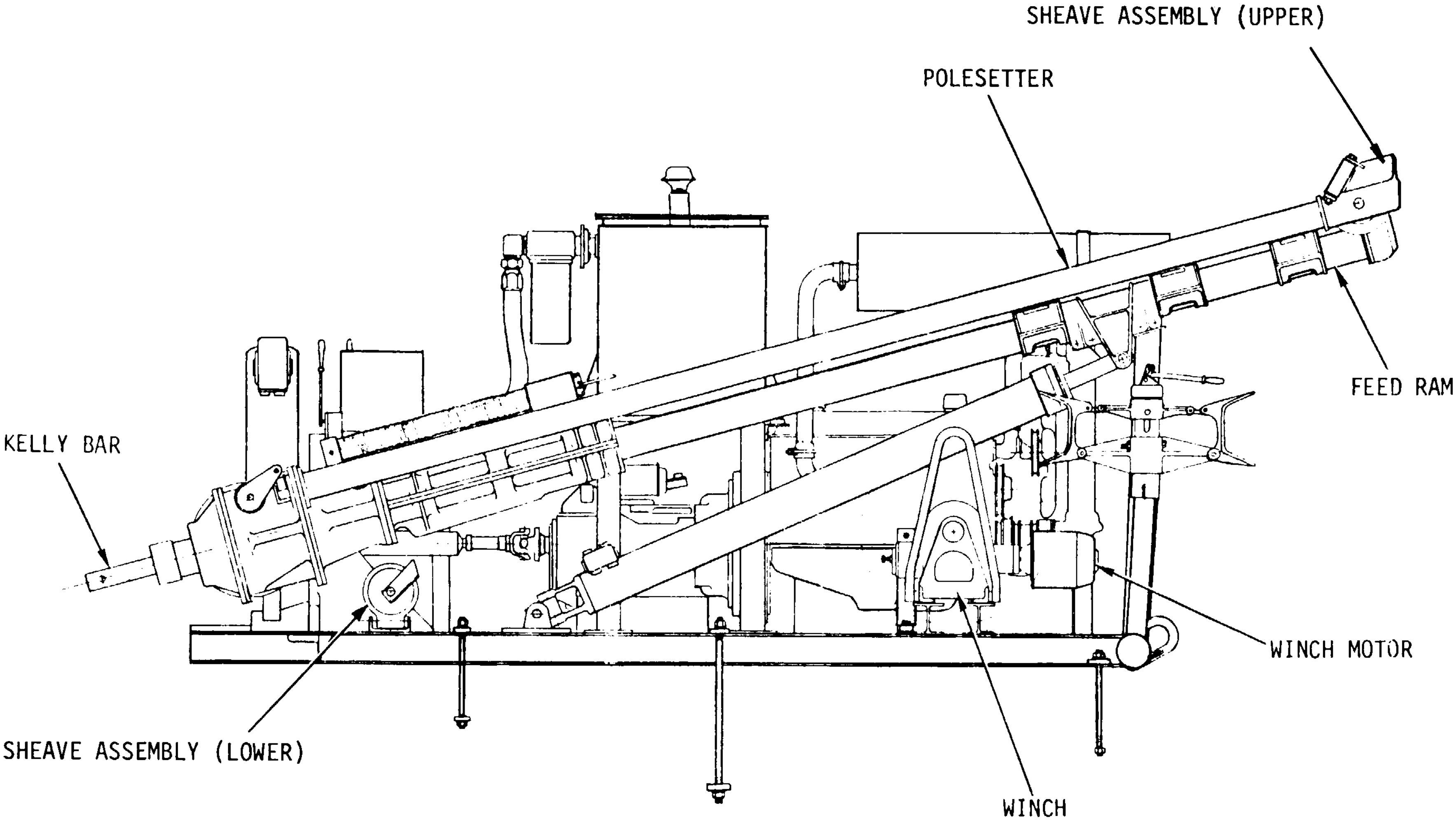
ITEM	PART NO.	QTY.	DESCRIPTION
1	9892	1	NUT - PACKING - FINAL DRIVE
2	16174	1	GLAND - PACKING
3	4193	8	PACKING - LOWER FEED RAM
4	5977	11	CAPSCREW - HEX HD - 1/2 - 13 UNC X 1 1/4 - GR 5
5	5975	2	WASHER - LOCK CUT - 1/2
6	16985	3	TAB LOCK
7	20110	1	FITTING - PLUG - PIPE - 1/2 - 14 NPT - SQ HD - MAG.
8	9893	1	SEAL - GREASE - (455371)
9	16162	4	PIN - SPRING - TUBULAR - SPLIT - 3/8 X 1 1/4
10	8396	1	HOUSING - LOWER - FINAL DRIVE
11	5348	1	GASKET SET - HOUSING (1/64, 1/32, 3/64)
12	9894	1	CUP - BEARING - (68712)
13	9895	1	CONE - BEARING - (68462)
14	11149	1	SHIM SET (.005, .010, .015) - 5 5/8 O.D.
15	7604	1	PIN - COTTER - 1/8 DIA X 1 3/4
16	11759	1	NUT - PINION DRIVE - HEX - 1 1/4 - 12 UNF THIN
17	11760	1	WASHER - SPACER - .156 THK.
18	11407	1	ADAPTER - PINION DRIVE
19	6131	2	CUP - BEARING
20	6130	2	CONE - BEARING - (53176)
21	38742	1	SPACER - 6 1/2 O.D. X 4 1/2 I.D. X .130
22	7794	1	CAPSCREW - HEX HD - 9/16 - 12 UNC X 1 - GR 5
23	6299	5	CAPSCREW - HEX HD - 9/16 - 12 UNC X 1 1/2 - GR 5
24	6351	6	WASHER - LOCK - CUT - 9/16
25	19905	1	HOUSING - BEARING
26	11079	1	SPACER - BEARING - .533 THK
27	11114	1	SHIM SET - (.005, .010, .015) 2 1/8 O.D.
28	37165	1	SHIM SET - (.005, .010, .015) 6 O.D. X 5 1/2 I.D.
29	30929	12	CAPSCREW - HEX HD. - 7/16 - 20 UNF X 2 1/4 - GR 8 LOCK
30	32370	1	GEAR ASSEMBLY - RING & PINION - FINE TOOTH
31	6122	1	CUP - BEARING - (52618)
32	6121	1	CONE - BEARING - (52400)
33	11150	1	SHIM SET - LAMINATED (.002, .032) 5 1/8 O.D.
34	9891	1	DRIVE - MAIN - 2 1/4
35	6135	1	SEAL - GREASE - (55035)
36	42543	2	CAPSCREW - HEX HD. - 1/4 - 20 UNC X 1 1/2 - GR 5
37	6293	2	NUT - ELASTIC STOP - 1/4 - 20 UNC
38	6068	1	COVER - BEARING RETAINER
39	6119	1	BEARING - ROLLER - (RS5305W)
40	5347	1	SHIM SET (.005, .010, .015)
41	18849	1	PACKING
42	32601	1	GAUGE - SIGHT - 1/2 NPT
43	11161	1	HOUSING - FINAL DRIVE
44	30642	1	FITTING - PRESSURE RELIEF - 1/8 NPT - 5 LB
45	5986	1	CAPSCREW - HEX HD. - 1/2-13 UNC X 1 3/4 GR 5
46	6291	1	NUT - ELASTIC STOP - 1/2 - 13 UNC
47	16996	1	SHIM SET (.005, .010. .015) - 7 O.D. X 6 I.D.

TITLE

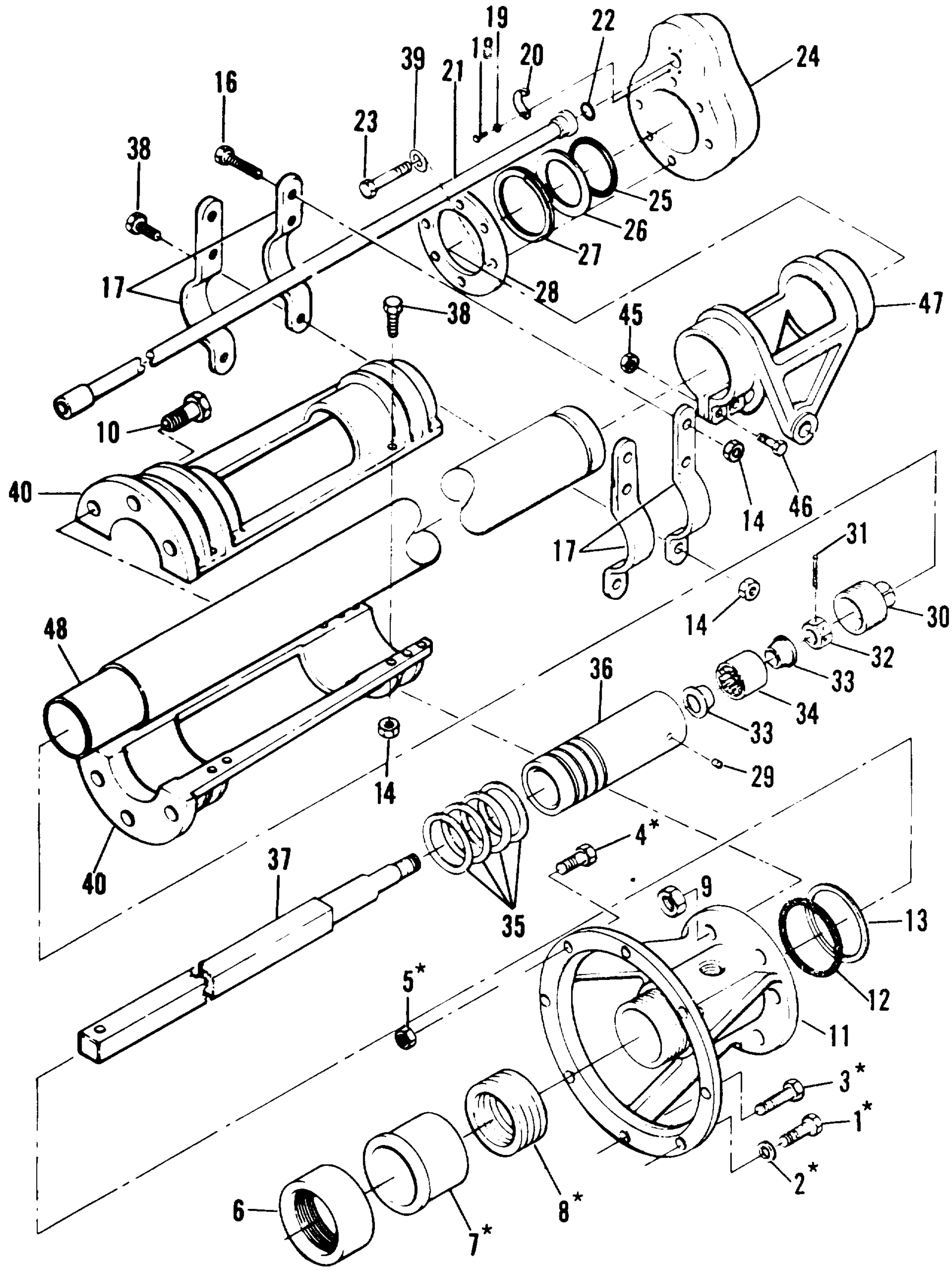
RIGHT ANGLE DRIVE ASSEMBLY
ASSEMBLY 44831



ITEM	PART NO.	QTY.	DESCRIPTION
			ASSEMBLY 44831
1	5997	18	CAPSCREW - HEX HD. - 7/16 - 14 UNC X 1 3/4 - GR 5
2	6088	2	WASHER - LOCK - INTERNAL - 7/16
3	16984	4	LOCK TAB
4	16983	6	LOCK TAB
5	8397	1	RING - RETAINER - FINAL DRIVE
6	8388	1	RING - RETAINER
7	6716	4	NUT - LOCK - 5/8 - 11 UNC
8	6643	4	CAPSCREW - 5/8 - 11 UNC X 2 1/2
9	5929	9	FITTING - GREASE - STR - 1/8 NPT
10	11315	1	ARM - BOLT ON TYPE
11	5977	11	CAPSCREW - HEX HD - 1/2 - 13 UNC X 1 1/4 - GR 5
12	5975	19	WASHER - LOCK - CUT - 1/2
13	16835	1	LINER - BRASS - INTERMEDIATE RING
14	11018	1	RING - INTERMEDIATE
15	5348	1	GASKET
16	7775	1	CUP - BEARING
17	7774	1	CONE - BEARING
18	42902	12	CAPSCREW - HEX HD. - 1/2 - 20 UNF X 2 LG - GR 8
19	6128	1	CUP - BEARING
20	6127	1	CONE - BEARING
21	11151	1	SHIM - LAMINATED - (.005, .015)
22	30876	1	CARRIER - RING GEAR
23	7604	1	PIN - COTTER - 1/8 DIA. X 1 3/4 LG.
24	11127	1	NUT - PINION
25	16999	1	WASHER - SPACER
26	16986	1	YOKE
27	16148	1	SEAL - PINION DRIVE
28	6130	1	CONE - BEARING
29	6131	1	CUP - BEARING
30	11643	1	SPACER - BEARING
31	11114	1	SHIM - SET
32	42728	8	CAPSCREW - HEX HD - 1/2-13 UNC X 1 1/2 LG - GR 8
33	30490	12	NUT - SPECIAL - 1/2 - 20 UNF - GR 8
34	16149	1	CARRIER - PINION
35	11170	1	SHIM
36	11167	1	CUP - BEARING
37	11168	1	CONE - BEARING
38	11166	1	BEARING - ROLLER
39	18757	1 SET	RING GEAR AND PINION SET
40	16003	1	LINER - BRASS - FRAME RING
41	8695	2	LEVEL - LINE
42	20110	1	PLUG - PIPE - 1/2 - SQ. HD. MAGNETIC
43	32601	1	GAUGE - SIGHT - 1/2 NPT
44	16162	4	PIN - DOWEL
45	11031	1	HOUSING - RT ANGLE
46	42727	14	CAPSCREW - HEX HD - 7/16 - 14 UNC X 1 3/4 - GR 8
47	16840	1	SHIM SET (.010 - .005)
48	16161	2	HOLDER-LEVEL
49	19584	1	POINTER (NOT SHOWN)


SHEAVE ASSEMBLY (UPPER)
POLESETTER
FEED RAM
KELLY BAR
WINCH MOTOR
SHEAVE ASSEMBLY (LOWER)
WINCH

ASSEMBLY 32251



*FEED RAM INSTALLATION - REF. 44922

TITLE

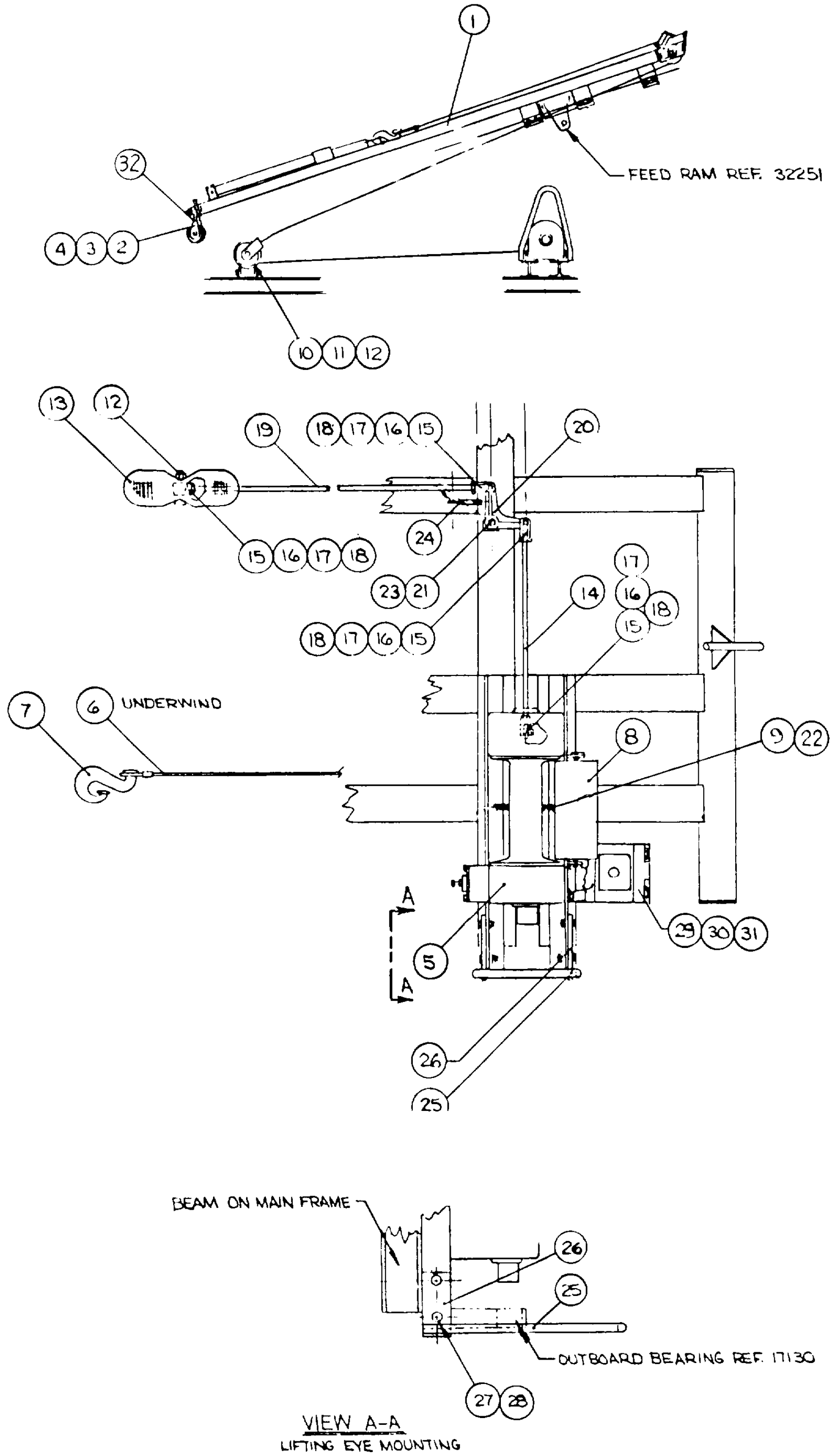
FEED RAM ASSEMBLY

ASSEMBLY 32251

ITEM	PART NO.	QTY.	DESCRIPTION
*1	42821	2	CAPSCREW-HEX HD.-5/8-11 UNC X 2 3/4 - GR 5
*2	5984	2	WASHER-LOCK-CUT-5/8
*3	42705	4	CAPSCREW-HEX HD. - 5/8-11 UNC X 2 1/4 - GR 5
*4	6414	2	CAPSCREW-HEX HD. - 5/8-11 UNC X 2 3/4 - GR 5
*5	6716	6	NUT-ELASTIC STOP - 5/8 - 11 UNC
6	3588	1	NUT-UPPER PACKING
*7	3589	1	GLAND - PACKING - UPPER
*8	16758	1	PACKING SET - UPPER FEED RAM
9	42606	6	NUT-ELASTIC STOP - 3/4 10 UNC
10	7807	6	CAPSCREW-HEX HD. - 3/4 10 UNC X 2 1/2 LG - GR 5
11	16694	1	SUPPORT - FEED RAM
12	16695	1	0 RING - 4 1/8 I.D. X 4 1/2 O.D. X 3/16 DIA.
13	16696	1	RING - BACK UP - 4 1/8 I.D. X 4 1/2 O.D. X 3/16 WIDE
14	6291	16	NUT - ELASTIC STOP - 1/2 13 UNC
*15	42827	1	SCREW-SET-SQ HD-3/8-16 UNC X 3 (NOT SHOWN)
16	6368	4	CAPSCREW - HEX HD. - 1/2 13 UNC X 2 3/4 LG - GR 5
17	16251	4	CLAMP - TRANSFER TUBE - HALF
18	7784	4	CAPSCREW-HEX HD. - 7/16 14 UNC X 1 1/2 LG - GR 5
19	5959	4	WASHER - LOCK - 7/16
20	16628	2	FLANGE - SPLIT - HALF - 1 1/4
21	32229	1	TUBE - TRANSFER
22	16600	1	0 RING - 1 1/2 I.D. X 1 3/4 O.D. X 1/8 DIA.
23	42724	12	CAPSCREW - HEX HD. - 3/8 16 UNC X 1 1/2 LG -GR 8
24	16444	1	CAP - END - BARREL - FEED RAM
25	16701	1	0 RING - 4 1/4 I.D. X 4 5/8 O.D. X 3/16 DIA.
26	16700	1	RING - BACKUP - 4 1/4 I.D. X 4 5/8 O.D. X 3/16 WIDE
27	16699	1	RING - LOCK - 4 1/4 O.D. - BARREL - FEED RAM
28	16698	1	RETAINER - CAP - FEED RAM - 4 1/4 O.D.
29	11744	1	PIN - PISTON PLUG
30	4238	1	PLUG - PISTON
31	5941	1	PIN - COTTER - 1/4 DIA. X 2 1/2 LG.
32	4283	1	NUT - CASTELLATED - THIN - 1 3/8 12 UNF
33	6125	2	BEARING - CONE - 1.500 I.D.
34	6124	1	BEARING - CUP - 3.151 O.D.
35	11136	4	RING - PISTON - 3 3/4 0.D.
36	11146	1	PISTON - FEED RAM - 3 3/4 O.D.
37	32232	1	KELLY - 2 1/4 SQ.
38	5994	12	CAPSCREW - HEX HD. - 1/2 13 UNC X 2 LG. - GR 5
39	5962	12	WASHER - LOCK - INTERNAL - 3/8
40	11450	2	BRACE - BARREL - FEED RAM
41	--------		
42	--------		
43	--------		
44	--------		
45	6716	4	NUT - ELASTIC STOP - 5/8 11 UNC
46	42706	4	CAPSCREW - HEX HD. - 5/8 11 UNC X 3 1/4 LG - GR 5
47	11574	1	SADDLE - BARREL - FEED RAM
48	32233	1	BARREL - FEED RAM - 3 3/4 I.D.
*49	4193	8	PACKING - LOWER FEED RAM (NOT SHOWN)
*50	16174	1	GLAND - PACKING - LOWER (NOT SHOWN)

*FEED RAM INSTALLATION -REF 44922

SHEET 2 OF 2 PUBLICATION DWG. NO. PM-45-027


FEED RAM REF. 32251
UNDERWIND
A
A
BEAM ON MAIN FRAME
OUTBOARD BEARING REF. 17130
VIEW A-A
LIFTING EYE MOUNTING

REF. 44847

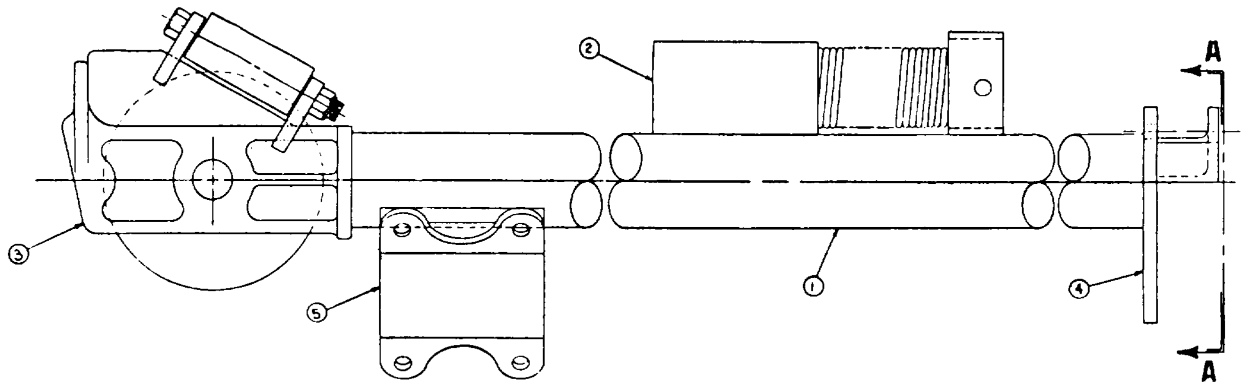
POLESETTER AND WINCH ASSEMBLY

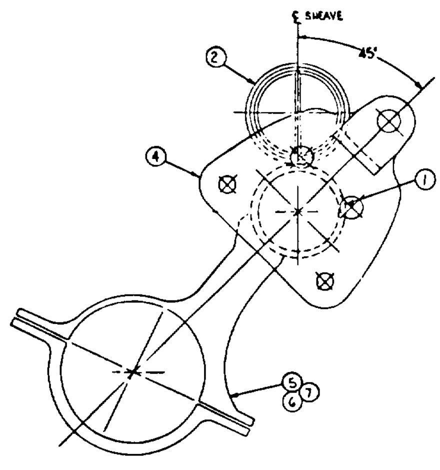
5

ITEM	PART NO.	QTY.	DESCRIPTION
1	44848	1	BOOM ASSY
2	16450	1	BLOCK - SNATCH
3	7801	I	CAPSCREW - HEX HD - 5/8 - 11 UNC X 4 - GR 5
4	6716	1	NUT - ELASTIC STOP - 5/8 UNC
5	31649	1	WINCH - RAMSEY J8 W/EXTENDED SH.
6	19656	1	CABLE - 7/16 X 150 W/EYE
7	18567	1	HOOK - CABLE
8	17020	1	ROLLER ASSY-WINCH - J8
9	34027	1	SPRING - ROLLER - .132 WIRE
10	16851	1	SHEAVE ASSY - 6" LOWER
11	7811	1	CAPSCREW - HEX HD - 3/4 - 10 UNC X 5 1/2 - GR 5
12	42606	2	NUT - ELASTIC STOP - 3/4 - 10 UNC
13	16096	1	PEDAL - WINCH
14	45148	1	ROD - SHIFTING - WINCH
15	11329	4	CLEVIS - JAW - 5/8 TAP - 7/16 PIN
16	11242	4	PIN - CLEVIS - 7/16 X 1 1/2
17	6718	4	PIN - COTTER - 3/32 X 1 1/4
18	5978	4	NUT - HEX - 5/8 - 11 UNC
19	32622	1	ROD - SHIFTING - LONG
20	44920	1	LINK - SHIFTING - 900
21	5986	1	CAPSCREW - HEX HD - 1/2 - 13 UNC X 1 3/4 - GR 5
22	9207	2	PIN - COTTER - 1/4 X 1 1/2
23	42627	2	WASHER - FLAT - STD - 1/2
24	16515	1	SPRING - BELL CRANK - .120 WIRE
25	34040	1	EYE - LIFTING - WINCH
26	44910	2	BRACKET - LIFTING EYE
27	5985	2	CAPSCREW - HEX HD - 1/2 - 13 UNC X 2 1/4 - GR 5
28	6291	2	NUT - ELASTIC STOP - 1/2 - 13 UNC
29	33196	1	MOTOR - WINCH
30	6299	4	CAPSCREW - HEX HD - 9/16 - 12 UNC X 1 1/2 - GR 5
31	6351	4	WASHER - LOCK - CUT - 9/16
32	47028	1	SPACER

REF 44847

SHEET 2 OF 2 PUBLICATION DWG. NO. PM-45-028





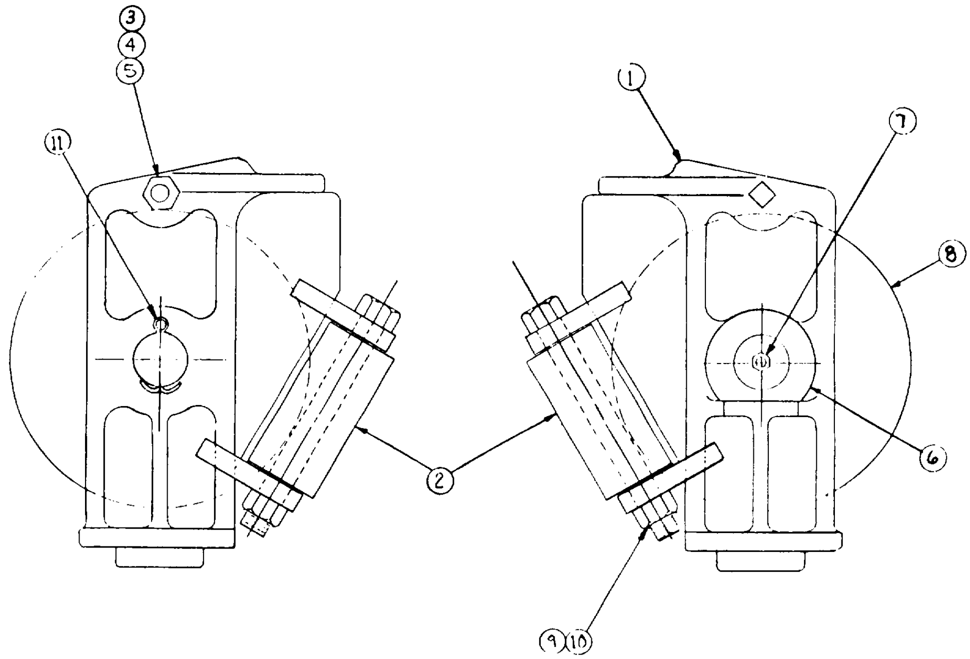
SECT. "A-A"

ITEM	**PART NO.**	**QTY.**	**DESCRIPTION**
1	12141	12.57 FT	PIPE - STL - SCH 40 - 3"
2	16469	1	CABLE ANCHOR - SPRING
3	43373	1	SHEAVE ASSEMBLY
4	17043	1	PLATE - BASE - POLESETTER
5	11630	3	CLAMP ASSEMBLY
6	5994	12	CAPSCREW - HX HD. - 1/2 UNC X 2 - GR 5
7	6291	12	NUT - ELASTIC STOP - 1/2 UNC

REF. 44848
SHEET 1 OF 1 PUBLICATION DWG. NO. PM-45-029

TITLE

SHEAVE ASSEMBLY (UPPER) - POLESETTER



5

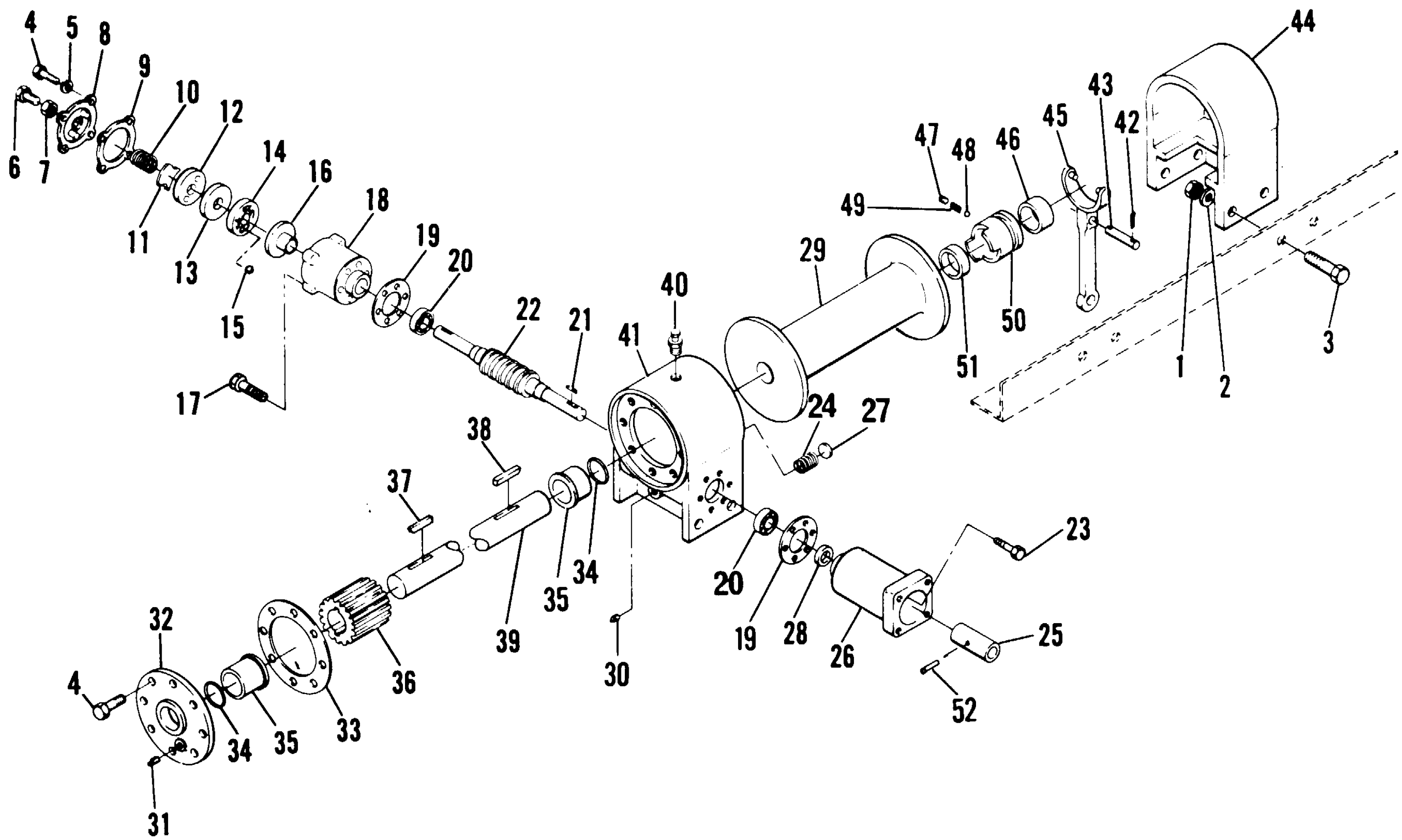
ITEM	PART NO.	QTY.	DESCRIPTION
1	45562	1	HOUSING - SHEAVE - POLESETTER
2	35028	2	ASSY - POLESETTER SHEAVE ROLLER
3	11509	1	SPACER
4	7574	1	CAPSCREW - HEX HD - 1/2 - UNC X 3 1/4
5	6291	1	NUT - ELASTIC STOP
6	16764	1	PIN - SHEAVE
7	5929	1	FITTING - STR - GREASE - 1/8 NPT
8	19556	1	SHEAVE - UPPER - 8" DIA.
9	7813	2	CAPSCREW - 3/4 NC X 6 1/2 LG.
10	42606	2	NUT - ELASTIC STOP - 3/4 NC
11	40180	1	PIN - COTTER

REF 43373

SHEET 1 OF 1 PUBLICATION DWG. NO. PM-45-030

TITLE

WINCH ASSEMBLY W/ SHAFT EXTENSION
ASSEMBLY 31649



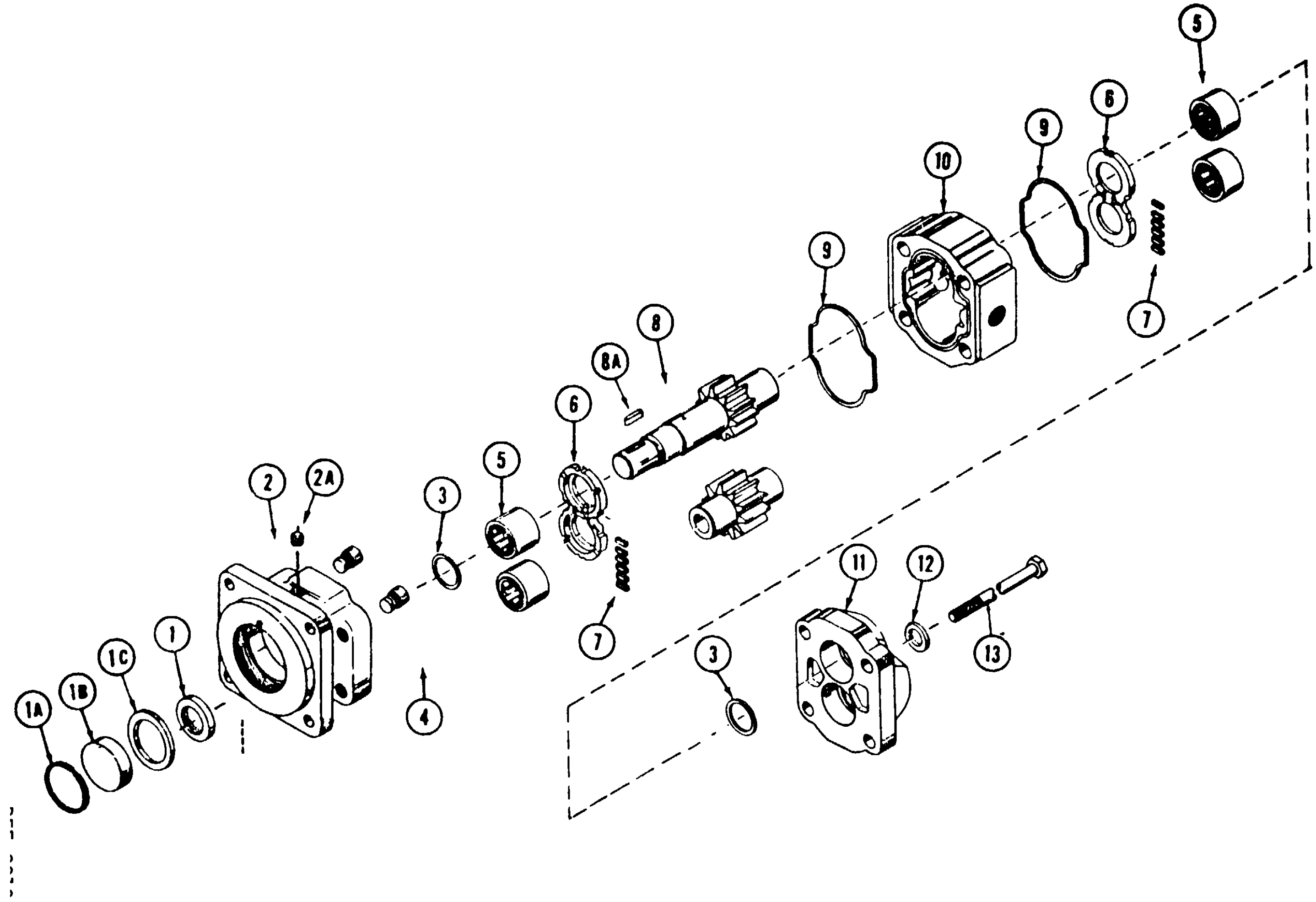
SHEET 1 OF 2 PUBLICATION DWG. NO. PM-45-031

TITLE

WINCH ASSEMBLY W/ SHAFT EXTENSION
ASSEMBLY 31649

ITEM	PART NO.	QTY.	DESCRIPTION
1	6291	8	LOCKNUT - 1/2 - NC
2	5975	8	LOCKWASHER - 1/2
3	5994	8	CAPSCREW - HEX HD - 1/2 - NC X 2
4	6093	12	CAPSCREW - HEX HD - 5/16 - NC X 3/4
5	6001	4	LOCKWASHER - 5/16
6	5972	1	CAPSCREW - HEX HD - 1/2 - NF X I 1/2
7	6169	1	NUT - JAM - 1/2 - NF
8	16423	1	COVER
9	16411	1	GASKET
10	16412	1	COIL SPRING
11	16413	1	SPRING FLAT
12	16414	1	RETAINER
13	16415	1	DISC
14	16416	1	CAM
15	16417	2	BALL
16	16418	1	HUB
17	F1010A	6	CAPSCREW - SOCKET HEAD
18	16419	1	HOUSING
19	16420	2	GASKET I’5
20	16332	2	BEARING 5
21	16422	2	KEY
22	16421	1	WORM
23	F1110A	6	CAPSCREW - SOCKET HEAD - 9/16 - NC X 1
24	16432	1	SPRING
25	16430	1	ADAPTER
26	16428	1	HOUSING
27	17223	1	DRAG BRAKE
28	16427	2	SEAL
29	16433	1	DRUM
30	5950	1	PIPE PLUG
31	6008	1	PIPE PLUG
32	16410	1	COVER
33	16341	1	GASKET
34	17030	2	"0" RING
35	16424	2	BUSHING
36	16340	1	GEAR
37	16339	2	KEY
38	16426	2	KEY
39	32234	1	SHAFT
40	16280	1	PRESSURE RELIEF PLUG
41	16431	1	HOUSING
42	6718	2	COTTER PIN
43	17029	1	SHAFT
44	16441	1	HOUSING
45	16440	1	YOKE
46	16439	1	BUSHING
47	16438	1	SCREW - ADJUSTING
48	16436	I	BALL
49	16437	1	SPRING
50	16435	1	CLUTCH
51	16434	1	SPACER
52	N/A	1	PIN

5


5
6
9
10
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8A
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5
2
2A
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3
11
12
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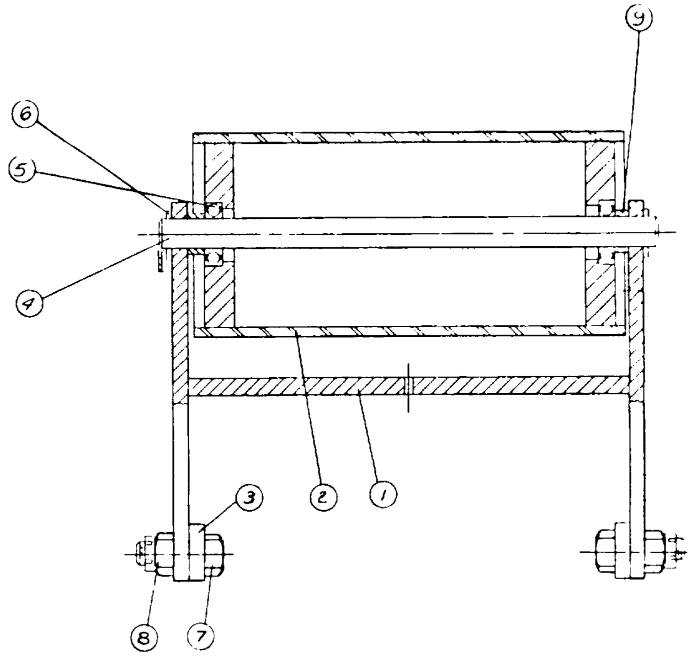
1
1C
1B
1A
4

ITEM	PART NO.	QTY.	DESCRIPTION
1	35817	1	SEAL
1A	35818	1	SNAP RING
1B	35819	1	SPACER
1C	35820	1	SEAL RETAINER
2	35821	1	SHAFT END COVER
2A	35822	1	PLUG
3	30678	1	RING SEAL
4	35823	2	CHECK ASSEMBLIES
5	16366	4	ROLLER BEARINGS
6	16367	2	THRUST PLATES
7	18672	1 STRIP	POCKET SEALS
8	35824	1 SET	INTEGRAL SHAFT & GEAR
8A	35825	1	KEY
9	18674	2	"0" RINGS
10	35826	1	GEAR HOUSING
11	31319	1	PORT END COVER
12	18677	4	WASHERS
13	35827	4	CAPSCREWS

5

REED TOOL COMPANY
SHERMAN, TEXAS

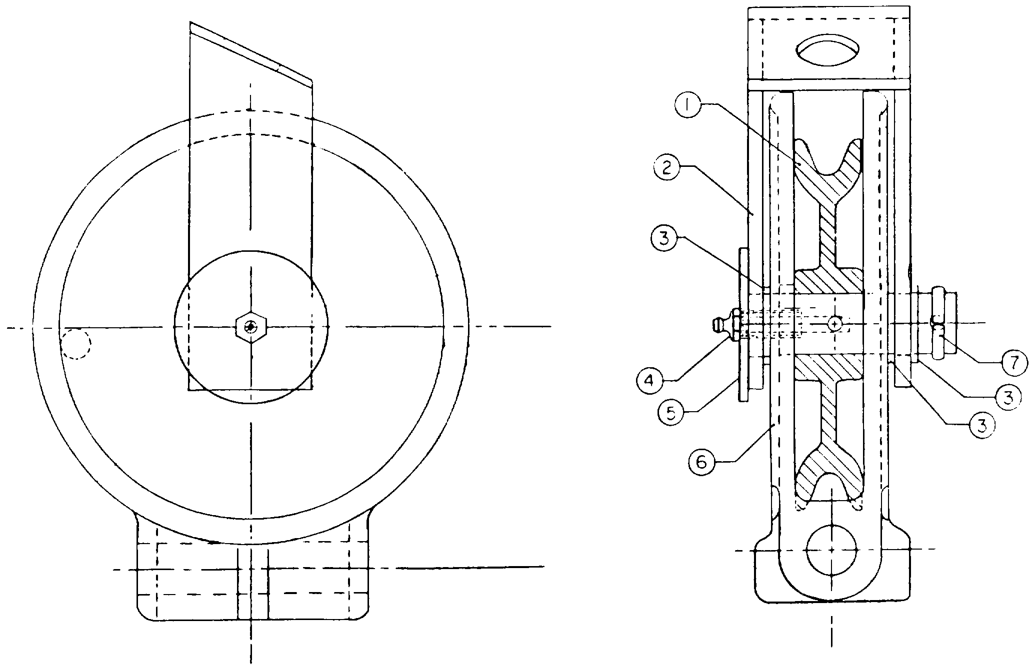
TITLE
ROLLER ASEEMBLY - WINCH



ITEM	**PART NO.**	**QTY.**	**DESCRIPTION**
1	17021	1	BRACKET - ROLLER WINCH
2	17022	1	ROLLER - WINCH - 5 1/4 O.D.
3	19760	2	LUG-BRACKET-WINCH ROLLER
4	19773	1	SHAFT-ROLLER-WINCH
5	18602	2	SEAL - BEARING - WINCH ROLLER
6	43221	2	PIN - SPRING - 1/8 DIA X 1 1/4 LG
7	5972	2	CAPSCREW - HEX HD - 1/2 - 13 UNC X 1 1/2 LG
8	6291	2	NUT - ELASTIC STOP - 1/2 - 13 UNC
9	19759	2	SPACER - SHAFT - ROLLER BEARING

REV C SHEET 1 OF 1 PUBLICATION DWG. NO. PM-45-033

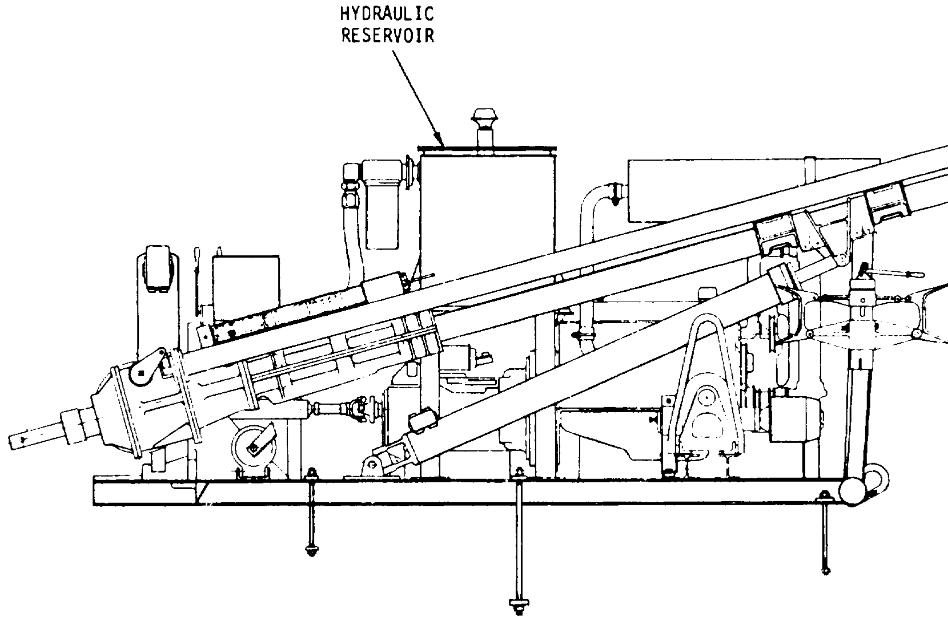
SHEAVE ASSEMBLY (LOWER) - POLESETTER

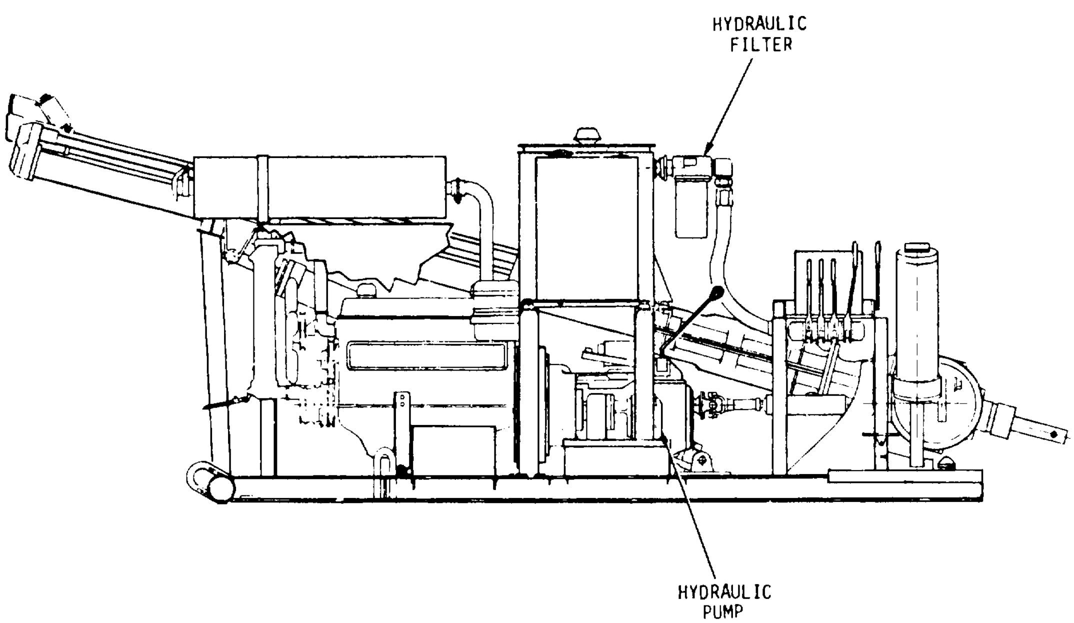


ITEM	PART NO.	QTY.	DESCRIPTION
1	11510	1	SHEAVE - 6 IN. LOWER
2	16452	1	CABLE GUIDE - LOWER
3	11762	1	WASHER - FLAT - 1"
4	5929	1	FITTING - GREASE - STR - 1/8 NPT
5	11513	1	SHEAVE PIN - LOWER
6	11727	1	HOUSING - SHEAVE - 6"
7	42949	1	PIN - COTTER - 1/4 X 1 LG

REF. 16851

REVISION A SHEET 1 OF 1 PUBLICATION DWG. NO. PM-45-034

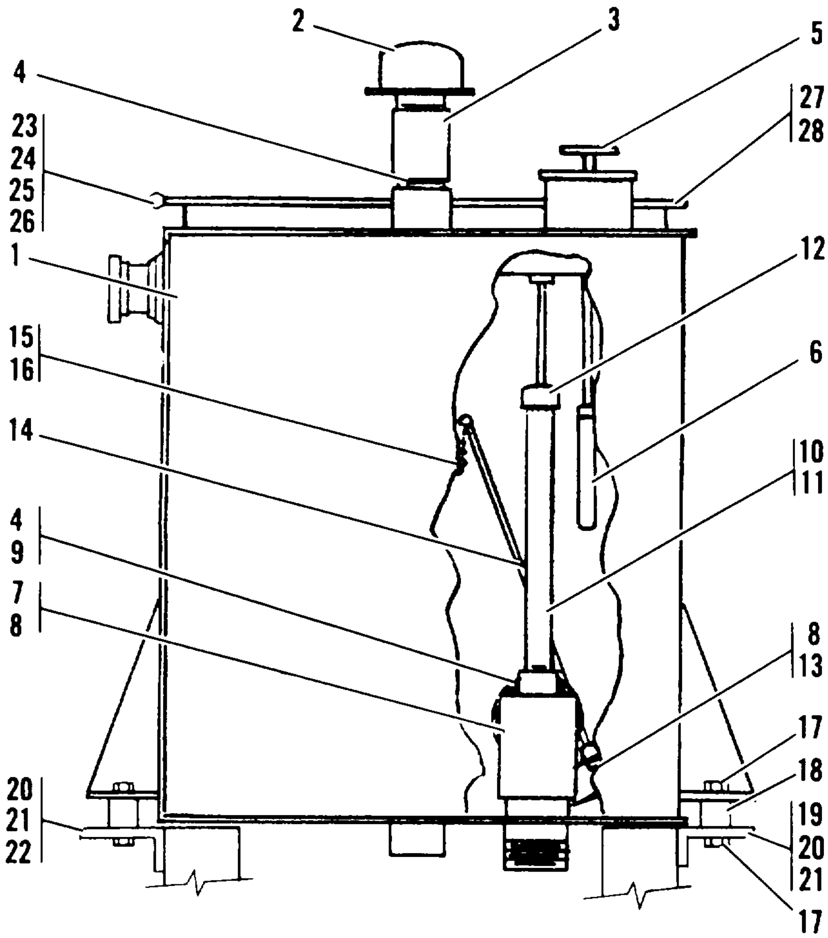




6

TITLE

HYDRAULIC RESERVOIR ASSEMBLY
ASSEMBLY 44954



REF 44954

SHEET 1 OF 2 PUBLICATION DWG. NO. PM-45-036

TITLE

HYDRAULIC RESERVOIR ASSEMBLY
ASSEMBLY 44954

ITEM	PART NO.	QTY.	DESCRIPTION
1	32491	1	RESERVOIR - HYDRAULIC
2	16076	1	BREATHER - DONALDSON #BA500-0099
3	34067	1	EXTENSION - BREATHER
4	16897	2	NIPPLE - STL - SCH 40 - 2 X 2 (CLOSE)
5	18449	1	GAUGE - OIL LEVEL
6	18450	1	TRAPPER - TANK - MAGNETIC
7	16819	1	ADAPTER - SUCTION
8	16823	2	0 RING - 2 1/4 I.D. X 2 5/8 O.D. X 3/16 DIA
9	16821	1	STRAINER - HYDRAULIC OIL
10	30636	1	NIPPLE - STL - SCH 40 - 1 X 12 PLUGGED
11	45131	1	SPRING - I DIA X LG X 12 GA
12	16906	1	RELEASE - SUCTION ADAPTER
13	16832	1	PLUG - AUXILIARY
14	30345	1	HANDLE - AUXILIARY PLUG
15	32898	1.5 FT	CHAIN - SASH - #30 BLUE CHROME
16	5939	2	PIN - COTTER - 1/8 X 1
17	7972	8	NUT - ELASTIC STOP - 3/8 - 16 UNC
18	32576	4	MOUNTS - HYDRAULIC RESERVOIR
19	44960	1	SUPPORT - RESERVOIR - FRONT
20	5977	8	CAPSCREW - HEX HD - 1/2 - 13 UNC X 1 1/4 - GR 5 (NOT SHOWN)
21	6291	8	NUT - ELASTIC STOP - 1/2 - 13 UNC (NOT SHOWN)
22	44961	1	SUPPORT - RESERVOIR - REAR
23	31739	1	BAND
24	31740	1	BOLT- 3/8 NC X 4 1/2
25	31741	1	NUT-HEX-SPECIAL- 3/8 NC
6	16083	2	WASHER-FLAT- 3/8
7	31738	1	LID
8	31736	2	GASKET

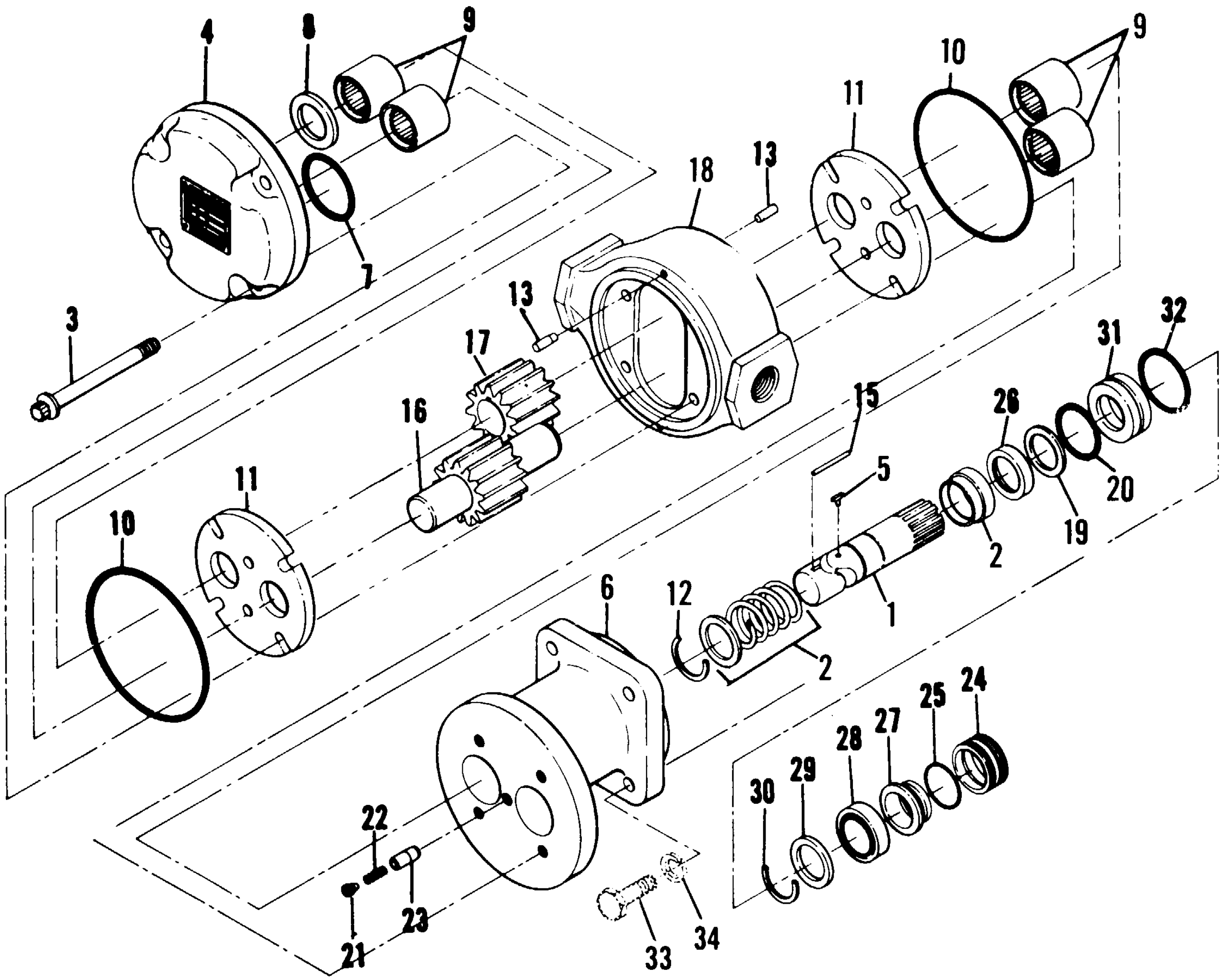
NOTE: FOR FILTER ASSEMBLY AND ELEMENT SEE "HYDRAULIC PLUMBING INSTALLATION" THIS SECTION

6

TITLE

HYDRAULIC PUMP ASSEMBLY

ASSEMBLY 16780

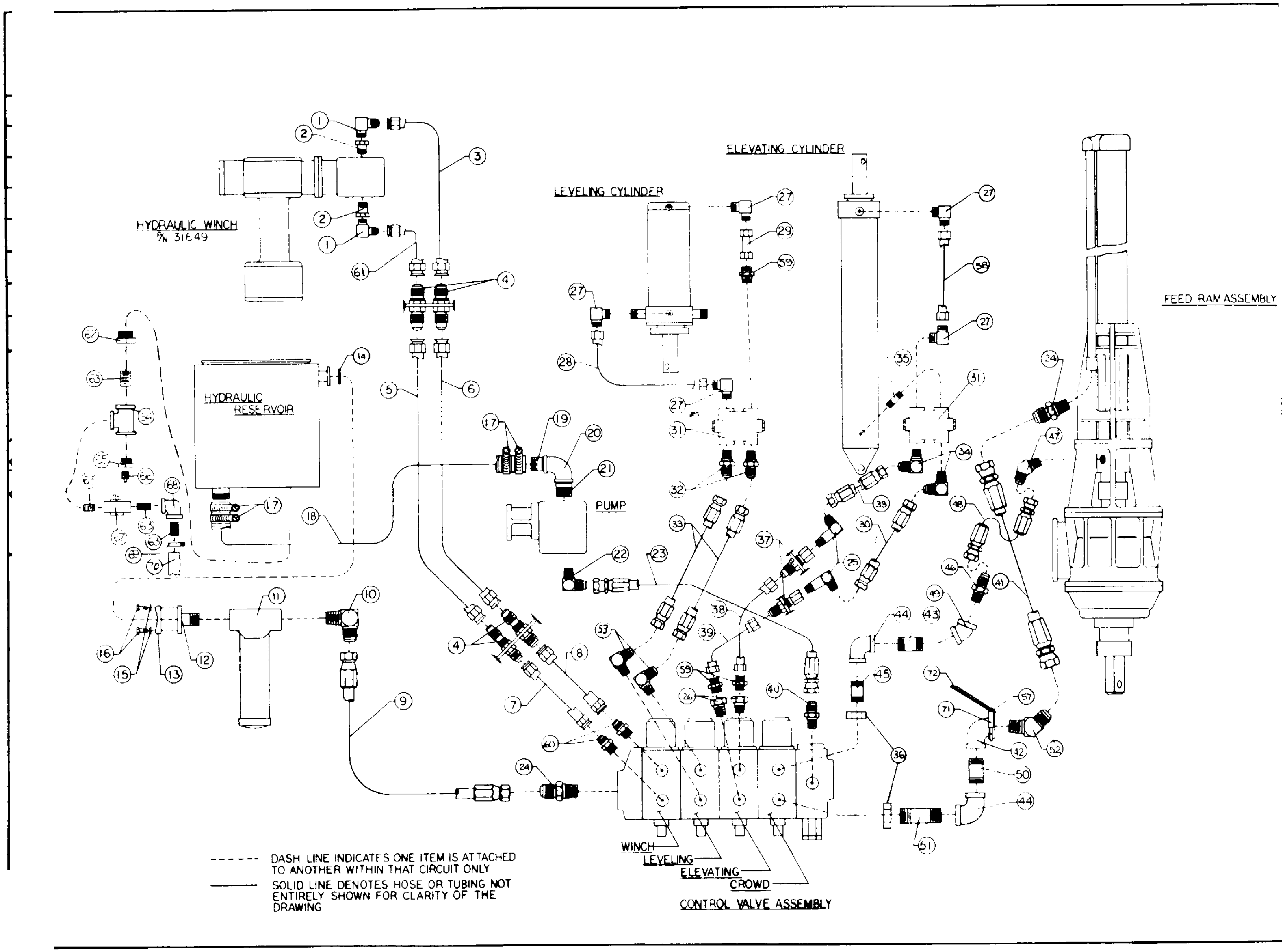


HYDRAULIC PUMP ASSEMBLY

ITEM	PART NO.	QTY.	DESCRIPTION
1	16781	1	SHAFT
2	16791	1	SEAL ASSEMBLY
3	16799	4	CAPSCREW
4	16804	1	COVER
5	16811	1	KEY - DRIVE
6	16786	1	ADAPTER
7	16793	4	"0" RING
8	16801	1	WASHER - THRUST
9	16798	4	BEARING
10	16796	2	"0" RING
11	16803	2	PLATE - WEAR
12	16792	1	RING - SNAP
13	16795	4	DOWEL PIN
*14	16794	AS REQD	SHIM
15	16802	1	DOWEL PIN
16	16797	1	DRIVEN GEAR
17	16800	1	DRIVE GEAR
18	16812	1	HOUSING
19	16809	2	BACK UP RING
20	16810	1	"O" RING
21	16807	2	CHECK
22	16806	2	SPRING
23	16805	2	GUIDE
24	16783	1	RETAINER
25	16784	1	"O" RING
26	16785	1	SEAL SLEEVE
27	16782	1	SEAL
28	16787	1	BEARING
29	16789	1	RETAINER - RING - SNAP
30	16788	1	RING - SNAP
31	16790	1	SEAT - ASSY - SEAL
32	16808	1	"O" RING
**33	5986	4	CAPSCREW
**34	5975	4	WASHER

*ITEM #14 (16794-SHIM) NOT SHOWN, WHEN REQUIRED, IS USED BETWEEN MATING FACES OF ITEM #8 AND ITEM #11, BOTH SIDES.

**SHOWN FOR REFERENCE ONLY. ACTUALLY CALLED OUT AS ITEMS 29 AND 30 ON PAGE 18 (THIS MANUAL)


HYDRAULIC WINCH
P/N 31649
HYDRAULIC RESERVOIR
PUMP
LEVELING CYLINDER
ELEVATING CYLINDER
FEED RAM ASSEMBLY
WINCH
LEVELING
ELEVATING
CROWD
CONTROL VALVE ASSEMBLY
DASH LINE INDICATES ONE ITEM IS ATTACHED TO ANOTHER WITHIN THAT CIRCUIT ONLY
SOLID LINE DENOTES HOSE OR TUBING NOT ENTIRELY SHOWN FOR CLARITY OF THE DRAWING

HYDRAULIC PLUMBING INSTALLATION

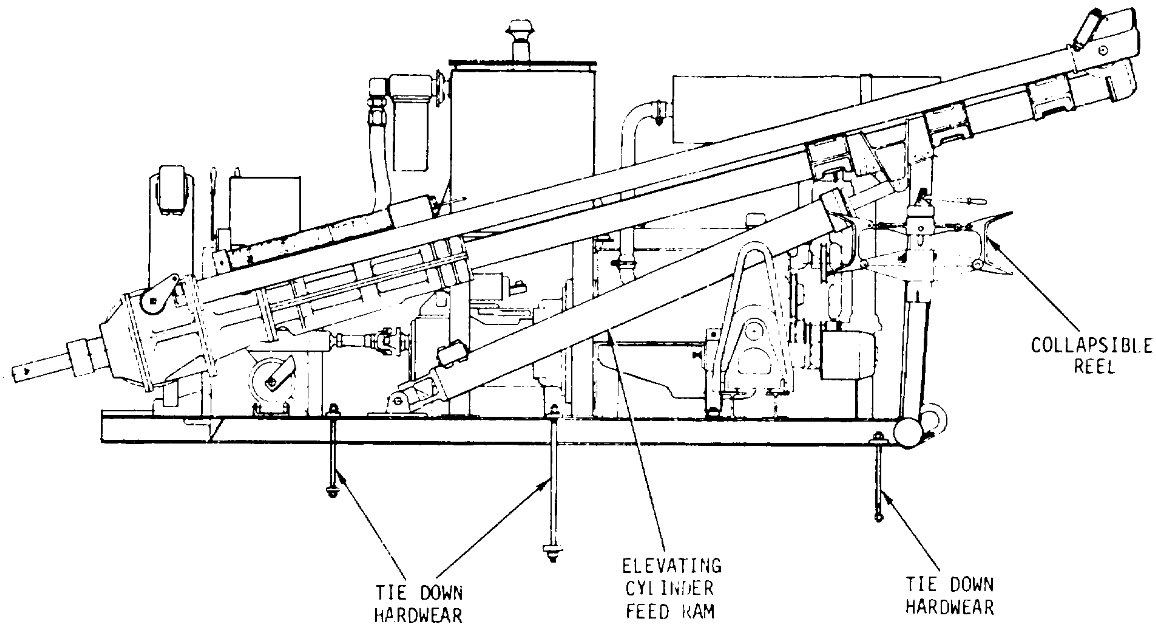
ITEM	PART NO.	QTY.	DESCRIPTION
1	16659	2	FITTING-HYD-90 -3/4 M NPT X 3/4 TUBE
2	8335	2	FITTING-BUSHING-PIPE-HEX-1 X 3/4
3	32621	1	TUBING-WINCH MOTOR-LONG
4	16661	4	FITTING-HYD-BHD-3/4 TUBE X 3/4 TUBE
5	32619	1	TUBING-WINCH-LONG-FRAME
6	32618	1	TUBING-WINCH-SHORT-FRAME
7	32626	1	TUBING-WINCH-SHORT-VALVE
8	32625	1	TUBING-WINCH-LONG-VALVE
9	42780	1	HOSE ASSY-HYD-1 1/4 F JIC X 1 1/4 F JIC X 31-625 PSI
10	36382	1	FITTING-HYD-900-1 1/4 M NPT X I 1/4 M JIC
*11	44923	1	FILTER ASSY - HYD - DENISON # RLF-12-070-25-0
12	31900	1	ADAPTER-I 1/2 M NPT TO 2" SPLIT FLANGE
13	16862	2	FLANGE-SPLIT-HALF-2"
14	16357	1	"0" RING - 2 1/4 ID X 1 1/2 O.D. X 1/8 W
15	5975	4	WASHER - LOCK - CUT - 1/2
16	5977	4	CAPSCREW-HEX HD. - 1/2 - 13 UNC X I 1/4 - GR 5
17	16892	4	CLAMP - HOSE - 2 DIA TO 2 3/4 DIA
18	16863	1.84 FT	HOSE - SUCTION - 2 3/8 ID.
19	16881	1	NIPPLE - STL - SCH 80 - 2 X 3
20	16882	1	FITTING-90 -REDUCING-PIPE-2 1/4 X 2-X HVY
21	16883	1	NIPPLE-STL-SCH 80-1 1/4 X 1 1/2 (CLOSE)
22	31807	1	FITTING-HYD-900-1 1/2 M NPT X 1 1/4 M JIC
23	45136	1	HOSE ASSY-HYD-1 1/4 F JIC X 1 1/4 F JIC X 46 - 2250 PSI
24	31399	2	FITTING-HYD-STR- 1 1/4 M NPT X 1 1/4 M JIC
25	35625	2	FITTING-HYD-900-EXTENDED-3/4 M NPT X 1/2 F NPT
26	35631	2	FITTING-HYD-BUSHING-3/4 M NPT X 1/2 F NPT
27	16650	5	FITTING-HYD-900- 1/2 M NPT X 1/2 TUBE
28	32624	1	TUBING-LONG-LEVELING CYL
29	32620	1	TUBING-SHORT-LEVELING CYL
30	38150	1	HOSE ASSY-HYD-1/2 FJIC X 1/2 FJIC X 36 X 2000 PSI
31	18259	2	VALVE - LOCK - 1/2 NPT PORTS (GRE #Lo 50D)
32	31396	2	FITTING - HYD - STR - 1/2 MNPT X 1/2 M JIC
33	41992	2	HOSE ASSY - HYD - 1/2 FJIC X 1/2 FJIC X 32 X2000 PSI
34	30835	2	FITTING - HYD - 900 - 1/2 M NPT X 1/2 M JIC
35	17751	1	NIPPLE - STL - SCH 80 - 1/2 X 3 1/2
36	18748	2	NUT - SEAL - 1" NPTF
37	16653	2	FITTING-HYD-BHD-1/2 FNPT X 1/2 TUBE
38	32717	I	TUBING - ELEVATING CYL - V. TO BHD - SHORT
39	32718	1	TUBING - ELEVATING CYL - V. TO BHD - LONG
40	38623	1	FITTING - HYD
41	41220	1	HOSE ASSY - HYD - 1 1/4 F JIC X 1 1/4 F JIC X 60 X 2250 PSI
42	17711	1	FITTING - 90° - REDUCING - PIPE - 1 1/4 X I XHVY
43	6662	1	NIPPLE - STL - SCH 80 - 1 X 1 1/2 (CLOSE)
44	6667	2	FITTING - 900 - PIPE - 1 - XHVY
45	6672	1	NIPPLE - STL - SCH 80 - 1 X 2 1/2
46	31398	1	FITTING - HYD - STR - 1 MNPT X 1 MJIC
47	32149	1	FITTING - HYD - 450 - 1 MPT X 1 MJIC
48	42073	1	HOSE ASSY - HYD - 1 FJIC X 1 FJIC X 48 X 2500 PSI
	*32418	1	ELEMENT - HYD FILTER ASSY (NOT SHOWN)

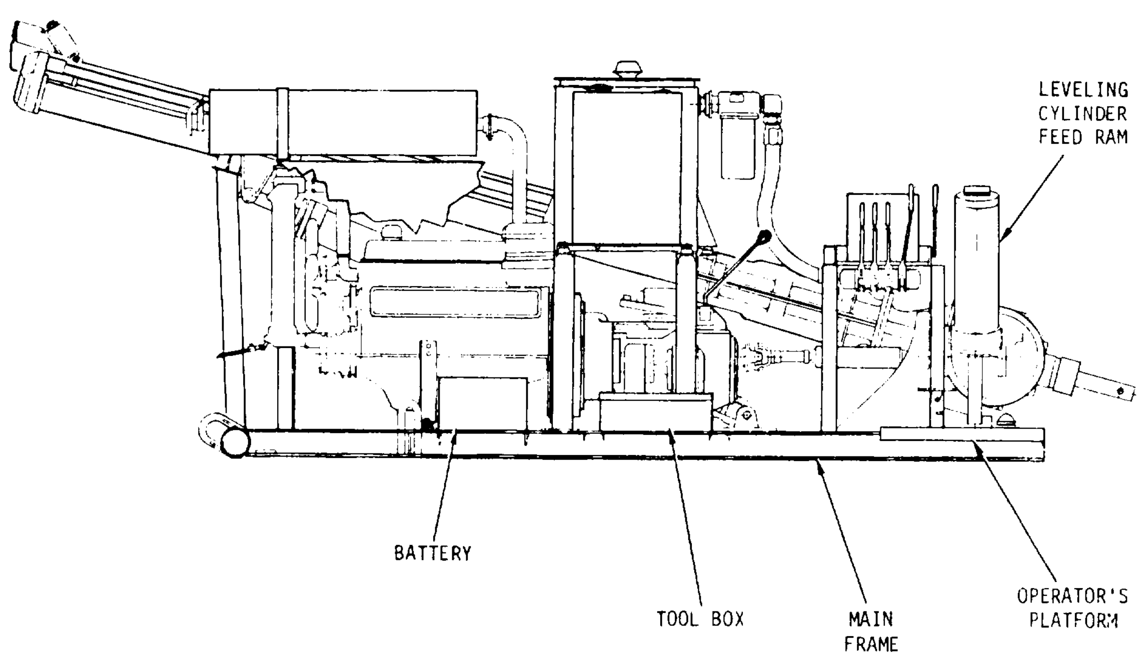
REF 45142

HYDRAULIC PLUMBING INSTALLATION

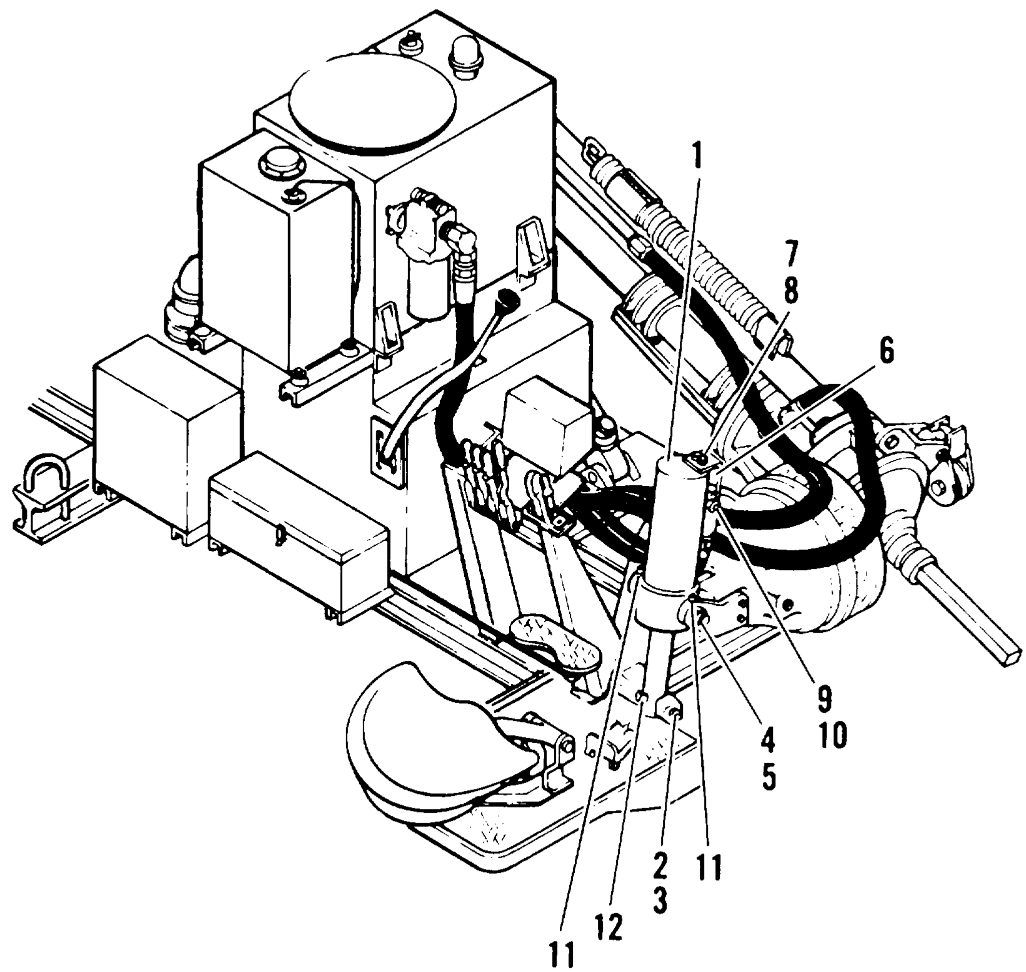
ITEM	PART NO.	QTY.	DESCRIPTION
49	6665	1	FITTING - 450 - PIPE - 1 - XHVY
50	6704	1	NIPPLE - STL - SCH 80 - 1 X 8
51	17012	1	NIPPLE - STL - SCH 80 - 1 X 4 1/2
52	30076	1	FITTING - HYD - 450 - 1 1/4 M NPT X 1 1/4 M JIC
53	37670	2	FITTING - HYD - 90°- 3/4 MNPT X 1/2 MJIC
54	-------		
55	-------		
56	-------		
57	6292	2	NUT - ELASTIC STOP - 5/16 - 18 UNC
58	45145	1	TUBING - ELEVATING CYL BARREL
59	16648	3	FITTING - HYD - STR - 112 M NPT X 1/2 TUBE
60	16658	2	FITTING - HYD - STR - 3/4 M NPT X 3/4 TUBE
61	32617	1	TUBING - WINCH MOTOR - SHORT
62	34048	1	FITTING - BUSHING - PIPE - HEX - 1 1/2 X 3/4
63	7173	3	NIPPLE - STL - SCH 80 - 3/4 X 2
64	8371	1	FITTING - TEE - PIPE - 3/4 X 3/4 X 3/4 SIDE - XHVY
65	8334	1	FITTING - BUSHING - PIPE - HEX - 3/4 X 1/2
66	20110	1	FITTING - PLUG - PIPE - SQ. HD - 1/2 - MAGNETIC
67	17783	1	VALVE - GAS SERVICE STOP - 3/4 NPT
68	8317	1	FITTING - 900 - PIPE - 3/4 - XHVY
69	16888	1	CLAMP - HOSE - 3/8 TO 1
70	30213	6.00 FT	HOSE - HEATER - 1"
71	31884	1	CLAMP - MUFFLER
72	45197	1	BAR - PIPING SUPPORT

REF 45142


COLLAPSIBLE
REEL
TIE DOWN
HARDWEAR
ELEVATING
CYLINDER
FEED RAM
TIE DOWN
HARDWEAR


LEVELING
CYLINDER
FEED RAM
BATTERY
TOOL BOX
MAIN
FRAME
OPERATOR'S
PLATFORM

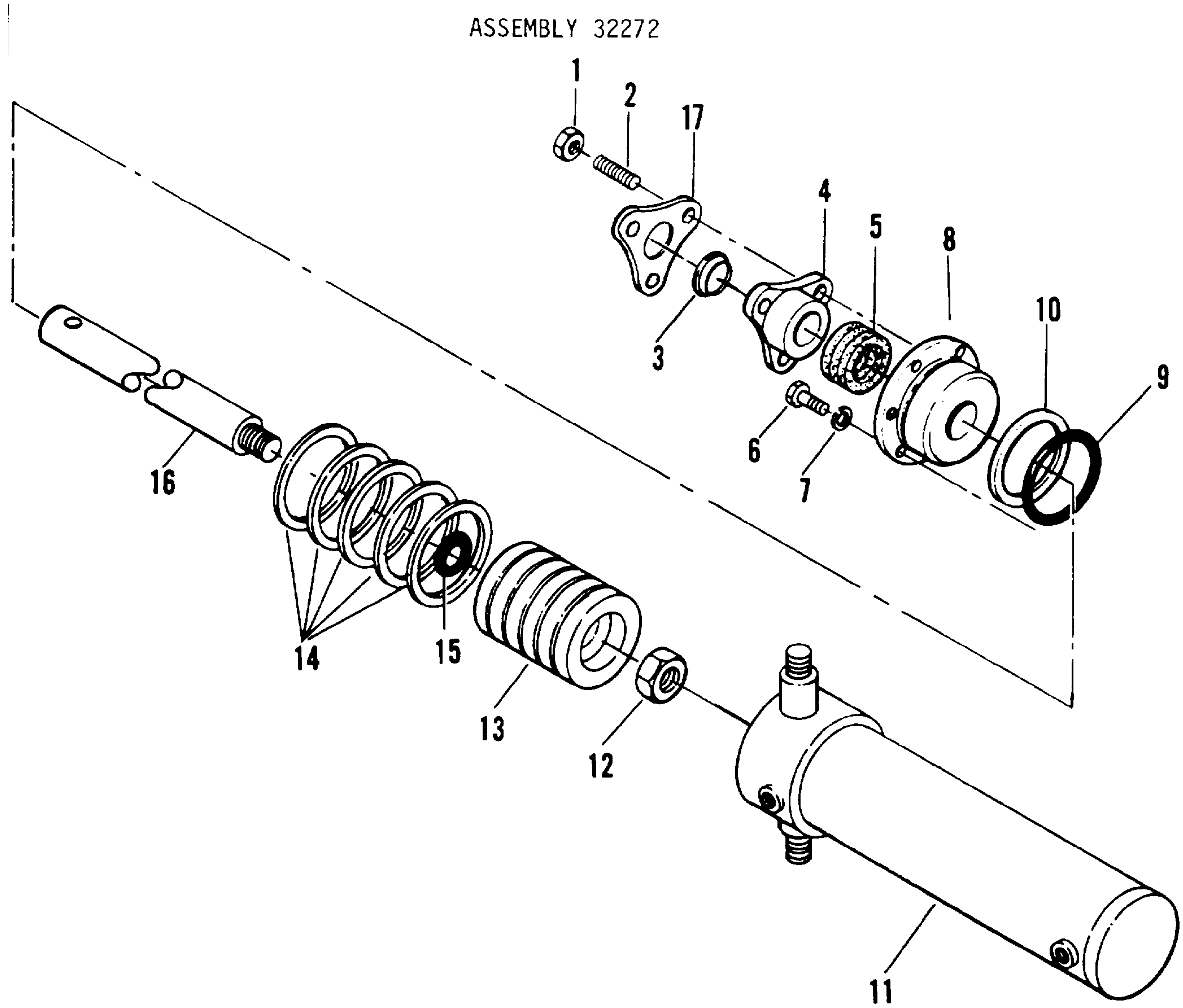
LEVELING CYLINDER ASSEMBLY



ITEM	PART NO.	QTY.	DESCRIPTION
1	32272	1	CYL - LEVELING
2	7829	1	CAPSCREW - HEX HD - 1 - 8 UNC X 6 - GR 5
3	35800	1	NUT - ELASTIC STOP - 1 8 UNC
4	42968	2	NUT ELASTIC STOP - THIN - 1 - 14 UNS
5	11762	2	WASHER - FLAT - STD - 1
6	33380	1	BRACKET - VALVE - LOADLOCK
7	6092	2	CAPSCREW - HEX HD - ½ - 13 UNC X 1 - GR 5
8	6291	2	NUT - ELASTIC STOP - ½ - 13 UNC
9	7722	2	CAPSCREW - HEX HD - 5/16 - 18 UNC X 2 ½ GR 5
10	6292	2	NUT - ELASTIC STOP - 5/16 - 18 UNC
11	5929	2	FITTING - GREASE - 1/8 NPT - STR
12	18377	1	FITTING - GREASE - 1/98 NPT - 90^{o}

REF. 45086

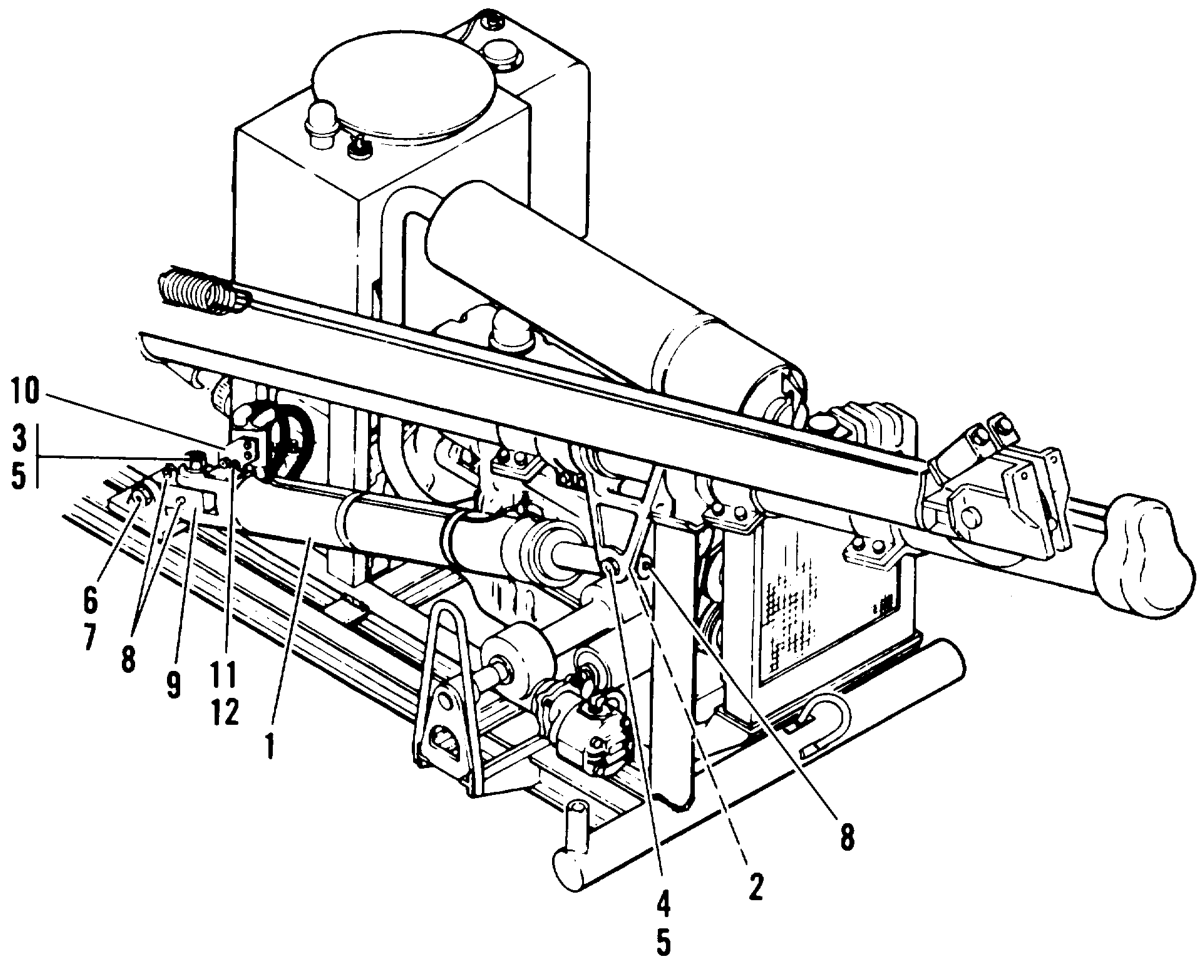
REED TOOL COMPANY **TITLE**
SHERMAN, TEXAS LEVELING CYLINDER ASSEMBLY



ITEM	PART NO.	QTY.	DESCRIPTION
1	9440	3	NUT - HEX- ½ 2-0 UNF - 3N
2	16256	3	BOLT - STUD - ½ NC X ½ NF X 3 ½ LG
3	19321	1	WIPER ROD - 2 I.D.
4	32270	1	GLAND PACKING
5	14061	1 SET	packing - ROD - 2 I.D.
6	5986	6	CAPSCREW - STL ½ 13 NC X 1 2/4
7	5975	6	WASHER - LOCK ½ DIA
8	30837	1	CAP - CYL 78 ½ OD X 2 ID
9	19729	1	“O” RING - 5 ¾ ID X 6 OD X 1/8 (NAT #623034)
10	30288	1	BACKUP RING - 6 DIA (NAT #624434)
11	33401	1	BARREL ASSEMBLY - MACHINES
12	42646	1	LOCKNUT - 1 ¼ NF
13	30299	1	PISTON - CYL 6 DIA
14	18849	4	PACKING - PISTON - ¼ X ¼ X 19
15	16610	1	“O” RING - 1/8 W X 1 ¼ ID X 1/1/2 OD
16	33399	1	SHAFT - 2 O.D. X 28 ¾
17	32581	1	RETAINER

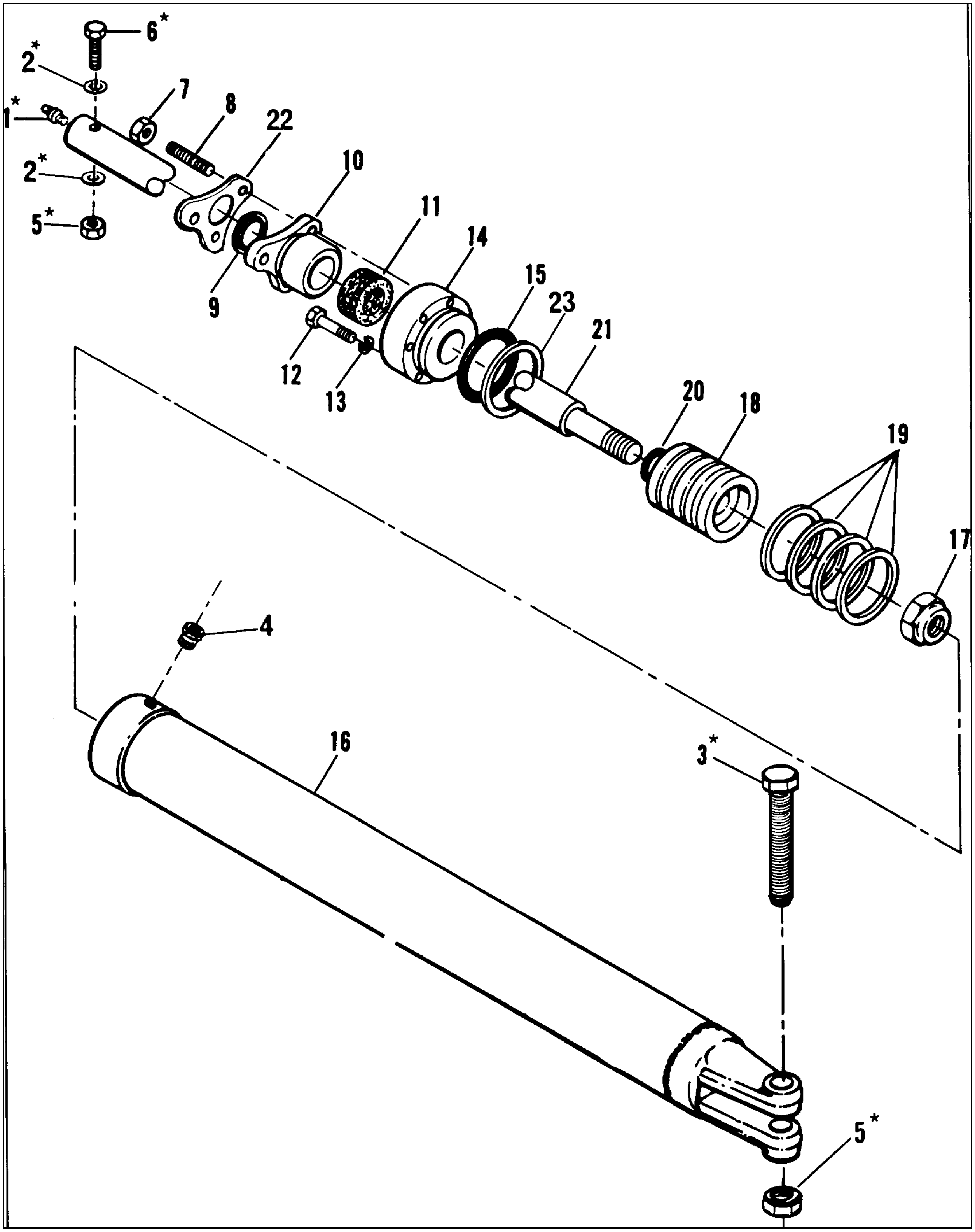
SHEET 1 OF 1 **PUBLICATION DWG. NO.** **PM-45-041**

ELEVATING CYLINDER ASSEMBLY



ITEM	PART NO.	QTY.	DESCRIPTION
1	32271	1	CYLINDER ASSEMBLY ELEVATING
2	16449	2	SPACER - MOUNTING - UPPER
3	11141	1	CAPSCREW - HEX HD. - 1 - 8 UNC X 6 ½ GR 8
4	35799	1	CAPSCREW - HEX HD. - 1 - 8 UNC X 7 ½ GR 8
5	42701	2	NUT - ELASTIC STOP - 1 - 8 UNC
6	35806	1	CAPSCREW - HEX HD - 1 ¼ UNC X 8 GR 8
7	34091	1	NUT ELASTIC STOP - 1 ¼ UNC X 8 GR 8
8	5929	3	FITTING - GREASE - 1/8 NPT
9	12001	1	BLOCK - PIVOT
10	33381	1	BRACKET - MOUNTING - VALVE
11	7722	2	CAPSCREW - HEX HD. - 5/16 - 18 UNC X 2 ½ GR 5
12	6292	2	NUT - ELASTIC STOP - 5/16 - 18 UNC

REF 45127



* ELEVATING CYLINDER INSTALLATION REF. 45127

REED TOOL COMPANY **TITLE**
SHERMAN, TEXAS

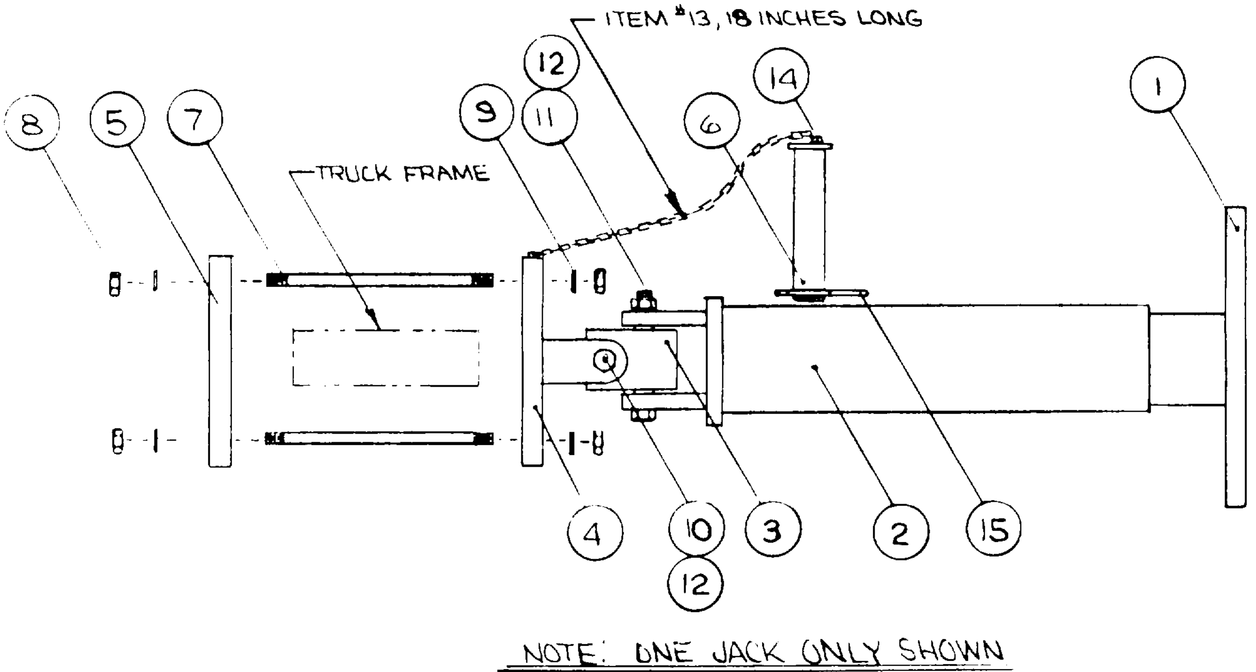
ELEVATING CYLINDER ASSEMBLY

ITEM	PART NO.	QTY.	DESCRIPTION
1*	5929	3	GREASE - 1/8 NPT
2*	16449	2	SPACER - MOUNTING - UPPER
3*	35799	1	CAPSCREW HEX HD. - 1 - 8 UNC X 7 1/2 - GR 8
4	35117	1	VALVE - RELIEF - THERMAL - 1/8 NPT - 3000#
5*	42701	2	NUT - ELASTIC STOP - 1 - 8 UNC
6*	11141	I	CAPSCREW - HEX HD. - 1 - 8 UNC X 6 1/2 GR 8
7	9440	3	NUT - STOP - ELASTIC - 1/2 - 20 UNF
8	16256	3	BOLT - STUD - 1/2 X 2
9	19321	1	WIPER - ROD - 2" I.D. (C/R P.S47)
10	32270	1	GLANT - PACKING
11	14061	1	PACKING
12	42575	6	CAPSCREW - 3/8 - 16 NC X 1 3/4 LG - GR 5
13	5989	6	WASHER - LOCK - CUT - 3/8
14	30504	1	CAP - CYLINDER
15	19725	1	"0" RING - 4 3/4 D - NATIONAL NO. 623024
16	44908	I	BARREL ASSEMBLY - 4 3/4 I.D. X 69 3/4
17	42646	1	NUT - STOP - ELASTIC - 1 1/4 - 12 NF
18	30502	1	PISTON
19	18849	1	PACKING - BELMONT - 1/4 SQ X 70" LG.
20	16610	1	"0" RING - 1/8 X 1 1/4 I.D. X 1 1/2 0.D. - NATIONAL NO. 622723
21	16508	1	SHAFT - 2 DIA. X 75
22	32581	1	RETAINER
23	30287	1	RING - BACK UP - 4 3/4 D. - NATIONAL NO. 624424

* ELEVATING CYLINDER INSTALLATION REF. 45127

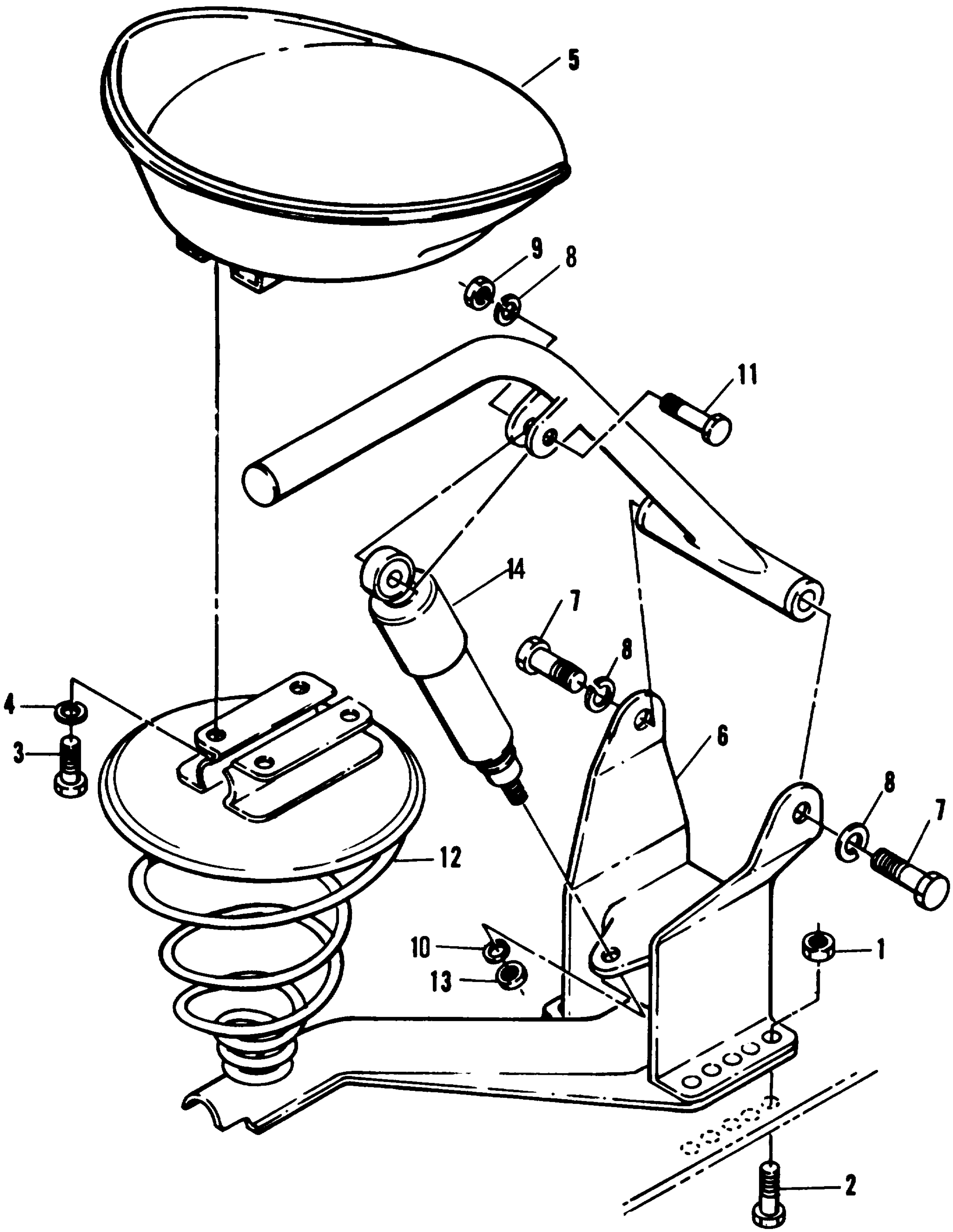
REF 45127

SUPPORT JACKS ASSEMBLY



ITEM	PART NO.	QTY.	DESCRIPTION
1	45217	2	PAD & LOWER TUB - JACK
2	11646	2	TUBE - JACK UPPER
3	8598	2	BLOCK - UNIVERSAL
4	17035	2	BRACKET - JACK
5	17034	2	BAR - HOLD DOWN
6	45218	2	PIN - CLEVIS 1 X 6
7	34046	4	BOLT - TIE - 3/4 X 28
8	6371	8	NUT - HEX - ¾ - 10 UNC
9	5965	8	WASHER - LOCK - CUT ¾
10	7810	2	CAPSCREW - HEX HD - ¾ - 10 UNC X 5 GR 5
11	8279	2	CAPSCREW - HEX HD - ¾ - 10- UNC 4 1/2 GR 5
12	42606	4	NUT - ELASTIC STOP - ¾ - 10 UNC
13	32898	3	CHAIN - #30 SASH
14	37394	4	SCREW - SELF TAP
15	19156	2	CLIP - HAIR PIN - 5/32

REF 45199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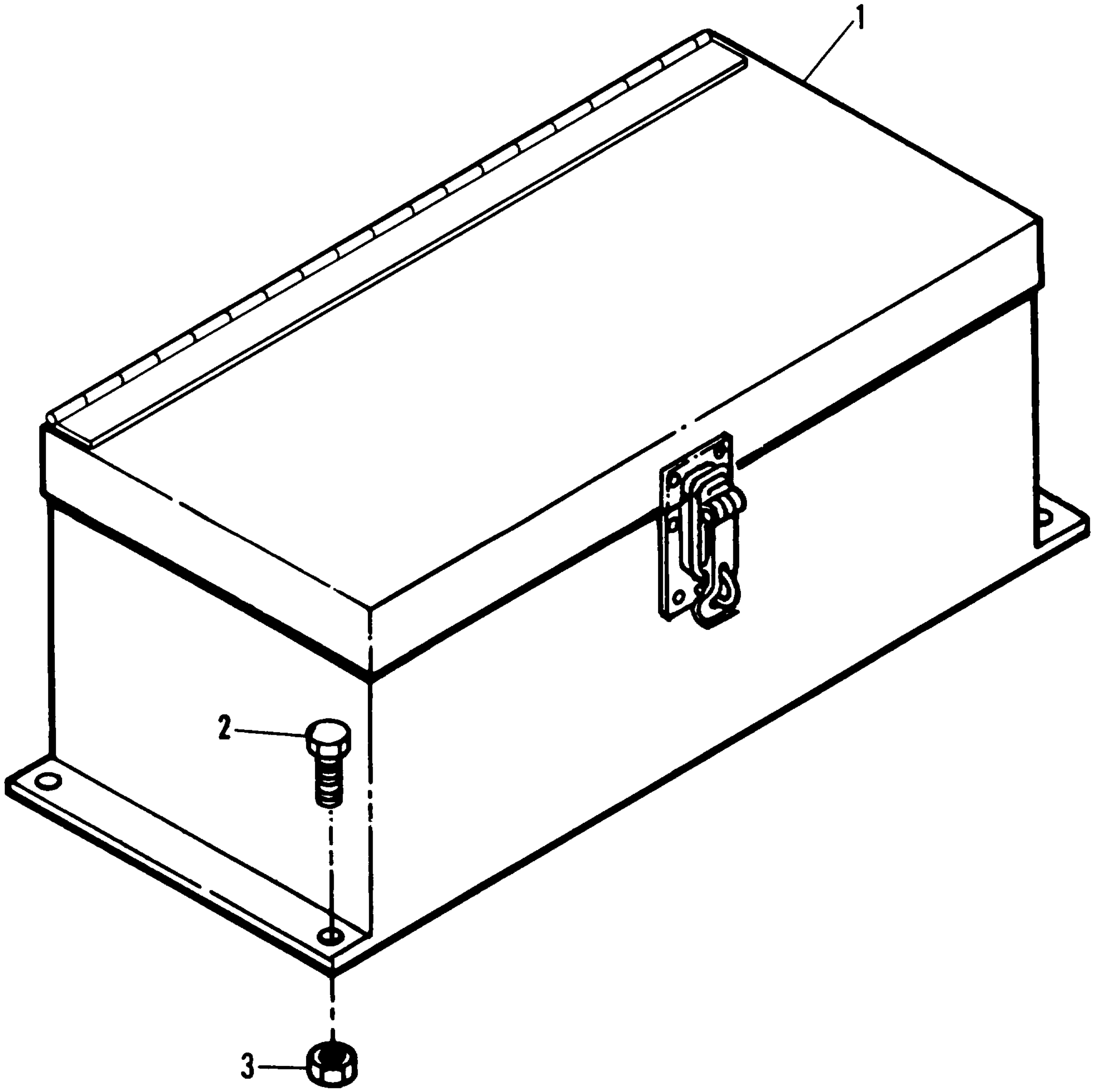
SEAT ASSEMBLY

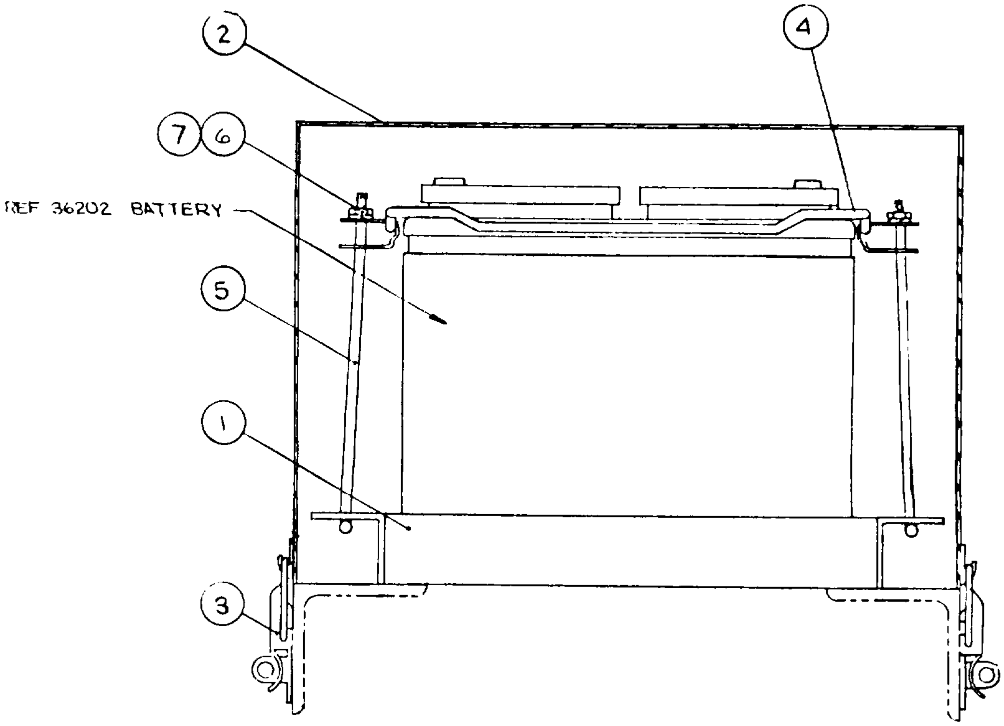
ITEM	**PART NO.**	**QTY.**	**DESCRIPTION**
1	6716	4	NUT - ELASTIC STOP - 5/8 UNC
2	6414	4	CAPSCREW - HEX HEAD - 5/8 UNC X 1 3/4
3	5960	4	CAPSCREW - HEX HD - 7/16 X 20 UNF X 3/4 LG.
4	6088	4	WASHER - LOCK - STAR - INTERNAL - 7/16
5	18504	1	PAN - SEAT
6	18696	1	BRACKET ASSEMBLY - SEAT
7	-----	2	CAPSCREW 1/2 X 1 NF
8	5975	3	WASHER
9	5973	1	NUT - HEX 1/2 NC
10	5989	1	WASHER - LOCK - 3/8
11	7662	1	HEX HD. CAPSCREW 1/2 X 2 1/4 NC
12	18505	1	SPRING - SEAT
13	5976	1	NUT - HEX - 3/8 NF
14	18506	1	ABSORBER - SHOCK



ITEM	**PART NO.**	**QTY.**	**DESCRIPTION**
1	17129	1	BOX - TOOL - ASSEMBLY
2	6092	4	CAPSCREW - HEX HD - ½ - 13 UNC X 1
3	6291	4	NUT - ELASTIC STOP - ½ - 13 UNC

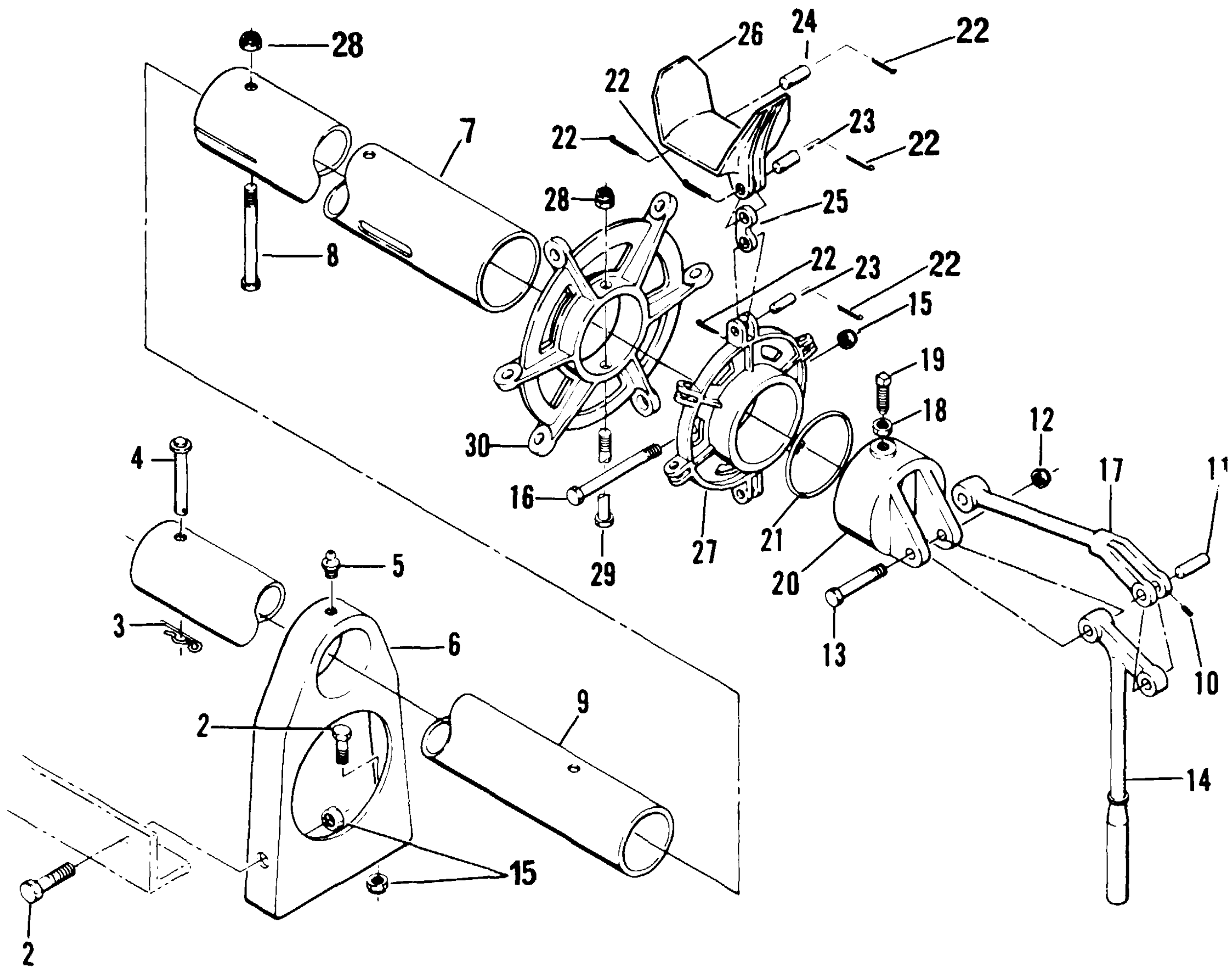
REF 45237

REED TOOL COMPANY **TITLE**
SHERMAN, TEXAS



ITEM	PART NO.	QTY.	DESCRIPTION
1	36204	1	BOD BATTERY 12V GN 24F & R-24F
2	44827	1	COVER BATTERY 15 X 9 X 10 TALL
3	18870	2	CATCH PULL DRAW HD
4	36203	1	BRACKET HOLD DOWN
5	18217	2	ROD TIE DOWN BATTERY
6	6001	2	NUT HEX 5/16 18 UNC
7	6002	2	WASHER LOCK CUT 5/16

SHEET 1 OF 1 **PUBLICATION DWG. NO.** **PM-45-047**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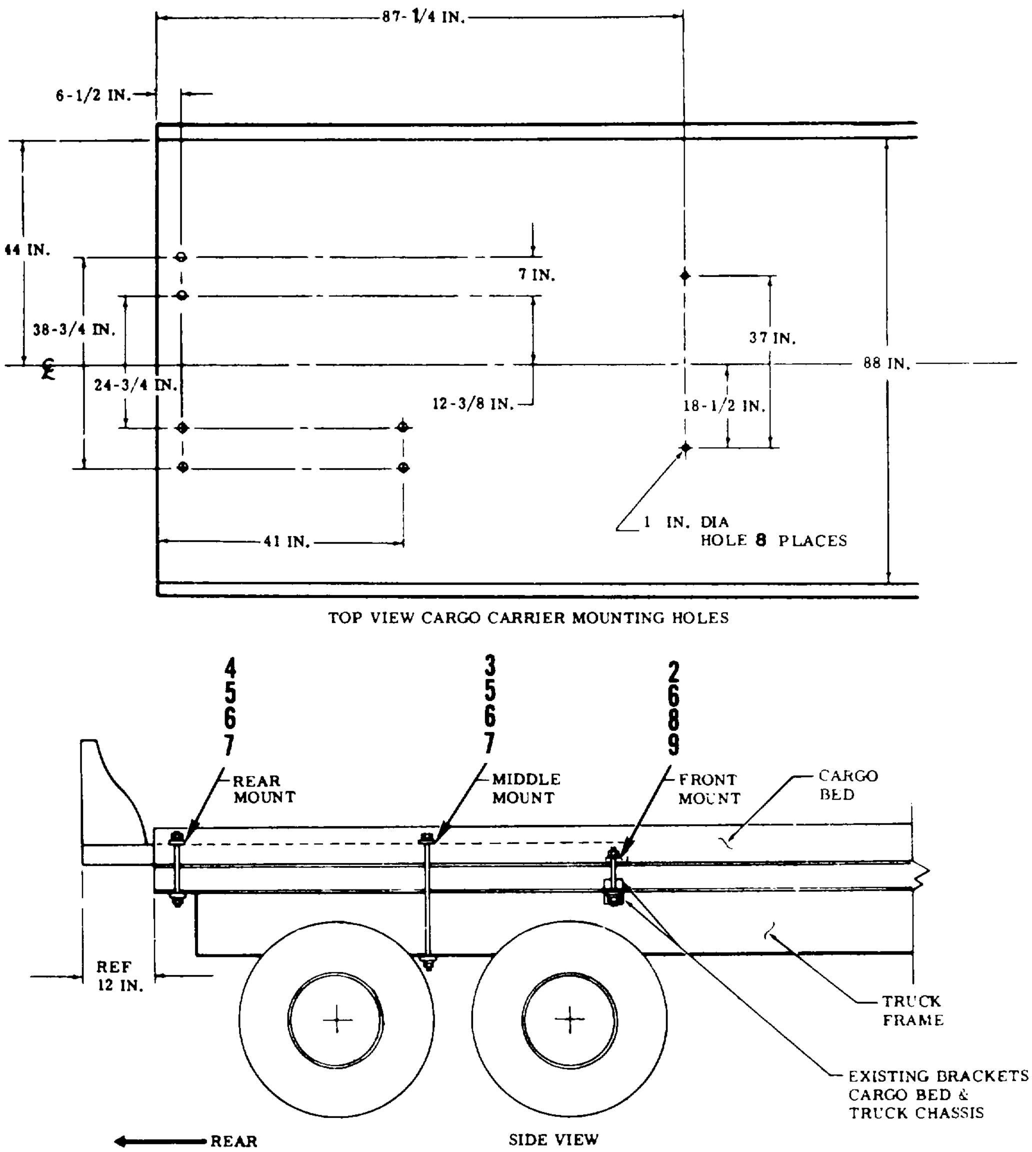
COLLAPSIBLE REEL ASSEMBLY

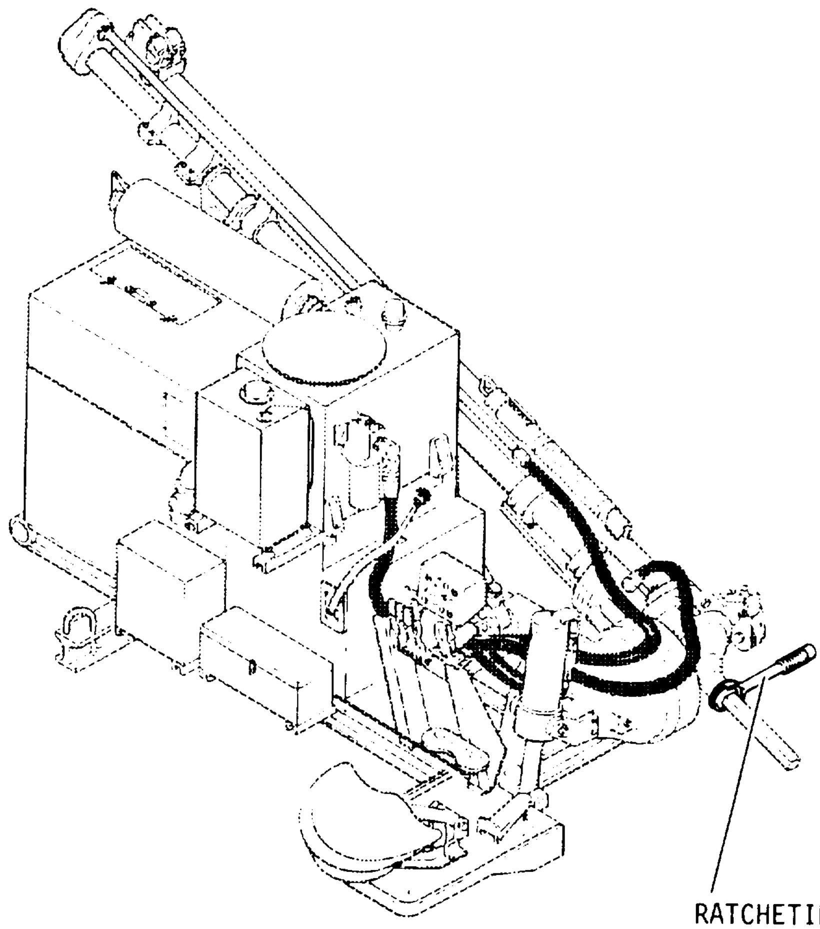
ITEM	PART NO.	QTY.	DESCRIPTION
1	10056	10	SHIM (NOT SHOWN)
2	5986	4	CAPSCREW-HEX HD-1/2 UNC X 1 3/4 GR 5
3	32414	1	PIN - HAIR
4	32415	1	PIN - 5/8 DIA. X 3
5	5929	1	FITTING - GREASE - STR - 1/8 NPT
6	17130	1	BEARING - OUTBOARD - J8
7	32235	1	SHAFT
8	5963	1	CAPSCREW-HEX HD-5/8 UNC X 4 1/2 GR 5
9	34000	1	SHAFT - EXTENDED - J8 WINCH
10	6413	1	SETSCREW - SOC. HD - 1/4 - UNC X 1/4 LG
11	32238	1	PIN - 3/8 DIA X 1 1/2 LG
12	7972	1	NUT - STOP - ELASTIC - 3/8 UNC
13	6881	1	CAPSCREW - HEX HD - 3/8 UNC X 3 LG. GR 5
14	11990	1	HANDLE
15	6291	5	NUT - STOP - ELASTIC - 1/2 UNC GR 5
16	7793	1	CAPSCREW - HEX HD - 1/2 UNC X 5 GR 5
17	11992	1	LINK - LEVER
18	5991	2	NUT - HEX - 3/8 UNC GR 5
19	42795	2	SETSCREW - SQ HD - 3/8 UNC X 1
20	11991	1	CAP - LEVER BRACKET
21	32239	1	0 - RING - 3 I.D. X 3 3/8 O. D. X 3/16 DIA.
22	5939	36	PIN - COTTER - 1/8 DIA X 1
23	32237	12	PIN - 5/8 DIA X 2
24	32236	6	PIN - 5/8 DIA X 2 7/8
25	11993	6	LINK - SADDLE
26	11995	6	SADDLE
27	11994	1	SPIDER - FLOATING
28	6716	2	NUT - STOP - ELASTIC - 5/8 UNC
29	7802	1	CAPSCREW - HEX HD - 5/8 UNC X 5 - GR 5
30	11996	1	SPIDER - STATIONARY

ASSEMBLY 45239



ITEM	PART NO.	QTY.	DESCRIPTION
1	19186	1	WREN H CHAIN SMALL (SEE SECTION 8, PAGE 71)
2	42745	2	BOLT TIEDOWN ¾ X 3 ½ UNC
3	7813	2	BOLT TIE DOWN ¾ X 6 ½ UNC
4	18283	4	BOLT TIE DOWN ¾ X 18
5	6371	12	NUT HEX ¾ 10 UNC
6	5965	12	WASHER LOCK CUT 3/4
7	17147	6	STRAP TIE DOWN
8	-------		
9	46980		PLATE 3 X 4

REED PT. NO. 19186



*THIS OTC PART MUST BE MODIFIED BY ADDING 8 INCHES OF REPLACEMENT CHAIN (TOTAL CHAIN LENGHT TO BE 24 INCHES)

OPERATOR
AND
MAINTENANCE
INSTRUCTIONS

FORD INDUSTRIAL
GASOLINE ENGINE
3.3 LITRE (200 CID)

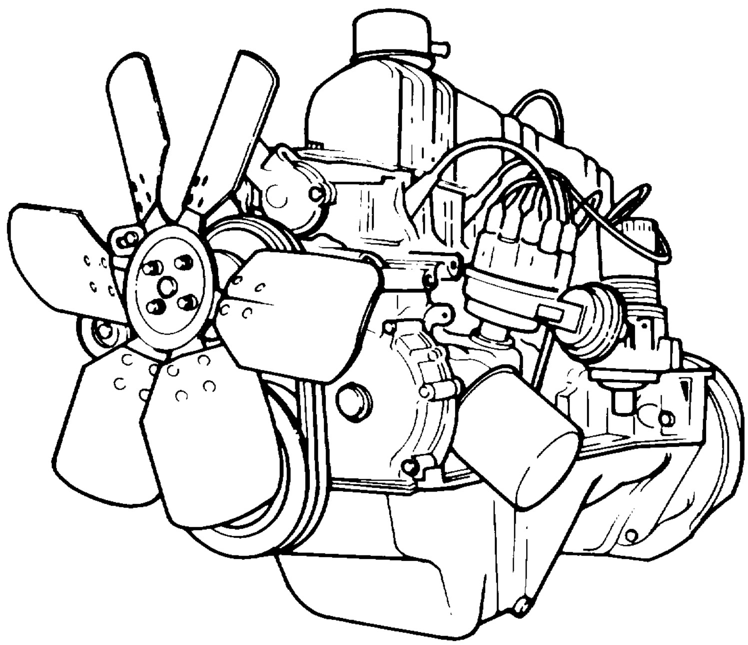


Table of Contents

INTRODUCTION

We are highly pleased that you have selected a Ford unit for your engine requirements. The Ford Motor Company takes great pride in the long tradition of quality products and great values that the Ford name represents.

Ford Industrial Engines are tested and inspected before leaving the factory. However, certain checks should be made before putting them into regular operation. Read the Initial Start Up requirements in the Maintenance Instructions.

HOW TO USE THIS MANUAL

We wrote the manual especially for you. We hope you use it to get to know your engine and how to get the most out of it. That is why we urge you to read this manual from cover to cover. First, you'll become familiar with the various controls and instruments. As you read further, we tell you how to maintain your engine and what services need to be performed to keep it in excellent running condition.

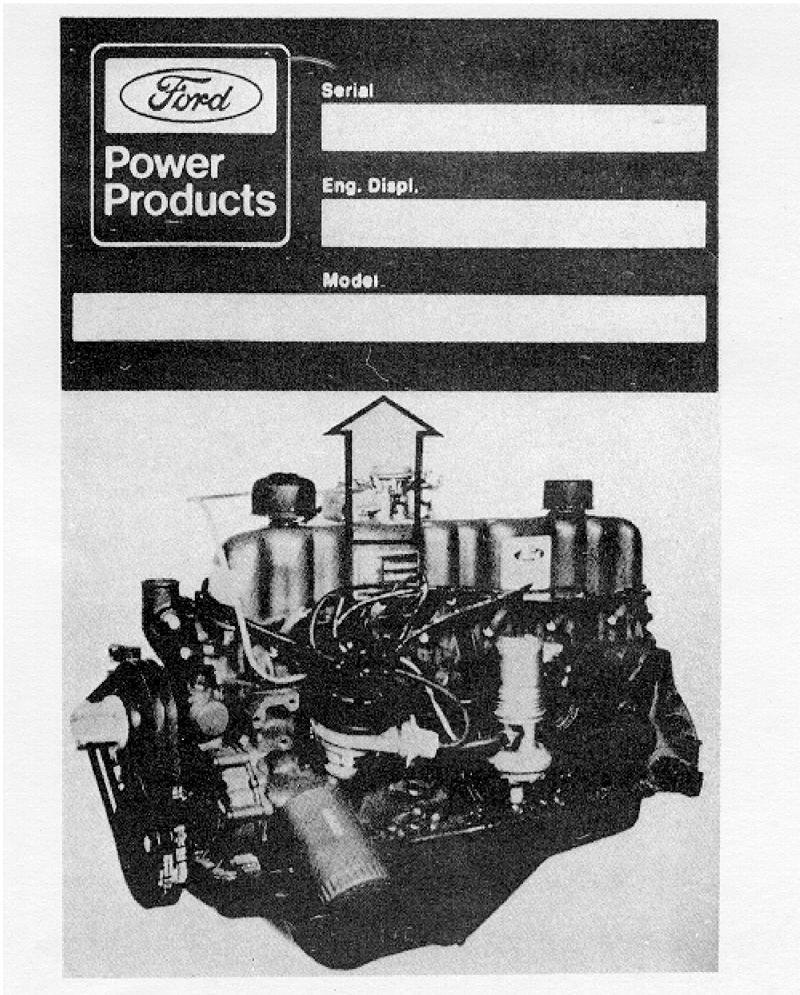
The Subject Index on the title page permits you to quickly open the manual to any Section. The Alphabetical Index at the back of the manual provides a page reference to a particular item or procedure.

Ford Industrial Engines are built with a variety of standard and/or optional components to suit a wide range of customer requirements. This manual does not identify equipment as standard or optional. All the equipment described in this manual may not be found on your engine or power unit.

The descriptions and specifications contained in this manual were effect at the time it was approved for printing. The Ford Companies reserve the right to discontinue models at any time, or to change specifications or design without notice and without incurring obligation.

ENGINE IDENTIFICATION

An Identification Decal is affixed to the left side of the rocker cover of each engine. The decal contains the engine serial number which identifies this unit from all others. Next is the engine displacement which determines the engine specifications, then the model number and S. O. or special options which determine the parts or components required on this unit. Use all numbers when seeking information or ordering replacement parts for this engine. For a handy reference, record the information on the decal below.



PARTS AND SERVICE

Replacement parts can be obtained through your local Ford Power Products Distributors and Dealers. They are listed in the accompanying directory or can be found in the yellow pages under “Engines”.

Ford Power Products Distributors and Dealers are equipped to perform major and minor repairs. They are anxious to see that all of your maintenance and service needs are quickly and courteously completed.

Operating Instructions

CONTROLS

Starter Button

Engage the starter by pulling the ignition switch to the ON position and depress the starter button. Release the button when the engine starts.

Choke Control

The choke control is connected to the carburetor and op-crates the choke butterfly to enrich the fuel mixture on cold starts. Pulling the control out closes the choke and pushing it in opens the choke.

Power Take-Off

The power take-off control handle allows engagement and disengagement t,1 the power take-off clutch.

On Funk units, moving the lever away from the engine engages the clutch.

When moving the handle to engage the clutch and pick up the load, do so in a smooth manner. .Moving the clutch handle too slowly will cause slippage and wear, while moving it too fast will cause quick engagement and possible damage to the power take-off, engine or driven equipment.

INSTRUMENTS

Oil Pressure Gauge

The oil pressure gauge registers the lubricating system pressure in pounds-per-square-inch and should be frequently checked to ensure that the system is functioning correctly. Normally the pressure registered by the gauge should remain constant for a given engine speed (see Specifications).

Should the pressure fluctuate or drop, stop the engine and find the cause. Do not operate the engine at lower than normal oil pressures.

Ammeter

This instrument registers the charging current which is being passed to the battery by the alternator. It also registers a discharge equivalent to the amount of current being used by the electrical equipment when the alternator is not charging.

Temperature Gauge

The temperature gauge registers the coolant temperature and will indicate overheating which may arise from low coolant level, clogged radiator, loose fan belt or faulty thermostat.

By operating the engine at the correct temperature maximum power, longer life and better fuel economy will be ensured.

Safety Switch

The optional low oil pressure - high water temperature safety switch automatically shuts off the ignition when the oil pressure drops below a preset value, or when the water temperature rises above a preset value. The switch operates in conjunction with contacts integral with the oil pressure warning mechanism and the water temperature gauge. The contacts are adjusted by an Allen head screw on the face of the gauge. A button on the instrument panel is used to override the safety switch when starting the engine.

Tachometer

The tachometer (optional) indicates the engine speed in hundreds of revolutions per minute. It serves as a guide to maintain engine speed in the most desirable operating ranges.

Hourmeter

This instrument (optional) records the hours of operation and is used to determine when periodic maintenance is required.

STARTING THE ENGINE

Release the load on the power take-off, or if the engine is equipped with a transmission, disengage the clutch. If the engine is started with the load engaged, it imposes an unnecessary strain on the starter and battery.

CAUTION - All internal combustion engines give off various fumes and gases while running. Do not start or run the engine in a closed or poorly ventilated building where the exhaust gases can accumulate. Avoid breathing these gases as they may contain poisonous carbon monoxide which can endanger your health or life if inhaled steadily for even a few minutes.

Normal Starts

Pull the throttle out about ½ inch and the choke out about halfway. Turn the ignition switch to the ON position. Push the starter button. After the engine starts, decrease the throttle setting and adjust the choke for fast idle warm-up. When the engine is at normal operating temperature, push the choke in all the way.

CAUTION - If the engine stalls or falters in starting, wait three or four seconds before re-engaging starter. This will prevent possible damage to the starter or engine.

The starter should not be operated for periods longer than 30 seconds at a time. An interval of at least two minutes should be observed between such cranking periods to protect the starter from overheating.

Engine Cold

Pull the throttle out about ½ inch and the choke all the way out. Turn the ignition switch to the ON position. Press the starter button. When the engine starts, adjust the choke setting to keep the engine running smoothly. When the engine is at normal operating temperature, push the choke in all the way.

To assure satisfactory operation in cold weather, allow approximately five minutes for engine warm-up before engaging load.

CAUTION - If the engine stalls or falters in starting, wait three or four seconds before re-engaging starter. This will prevent possible damage to the starter or engine.

The starter should not be operated for periods longer than 30 seconds at a time. An interval of at least two minutes should be observed between such cranking periods to protect the starter from overheating.

Engine Flooded

To start a “flooded” engine, press the throttle control release button and pull the throttle out all the way and push the choke in all the way. Turn the ignition switch to the ON position. Press the starter button until the engine starts. Release the starter button. Push the throttle in gradually as engine speed increases.

CAUTION -- If the engine stalls or falters in starting, wait three or tour seconds before re-engaging the starter. This will prevent possible damage to the starter or engine.

The starter should not be operated for periods longer than 30 seconds it a time. An interval of at least two minutes should be observed between such cranking periods to protect the starter from overheating.

STOPPING THE ENGINE

Normal Conditions

Following normal operating conditions, lower the engine speed to idle, disengage the clutch, and then turn the ignition switch tot the OFF position. If the engine has been running under high power, let it run at last idle speed a few minutes to cool the engine down.

Never turn off the ignition, then suddenly pull the choke out, with the thought in mind that this will "prime" the system for the next start. This is poor practice, because the large quantity of raw gasoline entering the combustion chambers will wash all the oil off the cylinder walls. When started again, the engine will operate for a few moments without any lubrication on the cylinder walls, which may result in scuffing of the pistons, rings, and cylinder walls. At best, engine life will be shortened considerably.

Abnormal Conditions

Under abnormally overheated conditions, the engine may continue to run after the ignition switch is turned off. If this case is ever encountered, turn on the ignition switch immediately and allow the engine to idle until it has cooled enough to stop. If the engine is overheated due to a loss of coolant, it is best to stop the engine immediately, if necessary by applying the load. Allow the engine to cool, then check the coolant and oil levels. Add engine oil if necessary, then, after the engine has returned to a normal temperature, add coolant slowly until the radiator is full.

CAUTION - Avoid injury when checking a hot engine. Cover the radiator cap in a thick cloth and turn it slowly counter-clockwise to the first stop. After the pressure has been completely released, press the cap downward and finish removing the cap.

The above instructions also apply to engines that stop due to operation of the low oil pressure-high water temperature safety switch. However, if engine stops due to low oil pressure, do not restart until the cause has been determined and corrected.

SPECIAL SITUATIONS

Problem Diagnosis

Most operating troubles that might be encountered with a new or well maintained unit will be of a minor nature. Therefore, if you have troubles starting or operating your engine, look for some simple cause rather than failure of a major component. For instance: Loose or corroded battery connections arc much more likely than battery failure.

A loose ignition wire is much more likely than distributor, coil or ignition system failure.

In many cases, engine operating troubles are coupled with outside factors, such as climatic conditions, operating conditions, change of servicing or fueling source, or change of operator.

Engine troubles that occur as a result of normal use and wear usually give plenty of advance warning. These troubles usually result from overlooking the Scheduled Preventive Maintenance Services (Page 14).

Whenever engine performance seems less than normal in any category, it is best to consult with your dealer at the first symptom rather than wait until a serious problem develops. One of the aims of regular maintenance is to help you in just these circumstances.

Engine Won't Crank

1. Turn the key to the ON position and press the starter button. If nothing happens, an electrical lead(s) may be loose or disconnected, the battery cables may be loose, disconnected or corroded or the battery discharged.

2. Another indication of loose battery connections or low battery condition is a stuttering noise from the engine compartment when the ignition s' itch is turned to ON and the starter button depressed. Check the connections to the starter motor and the solenoid switch in addition to the battery and ground connections.

3. Try operating the starter button several times. Should the switch be corroded, this operation may clean the contacts enough to make the switch temporarily operable until you can reach your dealer.

4. If all the electrical connections are tight and you need assistance to start, read the instructions under Emergency Starting (Page 12).

Engine Cranks But Won't Start

1. Check the fuel tank. You may be out of fuel. If there is fuel in the tank, the trouble may be in either the ignition system or the fuel system.

2. Check the ignition system. Remove the wire from one of the spark plugs by grasping the moulded cap of the wire only, and insert a short piece of bare wire or other metal in the terminal of the wire.

   NOTE - Spark plug wires carry high tension electrical current, capable of giving a shock. Be sure to grasp the moulded boot well hack from the open end.

   Hold the cap so that the inserted bare wire is about 1/4 inch from the engine block and crank the engine (with the ignition switch on) for at least three seconds.

If there is no spark between the wire and the metal, the trouble may be in the distributor or coil. If you see a spark, then check the fuel system for trouble.

3. The fuel system may have a restricted fuel line, plugged fuel filter, air leaks in the fuel line or a faulty fuel pump.

4. Check the manual choke. The choke linkage may be binding or damaged so that the choke plate in the carburetor is not opening and closing properly.

Engine Runs Hot

Listed below are items which could cause an engine to overheat.
1. Low coolant level.
2. Loose or broken fan belt.
3. Inoperative thermostat.
4. Dirty cooling system
5. Radiator fins restricted with leaves, dirt, etc.
6. Prolonged idling.
7. Running engine with frozen coolant.
8. Leaky head gasket.
9. Overloading, especially during hot weather.

Emergency Starting

Use of Booster Battery and Jumper Cables - Particular care should be used when connecting a booster battery in order to prevent sparks. To jump start (negative grounded battery):

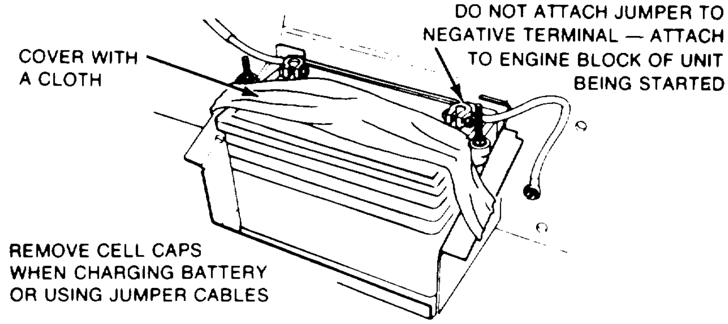
(1) remove vent caps and cover the battery fill openings with a cloth
(2) shield eyes

(3) connect ends of one cable to positive (+) terminals of each battery.

(4) connect one end of other cable to negative (-) terminal of "good" battery.

(5) connect other end of cable to engine block on unit being started (NOT TO NEGATIVE (-) TERMINAL OF BATTERY).

To prevent damage to other electrical components on unit being started, make certain that engine is at idle speed before disconnecting jumper cables.



REMOVE CELL CAPS AND COVER THE BATTERY FILL OPENINGS WITH A CLOTH WHEN CHARGING OR USING JUNIPER CABLES.

WARNING - Batteries contain SULFURIC ACID. In case of acid contact with skin, eyes, or clothing, FLUSH IMMEDIATELY WITH WATER FOR A MINIMUM OF FIVE MINUTES. Get "on-the-spot" medical attention immediately.

Hydrogen and oxygen gases are produced during normal battery operation. This gas mixture can explode if flames or sparks are brought near the battery. When charging or using battery in an enclosed space always provide ventilation.

Keep fire away from the top of open battery cells. Combustible gas is always present.

CAUTION - Avoid the use of a 24-volt battery booster and jumper cable hook-up to start an engine with a dead battery, as this will damage the unit's electrical system.

MAINTENANCE SCHEDULE AND RECORD

Initial Start-up Sequence	Operation	Daily	Every 100 Hours	Every 200 Hours	Every 400 Hours	Every 800 Hours	Seasonal or As Required	More Frequent (1)
1	Oil, Engine, Check Level							
2	Coolant, Check Level in Radiator							
3	Fuel, Oil and Coolant Leaks, Check							
4	Governor, Check Oil Level	(2)						
	PTO Release Bearing, Lubricate							
	Oil, Engine Change							
	Oil Filter, Change							
5	Air Cleaner (Oil Bath), Clean and Refill							
5	Air Cleaner (Dry Type), Clean or Replace Element							
6	Battery, Check Charge and Level							
	Crankcase Vent System							
	Distributor, Lubricate							
7	PTO Bearings, Lubricate							
	Radiator, Inspect and Clean Exterior							
	Battery Cables, Clean							
9	Fan, Alternator & Governor Belts, Check and Adjust							
	Throttle, Governor and Choke Linkage, Lubricate							
	Fuel Filter, Replace							
	Cooling System, Check or Refill							
14	Idle Speed, Check and Adjust							
15	Idle Mixture, Check and Adjust							
	Spark Plugs, Clean, Adjust and Test							
	Distributor, Clean and Check Points							
10	Ignition Timing, Check and Adjust (Check Advance)							
	PCV Valve, Replace (If So Equipped)							
	PCV Hoses, Tubes, and Fittings, Clean (If So Equipped)							
11	Intake Manifold Bolts, Torque							
16	Throttle and Governor, Adjust							
	Spark Plugs, Replace							
	Points, Replace							
12	Cylinder Head Bolts, Torque							
13	All Bolts and Nuts, Check for Tightness							
8	PTO Clutch Release and Shaft Bearings, Adjust							

(1) More frequent Intervals may be required n dusty areas

(2) Check Governor off level weekly

MAINTENANCE INSTRUCTIONS

Initial Start Up

Your Ford Industrial Engine was inspected before leaving the factory. However, the initial start-up checks must be made before putting the unit into operation. The Preventive Maintenance Schedule (Page 14) provides a handy check-off list as well as a sign- off and record as to when the operations were performed. Perform the operations in the sequence listed in the left hand column.

Routine Service

Make sure your unit is ready to go whenever you need it. There are some things that you can do, or have done, to be sure it is well cared for:

- Keep the fuel tank filled. A full tank reduces the possibility of condensation forming in the tank and moisture entering the fuel lines.
- Make frequent checks of the engine oil and coolant levels.
- Check the battery fluid level often, especially if your engine is being operated in a warm, dry climate.
- Keep engine air filter clean.
- Watch the engine temperature.
- Watch engine oil pressure.
- Watch the ammeter.
- Lube power take-off regularly.

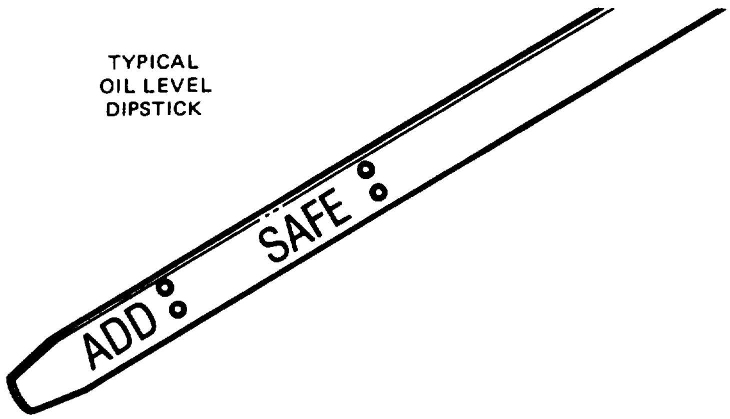
Scheduled Preventive Maintenance

The operations listed in the maintenance schedule are covered in detail on the following pages. Whenever your vehicle requires maintenance of any kind, your Ford Power Products distributor or dealer has skilled technicians who will do an expert job of keeping your engine in its prime condition.

Engine Oil

Checking Oil Level

The oil level should be checked frequently, at least daily, and maintained between the ADD and SAFE marks on the dipstick. Allow a few minutes after shutting the engine off for the oil to drain down before checking.



CAUTION - Do not operate the engine with the oil level below the SAFE mark on the dipstick.

Adding Oil

It is normal to add some oil between oil changes. The amount will vary with the severity of operations. When adding or replacing engine oil be sure oils meet the specifications listed.

Changing Oil and Filter

For most operations, the engine oil and filter must be changed every 100 hours or seasonally. Under normal operating conditions, you do not need to change more often if you use oil and filters of the recommended quality.

The oil and filter should be changed more often if the engine is operated in dusty areas, for extended idling or low speed operation, or frequent stops during cold weather. No break-in oil change is required.

Oil Quality

In order to properly protect your engine, you should use motor oils marked on the container as meeting S.A.E. Classifications SE, SD or Ford Specification ESE-M2C101-C. Oils meeting these specifications have been formulated to keep the engine operating at peak efficiency and inhibit the formation of corrosive acids.

Oil Viscosity

When you change or add oil, you should select oil with the proper specifications and with the viscosity, selected from the following table, which most closely matches temperature range you expect to encounter for the next 100 hours of operation.

SINGLE VISCOSITY OILS When Outside Temperature is Consistently	Use SAE Viscosity Number
-100F to +320F	(') 10W
+10OF. to +60°F	20W-20
+32OF to +90°F	30
Above 60°F	40

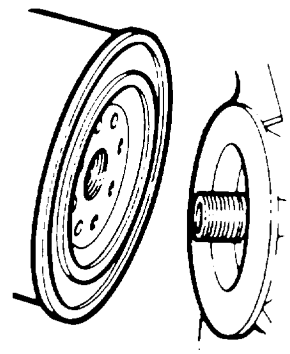
MULTI-VISCOSITY OILS When Outside Temperature is Consistently	Use SAE Viscosity Number
Below +32OF	(') 5W-30
-10°F to+90°F	O1W-30
-100F. to +900F. (or above)	10W-40
Above +1 0°F	20W-40

(*) Where sustained high RPM operation is anticipated, use 20W20.

Oil Filter

Your engine is equipped with a Motorcraft oil filter. A filter of this quality should be used throughout the life of the engine. It is designed to protect your engine by filtering harmful abrasive and sludgy particles without clogging up or blocking the flow of oil to vital engine parts. This filter is especially designed for use in engines built by Ford to give successful operation with the recommended oil and filter change intervals.

Spin-On Type Filter Replacement To replace the spin-on filter, place a drain pan under the filter and unscrew the filter unit. Discard the entire unit. Coat the gasket surface of the new filter with engine oil and hand-tighten it onto the adapter until the gasket contacts the adapter face; then advance another one-half turn. Fill the crankcase and run the engine to check for leaks.



CAUTION - Do not handle a hot oil filter with bare hands.

Refer to the maintenance schedules for the proper intervals for changing the oil filter.

Air Cleaner

Oil Bath

The air cleaner should be inspected constantly for leaks. A damaged air cleaner can seriously affect the performance and life of the engine. The following service steps should be made each time the engine is serviced.

- Watch all connections for mechanical tightness.
- If cleaner has been dented or damaged, check all connections immediately.
- In case of leakage and if adjustment does not correct the trouble, replace necessary parts or gaskets.

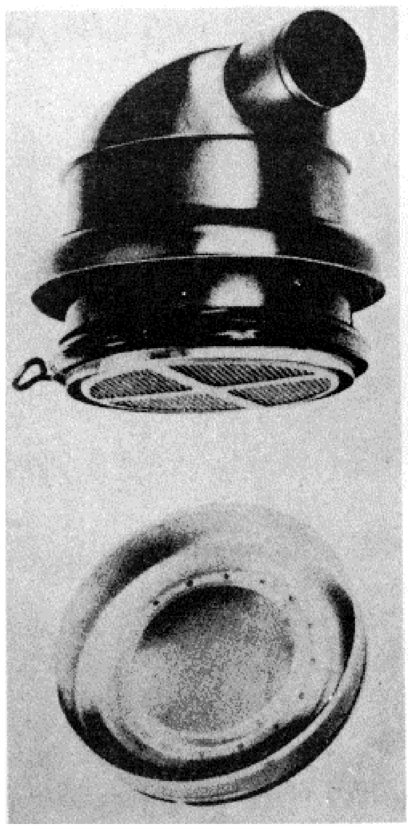
Cleaning

Remove the air cleaner lower section which consists of the oil cup. Remove the body of the air cleaner from its mounting. Soak the body assembly or element in fuel oil to loosen the dirt, then flush the element with clean fuel oil and allow it to drain thoroughly. Push a lint-free cloth through the center tube to remove any dirt or oil. Pour out the oil in the cup, remove all sludge and wipe .the baffle and cup clean. Clean and check all gaskets and sealing surfaces to ensure the air-tight seals.

CAUTION - Do not over or under fill the cup. Over-filling means loss of filtering capacity. Under-filling means lack of efficiency.

Check the air inlet housing before installing the air cleaner assembly on the engine. The inlet will be dirty if the air cleaner servicing has been neglected, if dust-laden air has been leaking past the air cleaner to air inlet housing seal or if the flex tubing is ruptured.

Install the body of the air cleaner in its mounting bracket and then install the lower portion to the body. Make sure that the flex tubing is mounted securely to the air inlet housing and the filter outlet.

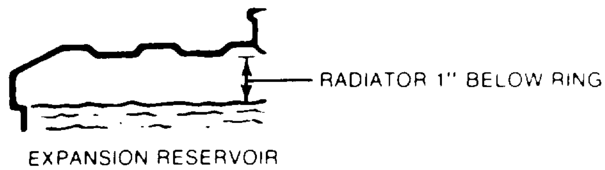


Air Cleaner - Oil Bath Type

COOLING SYSTEM

Coolant Level

Maintain the coolant level at one inch below the top of the radiator upper tank.



CAUTION - Avoid injury when checking a hot engine. Cover the radiator cap in a thick cloth and turn it slowly counterclockwise to the first stop. After the pressure has been completely released, press downward and finish removing cap. Do not add coolant to an engine that has become overheated until the engine cools. Adding coolant to an extremely hot engine can result in a cracked block or cylinder head.

In freezing weather, test the coolant for proper antifreeze protection to anticipated lowest temperature. Add antifreeze solution to maintain proper protection.

Radiator

Inspect the exterior of the radiator for obstructions. Remove all bugs, dirt or foreign material with a soft brush or cloth. Use care to avoid damaging the fins. If available, use compressed air or a stream of water to dislodge particles between the fins. Use compressed air or water in the opposite direction to normal air flow.

Check all hoses and connections for leaks. If any of the hoses are cracked, frayed, or feel spongy, they should be replaced.

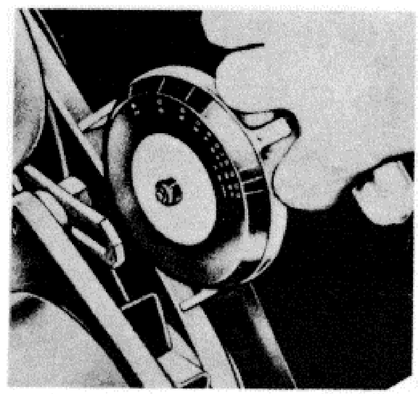
When refilling the cooling system with plain water add one can of Ford Rotunda Rust Inhibitor 8A-19546-C. If temperatures below +320F. are anticipated, replenish coolant with equal parts water and Ford Rotunda Long Life Coolant Concentrate 8A-19549-A. This will provide protection to -350F. If coolant other than this is used it must meet Ford Specification M-97B18C.

DRIVE BELTS

The water pump is belt driven. This same belt may also drive the fan and/or alternator. The drive belt(s) should be properly adjusted at all times. A loose drive belt causes improper alternator, fan and water pump operation, in addition to overheating. Over tightening the belt may result in excessive wear on the alternator and water pump bearings, as well as premature wear on the belt itself. Therefore, it is recommended that a belt tension gauge be used to check and adjust the belt tension. Any belt that has operated for a minimum of 10 minutes is considered a used belt, and, when adjusted, it must be adjusted to the reset tension shown in the specifications.

Belt Tension

Install the belt tension tool on the drive belt and check the tension following the instructions of the tool manufacturer.



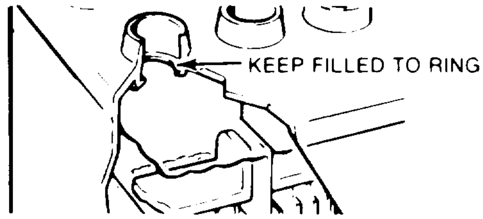
Checking Belt Tension

If the tension is not to specification, loosen the alternator mounting and adjusting arm bolts. Move the alternator away from the engine until the correct tension is obtained. Remove the gauge. Tighten the alternator adjusting arm and mounting bolts. Install the tension gauge and recheck the belt tension.

BATTERY

Checking Water Level

Because the battery is the "heart" of your unit’s electrical system, periodic checks arc necessary to keep it functioning properly. Keep the battery fluid level up to the ring under the filler cap.



Adding Water

Ordinary tap water may be used except in areas where the water is known to be exceptionally hard or to have a high mineral or alkali content. In such areas, use distilled water. If water is added during freezing weather, run the engine 20 to 30 minutes before shutting it off. This mixes the added water with the electrolyte and will prevent it from freezing and damaging the battery. Have the battery charge checked regularly during extremely cold weather. When the specific gravity falls below 1.230 (corrected to 800F), recharge the battery. Make sure the cables are clean and tightly clamped to the battery terminals. Keep the top of the battery clean and dry.

Keep fire away from the top of open battery cells. Combustible gas is always present.

If there is any corrosion on the cables and terminals remove it with a wire brush and neutralize the acid with a solution of baking soda or ammonia and water. After cleaning, flush the top of the battery with clean water, install the terminal clamps on the battery posts, and coat the parts with grease to retard further corrosion.

CRANKCASE VENTILATION SYSTEM

Open System

The engines equipped with the open crankcase ventilation have two breather caps, located on the rocker cover. The caps should be cleaned in a petroleum solvent at every oil change.

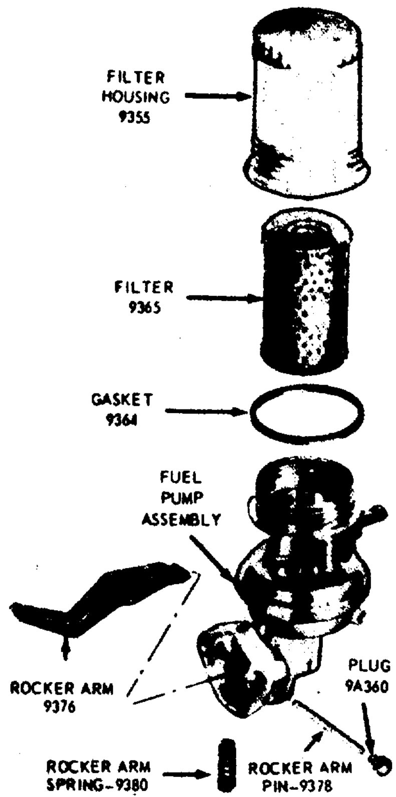
Closed System (P.C.V.)

The closed system is known as the positive crankcase ventilation system. Clean air is supplied from the air cleaner by a tube to the closed oil filler cap on the rocker cover. The fumes are vented out through a regulator valve at the rear of the rocker cover and into the intake manifold. The P.C.V. valve (regulator valve) must be replaced at 400 hours. The hoses, tubes and fittings of this system must be cleaned at 800 hours.

FUEL FILTERS

Disposable Filter

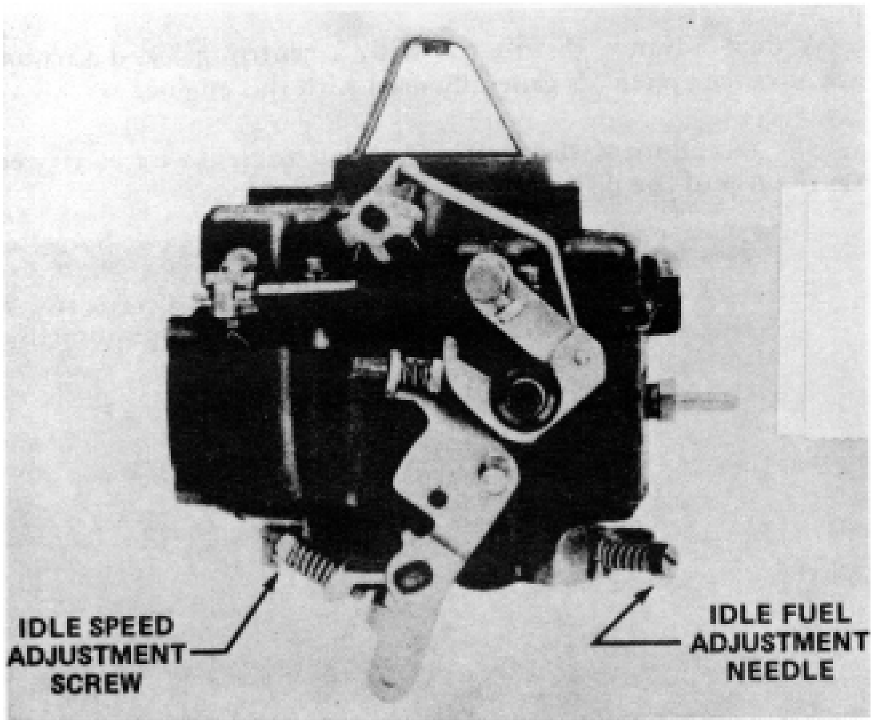
The disposable filter is located on the fuel pump body. Unscrew the filter housing from the body and remove the filter element and gasket. Discard the element and gasket. Clean the filter housing in a petroleum cleaning solvent.



Disposable Filter

Place a new filter clement over the spout in the body. Be sure to use the proper type element for the installation. Coat the new gasket with light engine oil and position the gasket on the filter housing or body. Screw the filter housing onto the filter body. Hand tighten the filter housing until the gasket contacts the body, and then tighten an additional 1/8 turn. Start the engine and check for leaks.

CARBURETOR ADJUSTMENTS



Carburetor Idle Adjustment Points

NOTE: *The final idle speed and mixture adjustments are made when the engine is at operating temperature.*

Operate the engine until a normal operating temperature is obtained. Make sure the choke plate is fully open. Turn the idle speed adjustment screw until the desired rpm is obtained. Turn the idle fuel adjustment screw inward until the engine rpm begins to drop from the lean mixture. Turn the needle outward (counterclockwise) until the engine rpm increases and just begins to drop from the rich mixture; then turn the screw inward for maximum engine rpm and smoothness. Always favor a rich mixture rather than a lean mixture for final adjustment. A lean mixture will put an unnecessary heat load on the valves, and may cause premature valve failure.

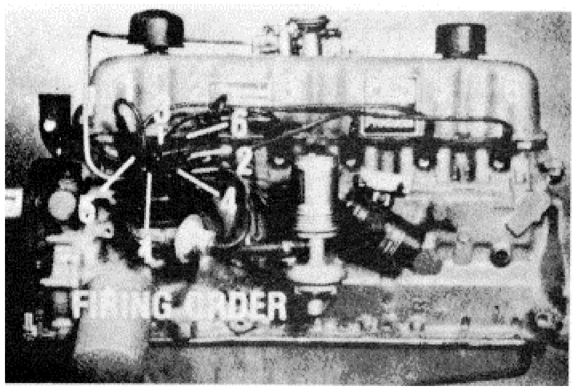
Check the engine idle speed and adjust it to specifications if necessary. Final engine idle speed may be varied within the specified rpm range to suit the conditions under which the unit is to be operated.

IGNITION SYSTEM

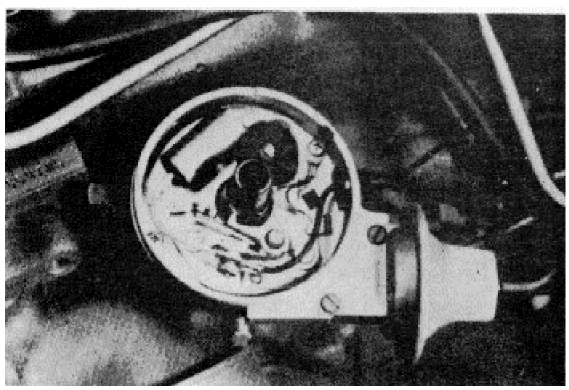
A dual advance distributor with a centrifugal and vacuum spark advance system, is generally used with this engine.

The direction of distributor rotation is clockwise as viewed from the top of the distributor.

The spark plug wires arc inserted in the distributor cap in the firing order of the engine 1-5-3-6-2-4. Number one socket is identified by the number one on the cap. The cylinders are numbered from front to rear - 1-2-3-4-5-6.



Engine Ignition Wiring



Dual Advance Distributor

Performance, fuel economy, and life expectancy of the engine depend largely on the correct distributor maintenance.

Breaker Point Check and Adjustment

At the specified intervals, the breaker points should be checked and adjusted as necessary. Inspect the points for excessive metal transfer, or a pitted or badly burned condition. Inspect the rubbing block for a loose, chipped or broken condition. Replace the defective points.

NOTE: *Do not use a file, sandpaper, or emery cloth to clean or remove pits from distributor points. Any abrasion of the point surfaces only causes them to burn faster. Files should be used only on spark plug electrodes.*

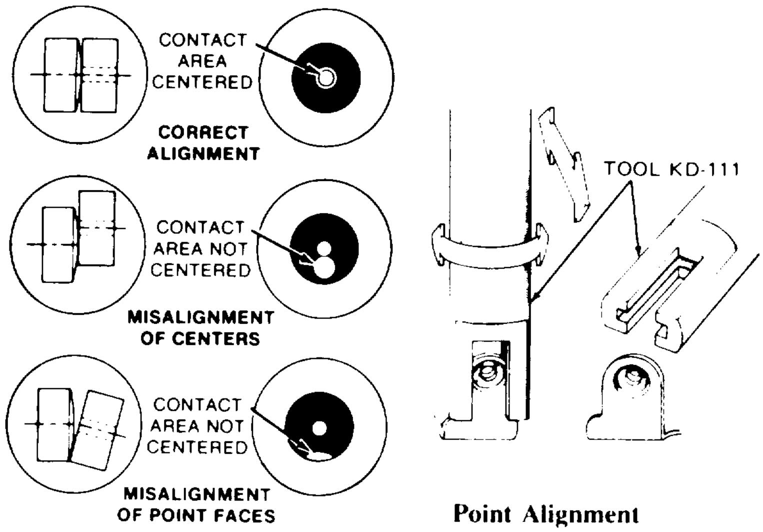
Replace Distributor Points

At the recommended intervals, or whenever inspection indicates a need, the distributor breaker points should be replaced. Replacement can be made without removing the distributor.

Disconnect the condenser and primary leads from the breaker point assembly. Remove the screws that secure the assembly to the breaker plate, then remove the assembly.

To install, place the assembly in position and install retaining screws. Be sure that the ground wire is under the breaker point screw near the pivot. Attach primary and condenser wires to assembly. Apply a light film of distributor cam lubricant to the cam. *Do not use engine oil.*

The vented-type breaker points must be accurately aligned and strike squarely in order to realize the full advantage provided by this design and to insure normal breaker point life. Turn the distributor cam (energize starter if distributor is in engine) so that breaker points are closed. Check the alignment of the points with a magnifying glass. Align the points to make full face contact by bending the stationary point bracket. Do not bend the movable arm. It is recommended that a special alignment tool be used for this operation.



Breaker Point Alignment

After the breaker points have been aligned, they should be adjusted to the correct gap with a feeler gauge or dwell meter. To adjust the points with a feeler gauge, turn the distributor shaft until the rubbing block rests on the peak of a cam lobe. Insert the correct blade of a clean feeler gauge between the points. The gap should be set to the larger opening (0.027 inch) because the rubbing block will wear down slightly while seating to the cam. When setting the points with a dwell meter, adjust the dwell angle to the low setting (35°). This will also compensate for rubbing block wear.

IGNITION TIMING

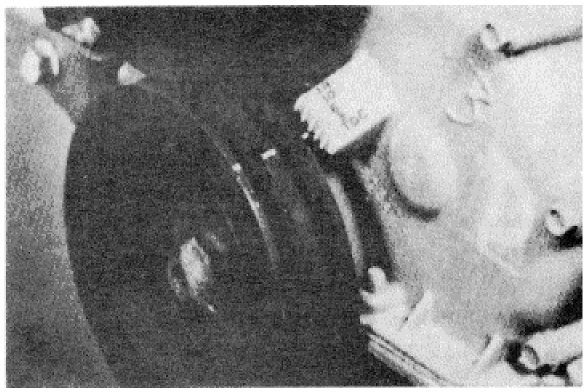
Each time the distributor points are replaced or adjusted, the ignition timing should be checked and adjusted as necessary. Proper adjustment of ignition timing must be maintained to provide maximum engine power output and best possible fuel economy.

The timing marks arc located on the engine front cover and can be seen from the left side. These marks and a notch on the crankshaft pulley or damper arc used to time the engine. The recommended timing setting is 60 B.T.D.C. Adjust the ignition timing as follows:

Disconnect the distributor vacuum line. Connect the timing light high tension lead to the No. 1 spark plug (front cylinder), and the other two leads to the proper battery terminals. Clean and chalk the timing marks to improve legibility.

Operate the engine at a maximum of 550 rpm, and direct the timing light at the pointer, keeping the timing marks in line with the center of the pulley and the light. The light should flash just as the 6) mark lines up with the notch on the damper.

If the 60 mark and the notch do not line up, loosen the distributor body clamp, and rotate the distributor until the mark and notch arc in line.



Ignition Timing Marks

NOTE*: Ignition timing is advance by counterclockwise rotation of the distributor body - retarded by clockwise rotation.*

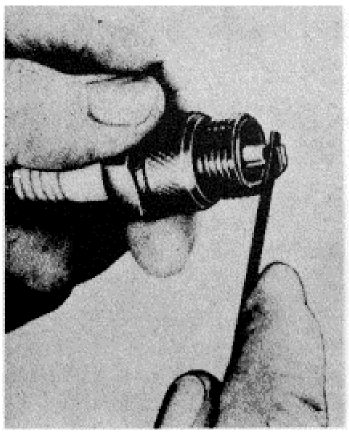
When the proper timing is obtained, tighten the distributor body clamp and connect the distributor vacuum line, then accelerate the engine %while watching the timing mark with the timing light to determine if the advance mechanism is functioning. The notch on the crankshaft pulley should advance as engine rpm increases. This check will confirm whether or not the advance mechanism 1s functioning, hut it does not indicate proper distributor calibration.

In order to properly adjust the distributor advance, the distributor must be removed from the engine and checked on a distributor testing machine. If you do not have the proper equipment, your local Ford Industrial Products Dealer will be pleased to perform this operation for you. The distributor advance specifications are given in the Specifications Section.

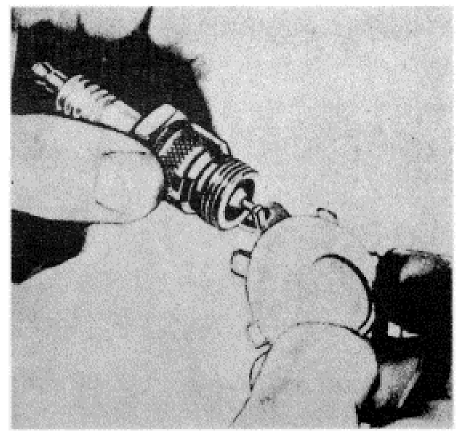
Spark Plugs

The spark plugs should be cleaned, tested and gapped at the recommended intervals.

Remove the wires from each spark plug by grasping, twisting and then pulling the moulded cap of the wire only. Do not pull directly on the wire because the wire connection inside the cap may become separated.



Dressing Spark Plug Electrodes



Spark Plug Gapping

After loosening each spark plug one or two turns, clean the area around each spark plug port with compressed air, then remove the spark plugs.

After cleaning, examine the plug carefully for cracked or broken insulators, badly pitted electrodes, and other signs of malfunction. Replace as required.

After cleaning, dress the electrodes with a small file to obtain flat parallel surfaces on both the center and side electrodes. Set the spark plug gap to specifications by bending the ground electrode. All spark plugs new or used should have the gap checked as required.

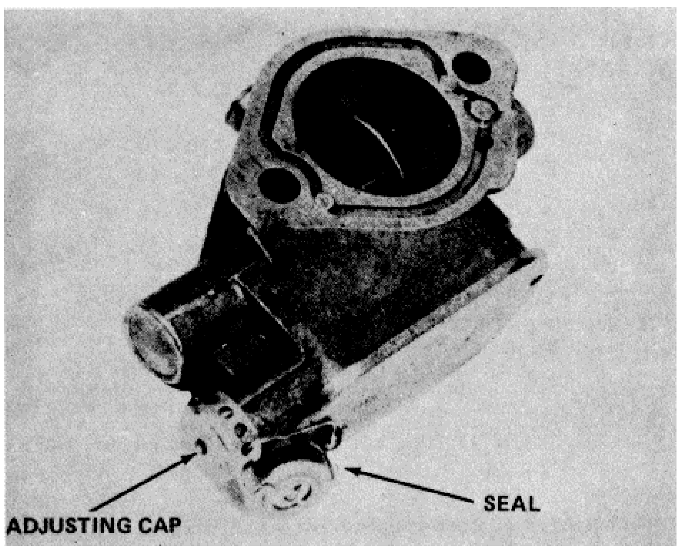
Install the spark plugs and torque each plug to specifications.
Connect the spark plug wires.

NOTE - Do not over tighten spark plugs. The gap may change considerably due to distortion of the plug outer shell.

Governor

Velocity Governor - Adjustment

The velocity governor is a single unit mounted between the carburetor and the intake manifold. There is no provision for repair of this unit. It should be replaced when defective.



Velocity Governor

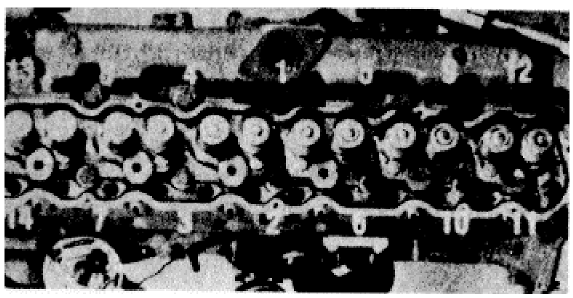
With the engine at normal operating temperature, operate the engine at wide open throttle and compare the rpm with the operating range which is stamped on the governor plate. In no case is the engine rpm to exceed 2800 rpm.

If adjustment is required, remove the seal attached to the governor adjusting cap. Turn the cap counterclockwise to increase rpm, clockwise to decrease rpm. When the adjustment is completed, stop the engine and reattach the seal.

CYLINDER HEAD BOLT TORQUE

The cylinder head bolts are tightened in three progressive steps, starting with the center bolts and working outward. Torque the bolts to 50-55 ft-lbs then to 60-65 ft-lbs and finally to 70-75 ft-lbs.

Torque the cylinder head bolts before starting your engine and also after the engine has been warmed up to normal operating temperature.



Cylinder Head Tightening Sequence

Lubrication

At the specified intervals, apply a few drops of engine oil to the distributor oil felt and apply an appropriate lubricant, such as Lubriplate (COAZ-19584-A) at the pivot points of the throttle, governor and choke linkage.

If equipped with a tachometer, disconnect the distributor head connections and remove cable from housing. Coat lightly with an appropriate lubricant such as Lubriplate (Ford part number COAZ-19584-A) or speedometer cable lubricant (B5A-19581-A). Replace cable in housing and attach housing to distributor and tachometer head. Be sure that the ends of the cable are firmly seated in their respective receptacles before starting the engine.

Perform this operation at specified intervals, and oftener if needle shows a tendency to fluctuate during operation.

STORAGE

One Month

While engine is running, treat upper cylinders by spraying N1-4834-A, Engine Preservative Oil (S.A.E. 10), or equivalent into carburetor air intake for about two minutes. Open throttle for short burst of speed, shut off ignition and allow engine to come to a stop while continuing to spray M-4834-A into air intake.

Leave spark plugs in holes or seal spark plug holes with suitable threaded metal plugs and cover all openings into engine with dust proof caps or shields.

Drain oil, water, and gasoline.

If engine is less transmission, spray flywheel and ring gear with mixture of one part M-4850, Anti-Rust Bodied Oil, and one part M-4970, Stoddard Solvent, or equivalents.

MAINTENANCE INSTRUCTIONS

For Indefinite Period

Drain crankcase completely and refill with M-4834-A, Engine Preservative Oil (S.A.E. 10), or equivalent.

Run engine until completely out of gasoline, then restart and run on M-534-H or equivalent unleaded, undyed gasoline for at least 10 minutes.

While engine is still running and at completion of above run, treat upper cylinders by spraying NM-4834-A into carburetor air intake for about two minutes. Open throttle for short burst of speed, shut off ignition and allow engine to come to a stop while continuing to spray M-4834-A into air intake.

Drain oil and gasoline. Drain water at the bottom of radiator and also left rear side of cylinder block.

Disconnect and remove battery.

Remove grease and oil from exterior surface of engine. Leave spark plugs in holes or seal spark plug holes with suitable threaded metal plugs.

Seal all openings in engine and accessories with M-6471, Nonhydroscopic Adhesive Tape, or equivalent. Mask off all areas to be used for electrical contact.

Make sure all surfaces are dry, then spray all taped openings, all engine accessories including ignition wiring, and all exterior surfaces of engine with M-4858-B, Insulation Compound, or equivalent.

If engines are equipped with automotive type clutch, block clutch in slightly disengaged position so that lining and pressure plate are not in contact.

Specifications

All Specifications are given in inches unless otherwise noted.

GENERAL

Maximum Gross Horsepower at rpm
200 .... 99 at 2800

Maximum Gross Torque - Foot Pounds at rpm
200 .... 180 at 2200

Bore and Stroke
200 .... 3.68 x 3.13

Firing Order 1-5-3-6-2-4
Idle Speed (rpm) 550
Oil Capacity with Filter (Approximate) .... 4.5 qts.

CYLINDER HEADS

Gasket Surface Flatness .... 003 inch in any 6 inches or .007 inch overall
Valve Guide Bore Diameter 0.3115-0.3125
Valve Seat Width
Intake 0.060-0.080
Exhaust 0.070-0.090
Valve Seat Angle .... 45°
Valve Seat Runout - Maximum 0.0015

VALVE MECHANISM

Valve Lash - Hot and Cold .... Zero
Valve Stem Diameter
Intake
Standard 0.3100-0.3107
0.003 Oversize 0.3130-0.3137
0.015 Oversize 0.3250-0.3257
0.030 Oversize 0.3400-0.3407
Exhaust
Standard 0.3098-0.3105
0.003 Oversize 0.3128-0.3135
0.015 Oversize 0.3248-0.3255
0.030 Oversize 0.3398-0.3405
Valve Face Angle .... 44°

Valve Stem to Valve Guide Clearance
Intake 0.0008-0.0025
Wear Limit 0.0055
Exhaust 0.0010-0.0027
Wear Limit 0.0055
Valve Head Diameter
Intake 1.642-1.660
Exhaust 1.381-1.399
Valve Face Runout.. Wear Limit 0.002
Valve Spring Free Length - Approximate..1.79
Valve Spring Out of Square - Maximum 0.078
Valve Spring Pressure -
Lbs at Specified Length .... 51-57 at 1.590
Wear Limit 46 at 1.590
142-158 at 1.222
Wear Limit 128 at 1.222
Valve Spring Assembled Height -
Pad to Retainer ....1-9/16 - 1-5/8
Hydraulic Valve Lifter Leak Down
Rate - Second 5-50
Valve Push Rod Runout- Maximum 0.025
Valve Tappet Diameter - Standard 0.8740-0.8745
Valve Tappet to Tappet
Bore Clearance 0.0007-0.0027
Wear Limit 0.0050
Valve Tappet - Collapsed
Valve Clearance
200 .... 079-.209

CAMSHAFT AND TIMING GEARS

Camshaft Journal Diameter -Standard 1.8094-1.8105
Camshaft Journal Runout..0.008
Camshaft Journal to Bearing Clearance.. 0.001-0.003
Wear Limit 0.006
Camshaft Journal Out-of-Round 0.0005
Camshaft End Play.. 0.001-0.007
Wear Limit 0.009
Camshaft Gear to Crankshaft
Gear Backlash 0.002-0.004

Camshaft Lobe Lift
Intake 0.2320
Exhaust 0.2320
Maximum Allowable Lobe Lift Loss 0.005
Assembled Gear Face Runout - Maximum 0.005
Timing Chain Deflection - Maximum 0.500

CAMSHAFT BEARINGS

Inside Diameter 1.8115-1.8125
Location in Relation to Front Face
of Block Cam Bearing Bore Face -
No. 1 Bearing Only - Below 0.1150-0.1250

FLYWHEEL

Flywheel Clutch Face Runout - Maximum 0.007
Assembled Flywheel O.D. Runout 0.018

CRANKSHAFT

Main Bearing Journal Diameter
200 .... 2.2482-2.2490

Main Bearing Journal Runout 0.005
Connecting Rod and Main Bearing
Journals Out-of-Round - Maximum 0.0004
Connecting Rod and Main Bearing
Journals Taper - Maximum 0.0003/inch
Thrust Bearing Journal Length
200 .... 1.275-1.277

Main Bearing Journal Thrust
Face Runout 0.001
Connecting Rod Journal Diameter 2.1232-2.1240
Crankshaft Free End Play 0.004-0.008
Wear Limit 0.012
Assembled Gear Face Runout 0.010

MAIN BEARINGS

Journal Clearance 0.008-0.0024
Wall Thickness
200 .... 0.0758-0.0761

SPECIFICATIONS

CONNECTING ROD

Piston Pin Bushing l.D. - Standard 0.9107-0.9112
Bearing Bore Diameter 2.2390-2.2398
Bearing Bore Out-of-Round and Taper 0.0004
Connecting Rod Length - Center to Center
200 .... 4.71354.7165

Twist Total Difference - Maximum' 0.008
Bend Total Difference -Maximum 0.004
Connecting Rod Assembly - Assembled
to Crankshaft Side Clearance 0.0035-0.0105
Wear Limit 0.014

'Pin bushing and crankshaft bearing bore must be parallel and in the same vertical plane within the specified total difference at ends of 8-inch long bar measured 4 inches on each side of rod.

CONNECTING ROD BEARINGS

Bearing to Crankshaft Clearance -
Maximum 0.0008-0.0023
Wall Thickness - Standard 0.0571-0.0574

PISTON

Piston Diameter
Coded Red 3.6784-3.6790
Coded Blue 3.6776-3.6802
0.003 Oversize 3.6808-3.6814
Piston to Bore Clearance* 0.0013-0.0021

*Measured 900 to pin centerline and at pin centerline height.

PISTON PIN

Piston Pin Diameter - Standard 0.9120-0.9123
Piston Pin Length 3.010-3.040
Piston Pin to Piston Clearance 0.0003-0.0005
Wear Limit 0.0008

PISTON RINGS

Top Compression Ring Width 0.077-0.078
Bottom Compression Ring Width 0.077-0.078

Top Compression Ring Side Clearance 0.002-0.004
Bottom Compression Ring Side Clearance 0.002-0.004
Compression Ring Side Clearance Wear Limit 0.006
Oil Ring Side Clearance .... Snug
Oil Ring Side Clearance Wear Limit 0.0070
Top Compression Ring - Standard Bore -
Ring Gap Width 0.010-0.020
Bottom Compression Ring - Standard
Bore - Ring Gap Width 0.010-0.020
Oil Pan - Standard Bore - Ring Gap Width 0.015-0.055

CYLINDER BLOCK

Cylinder Bore Diameter 3.6800-3.6836
Cylinder Bore Out-of-Round -
Maximum 0.0010
Wear Limit 0.0050
Cylinder Bore Taper 0.001
Wear Limit 0.010
Head Gasket Surface Flatness .... 0.003 inch in any 6
inches or 0.007 inch overall
Main Bearing Bore Diameter
200 .... 2.4012-2.4020

OIL PUMP

Relief Valve Spring tension - Lbs at Specified Length
200 .... 9.0-10.1 at 1.078

Relief Valve Clearance 0.0015-0.0029
Drive Shaft to Housing Bearing Clearance 0.0015-0.0029
Rotor Assembly End Clearance -
Pump Assembled 0.001-0.004
Outer Race to Housing -
Radial Clearance 0.006-0.013
Oil Pressure - Hot at 2000 rpm 35-60

IGNITION SYSTEM

Ignition Timing - B.T.C. - Recommended 60
Breaker Arm Spring Tension (Ounces) 17-21
Contact Spacing 0.027
Contact Dwell at Idle Speed .... 350 -390

SPECIFICATIONS

Shaft End Play Clearance 0.022-0.033
Condenser
  Capacity (Microfarads) 0.21-0.25
  Maximum Leakage (Megohms) 10
  Maximum Series Resistance (Ohms) 1
Coil
  Primary Resistance (Ohms) 1.40-1.54 (750F.)
  Secondary Resistance (Ohms) 7600-8800 (750F.)
  Amperage Draw
  Engine Stopped 4.5
  Engine Idling 2.5
  Primary Circuit Resistor (Ohms) 1.30-1.40 (750F.)
Spark Plugs
  Type .... Autolite BRF-82
  Size 18mm
  Gap (Inches) 0.034
  Torque (ft-lbs) 15-20

DISTRIBUTOR ADVANCE CHARACTERISTICS

CENTRIFUGAL ADVANCE. Set the test stand to ^{0o} at 250 rpm and O inches of vacuum.

rpm (Distributor)	Advance (Degrees)	Vacuum (Inches of Mercury)
500	'/2-11/,	0
750	4'/2 - 61/2	0
1000	6 - 8	0
1500	8 - 10	0
2000	81/2 - 11	0

VACUUM ADVANCE. Set the test stand to ^{0o} at 1000 rpm and 0 inches of vacuum.

rpm (Distributor)	Advance (Degrees)	Vacuum (Inches of Mercury)
1000	0 - 1%	5
1000	2 -6	10
1000	6% - 9%	12%1

SPECIFICATIONS

CARBURETOR

The following specifications are applicable to the D5JL-9510-C carburetor.

Name	Holly
Model	1940
List No	7458
Main jet	#66
Power Valve Timing (In. hg)	7.5-5.5
Idle RPM	550-575
Fast Idle	1500

THERMOSTAT

Begins to Open (OF.)	157-164
Fully Open (OF.)	190

TORQUE LIMITS - FOOT-POUNDS

Main Bearing Cap Bolts - Oiled Threads	60-70
Cylinder Head Bolts - Oiled Threads	
Step 1	50
Step 2	65
Step 3	75
Oil Pan to Cylinder Block	7-9
Manifold to Cylinder Head	13-18
Exhaust Pipe to Manifold	25-35
Flywheel to Crankshaft	75-85
Oil Pump to Cylinder Block	12-15
Oil Pump to Cover Plate	9-12
Oil Filter Adapter to Cylinder Block	10-15
Oil Filter	Gasket contact plus 1/2 turn
Cylinder Front Cover	7-9
Water Outlet Housing	12-15
Valve Rocker Arm Cover	3-5
Damper or Pulley to Crankshaft	85-100
Connecting Rod Nuts	19-24
Camshaft Thrust Plate to Block	12-15

Valve Rocker Arm Stud Adjusting Nut* 4.5-15
Water Pump to Cylinder Block 12-15
Oil Pick-up Tube to Oil Pump 12-15
Engine Governor to Cylinder Block 23-28
Oil Pan Drain Plug 15-25
Camshaft Sprocket to Camshaft 3545
*With tappet on camshaft base circle, turn adjusting nut counterclockwise.

TORQUE LIMITS FOR VARIOUS SIZE BOLTS

CAUTION: In the event that any of the limits below are in disagreement with any of those listed above, the above limits prevail.

Size (Inches)	1/4-20	1/4-28	5/16-18	5/16-24	3/8-16	3/8-24
Torque (foot-pounds)	6-9	6-9	12-18	15-18	22-32	30-35
Size (Inches)	7/16-14	7/16-20	1/2-13	1/2-20	9/16-18	5/8-18
Torque (Foot-Pounds	40-55	50-60	5580	70-80	85-120	130-145

BELT TENSION

All Except Governor
- New .... 140 Lbs.
- Used .... 110Lbs.

Governor
- New .... 70 Lbs.
- Used .... 50 Lbs.

Any belt that has operated for ten minutes or more is considered a used belt.

LUBE OIL SPECIFICATIONS

There are numerous commercial crankcase oils marketed today. Lubricants marketed for gasoline and/or diesel service consist of refined crude oil to which has been added additives compounded to meet desired engine performance levels. Oil additive selection is based on evaluations conducted by the oil supplier. (The term oil supplier refers to refiners, blenders and rebranders of petroleum products and does not include distributors of such products.) Experience has shown that oil performance in commercial gasoline and diesel service applications varies from brand to brand.

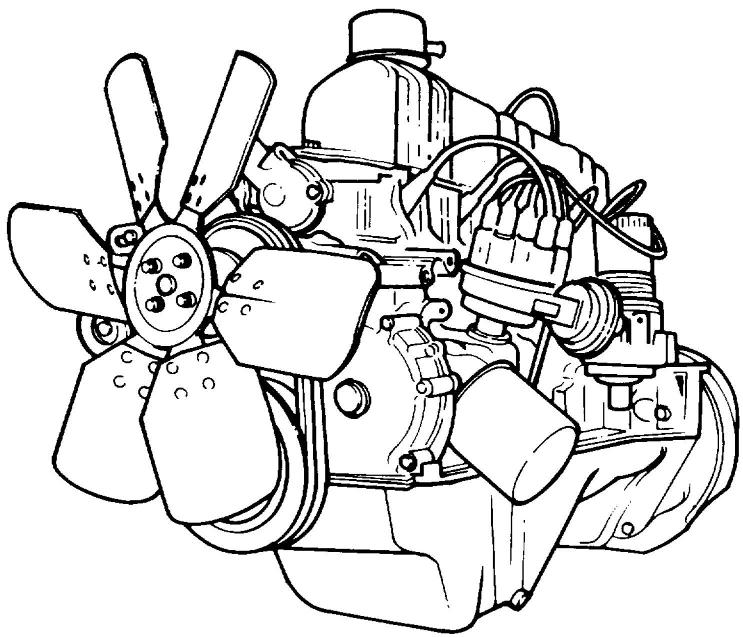
Ford industrial engines have given optimum performance and experienced the longest service with oils which meet Ford Specification ESE-Nl2C101-C or API rating SD/SE.

The oil filter elements must be replaced each time the oil is changed. It is recommended that only oil filters that meet Ford Specification ESE-C8AF-6714-A, or "C" be used. Oil filters that state on the filter or container that they are acceptable for engine manufacturers' warrant) coverage replacement arc acceptable to Ford Industrial Engine and Turbine Operations. The importance of adhering to the foregoing recommendation particularly in service applications cannot be over-emphasized. Operators should be cautioned that failure to adhere to Ford lubrication system recommendations can void their warranty coverage.

INDEX

SERVICE
(REPAIR AND OVERHAUL)
INSTRUCTIONS

FORD INDUSTRIAL
GASOLINE ENGINE
3.3 LITRE (200 CID)



Introduction

This Service Manual provides the Service technician with information for the proper servicing of the Ford 200 CID Industrial Engine.

In general, this manual covers the servicing of the engine and associated standard equipment. In many cases, engines are supplied with accessories and equipment that are unique to the application. If service information is ever required on such unique accessories or equipment it is suggested that the Industrial Engine Operations of Ford Motor Company be contacted. The proper information will either be forwarded or the Service Technician will be advised where it can be obtained.

The information in this manual is grouped in sections according to the type of work being performed. The various sections are indicated in the Index. In addition, each section is subdivided to include topics such as diagnosis and testing, cleaning and inspection, overhaul, removal and installation procedures, disassembly and assembly procedures, and service specifications.

Industrial Engine Operations
Ford Parts and Service Division
P.O. Box 3080
Livonia, Michigan 48151

200 CID GASOLINE ENGINE

Part 1 Basic Engine

IDENTIFICATION

An Identification Decal (Figure 1) is affixed to the left side of the rocker cover of each engine. The decal contains the engine serial number which identifies this unit from all others. Next is the engine displacement which determines the engine specifications, then the model number and S.O. or special options which determines the parts or components required on this unit. Use all numbers when seeking information or ordering replacement parts for this engine.

DESCRIPTION

The Ford 200 cubic inch six-cylinder engines are available as engine assemblies.

These six-cylinder engines are the latest in engine design from Ford Motor Company and they incorporate many features for smooth, powerful operation, long life, and a minimum of service.

The cylinder block is manufactured from cast iron using the Ford-pioneered precision casting process. This process provides ultra-lightweight design with a maximum of strength and rigidity. Special design features of the cylinder block include seven main bearings and full-length, full-circle water jackets. The seven main bearings provide a rugged 'foundation" for extra durability and a smoothness of operation comparable to many V-8s. The full-length, full-circle water jackets help eliminate hot-spots and provide more uniform cylinder wall expansion under heavy-duty operation.

The precision-molded, cast-alloy iron crankshaft is carried in seven replaceable copper-lead alloy main bearings. Crankshaft end thrust is controlled by the flanges of the No.
5 main bearing.

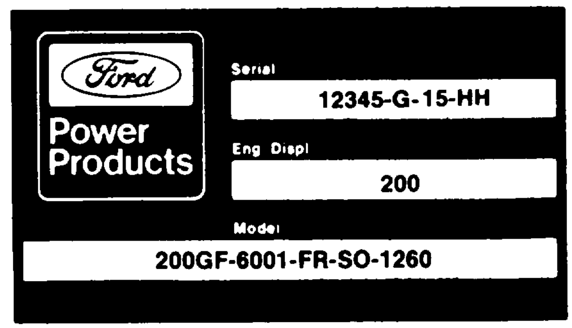


FIG. 1 Identification Decal

The aluminum alloy piston has three rings, two compression and one oil control. The auto thermic cam-ground pistons give longer life with a minimum of maintenance. The connecting rods are forged steel and use replaceable copper-lead bearings.

The camshaft is supported by four bearings pressed into the block. It is driven by gears from the crankshaft. Camshaft end play is controlled by a plate bolted to the front of the cylinder block.

The distributor, located on the left side of the engine, is driven by a gear on the camshaft and, in turn, drives the rotor-type oil pump through an intermediate driveshaft.

The cylinder head assembly contains the fuel intake and exhaust passages, the valves, the valve guides, and the valve rocker arm assemblies. The valve guides are an integral part of the cylinder head. The intake and exhaust valves are actuated through the hydraulic valve lifters and rocker arms.

An exhaust-heated section of the intake manifold provides the heat to vaporize the incoming fuel charge until the engine reaches operating temperature.

A pressure lubrication system is maintained by a rotor type oil pump mounted in the crankcase. Oil is pumped from the oil pan sump at the rear of the oil pan through passages to the bearings and other engine components. A spring-loaded relief valve in the pump limits the maximum pressure in the system. A full-flow filter cleans the entire output of the pump before the oil enters the engine. A valve, integral with the filter, provides a bypass to an oil gallery, if the filter should become clogged.

These engines are equipped with a crankcase ventilation system that vents crankcase fumes through two vented oil fill caps on the rocker arm cover.

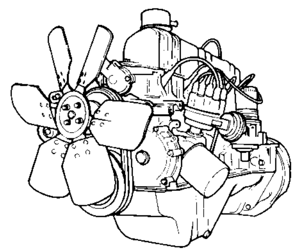


FIG 2 Engine Assembly

DIAGNOSIS AND TESTING CAMSHAFT LOBE LIFT
Check the lobe lift in consecutive order and make a note of the readings.

I. Remove the air cleaner and valve rocker arm cover.
2. Remove the valve rocker arm shaft assembly as detailed in Removal and Installation. Install a solid tappet-type push rod in the push rod bore of the camshaft lobe to be checked or use an adapter for ball end push rods.
3. Make sure the push rod is in the valve lifter socket.
Install a dial indicator in such a manner as to have the ball socket adapter of the indicator on the end of the push rod in the same plane as the push rod movement (Figure 3).
4. Connect an auxiliary starter switch in the starting circuit. Crank the engine with the ignition switch OFF.
Bump the crankshaft over until the tappet or lifter is on the base circle of the camshaft lobe. At this point, the push rod will be in its lowest position.
5. Zero the dial indicator. Continue to rotate the crankshaft slowly until the push rod is in the fully raised position (highest indicator reading).
6. Compare the total lift recorded on the indicator with specifications.
7. To check the accuracy of the original indicator reading, continue to rotate the crankshaft until the indicator reads zero. If the lift on any lobte I below specified wear limits, the camshaft and the valve lifters operating on the worn lobe(s) must be replaced.
8. Remove the dial indicator and auxiliary starter switch.
9. Install the rocker arm shaft assembly as detailed under Removal and Installation.
10. Install the valve rocker arm cover and the air cleaner.

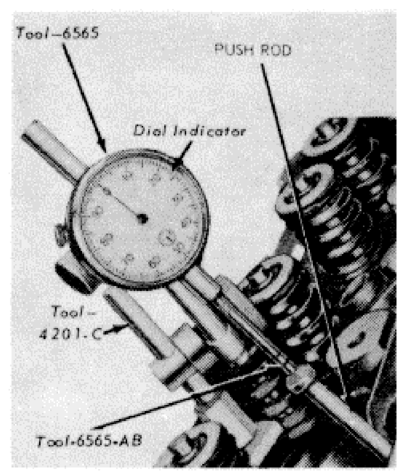


FIG. 3 Testing Camshaft Lobe Lift Typical

COMPRESSION TEST COMPRESSION GAUGE CHECK

1. Be sure the crankcase is at the proper level and the battery is properly charged. Operate the engine for a minimum of 30 minutes at 1200 rpm or until the engine is at normal operating temperature. Turn the ignition switch off; then remove all the spark plugs.

2 Set the carburetor throttle plates and choke plate in the wide open position.
3. Install a compression gauge in No 1 cylinder.
4. Install an auxiliary starter switch in the starting circuit Using the auxiliary-y starter switch. crank the engine (with the ignition switch OFF) at least five compression strokes and record the highest reading. Note the approximate number of compression strokes required to obtain the highest reading
5. Repeat the test on each cylinder as was required to obtain the highest reading on the No. 1 cylinder.

TEST CONCLUSION

The indicated compression pressures are considered normal if the lowest reading cylinder is within 75'; of the highest Refer to the following example and Figure 4.Seventy.-five percent of 140 the highest cylinder reading, is 105 Therefore, cylinder No 7 being less than 75%, of cylinder No 3 indicates an improperly seated valve or worn or broken piston rings. If one more cylinders read low. squirt approximately one 1 tablespoon of engine oil on top of the pistons In the low reading cylinders Repeat compression pressure check on these cylinders

1. If compression improves considerably the piston rings are at fault.
2. If compression does not improve, valves are sticking or seating poorly.
3. If two adjacent cylinders indicate low compression pressures and squirting oil on the pistons does not increase the compression. the cause may he at cylinder head gasket leak between the cylinders. Engine oil and/or coolant in the cylinders could result from this problem.

It is recommended that the following quick reference chart be used when checking cylinder compression pressures. The chart has been calculated so that the lowest reading number is 75'7 of the highest reading.

EXAMPLE

After checking the compression pressures in all cylinders, it was found that the highest reading obtained was 196 psi. The lowest pressure reading was 155 psi. The engine is within specifications and the compression is considered satisfactory.

HYDRAULIC VALVE LIFTER

Dirt. deposits of gum and varnish and air bubbles in the lubricating oil can cause hydraulic valve lifter failure or malfunction Dirt, gum and varnish can keep a check valve from seating and cause a loss of hydraulic pressure. An open valve disc will cause the plunger to force oil back into the valve lifter reservoir during the time the push rod is being lifted to force the valve from its seat.

Air bubbles in the lubricating system can be caused by too much oil in the system or too low an oil level. Air may also be draw, in into the lubricating system through an opening in a damaged oil pick-up tube Air in the hydraulic system can cause a loss of hydraulic pressure.

Assembled valve lifters can he tested with Tool 6500-E to check the leak-down rate The leak-down rate specification is the time in seconds for the plunger to move the length of Its travel while under a 50 Ib. load Test the valve lifters as follows:

1. Disassemble and clean the lifter to remove all traces of engine oil Lifters cannot be checked with engine oil in them Only the testing fluid can be used
2. Place the valve lifter in the tester with the plunger facing upward. Pour hydraulic tester fluid into the cup to a level that will cover the valve lifter assembly The fluid can be purchased from the manufacturer of the tester Do not use kerosene. for it will not provide an accurate test
3. Place a 5/16 inch steel ball in the plunger cup (Figure 5).
4. Adjust the length of the ram so that the pointer is 1/16 Inch below the starting mark when the ram contacts the valve lifter plunger (Figure 5) to facilitate timing as the pointer passes the start timing mark.

FIG 5. Placing Steel Ball in Valve Lifter Plunger

Maximum PSI	Minimum PSI	Maximum PSI	Minimum PSI	Maximum PSI	Minimum PSI
134	101	174	131	214	160
136	102	176	132	216	162
138	104	178	'33	218	163
140	105	180	135	220	165
142	107	182	136	222	166
144	108	184	138	224	168
146	110	186	140	226	169
148	111	188	141	228	171
150	113	190	142	230	172
152	114	192	144	232	174
154	115	194	145	234	175
156	117	196	147	236	177
158	118	198	148	238	178
160	120	200	150	240	180
162	121	202	151	242	181
164	123	204	153	244	183
166	124	206	154	246	184
168	126	208	156	248	186
170	127	210	157	250	187
172	129	212	158		

FIG. 4 Quick Reference Compression Pressure Limit Char *CA1005-A*

Use the center mark on the pointer scale as the stop timing point instead of the original stop timing mark at the top of the scale.

5. Work the valve lifter plunger up and down until the lifter fills with fluid and all traces of air bubbles have disappeared.,
6. Allow the ram and weight to force the valve lifter plunger downward. Measure the exact time it takes for the pointer to travel from the start timing to the stop timing marks on the tester.
7 .A valve lifter that is satisfactory must have a leak-down rate (time in seconds) within the minimum and maximum limits specified.
8. If the valve lifter Is not within specifications. replace it with a new lifter. It is not necessary to test a new lifter before installing it in the engine.

POSITIVE CLOSED-TYPE VENTILATION SYSTEM

A malfunctioning closed crankcase ventilation system may be indicated by loping or rough engine idle. Do not attempt to compensate for this idle condition by disconnecting the crankcase ventilation system and making carburetor adjustments. **The removal of the crankcase ventilation system from the engine will adversely affect the fuel economy and engine ventilation with resultant shortening of engine life**. To determine whether the loping or rough idle condition is caused by a malfunctioning crankcase ventilation system, perform either of the following tests.

AIR INTAKE TEST

This test is performed with the crankcase ventilation tester C8AZ-6B627-A (Figure 6) which is operated by the engine vacuum through the oil fill opening. Follow the procedures described below to install the tester and check the crankcase ventilation system for faulty operation.

FIG. 6 Crankshaft Ventilation System Tester

1. With the engine at normal operating temperature, remove the oil filler cap.
2. Hold the tester C8AZ-6B627-A over the opening in the valve cover. Make sure the surface is flat to form a seal between the cover and tester. If the cover is distorted, shape it as required to make an air tight seal. An air leak between the cover and tester will render the tester inoperative.
3. Start the engine and allow it to operate at the recommended idle speed.
   Hold the tester over the oil filler cap opening making sure that there is a positive seal between the tester and cover.
5. If the ball settles in the GOOD (green) area. the system is functioning properly. If the ball settles in the REPAIR (red) area, clean or replace the malfunctioning components as required.
6. Repeat the test ALTER repairs are made to make sure that the crankcase ventilation system is operating satisfactorily.

Clean and replace the malfunctioning components as required. Repeat the test to ensure that the crankcase ventilation system is operating satisfactorily.

CRANKCASE VENTILATION REGULATOR VALVE TEST

Install a known good regulator valve (PCV) in the crankcase ventilation system.

Start the engine and compare the engine idle condition to the prior Idle condition.

If the idle condition is found to be satisfactory. use the new regulator valve and clean the hoses, fittings. etc.

If the loping or rough Idle condition remains when the good regulator valve is installed. the crankcase ventilation regulator valve is not at fault. Check the crankcase ,ventilation system for restriction at the intake manifold or carburetor spacer. If the system is not restricted. further engine component diagnosis will have to be conducted to find the malfunction.

CRANKSHAFT END PLAY

1. Force the crankshaft toward the rear of the engine.
2. Install a dial indicator so that the contact point rests against the crankshaft flange and the indicator axis is parallel to the crankshaft axis (Figure 7).
3. Zero the dial indicator. Push the crankshaft forward and note the reading on the dial.
4. If the end play exceeds the wear limit. replace the thrust washers. If the end play is less than the minimum limit inspect the thrust hearing faces for scratches. burrs.
   nicks, or dirt.

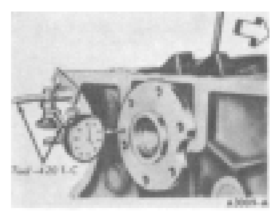


FIG 7 Checking Crankshaft End Play

TIMING CHAIN DEFLECTION I. Rotate the crankshaft in a counterclockwise direction (as viewed from the front) to take up the slack on the left side of the chain.
2. Establish a reference point on the block and measure from this point to the chain (Figure 8) 3. Rotate the crankshaft in the opposite direction to take up the slack on the right side of the chain. Force the left side of the chain out with the fingers and measure the distance between the reference point and the chain. The deflection is the difference between the two measurements. If the deflection exceeds specifications. replace the timing chain and sprockets.

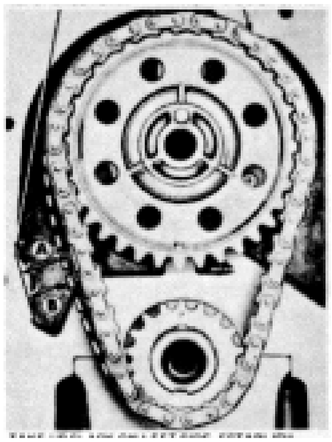


FIG. 8 Checking Timing Chain Deflection

FLYWHEEL FACE RUNOUT

Install a dial indicator so that the indicator point bears against the flywheel face. Turn the flywheel making sure that it is full forward or rearward so that crankshaft end play will not be indicated as flywheel runout.

If the clutch face runout exceeds specifications. remove the flywheel and check for burrs between the flywheel and the face of the crankshaft mounting flange. If no burrs exist. check the runout of the crankshaft mounting flange. Replace the flywheel or machine the crankshaft-flywheel mounting face sufficiently to true up the surface if the mounting flange runout exceeds specifications Replace it or reinstall it on the flywheel.

CAMSHAFT END PLAY

Push the camshaft toward the rear of the engine. Install a dial indicator so that the indicator point is on the camshaft sprocket (Figure 9). Zero the dial indicator. Position a large screwdriver between the camshaft gear and the block. Pull the camshaft forward and release It. Compare the dial indicator reading with specifications. If the end play is excessive, replace the thrust plate retaining the camshaft. Remove the dial indicator.

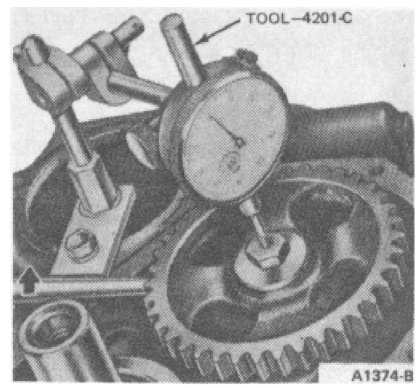


FIG. 9 Checking Camshaft End Play Typical

CLEANING AND INSPECTION

The cleaning and inspection procedures are for a complete engine overhaul: therefore, for partial engine overhaul or parts replacement, follow the pertinent cleaning or inspection procedure.

INTAKE MANIFOLD

Cleaning Remove all gasket material from the machined surfaces of the manifold. Clean the manifold in a suitable solvent and dry it with compressed air.

Inspection

Inspect the manifold for cracks. damaged gasket surfaces. or other defects that would make it unfit for further service. Replace all studs that are stripped or otherwise damaged Remove all filings and foreign matter that may have entered the manifold as a result of repairs.

EXHAUST MANIFOLDS

Cleaning

Remove all gasket material from the manifolds.

Inspection

Inspect the cylinder head Joining flanges of the exhaust manifold for evidence of exhaust gas leaks.

Inspect the manifolds for cracks, damaged gasket surfaces, or other defects that would make them unfit for further service.

VALVE ROCKER ARM AND/OR SHAFT ASSEMBLY

Cleaning Clean all the parts thoroughly. Make sure all oil passages are open.

Make sure the oil passage in the push rod end of the rocker arm is open.

Inspection

On rocker arm shaft assemblies. check the clearance between each rocker arm and the shaft by checking the ID of the rocker arm bore and the OD of the shaft. If the clearance between any rocker arm and the shaft exceeds the wear limit, replace the shaft and/or the rocker arm. Inspect the shaft and the rocker arm bore for nicks, scratches. scores or scuffs.

Inspect the pad at the valve end of the rocker arm for indications of scuffing or abnormal wear. If the pad is grooved, replace the rocker arm. Do not attempt to true this surface by grinding.

Check the rocker arm adjusting screws and the push rod end of the rocker arms for stripped or broken threads, and the ball end of the adjusting screw for nicks. scratches or excessive wear.

PUSH RODS

Cleaning

Clean the push rods in a suitable solvent.

Inspection

Check the ends of the push rods for nicks, grooves, roughness or excessive wear.

The push rods can be visually checked for straightness while they are installed in the engine by rotating them with the valve closed. They also can be checked with a dial indicator (Figure 10).

If the push rod is visibly bent, it should be replaced

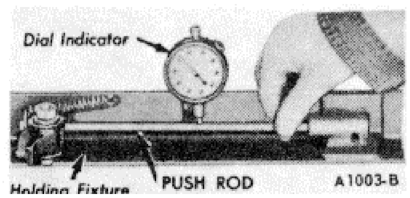


FIG. 10 Checking Push Rod Runout

CYLINDER HEADS

Cleaning

With the valves installed to protect the valve seats, remove deposits from the combustion chambers and valve heads with a scraper and a wire brush. Be careful not to damage the cylinder head gasket surface. After the valves are removed, clean the valve guide bores with a valve guide cleaning tool. Using cleaning solvent to remove dirt, grease and other deposits, clean all bolt holes. Remove all deposits from the valves with a fine wire brush or buffing wheel.

Inspection

Check the cylinder head for cracks and inspect the gasket surface for burrs and nicks. Replace the head if it is cracked.

The following inspection procedures are for a cylinder head that is to be completely overhauled. For individual repair operations, use only the pertinent inspection procedure.

When a cylinder head is removed because of gasket leaks, check the flatness of the cylinder head gasket surface (Figure 11) for conformance to specifications. If necessary to refinish the cylinder head gasket surface, do not plane or grind off more than 0.010 inch.

FIG. 11 Typical Cylinder Head Flatness

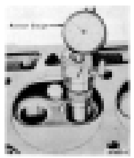


FIG. 12 Checking Valve Seat Runout

Check the valve seat runout with an accurate gauge (Figure 12). Follow the instructions of the gauge manufacturer. If the runout exceeds the wear limit, reface the valve and valve seat. Measure the valve seat width (Figure 4). Reface any valve seat whose width **is not within specifications**.

Inspect the valve face and the edge of the valve head for pits, grooves or other damage. Inspect the stem for a bent condition and the end of the valve head for pits, grooves, scores or other wear. Inspect the stem for a bent condition and the end of the stem for grooves or scores. Check the valve head for signs of burning, erosion, warpage and cracking. Minor pits, grooves, etc., may be removed. Discard valves that are severely damaged.

Inspect the valve spring, valve spring retainers, locks and sleeves for wear or damage. Discard any visually damaged parts.

Check the valve stem to valve guide clearance of each valve in its respective valve guide with the tool shown in Figure 13 or its equivalent. Use a flat end indicator point.

Install the tool on the valve stem until it is fully seated, and tighten the knurled set screw firmly. Permit the valve to drop away from its seat until the tool contacts the upper surface of the valve guide.

Position the dial indicator with its flat tip against the center portion of the tool's spherical section at approximately 90 degrees to the valve stem axis. Move the tool back and forth in line with the indicator stem. Take a reading on the dial indicator without removing the tool from the valve guide upper surface. Divide the reading by two. the division factor for the tool.

FIG 13 Checking Valve Stem Clearance

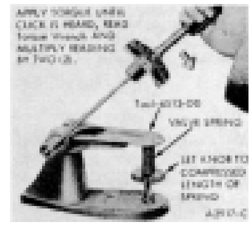


FIG 14 Checking Valve Spring Pressure

Check the springs for proper pressure (Figure 14) at the specified spring lengths (Tool 6513-DD). **Manually rotating the valve spring assemblies while installed in the engine must not be used to determine good and/or bad valve springs.** Weak valve springs cause poor engine performance. Replace any spring not within specifications.

Check each spring for squareness using a steel square and a flat surface (Figure 15). Stand the spring and square on end on the flat surface. Slide the spring up to the square. Revolve the spring slowly and observe the space between the top coil of the spring and the square. The out-of-square limits are 5/64 inch.

Follow the same procedure to check new valve springs before installation. Make certain the proper spring (color coded) is installed.

HYDRAULIC VALVE LIFTERS

The valve lifter assemblies should be kept in proper sequence so that they can be installed in their original position. Inspect and test each lifter separately so as not to intermix the internal parts. **If any part of the lifter assembly needs replacing, replace the entire assembly.**

Cleaning

Thoroughly clean all the parts in cleaning solvent and wipe them with a clean, lint-free cloth.

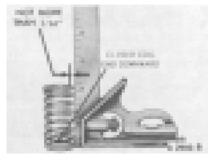


FIG. 15 Checking Valve Spring Squareness

Inspection

Inspect the parts and discard the entire lifter assembly if any part shows pitting, scoring, galling or evidence of nonrotation. Replace the entire assembly if the plunger is not free in the body. The plunger should drop to the bottom of the body by its own weight when assembled dry.

Assemble the lifter assembly and check for freeness of operation by pressing down on the push rod cup. The lifters can also be checked with a hydraulic tester to test the leak-down rate. Follow the instructions of the test unit manufacturer or the procedure in this manual.

CRANKSHAFT VIBRATION DAMPER AND SLEEVE

Cleaning

Clean the oil seal contact surface on the crankshaft damper sleeve with solvent to remove any corrosion, sludge or varnish deposits. Excess deposits that are not readily removed with solvent may be removed with crocus cloth. Use crocus cloth to remove any sharp edges, burrs or other imperfections which might damage the oil seal during installation or cause premature seal wear. **Do not use crocus cloth to the extent that the seal surface becomes polished. A finely polished surface may produce poor sealing or cause premature seal wear.**

Inspection

Inspect the crankshaft damper or sleeve oil seal surface for nicks, sharp edges or burrs that might damage the oil seal during installation or cause premature seal wear.

TIMING CHAIN AND SPROCKETS

Cleaning

Clean all parts in solvent and dry them with compressed air.

Lubricate the timing chain with engine oil before installing it on the engine.

Inspection

Inspect the chain for broken links. Inspect the sprockets for cracks and worn or damaged teeth. Replace all the components of the timing chain and sprocket assembly, if any one item needs replacement.

CAMSHAFT

Cleaning and Inspection

Clean the camshaft in solvent and wipe it dry. Inspect the camshaft lobes for scoring and signs of abnormal wear.

Lobe wear characteristics may result in pitting in the general area of the lobe toe. This pitting is not detrimental to the operation of the camshaft; therefore, the camshaft should not be replaced unless the lobe lift loss has exceeded 0.005 inch.

The lift of the camshaft lobes can be checked with the camshaft installed in the engine or on centers. Refer to Camshaft Lobe Lift.

Check the distributor drive gear for broken or chipped teeth. Replace the camshaft if this condition exists.

CRANKSHAFT

Cleaning

Handle the crankshaft with care to avoid possible fractures or damage to the finished surfaces. Clean the crankshaft with solvent, then blow out all oil passages with compressed air.

Inspection

Inspect the main and connecting rod journals for cracks, scratches, grooves or scores. Inspect the crankshaft oil seal surface for nicks, sharp edges or burrs that might damage the oil seal during installation or cause premature seal wear.

Measure the diameter of each journal in at least four places to determine an out-of-round, taper or undersize condition (Figure 16).

Check the fit of the clutch pilot bushing in the bore of the crankshaft. The bushing is pressed into the crankshaft and should not be loose. Inspect the inner surface of the bushing for wear or a bell-mouth condition. Check the ID of the bushing (Figure 17). Replace the bushing if it is worn or damaged or the ID is not within specifications.

Inspect the pilot bearing (ball bearing) when so equipped, for roughness. evidence of overheating or loss of lubricant. Replace if any of these conditions are found.

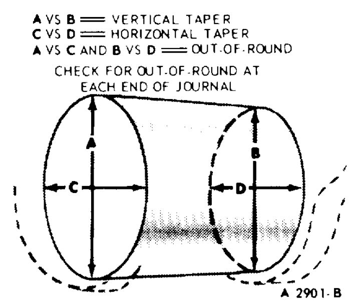


FIG 16 Crankshaft Journal Measurement

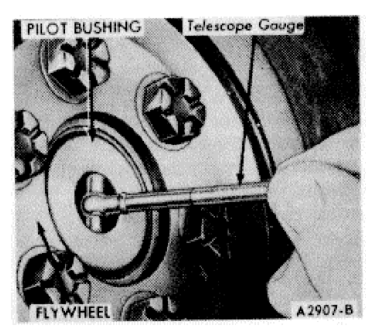


FIG 17 Checking Clutch Pilot Bushing Wear FLYWHEEL Inspection Inspect the flywheel for cracks, heat check, or other damage that would make it unfit for further service.

Machine the friction surface of the flywheel if it is scored or worn. If It is necessary to remove more than 0.045 inch of stock from the original thickness, replace the flywheel.

Inspect the ring gear for worn, chipped, or cracked teeth If the teeth are damaged. replace the ring gear.

With the flywheel installed on the crankshaft. check the flywheel face runout, following the procedure under Diagnosis and Testing.

CONNECTING RODS

Cleaning

Remove the bearings from the rod and cap. Identify the bearings if they are to be used again. Clean the connecting rod in solvent. including the rod bore and the back of the inserts. Do not use a caustic cleaning solution. Blow out all passages with compressed air.

Inspection

The connecting rods and related parts should be carefully inspected and checked for conformance to specifications. Various forms of engine wear caused by these parts can be readily Identified.

A shiny surface on either pin boss side of the piston usually indicates that a connecting rod is bent.

Abnormal connecting rod bearing wear can be caused by either a bent connecting rod. worn or damaged crank pin. or a tapered connecting rod bore.

Twisted connecting rods will not create an easily identifiable wear pattern. but badly twisted rods will, disturb the action of the entire piston. rings, and connecting rod assembly and may be the cause of excessive oil consumption Inspect the connecting rods for signs of fractures and the bearing bores for out-of-round and taper. If the bore exceeds the recommended limits and/or if the connecting rod is fractured, it should be replaced. Check the I D of the connecting rod piston pin bore. If the pin bore In the connecting rod is larger than specifications. install a 0.002 inch oversize piston pin. First, prefit the oversize piston pin to the piston pin bore by reaming or honing the piston. Then, assemble the piston. piston pin and connecting rod following the procedures for assembly. It is not necessary to ream or hone the pin bore in the connecting rod. Replace damaged connecting rod nuts and bolts. Check the connecting rods for bend or twist on a suitable alignment fixture. Follow the instructions of the fixture manufacturer. If the bend and/or twist exceeds specifications, the connecting rod must be straightened or replaced.

PISTONS, PINS AND RINGS

Cleaning

Remove deposits from the piston surfaces. Clean gum or varnish from the piston skirt, piston pins and rings with solvent. **Do not use a caustic cleaning solution or a wire brush to clean pistons.**

Clean the ring grooves with a ring groove cleaner Figure 18). Make sure the oil ring slots (or holes) are clean

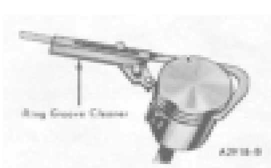


FIG. 18 Cleaning Piston Ring Grooves

Inspection

Carefully inspect the pistons for fractures at the ring lands. skirts and pin bosses, and for scuffed. rough or scored ski, If the lower inner portion of the ring grooves has a high step. replace the piston. The step will interfere with ring operation and cause excessive ring side clearance.

Spongy,. eroded areas near the edge of the top of the piston are usually caused by detonation or pre-ignition. A shiny surface on the thrust surface of the piston. offset from the centerline between the piston pin holes. can he caused by a bent connecting rod. Replace pistons that show signs of excessive wear, wavy ring lands or fractures or damage from detonation or pre-ignition.

Check the piston to cylinder bore clearance by measuring the piston and bore diameters. Refer to the specifications for the proper clearance. Refer to Cylinder Block Inspection for the bore measurement procedure. **Measure the OD of the piston with micrometers approximately 2'/4 inches below the dome and at 90 degrees to the piston pin bore**. Check the ring side clearance following the procedure under Fitting Piston Rings in this section.

Replace piston pins showing signs of fracture, etching or wear. Check the piston pin fit in the piston and rod. Refer to Piston and Connecting Rod Assembly.

Check the ()D of the piston pin and the ID of the pin bore in the piston. Replace any piston pin or piston that is not within specifications.

Replace all rings Check the end gap and side clearance.

Rings should not be transferred from one piston to another regardless of mileage or hours.

MAIN AND CONNECTING ROD BEARINGS

Cleaning

Clean the bearing inserts and caps thoroughly In solvent. and dry them with compressed air. **Do not scrape gum or varnish deposits from bearing shells.**

Inspection

Inspect each bearing carefully. Bearings that have a scored, chipped, or worn surface should be replaced. Typical examples of unsatisfactory bearings and their causes are shown in Figure 19. The copper-lead bearing base may be visible through the bearing overlay. This does not mean that the bearing is worn. It is not necessary to replace the bearing if the bearing clearance is within recommended limits.

Check the clearance of bearings that appear to be satisfactory with Plastigage as detailed under Main and Connecting Rod Bearings.

CYLINDER BLOCK

Cleaning

After any cylinder bore repair operation, such as honing or deglazing. clean the bore(s) with soap or detergent and water. Then, thoroughly rinse the bore(s) with clean water to remove the soap or detergent. and wipe the bore(s) dry with a clean, lint-free cloth. Finally, wipe the bore(s) with a clean cloth dipped in engine oil. If these procedures are not followed, rusting of the cylinder bore(s) may occur.

If the engine is disassembled, thoroughly clean the block with solvent. Remove old gasket material from all machined surfaces. Remove all pipe plugs that seal oil passages; then clean out all the passages. Blow out all passages, bolt holes, etc.. with compressed air. Make sure the threads in the cylinder head bolt holes are clean. Dirt in the threads may cause binding and result in a false torque reading. Use a tap to true up threads and to remove any deposits. Thoroughly clean the grooves in the crankshaft bearings and bearing retainers.

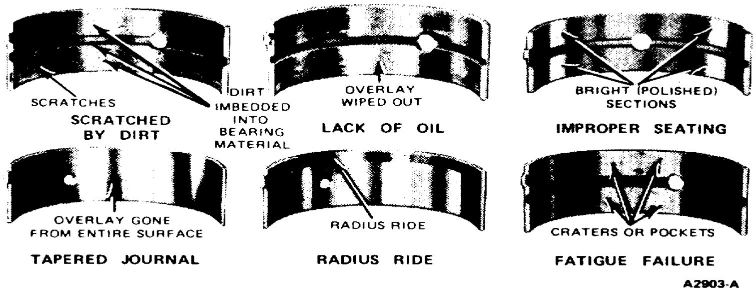


FIG. 19 Typical Bearing Failures

Inspection

After the block has been thoroughly cleaned, check it for cracks. Minute cracks not visible to the naked eye may be detected by coating the suspected area with a mixture of 25% kerosene and 75%7 light engine oil. Wipe the part dry and immediately apply a coating of zinc oxide dissolved In wood alcohol. If cracks are present, the coating will become discolored at the defective area. Replace the block if it is cracked.

Check all machined gasket surfaces for burrs, nicks. scratches and scores. Remove minor imperfections with an oil stone.

Replace all expansion-type plugs that show evidence of leakage.

Inspect the cylinder walls for scoring, roughness, or other signs of wear. Check the cylinder bore for out-of-round and taper. Measure the bore with an accurate bore gauge following the instructions of the manufacturer. Measure the diameter of each cylinder bore at the top, middle and bottom with the gauge placed at right angles and parallel to the centerline of the engine (Figure 20). **Use only the measurements obtained at 90 degrees to the engine centerline when calculating the piston to cylinder bore clearance.**

Refinish cylinders that are deeply scored and/or when out-of-round and/or taper exceed the wear limits. If the cylinder walls have minor surface imperfections, but the out-of-round and taper are within limits, it may be possible to remove such damage by honing the cylinder walls and installing new service piston rings providing the piston clearance is within specified limits.

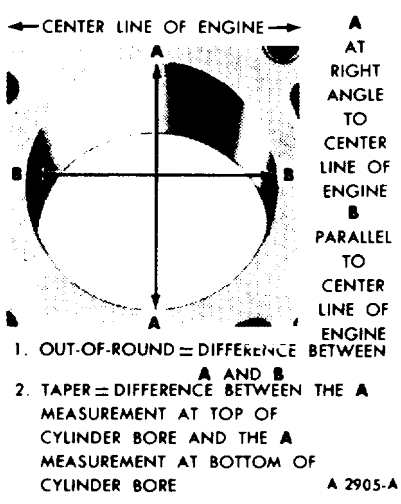


FIG. 20 Cylinder Bore Out-of-Round and Taper

OIL PAN

Cleaning

Scrape any dirt or metal particles from the inside of the pan. Scrape all old gasket material from the gasket surface. Wash the pan in a solvent and dry it thoroughly. Be sure all foreign particles are removed from below the baffle plate.

Inspection

Check the pan for cracks. holes, damaged drain plug threads, and a loose baffle or a damaged gasket surface. Inspect for damage (uneven surface) at the bolt holes caused by over-torquing the bolts. Straighten surfaces as required. Repair any damage, or replace the pan if repairs cannot be made satisfactorily.

OIL PUMP

Cleaning

Wash all parts in a solvent and dry them thoroughly with compressed air. Use a brush to clean the inside of the pump housing and the pressure relief valve chamber. Be sure all dirt and metal particles are removed.

Inspection

Refer to the specifications for clearances and wear limits.

Check the inside of the pump housing and the outer race and rotor for damage or excessive wear.

Check the mating surface of the pump cover for wear. If the cover mating surface is worn, scored or grooved, replace the cover.

Measure the outer race to housing clearance (Figure 21). Then check the clearance between the outer race and the rotor lobes.

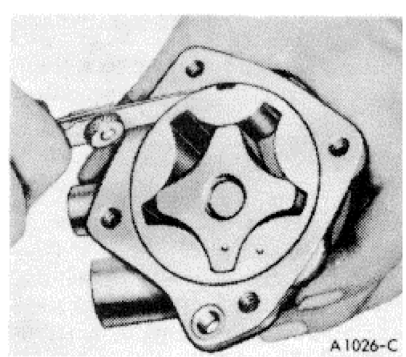


FIG 21. Checking Outer Race to Housing Clearance

With the rotor assembly installed in the housing, place a straight edge over the rotor assembly and the housing. Measure the clearance (rotor end play) between the straight edge and the rotor and outer race (Figure 22). **The outer race, shaft and rotor are replaceable only as an assembly**. Check the drive shaft to housing bearing clearance by measuring the

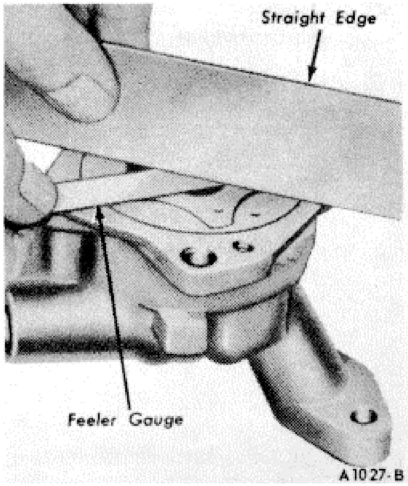


FIG. 22. Checking Rotor End Play

OD of the shaft and the ID of the housing bearing. Inspect the relief valve spring for a collapsed or worn condition Check the relief valve spring tension. If the spring tension is not within specifications and/or the spring is worn or damaged replace the spring. Check the relief valve piston for scores and free operation in the bore

POSITIVE CLOSED-TYPE CRANKCASE VENTILATION SYSTEM

Cleaning

Do not attempt to clean the crankcase ventilation regulator valve; it should be replaced at the specified maintenance interval. The oil filler cap and oil separator should be cleaned at the proper maintenance interval. Remove the cap and the oil separator and wash them in a low-volatility. petroleum-base solvent. Shake the cap dry and install them. Clean the crankcase ventilation system connection(s) on the intake manifold by probing with a flexible wire or bottle brush. Clean the hoses, fittings. tubes and associated hardware with a low-volatility, petroleum-base solvent and dry with compressed air.

OVERHAUL

CYLINDER HEAD

Replace the head if it is cracked. **Do not plane or grind more than 0.010 inch from the cylinder head gasket surface**. Remove all burrs or scratches with an oil stone.

REAMING VALVE GUIDES

If it becomes necessary to ream a valve guide (Figure 23) to install a valve with an oversize stem, a reaming kit is available which contains the following reamer and pilot combinations: a 0.003-inch OS reamer with a standard diameter pilot, a 0.015-inch OS reamer with a 0.003-inch OS pilot, and a 0.030-inch reamer with a 0.015-inch OS pilot.

When going from a standard size valve to an oversize valve always use the reamer in sequence. **Always reface the valve seat after the valve guide has been reamed, and use a suitable scraper to break the sharp corner (ID) at the top of the valve guide.**

REFACING VALVE SEATS

Refacing the valve seat should be closely coordinated with the refacing of the valve face so that the finished seat and valve face will be concentric and the specified interference fit will be maintained. This is important so that the valve and seat will have a compression-tight fit. Be sure that the refacer grinding wheels are properly dressed.

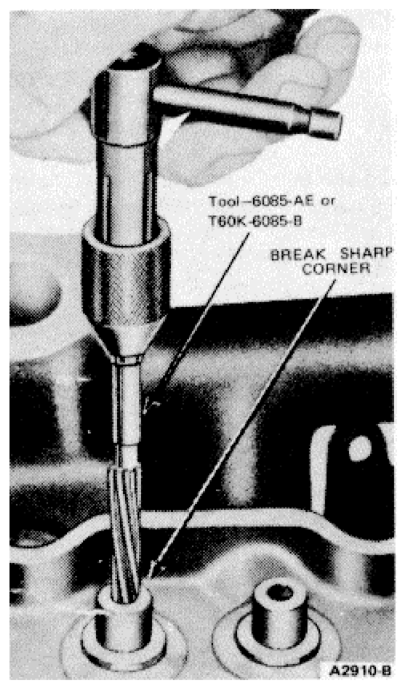


FIG 23. Reaming Valve Guides

Grind the valve seats of all engines to a true 45 degree angle (Figure 24). Remove only enough stock to clean up pits and grooves or to correct the valve seat runout. After the seat has been refaced. use a seat width scale or a machinist scale to measure the seat width (Figure 25). Narrow the seat, if necessary, to bring It within specifications, and center It on the valve face.

If the valve seat width exceeds the maximum limit, remove enough stock from the top edge and/or bottom edge of the seat to reduce the width to specifications. and center.

On the valve seats of all engines, use a 60 degree angle grinding wheel to remove stock from the bottom of the seats (raise the seats) and use a 30 degree angle wheel to remove stock from the top of the seats (lower the seats).

The finished valve seat should contact the approximate center of the valve face. It is good practice to determine where the valve seat contacts the face. To do this, coat the seat with Prussman blue and set the valve in place Rotate the valve with light pressure. If the blue is transferred to the center of the valve face. the contact IS satisfactory. If the blue is transferred to the top edge of the valve face. lower the valve seat. If the blue is transferred to the bottom edge of the valve face, raise the valve seat.

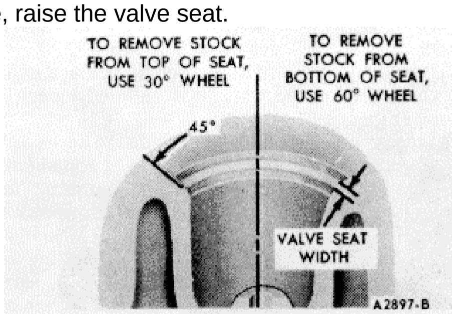


FIG 24. Refacing Valve Seat Width

VALVES

Minor pits. grooves. etc., may be removed. Discard valves that are severely damaged, if the face runout cannot be corrected by refinishing or stem clearance exceeds specifications. Discard any excessively worn or damaged valve train parts.

REFACING VALVES

The valve refacing operation should be closely coordinated with the valve seat refacing operations so that the finished angles of the valve face and of the valve seat will be to specifications and provide a compression-tight fit Be sure that the refacer grinding wheels are properly dressed.

Under no circumstances should the faces of aluminized intake valves be ground or the valves lapped in as this will remove the diffused aluminum coating and reduce the valve's wear and heat resistant properties. If the valve faces are worn or pitted it will be necessary to install new valves and to resurface the valve seats or. alternatively, lap the seats using dummy valves. The exhaust valves may be lapped in or the faces ground if required.

If the valve face runout is excessive and/or to remove pits and grooves, reface the valves to a true 44 degree angle. Remove only enough stock to correct the runout or to clean up the pits and grooves. If the edge of the valve head is less than 1/32 inch thick after grinding (Figure 26). replace the valve as the valve will run too hot in the engine. **The interference fit of the valve and seat should not be lapped out. Remove all grooves or score marks from the end of the valve stem, and chamfer it as necessary. Do not remove more than 0.010 inch from the end of the valve stem.**

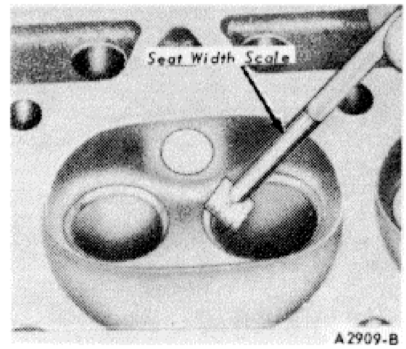


FIG 25. Checking Valve Seat Width

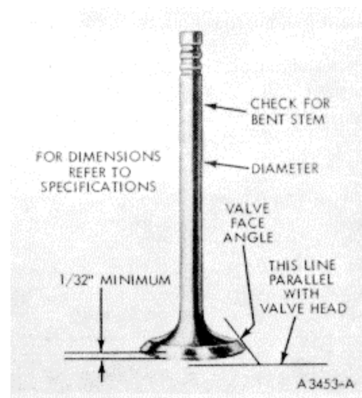


FIG 26. Critical Valve Dimensions

If the valve and/or valve seat has been refaced. it will be necessary to check the clearance between the rocker arm pad and the valve stem with the valve train assembly installed in the engine.

SELECT FITTING VALVES

If the valve stem to valve guide clearance exceeds the wear limit. ream the valve guide for the next oversize valve stem. Valves with oversize stem diameters of 0.003. 0.015 and 0.030 inch are available for service. Always reface the valve seat after the valve guide has been reamed. Refer to Reaming Valve Guides.

CAMSHAFT REPAIR

Remove light scuffs. scores or nicks from the camshaft machined surface with smooth oil stone.

CRANKSHAFT

Dress minor scores with an oil stone. If the journals are severely marred or exceed the wear limit, they should be refinished to size for the next undersize bearing.

REFINISHING JOURNALS

Refinish the journals to give the proper clearance with the next undersize bearing. If the journal will not clean up to maximum undersize bearing available, replace the crankshaft.

Always reproduce the same journal shoulder radius that existed originally. Too small a radius will result in fatigue failure of the crankshaft. Too large a radius will result in bearing failure due to radius ride of the bearing. After refinishing the journals, chamfer the oil holes. then polish the journal with a No. 320 grit polishing cloth and engine oil. Crocus cloth may also be used as a polishing agent.

FITTING MAIN OR CONNECTING ROD BEARINGS WITH PLASTIGAGE

1. Clean crankshaft journals. Inspect journals and thrust faces (thrust bearing) for nicks, burrs or bearing pickup that would cause premature bearing wear When replacing standard bearings with new bearings, it is good practice to fit the bearing to minimum specified clearance. If the desired clearance cannot be obtained with a standard bearing. try a 0.002 inch undersize in combination with a standard bearing to obtain the proper clearance.
2. If fitting a main bearing, position a jack under counter-weight adjoining bearing which is being checked. Support crankshaft with jack so its weight will not compress Plastigage and provide an erroneous reading.
3. Place a piece of Plastigage on bearing surface across full width of bearing cap and about 1/4 inch off center (Figure 27).
4. Install cap and torque bolts to specifications. Do not turn crankshaft while Plastigage is in place.
5. Remove cap. Using Plastigage scale, check width of Plastigage at widest point to get minimum clearance. Check at narrowest point to get maximum clearance. Difference between readings is taper of journals.
6. If clearance exceeds specified limits. on the connecting rod bearings, try a 0.002 inch undersize bearing in combination with the standard bearings. Bearing clearance must be within specified limits. If O 002 undersize main bearings are used on more than one journal. be sure they are all installed in cylinder block side of bearing. If standard and 0.002 inch undersize bearings do not bring clearance within desired limits, refinish crankshaft journal, then install undersize bearings.
7. After bearing has been fitted. remove Plastigage and apply light coat of engine oil to journal and bearings. Install bearing cap. Torque cap bolts to specifications.
8. Repeat procedure for remaining bearings that require replacement.

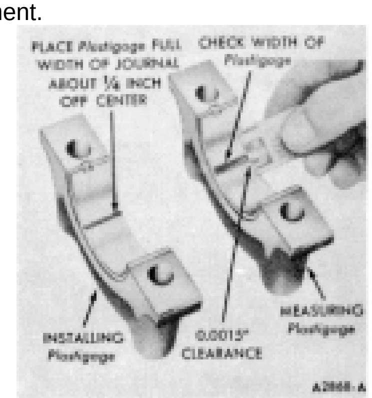


FIG. 27 Installing and Measuring Plastigage

PISTONS, PINS AND RINGS FITTING PISTONS

Pistons are available for service in standard sizes and the oversizes shown in the parts book.

The standard size pistons are color coded red or blue, or have .0025 O.S. stamped on the dome. Refer to the Specifications for standard size piston dimensions.

Measure the cylinder bore and select the piston to assure the proper clearance. When the bore diameter is in the lower one-third of the specified range, a red piston should be used. When the bore diameter is in the middle one-third a blue piston should be used. When the bore diameter is in the upper one-third, the 0.0025 O.S. piston should be used.

Measure the piston diameter to ensure that the specified clearance is obtained. It may be necessary periodically to use another piston (red or blue) that is either slightly larger or smaller to achieve the specified clearance. **If none can be fitted, refinish the cylinder to provide the proper clearance for the piston. When a piston has been fitted, mark it for assembly in the cylinder to which it was fitted. If the taper, out-of-round and piston to cylinder bore clearance conditions of the cylinder bore are within specified limits, new piston rings will give satisfactory service. If new rings are to be installed in a used cylinder that has not been refinished, remove the cylinder wall glaze (refer to Cylinder Block, Refinishing Cylinder Walls). Be sure to clean the cylinder bore thoroughly.**

1. Calculate the size piston to be used by taking a cylinder bore check. Follow the procedures outlined under Cleaning and Inspection.
2. Select the proper size piston to provide the desired clearance (refer to the specifications). The piston should be measured 21/4 inches below the dome and at 900 to the piston pin bore.
3. Make sure the piston and cylinder block are at room temperature (70 degrees F.). **After any refinishing operation allow the cylinder bore to cool, and make sure the piston and bore are clean and dry before the piston fit is checked.**

FITTING PISTON RINGS

1. Select the proper ring set for the size cylinder bore.
2. Position the ring in the cylinder bore in which it is going to be used.
3. Push the ring down into the bore area where normal ring wear is not encountered.
4. Use the head of a piston to position the ring in the bore so that the ring is square with the cylinder wall. **Use caution to avoid damage to the ring or cylinder bore.**
5. Measure the gap between the ends of the ring with a feeler gauge (Figure 28). If the ring gap is less or greater than the specified limits. try another ring set.
6. Check the ring side clearance of the compression rings with a feeler gauge inserted between the ring and its lower land (Figure 29). The gauge should slide freely around the entire ring circumference without binding. Any wear that occurs will form a step at the inner portion of the lower land. **If the lower lands have high steps, the piston should be replaced.**

FITTING PISTON PINS

The piston pins are selected to give the correct fit in the piston pin bore and bushing in the connecting rod. Pistons are only supplied in service complete with the piston pin, to ensure the correct fit. The piston pins should not be interchanged.

VALVE ROCKER ARM

If the pad at the valve end of the rocker arm has a grooved radius, replace the rocker arm. **Do not attempt to true this surface by grinding.**

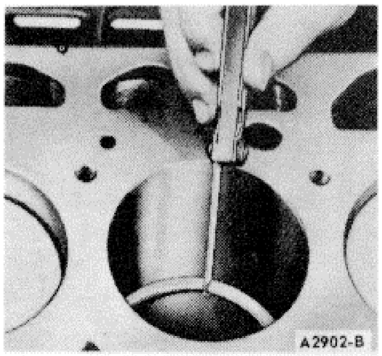


FIG. 28. Checking Piston Ring Gap

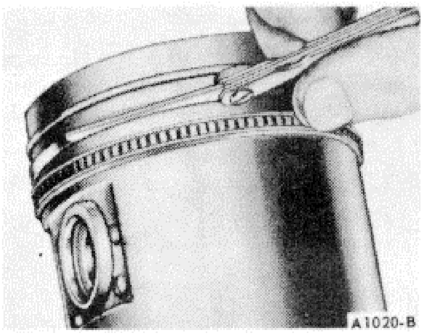


Fig. 29 Checking Piston Ring Side Clearance

PUSH RODS

Following the procedures under Push Rod Inspection, check the push rods for straightness.

If the runout exceeds the maximum limit at any point. discard the rod. Do not attempt to straighten push rods.

CYLINDER BLOCK

REFINISHING CYLINDER WALLS

Honing is recommended for refinishing cylinder walls only when the walls have minor scuffs or scratches, or for fitting pistons to the specified clearance. The grade of hone to be used is determined by the amount of metal to be removed. Follow the instructions of the hone manufacturer. If coarse stones are used to start the honing operation, leave enough material so that all hone marks can be removed with the finishing hone which is used to obtain the proper piston clearance.

Cylinder walls that are severely marred and/or worn beyond the specified limits should be refinished. **Before any cylinder is refinished, all main bearing caps must be in place and tightened to the proper torque so that the crankshaft bearing bores will not become distorted from the refinishing operation.**

Refinish only the cylinder or cylinders that require it. All pistons are the same weight, both standard and oversize; therefore, various sizes of pistons can be used without up-setting engine balance.

Refinish the cylinder with the most wear first to deter-mine the maximum oversize. If the cylinder will not clean up when refinished for the maximum oversize piston recommended, replace the block.

Refinish the cylinder to within approximately 0.0015 inch of the required oversize diameter. This will allow enough stock for the final step of honing so that the correct surface finish and pattern are obtained.

For the proper use of the refinishing equipment, follow the instructions of the manufacturer. Only experienced per-sonnel should be allowed to perform this work.

Use a motor-driven, spring pressure-type hone at a speed of 300-500 rpm. Hones of grit sizes 180-220 will normally provide the desired bore surface finish of 15/32 RMS. When honing the cylinder bores, use a lubricant mixture of equal parts of kerosene and SAE No. 20 motor oil. Operate the hone in such a way as to produce a cross-hatch finish on the cylinder bore. The cross-hatch pattern should be at an angle of approximately 30 degrees to the cylinder bore. After the final operation in either of the two refinishing methods described and prior to checking the piston fit, thoroughly clean and oil the cylinder walls. Mark the pistons to correspond to the cylinders in which they are to be installed. When the refinishing of all cylinders that require it has been completed and all pistons are fitted. thoroughly clean the entire block and oil the cylinder walls.

REPAIRING SAND HOLES OR
POROUS ENGINE CASTINGS

Porosity or sand hole(s) which will cause oil seepage or leakage can occur with modern casting processes. A complete inspection of engine and transmission should be made. If the leak is attributed to the porous condition of the cylinder block or sand hole(s). repairs can be made with metallic plastic (Part No. C6AZ-19554-A). **Do not repair cracks with this material**. Repairs with this metallic plastic must be confined to those cast iron engine component surfaces where the inner wall surface is not exposed to engine coolant pressure or oil pressure, for example:

1. Cylinder block surfaces extending along the length of the block. upward from the oil pan rail to the cylinder water jacket but not including machined areas.
2. Lower rear face of the cylinder block.
3. Intake manifold casting.
4. Cylinder head, along the rocker arm cover gasket surface.

The following procedure should be used to repair porous areas or sand holes in cast iron:

a. Clean the surface to be repaired by grinding or rotary filing to a clean bright metal surface. Chamfer or undercut the hole or porosity to a greater depth than the rest of the cleaned surface. Solid metal must surround the hole. Openings larger than 1/4 inch should not be repaired using metallic plastic. Openings in excess of 1/4 inch can be drilled, tapped and plugged using common tools. Clean the repair area thoroughly. Metallic plastic will not stick to a dirty or oily surface.
b. Mix the metallic plastic base and hardener as directed on the container. Stir thoroughly until uniform.
c. Apply the repair mixture with a suitable clean tool (putty knife, wood spoon, etc.) forcing the epoxy into the hole or porosity.
d. Allow the repair mixture to harden. This can be accomplished by two methods: heat cure with a 250 degree watt lamp placed 10 inches from the repaired surface, or air dry for 10-12 hours at temperatures above 50 degrees F.
e. Sand or grind the repaired area to blend with the general contour of the surrounding surface.
f. Paint the surface to match the rest of the block.

ADJUSTMENTS

HYDRAULIC VALVE CLEARANCE

A 0.060-inch shorter than standard push rod and a 0.060-inch longer than standard push rod are available for service to provide a means of compensating for dimensional changes in the valve mechanism. Refer to the Master Parts List or the specifications for the pertinent color code.

Valve stem to valve rocker arm clearance should be within specifications with the hydraulic lifter completely collapsed. Repeated valve reconditioning operations (valve and/or valve seat refacing) will decrease the clearance to the point that. if not compensated for, the hydraulic valve lifter will cease to function and the valve will be held open.

To determine whether a shorter or a longer push rod is necessary, make the following check:

1. Connect an auxiliary starter switch in the starting circuit. **Crank the engine with the ignition switch OFF until the No. 1 piston is on TDC after the compression stroke.**
2. With the crankshaft in the position designated in Steps 3 and 4, position the hydraulic lifter until the plunger is completely bottomed (Figure 30). **Take care to avoid excessive pressure that might bend the push rod**. Hold the lifter in this position and check the available clearance between the rocker arm and the valve stem tip with a feeler gauge.
   If the clearance is less than specified, Install an under-size push rod. If the clearance is greater than specified, install an oversize push rod.
3. With the No. 1 piston on TDC after the compression stroke, use the procedure in Step 2 and check the following valves:
   No. 1 Intake
   No. 1 Exhaust
   No.2 Intake
   No.3 Exhaust
   No. 4 Intake
   No. 5 Exhaust

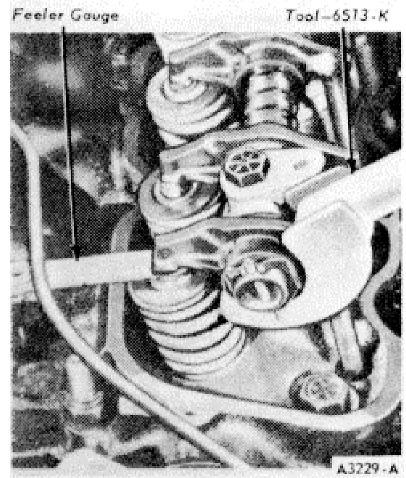


FIG 30 Checking Valve Clearance

4. Now rotate the crankshaft until the No. 6 piston is on TDC after the compression stroke (one revolution of the crankshaft). By using the procedure in Step 2. check the following valves:
   No. 2 Exhaust
   No. 3 Intake
   No. 4 Exhaust
   No. 5 Intake
   No. 6 Intake
   No. 6 Exhaust
5. When compressing the valve spring to remove the push rods. be sure the piston in the individual cylinder is below TDC to avoid contact between the valve and the piston. To replace a push rod. it will be necessary to remove the valve rocker arm shaft assembly. Upon replacement of a valve push rod, valve rocker arm shaft assembly or hydraulic valve lifter, the engine should not be cranked or rotated until the hydraulic lifters have had an opportunity to leak down to their normal operating position. The leak down rate can be accelerated by using the tool shown in Figure 30 on the valve rocker arm and applying pressure in a direction to collapse the lifter.

REMOVAL AND INSTALLATION

When installing nuts or bolts that must be torqued, refer to the Specifications. Oil threads with lightweight engine oil. Do not oil threads that require oil-resistant or water-resistant sealer. Refer to page 1-07 for cleaning and inspection and to page 1-03 for engine test procedures.

CRANKCASE VENTILATION SYSTEM

The closed crankcase ventilation system components are shown in Figure 31. (if so equipped).

Removal

1. Remove the inlet hose from the air cleaner and the oil filler cap. Remove the fresh air intake tube and the heat shroud tube.
2. Remove the air cleaner.
3. Grasp the crankcase vent hose near the rocker arm cover grommet and pull the regulator valve from the rocker arm cover.
4. Remove the regulator valve from the vent hose and re-move the vent hose from the hose fitting in the carburetor spacer.

Installation

1. Install the vent hose on the fitting in the carburetor spacer and the regulator valve in the hose.
2. Insert the regulator valve into the rocker arm cover mounting grommet.
3. Install the air cleaner.
4. Connect the inlet hose to the air cleaner and the oil filler cap. Connect the fresh air intake tube and the heat shroud tube.
5. Operate the engine and check for leaks.

VALVE ROCKER ARM COVER AND ROCKER ARM

Removal

1. Remove the air cleaner and the crankcase ventilation system. Remove the accelerator control cable bracket.
2. Remove the valve rocker arm cover and discard the gasket.

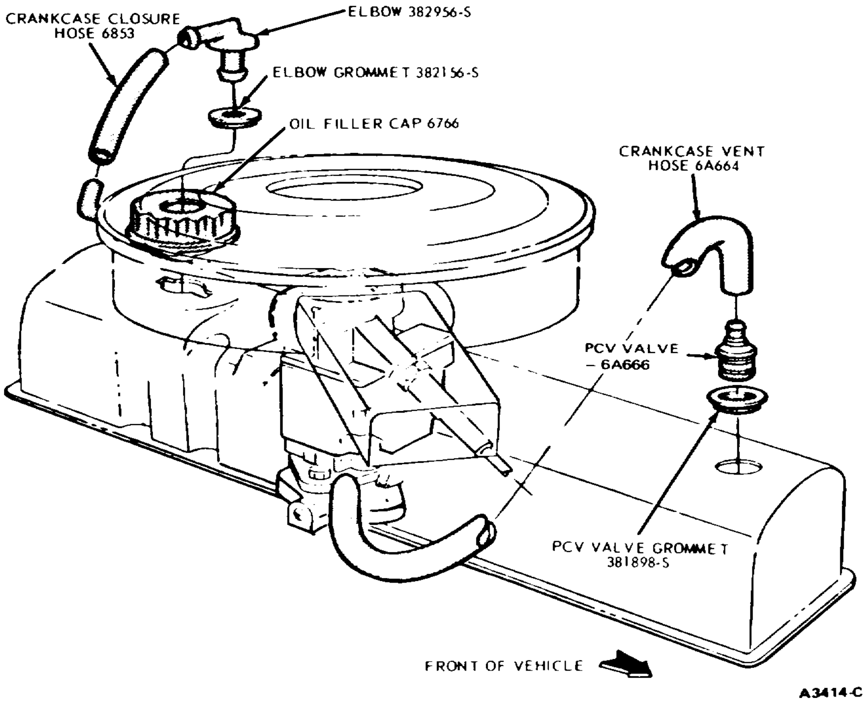


FIG 31. Closed Crankcase Ventilation System Components

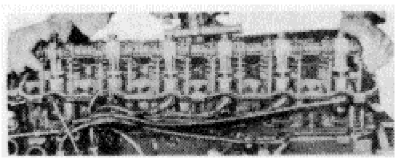


FIG. 32. Valve Rocker Arm Shaft Removal

3. Remove the rocker arm shaft support bolts by loosening the bolts two turns at a time in sequence. Remove the rocker arm shaft assembly (Figure 32). Remove the valve push rods. **Make sure the push rods are identified before removal so they can be returned to the same location when they are installed.**

Installation

1. Apply Lubriplate or equivalent to both ends of the push rods and to the valve stem tip.
2. Install the valve push rods. Position the valve rocker arm shaft assembly on the cylinder head.
3. Install and tighten all valve rocker arm support bolts, two turns at a time in sequence, until the supports fully contact the cylinder head. Torque the bolts to specifications.
4. If any part which could affect the valve clearance has been changed, check the valve clearance following the procedure outlined under Hydraulic Valve Lifter Adjustment.
5. Clean the valve rocker arm cover and cylinder head gasket surfaces. Install the gasket in the cover making sure that all of the tangs of the gasket are engaged in the notches provided in the cover. Connect all vacuum lines and components using previous identification for proper connection. Tighten the cover attaching bolts in two steps. First, torque the bolts to specifications; then, re-torque to the same specifications two minutes after initial tightening. Install the accelerator control cable bracket.
6. Install the crankcase ventilation system and the air cleaner.

VALVE SPRING, RETAINER AND STEM SEAL

Broken valve springs or leaking valve stem seals and retainers may be replaced without removing the cylinder head providing damage to the valve or valve seat has not occurred.

Removal

1. Remove the air cleaner. Remove the crankcase ventilation regulator valve from the valve rocker arm cover. Remove the valve rocker arm cover. Remove the applicable spark plug.
2. Loosen the valve rocker arm shaft support bolts two turns at a time, in sequence, until the valve spring pressure is relieved. Remove both valve push rods of the cylinder to be serviced.
3. Install an air line with an adapter in the spark plug hole.
4. Tighten the attaching bolts just enough to seat the rocker arm shaft supports on the cylinder head. Push the rocker arm to one side and secure it in this position (Figure 33). To move the rocker arm on either end of the shaft, it will be necessary to remove the retaining pin and spring washer and slide the rocker arm off the shaft.
5. Turn on the air supply. **Air pressure may turn the crankshaft until the piston reaches the bottom stroke**. Using the valve spring compression tool shown in Figure 33, compress the valve and remove the valve spring retainer locks, the sleeve, spring retainer and the valve spring. **If air pressure fails to hold the valve in the closed position during this operation, it can be presumed that the valve is not seating or is damaged. If this condition occurs, remove the cylinder head for further inspection.**
6. Remove the valve stem seal (Figure 34). If air pressure has forced the piston to the bottom of the cylinder, any removal of air pressure will allow the valve(s) to fall into the cylinder. A rubber band, tape or string wrapped around the end of the valve stem will prevent this condition and will still allow enough travel to check the valve for binds.

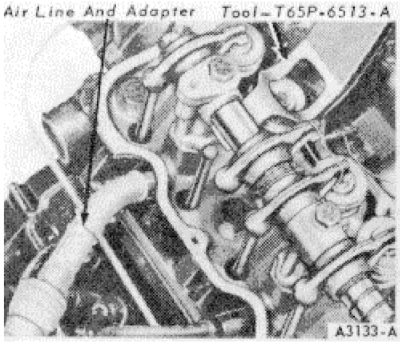


FIG 33. Compressing Valve Spring

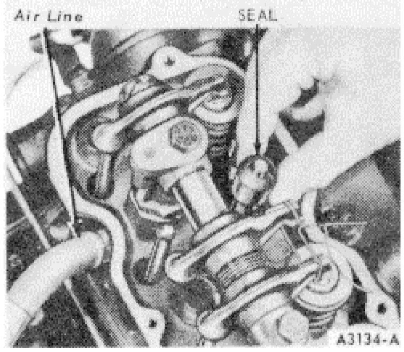


FIG 34. Removing Valve Stem Seal

Installation

1. Install a new valve stem seal. Position the spring over the valve. Install the spring retainer and sleeve. Compress the valve spring and install the valve spring retainer locks.
2. Apply Lubriplate or equivalent to both ends of the push rod, the valve and push rod ends of the rocker arm, and the valve stem tip. Remove the rocker arm shaft and install the push rod(s). making sure the lower end of the rod is positioned in the valve lifter push rod cup.
3. Remove the wire securing the valve rocker arm and slide the rocker arm into position. If an end valve rocker arm was removed. slide it into position on the shaft and install the spring washer and retainer pin. Turn off the air and remove the air line and adapter. Install the spark plug and spark plug wire.
4. Install the rocker arm shaft by following the instructions under Rocker Arm Installation.
5. Clean the valve rocker arm cover and cylinder head gasket surfaces. Install a new gasket in the cover making sure the gasket tangs are securely engaged with the notches in the cover. Position the cover on the head. Install and tighten the cover attaching bolts in two steps. First, torque the bolts to specifications. Two minutes later, torque the bolts to the same specifications.
6. Insert the regulator valve (with the vent hose attached) into the valve rocker arm cover mounting grommet. Install the air cleaner.

CYLINDER HEAD

Removal

1. Drain the cooling system. Remove the air cleaner. Disconnect the radiator upper hose.
2. Disconnect the throttle control cable at the carburetor.
3. Disconnect the fuel inlet line at the fuel filter hose.
4. Disconnect the distributor vacuum lines.
5. Disconnect the carburetor fuel inlet line at the fuel pump. Remove the lines as an assembly.
6. Disconnect the spark plug wires at the spark plugs and the temperature sending unit wire at the sending unit.
7. Remove the crankcase ventilation system. if so equipped. Remove the throttle control cable bracket.
8. Remove the valve rocker arm cover
9. Remove the valve rocker arm shaft assembly. Remove the valve push rods in sequence (Figure 35).
10. Remove the remaining cylinder head bolts and remove the cylinder head. **Do not pry between the cylinder head and block as the gasket surfaces may become damaged.**

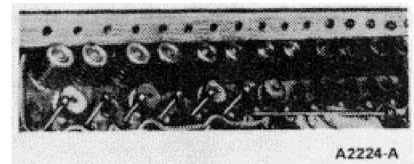


FIG 35. Valve Push Rod Removal

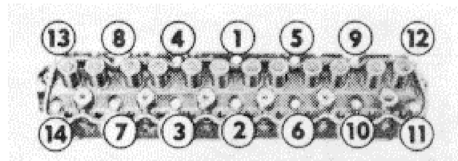


FIG 36. Cylinder Head Guide Studs

Installation

1. Clean the head and block gasket surfaces (refer to Page 1-07 for cleaning and inspection procedures). If the cylinder head was removed for a gasket change, check the flatness of the cylinder head and block. Install guide studs at each end of the cylinder block (Figure 36).
2. Position the cylinder head gasket over the guide studs on the cylinder block.
3. Install, but do not tighten two bolts at opposite ends of the head to hold the head and gasket in position. Re-move the guides and install the remaining bolts.
4. The cylinder head bolts are tightened in three progressive steps. Torque all the bolts in sequence (Figure 37) to specifications. When cylinder head bolts have been tightened following this procedure, it is not necessary to retorque the bolts after extended operation. However, on cylinder heads with composition gaskets, the bolts may be checked and retorqued, if desired. Tighten the exhaust manifold flange attaching nuts to specification.
5. Apply Lubriplate or equivalent to both ends of the push rods. Install the push rods in the original bores, positioning the lower end of the rods into the tappet sockets. Apply Lubriplate or equivalent to the valve stem tips and to the rocker arm pads.
6. Install the valve rocker arm shaft assembly following procedures under Valve Rocker Arm Shaft Installation. Check the valve clearance, following the procedure outlined under Valve Clearance Adjustment.

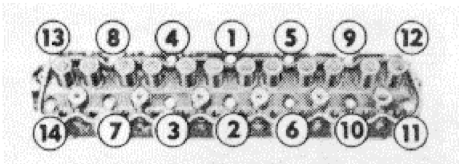


Figure 37. Cylinder Head Bolt Torque Sequence

7. Connect the radiator upper hose at the coolant outlet housing.
8. Position the distributor vacuum line and the carburetor fuel inlet line on the engine. Connect the fuel line at the fuel filter using a new clamp, then connect the distributor vacuum line at the carburetor.
9. Connect the throttle control cable bracket.
10. Connect the throttle control cable at the carburetor.
11. Connect the distributor vacuum line at the distributor. Connect the carburetor fuel inlet line at the fuel pump.
12. Connect the temperature sending unit wire at the sending unit. Connect the spark plug wires. **Be sure the wires are forced all the way down into their sockets.**
13. Fill and bleed the cooling system.
14. Install the crankcase ventilation system, if so equipped.
15. Start the engine and check for coolant and oil leaks.

HYDRAULIC VALVE LIFTERS

Before replacing a hydraulic valve lifter for noisy operation, he sure the noise is not caused by improperly adjusted valve clearance or by worn rocker arms or push rods.

Removal

1. Remove the cylinder head and related parts following the procedure under Cylinder Head Removal.
2. Using a magnet, remove the valve lifters (Figure AX). Place the lifters In a rack so they can be installed in the original positions.

If the lifters are stuck in their bores by excessive varnish or gum. it may be necessary to use a plier-type or claw-type tool to remove the lifters. Rotate the lifter back and forth to loosen any gum and varnish which may have formed on the lifter. **Keep the assemblies intact until they are to be cleaned. If the valve lifters are to be tested or disassembled and cleaned**. Follow the procedures on Page 1-07 If a hydraulic valve lifter has been disassem-bled and cleaned, **be sure to fill it with test fluid before installing it in the engine**. New valve lifters already contain test fluid.

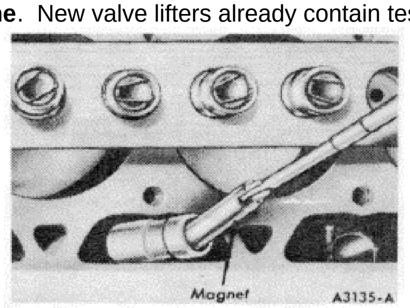


FIG. 38. Removing Valve Lifter

Installation

1. Install new (or cleaned) hydraulic valve lifters through the push rod openings with a magnet (Figure 38).
2. Install the cylinder head and related parts.

EXHAUST MANIFOLD

Removal

1. Remove the air cleaner and related parts.
2. Bend the exhaust pipe and manifold attaching bolt lock tabs back and remove the bolts. Remove the exhaust manifold.

Installation

1. Clean the mating surfaces of the exhaust pipe and cylinder head.
2. Position the exhaust manifold on the cylinder head and install the attaching bolts and tab washers. Torque the bolts and studs in sequence shown in Figure 39. Refer to specifications.
3. Install the exhaust pipe.
4. Install the air cleaner and related parts. Start the engine and check for exhaust leaks.

WATER PUMP

Removal

1. Drain the cooling system
2. Disconnect the radiator lower hose at the water pump. Remove the drive belt, fan, and water pump pulley.
3. Remove the water pump.

Installation

1. If a new water pump is to be installed, remove the heater hose fitting from the old pump and install it on the new pump. Clean the gasket surfaces on the water pump and cylinder block.
2. Coat the new gasket on both sides with water-resistant sealer and position it on the cylinder block.
3. Position the water pump and install the lockwashers and attaching bolts (the alternator adjusting arm is secured by one water pump bolt). Torque the bolts to specifications.
4. Connect the radiator lower hose to the water pump.
5. Install the water pump pulley and fan. Torque the bolts evenly and alternately to specifications.
6. Fill and bleed the cooling system. Operate the engine until normal operating temperature is reached. Check for leaks and check the coolant level.

CYLINDER FRONT COVER AND TIMING CHAIN

Removal

1. Drain the cooling system and the crankcase. Disconnect the radiator upper hose at the coolant outlet housing and the radiator lower hose at the water pump.
2. Remove the radiator Remove the drive belt, fan and pulley.
3. On a 200 CID engine, remove the cylinder front cover attaching screws from the cover and from the oil pan. Pry the top of the front cover away from the block slightly and, using a thin bladed knife, cut the oil pan gasket flush with the face of the cylinder block.

INSTRUCTIONS:
INSTALL 3/8-16 STUD & WASHER ASSEMBLY - HOLES NUMBERING 4 & 5 TORQUE TO 1/-24 FT-LB.
3/8-16 X 2.62 BOLT - HOLES 3-6-7-8-TORQUE TO 18-24 FT.-LB.
3/8-16 X 1.12 BOLT - HOLES 1-2-9-10-11 TORQUE TO 18-24 FT.-LB.

FRONT OF ENGINE ➔

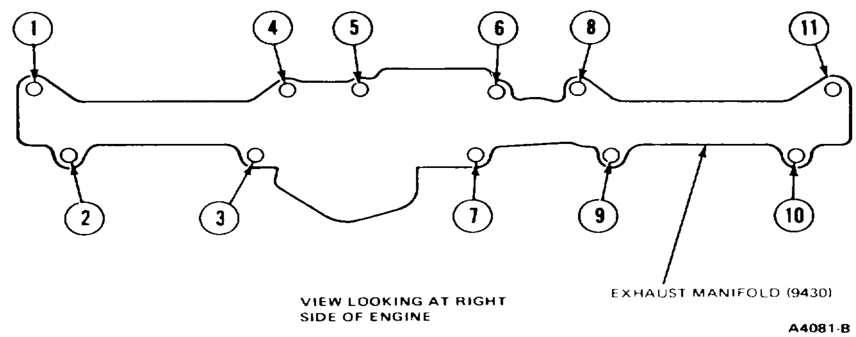


FIG 39. View Looking at Right Side of Engine

5. Clean any gasket material from the surfaces.
6. Rotate the crankshaft in a counterclockwise direction (as viewed from the front) to take up the slack on the left side of the chain.
7. Check timing chain deflection following the procedures given on Page 1-05. If the deflection exceeds '2 inch, replace the timing chain and sprockets.
8. Crank the engine until the timing marks are aligned as shown in Figure 40 Remove the camshaft sprocket attaching bolt and washer. Slide both sprockets and timing chain forward and remote them as an assembly (Figure 41).

Installation

1. Clean and inspect all parts before installation. Oil the timing chain after installing it on the camshaft and crankshaft. Be sure the timing marks on the sprockets are positioned as shown in Figure 40. Install the camshaft sprocket attaching bolt and washer. Torque the bolt to specifications.
2. Apply oil-resistant sealer to a new cylinder front cover gasket and position the gasket on the cylinder front cover. Apply sealer to the exposed area of the gasket. **On a 200 CID engine**, coat the gasket surface of the oil pan with oil resistant sealer. Cut and position the required portions of a new gasket on the oil pan. Apply sealer to the exposed areas of the gasket, including the corners where they contact the front cover gasket.
3. Install the cylinder front cover using the tool shown in Figure 43. Torque the attaching bolts to specifications.
4. Lubricate the hub of the crankshaft damper with Lubriplate or equivalent to prevent damage to the seal during installation or initial engine start. Install the crankshaft damper. Torque the attaching bolt to specifications.
6. Install the fan, pulley and drive belt. Adjust the drive belt.
7. Install the radiator. Connect the radiator upper and lower hoses. **Refill the crankcase with the proper grade and quantity of engine oil before starting the engine.**
8. Fill and bleed the cooling system.
9. Start the engine and check the ignition timing. Operate the engine at fast idle and check all hose connections and gaskets for leaks.

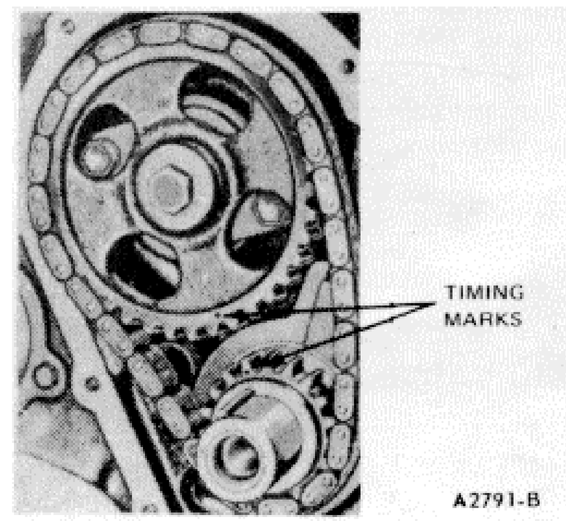


FIG. 40. Aligning Timing Marks

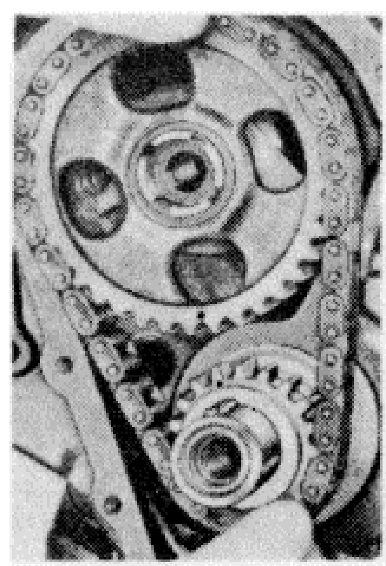


FIG. 41. Timing Chain and Sprockets Removal

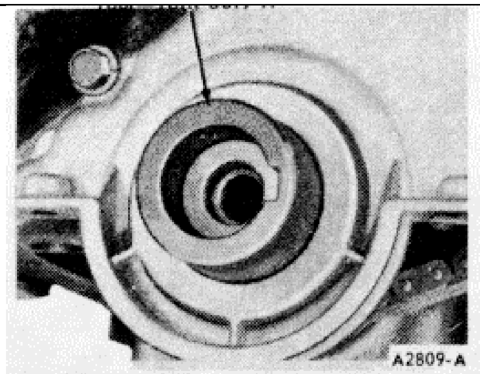


FIG. 43 Aligning Cylinder Front Cover

FRONT OIL SEAL

Removal

1. Remove the cylinder front cover.
2. Drive out the oil seal with a pin punch. Clean the recess in the cover.

Installation

1. Coat a new seal with grease and install the seal. Drive the seal in until it is fully seated in the recess (Figure 44). Check the seal after installation to be sure the spring is properly positioned in the seal.
2. Replace the cylinder front cover.

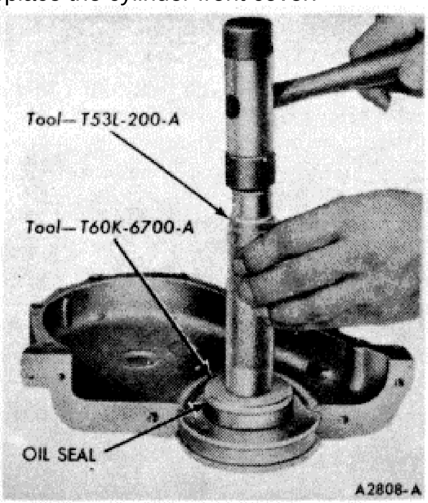


FIG. 44 Crankshaft Front Oil Seal Replacement

CAMSHAFT

The camshaft and related parts are shown in Figure 45.

Removal

1. Drain the cooling system and the crankcase. Remove the air cleaner.
2. Disconnect the radiator hoses from the coolant outlet housing and the water pump. Remove the radiator.
3. Disconnect the throttle control cable from the carburetor.
4. Disconnect the fuel inlet line at the fuel filter, and the distributor vacuum line from the carburetor.
5. Disconnect the distributor vacuum line from the distributor. Disconnect the carburetor fuel inlet line from the fuel pump. Remove the lines as an assembly.
6. Disconnect the spark plug wires from the spark plugs and the coil high tension lead at the coil. Remove the distributor cap and spark plug wires as an assembly. Disconnect the primary wire from the coil and remove it from the retaining clip on the cylinder head.
7. Disconnect the engine temperature sending unit wire from the sending unit. Disconnect the flexible fuel line from the fuel pump line and plug the line. Remove the distributor, the fuel pump, and the oil filter.
8. Remove the crankcase vent hose, regulator valve, valve rocker arm cover and cylinder head by following steps 7 through 10 under Cylinder Head Removal.
9. Using a magnet, remove the valve lifters and keep them in order so that they can be installed in their original locations (Figure 39). If the valve lifters are stuck in the bores by excessive varnish, etc., it may be necessary to use a claw-type tool to remove the lifters.
10. Loosen and remove the drive belt, fan and pulley. Remove the crankshaft damper.
11. Remove the oil level dipstick. Remove the oil pan (250 CID only). Remove the oil pump and inlet tube assembly.
12. Remove the cylinder front cover and gasket.
13. Push the camshaft toward the rear of the engine. Install a dial indicator so that the indicator point is on the camshaft sprocket cap screw (Figure 46). Zero the dial indicator. Position a large screwdriver between the camshaft sprocket and the block. Pull the camshaft forward and release it. Compare the dial indicator reading with specifications. If the end play is excessive, replace the thrust plate.
14. Remove the dial indicator. Remove the timing chain and sprockets as detailed under Cylinder Front Cover and Timing Chain Removal.
15. Remove the camshaft thrust plate. Carefully remove the camshaft by pulling it toward the front of the engine. Use caution to avoid damaging the journals and lobes.

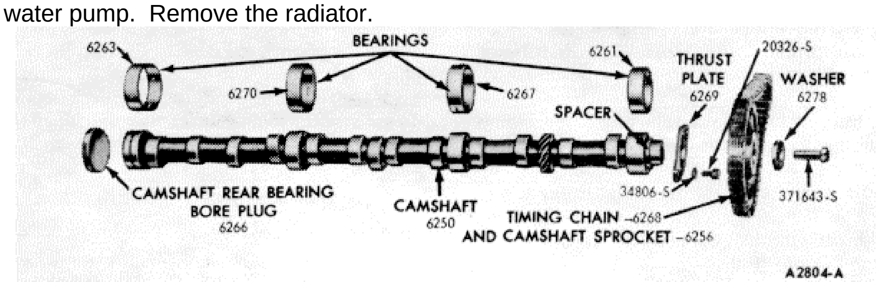


FIG. 45. Camshaft and Related Parts

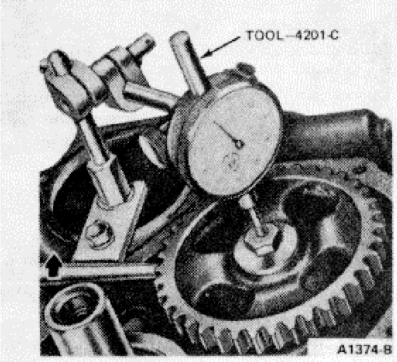


FIG 46 Checking Camshaft End Play

Installation

1. Clean the oil passage at the rear of the cylinder block that feeds the rocker arm shaft by blowing compressed air into the opening In the block Camshaft lobe, are to be coated with Lubriplate or equivalent and the journals lubricated with heavy oil SE before installation. Carefully slide the camshaft through the bearings.
2. Install the thrust plate with the oil groove toward the rear of the engine and torque the attaching bolts to specifications. Replace the crankshaft front oil seal.
3. Install the sprockets and timing chain. cylinder front cover and crankshaft damper as detailed under Cylinder Front Cover and Timing Chain Installation.
4. Clean the oil pump inlet tube screen, oil pan, and block gasket surfaces. Prime the oil pump by filling the inlet opening with oil and rotate the pump shaft until oil emerges from the outlet opening. Install the pump inlet tube. Install the oil pump and oil pan. Install the oil level dipstick.
5. Install the fan, fan pulley and drive belt Adjust the belt tension. Install the radiator.
6. Dip the base of the valve lifter body in Lubriplate or equivalent. Tappets or lifters and bores are to be lubricated with heavy oil SE before installation. Install the valve lifters in their original bores.
7. Install the cylinder head, push rods and the valve rocker arm shaft assembly by following the procedure under Cylinder Head Installation.
8. Using a new gasket, install the fuel pump and connect the flexible fuel line. Install the oil filter.
9. Position the No. 1 piston at TDC after the compression stroke. Position the distributor in the block with the rotor at the No. I firing position and the breaker points open. Install the distributor hold-down clamp.
10. Connect the engine temperature sending unit wire. Connect the coil primary wire. Install the distributor cap. Connect the spark plug wires and the coil high tension lead.
11. Install the carburetor fuel inlet line, using a new clamp on the filter tubing. Connect the distributor vacuum line to the carburetor.
12. Install the radiator and connect the radiator upper and lower hoses.
13. Connect the throttle control cable at the carburetor.
14. Fill the cooling system. Fill the crankcase.
15. Start the engine and check and adjust the ignition timing. Connect the distributor vacuum line to the distributor. Check for coolant and oil leaks. Adjust the engine idle speed and the idle fuel mixture.

CORE PLUGS

Removal

To remove a large core plug, drill a 1/2 inch hole in the center of the plug and remove with a clutch pilot bearing puller (Tool T59L-100-B and T58L-101-A) or pry it out with a large drift punch. On a small core plug, drill a 1/4 inch hole in the center of the plug and pry it out with a small pin punch. Clean and inspect the plug bore.

Prior to installing a core plug the plug bore should be inspected for any damage that would interfere with the proper sealing of the plug. If the bore is damaged it will be necessary to true the surface by boring for the next specified oversize plug.

Oversize (OS) plugs are identified by the OS stamped in the flat located on the cup side of the plug.

Coat the plug and/or bore lightly with an oil-resistant (oil galley) or water-resistant (cooling jacket) sealer and install it following the procedure for cup type or expansion type below:

Installation

Cup Type

Cup-type core plugs (Figure 47) are installed with the flanged edge outward. The maximum diameter of this plug is located at the outer edge of the flange. The flange on cup type plugs flares outward with the largest diameter at the outer (sealing) edge.

It is imperative to pull the plug into the machined bore using a properly designed tool. Under no circumstances is the plug to be driven into the bore using a tool that contacts the flange. This method will damage the sealing edge and will result in leakage and/or plug blow out.

The flanged (trailing) edge must be below the chamfered edge of the bore to effectively seal the plugged bore.

If the core plug replacing tool has a depth seating surface, do not seat the tool against a non-machined (casting) surface.

Expansion-Type

Expansion-type core plugs (Figure 47) are installed with the flanged edge inward. The maximum diameter of this plug is located at the base of the flange with the flange flaring inward.

It is imperative to push or drive the plug into the machined bore using a properly designed tool. Under no circumstances is the plug to be driven using a tool that contacts the crowned portion of the plug This method will expand the plug prior to installation and may damage the plug and/or plug bore.

When installed the trailing (maximum) diameter must be below the chamfered edge of the bore to effectively seal the plugged bore.

If the core plug replacing tool has a depth seating surface, do not seat the tool against a non-machined (casting) surface.

OIL PAN

Removal

1. Drain the crankcase.
2. Remove the oil level dipstick and the flywheel housing inspection cover.
3. Remove the oil pan and gasket.
4. Remove the oil pump inlet tube and screen.

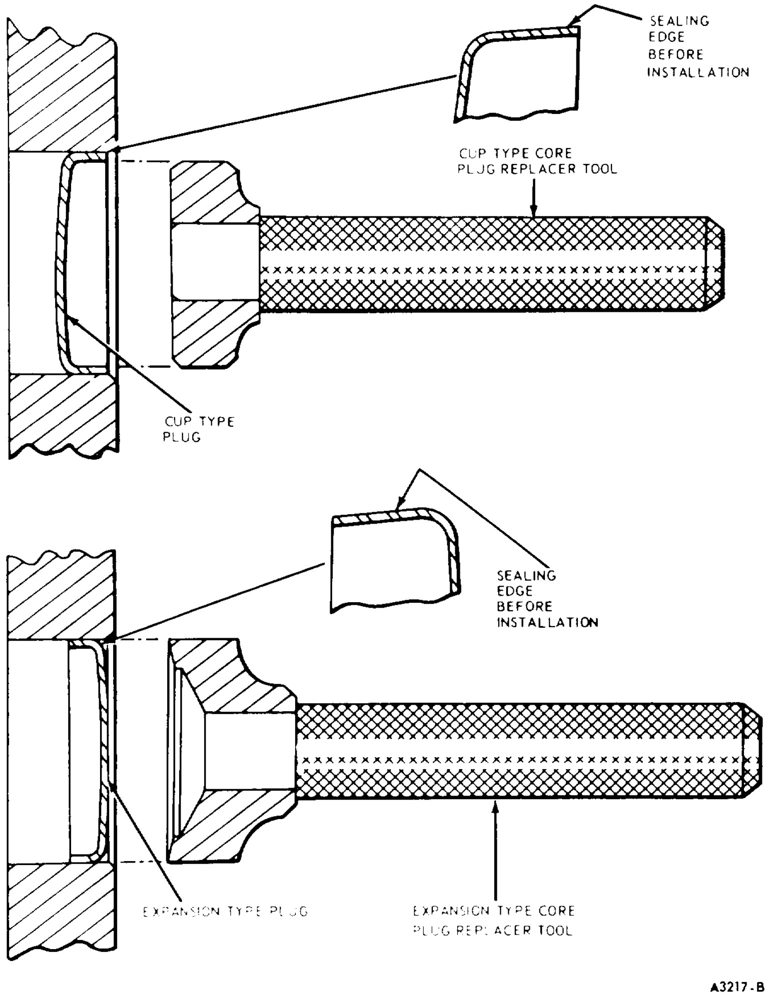


FIG 47. Core Plugs and Installation Tools - Typical

Installation

1. Clean the gasket surfaces of the block and oil pan. Be sure to clean the seal retainer grooves in the cylinder block and oil pan. The oil pan has a two-piece gasket. Coat the block surface and the oil pan gasket surface with oil-resistant sealer. Position the oil pan gaskets on the cylinder block (Figure 49).
2. Position the oil pan front seal on the cylinder front cover. Be sure the tabs on the seal are over the oil pan gasket.
3. Position the oil pan rear seal on the rear main bearing cap. Be sure the tabs on the seal are over the oil pan gasket.
4. Hold the oil pan in place against the block and install a bolt. finger tight, on each side of the oil pan. Install the remaining bolts. Torque the bolts from the center outward in each direction to specifications.
5. Install the oil level dipstick. Fill the crankcase with the proper grade and quantity of engine oil. Operate the engine and check for oil leaks.

OIL PUMP

Removal

1. Remove the oil pan and related parts as outlined under Oil Pan Removal.
2. Remove the oil pump attaching bolts and remove the oil pump. gasket, and intermediate drive shaft.

Installation

1. Prime the oil pump by filling the inlet port with engine oil. Rotate the pump shaft to distribute the oil within the pump body.
2. Position the intermediate drive shaft into the distributor socket.
3. Position a new gasket on the pump housing. Insert the intermediate drive shaft into the oil pump. Install the pump and shaft as an assembly. Do not attempt to force the pump into position if it will not seat readily. The drive shaft hex may be misaligned with the distributor shaft. To align, rotate the intermediate drive shaft into a new position. Torque the oil pump attaching screws to specifications.
4. Install the oil pan and related parts as outlined under Oil Pan Installation.

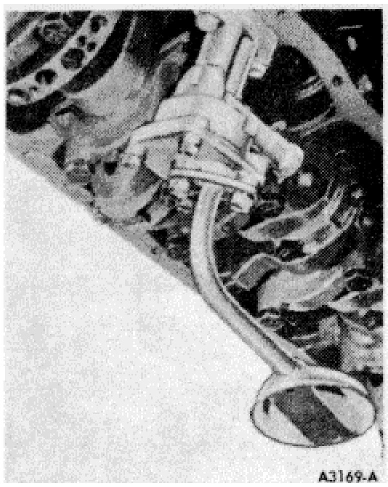


FIG. 48 200 CID Six Oil Pump Inlet Tube Installed

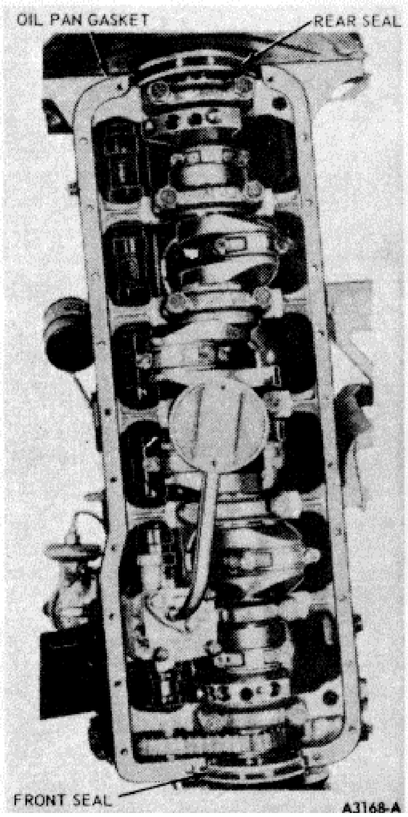


FIG. 49 200 CID Six Oil Pan Gaskets and Seals Installed

MAIN BEARINGS

Do not file or lap bearing caps or use bearing shims to obtain the proper bearing clearance.

Main bearings are available for service in standard sizes and 0.001 and 0.002 inch undersize. Undersize bearings, which are not selective fit, are available for use on journals that have been refinished.

Removal

1. Drain the crankcase. Remove the oil level dipstick. Remove the oil pan and related parts.
2. Remove the oil pump inlet tube and the oil pump.
3. Replace one bearing at a time, leaving the other bearings securely fastened. Remove the main bearing cap to which new bearings are to be installed.
4. Insert the upper bearing removal tool (Tool 6331) in the oil hole in the crankshaft.
5. Rotate the crankshaft in the direction of engine rotation to force the bearing out of the block.

Installation

1. Clean crankshaft journals. Inspect journals and thrust faces (thrust bearing) for nicks, burrs or bearing pickup that would cause premature bearing wear. When replacing standard bearings with new bearings, fit bearings to minimum specified clearance. If desired clearance cannot be obtained with a standard bearing, try one half of a 0.001 or 0.002 inch undersize in combination with a standard bearing to obtain the proper clearance. Be certain that bearings and that the bearing bore In the block or cap are clean. Foreign material under a bearing insert can cause bearing failure.
2. To install the upper main bearing, place the plain end of the bearing over the shaft on the locking tang side of the block and partially install the bearing so that the tool can be inserted in the oil hole in the crankshaft. With the tool positioned in the oil hole, rotate the crankshaft in the opposite direction of engine rotation until the bearing seats itself. Remove the tool.
3. Install the cap bearing.
4. Select-fit the bearings for proper clearance following procedures under Fitting Main and Connecting Rod Bearings on Page 1-13.
5. If the rear main bearing is replaced, replace the oil seal in the rear main bearing cap.
6. After the bearing has been fitted, apply a light coat of engine oil to the journal and bearings, then install the bearing cap. Torque the cap bolts to specifications. Repeat the procedure for the remaining bearings that require replacement.
7. If the thrust bearing cap (No. 5 main bearing) has been removed, install it as follows: Install the thrust bearing cap with the bolts finger tight. Pry the crankshaft forward against the thrust surface of the upper half of the bearing (Figure 50). Hold the crankshaft forward and pry the thrust bearing cap to the rear. This will align the thrust surfaces of both halves of the bearing. Retain the forward pressure on the crankshaft. Torque the cap bolts to specifications.
8. Clean the oil pump inlet tube screen. Prime the oil pump by filling the inlet opening with oil and rotating the pump shaft until oil emerges from the outlet opening. Then install the oil pump and the inlet tube, following instructions under Oil Pan Installation.
9. Clean the gasket surfaces of the block and oil pan. Be sure to clean the seal grooves of the block and oil pan. The oil pan has a two-piece gasket. Coat the block side of the gasket with an oil-resistant sealer. Position the oil pan gasket on the block, then install the oil pan and related parts following instructions under Oil Pan Installation. Install the oil level dipstick.
10. Fill the crankcase to the proper level with the recommended engine oil. Start the engine and check for oil pressure. Operate the engine at fast idle and check for oil leaks.

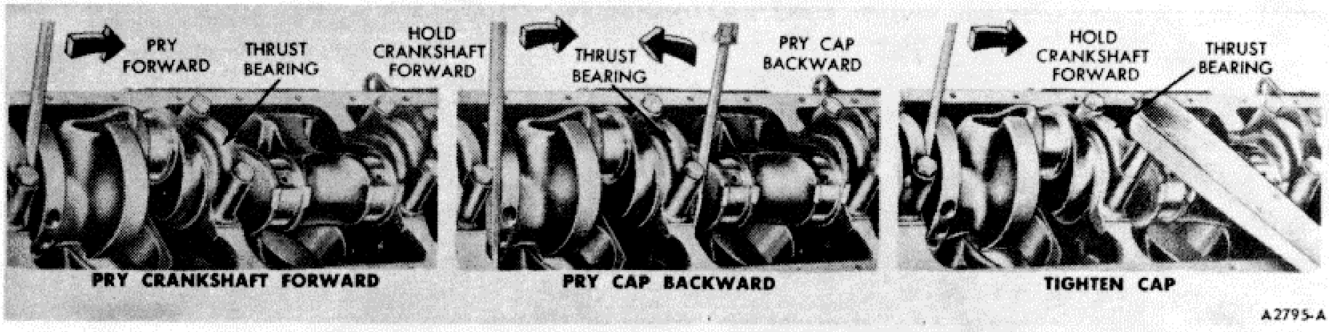


FIG. 50 Typical Thrust Bearing Alignment

CONNECTING ROD BEARING

Removal

1. Follow steps I and 2 under Main Bearing Replacement.
2. Turn the crankshaft until the connecting rod to which new bearings are to be fitted is down. Remove the connecting rod cap. Remove the bearing inserts from the rod and cap.

Installation

1. Be sure the bearing inserts and the bearing bore in the connecting rod and cap are clean. Foreign material under the inserts will distort the bearing and cause a failure.
2. Clean crankshaft journal. When replacing standard bearings with new bearings, fit the bearing to minimum specified clearance.
3. Install the bearing inserts in the connecting rod and cap with the tangs fitted in the slots provided.
4. Pull the connecting rod assembly down firmly on the crankshaft journal.
5. Select fit the bearings for proper clearance following procedures under Fitting Main and Connecting Rod Bearings.
6. After the bearing has been fitted, clean and apply a light coat of engine oil SE to the journal and bearings. Install connecting rod cap. Be sure connecting rod bolt heads are properly seated in connecting rod. Torque nuts to specifications.
7. Repeat the procedure for the remaining connecting rods that require new bearings.
8. Install the oil pump assembly and oil pan following the procedure under Main Bearings.

PISTONS AND CONNECTING RODS

Removal

1. Drain the cooling system and the crankcase.
2. Refer to Cylinder Head Removal and remove the cylinder head and related parts.
3. Remove the oil pan and related parts. Remove the oil pump inlet tube and the oil pump.
4. Turn the crankshaft until the piston to be removed is at the bottom of the stroke, then place a cloth on the piston head to collect the cuttings. Remove any ridge and/or deposits from the upper end of the cylinder bores with a ridge cutter. Follow the instructions furnished by the tool manufacturer. Never cut into the ring travel area in excess of 1/32 inch when removing ridges.
5. Make sure all the connecting rod cops are marked so that they can be installed in their original positions. Remove the connecting rod cap.
6. Push the connecting rod and piston assembly out the top of the cylinder with the handle end of a hammer. Avoid damage to the crankpin or the cylinder wall when removing the piston and rod.

Installation

1. Clean the oil pump inlet tube screen and the oil pan and block gasket surfaces.
2. Oil the piston rings, pistons and cylinder walls with light engine oil.
3. Be sure to install the pistons in the same cylinders from which they were removed, or to which they were fitted. The connecting rods and bearing caps are numbered from I to 6, beginning at the front of the engine. The numbers on the connecting rod and bearing cap must be on the same side when installed in the cylinder bore. If a connecting rod is transferred from one block or cylinder to another, new bearings should be fitted and the connecting rod should be numbered to correspond with the new cylinder.
4. Make sure the ring gaps are properly spaced around the circumference of the piston (Figure 51). Install a piston ring compressor on the piston and push the piston in with a hammer handle until it is slightly below the top of the cylinder (Figure 52). Be sure to guide the connecting rods to avoid damaging the crankshaft journals. Install the piston with the notch in the dome of the piston toward the front of the engine (Figure 54).
5. Check the clearance of each bearing, following the procedure under Connecting Rod Bearings.
6. After the bearings have been fitted, apply a light coat of engine oil to the journals and bearings.

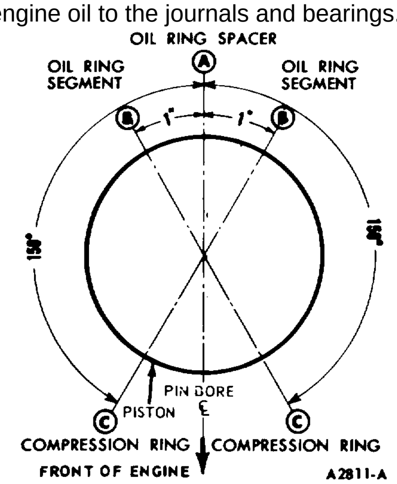


FIG. 51 Piston Ring Gap Spacing

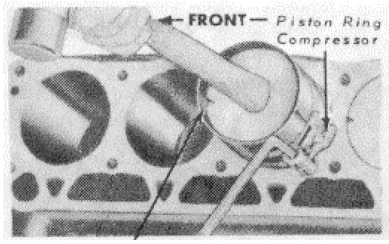


FIG 52 Piston Installed

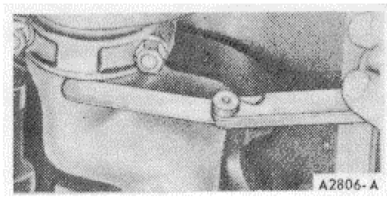


FIG 53 Typical Connecting Rod Side Clearance

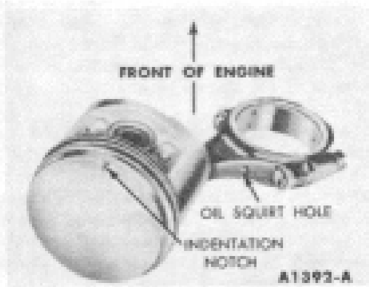


FIG 54 Typical Piston and Connecting Rod Assembly

7. Turn the crankshaft throw to the bottom of the stroke, then push the piston all the way down until the connecting rod bearing ,seat on the ,crankshaft journal Install the connecting rod cap Torque the nuts to specifications.
8. after the piston and connecting rod assemblies have been installed. check the connecting rod side clearance on each crankshaft journal (Figure 53)
9. Prime the oil pump by filling the inlet opening with oil and rotating the pump shaft until oil emerges from the outlet opening. Install the oil pump and the oil pump inlet tube. Install the oil pan and related parts
10. Install the cylinder head by following the instructions under Cylinder Head Installation.
11. Fill the crankcase with proper grade of oil
12. Start the engine and check for oil pressure. Operate the engine at fast Idle and check for oil and coolant leaks
13. Check and adjust the ignition timing. engine idle speed and the fuel mixture

CRANKSHAFT

The crankshaft and related parts are shown in Figure 55.

Removal

1. With engine placed on a work stand, remove the oil level dipstick.
2. Remove the accessory drive pulley (if so equipped). Remove the crankshaft damper attaching bolt and washer. Remove the crankshaft vibration damper.
3. Remove the cylinder front cover, Remove the cover gasket.
4. L heck the timing chain deflection, then remove the timing chain and sprockets as detailed under Cylinder Front Cover and Timing Chain Removal.
5. Invert the engine on the work stand. Remove the flywheel. Remove the oil pan and gasket. Remove the oil pump.
6. Make sure all bearing caps (main and connecting rod) are marked so that they can be installed in their original locations. Turn the crankshaft until the connecting rod from which the cap is being removed is down. Remove the connecting rod cap. Push the connecting rod and piston assembly up in the cylinder. Repeat for the remaining caps.

7 Remove the main bearing caps.

8. Carefully lift the crankshaft out of the block so that the thrust bearing surfaces are not damaged. **Handle the crankshaft with care to avoid possible fracture or damage to the finished surfaces.**

Installation

1. Remove the rear journal oil seal from the block and rear main bearing cap.
2. Remove the main bearing inserts from the connecting rods and caps.
3. Remove the connecting rod bearing inserts from the connecting rods and caps
4. Clean the rear journal oil seal grooves. Install a new rear journal oil seal in the block and rear main bearing cap.
5. Apply a thin coating of oil-resistant sealer to the rear main bearing cap at the rear of the top mating surface. Do not apply sealer to the area forward of the oil slinger groove.
6. If the crankshaft main bearing journals have been refinished to a definite undersize, install the correct undersize bearings. Be sure the bearing inserts and bearing bores are clean. Foreign material under the inserts will distort the bearing and cause a failure.
7. Place the upper main bearing inserts in position in the bores with the tang fitting the slot provided.
8. Install the lower main bearing inserts in the bearing caps.
9. Carefully lower the crankshaft into place. **Be careful not to damage the bearing surfaces.**
10. Check the clearance of each main bearing. Select fit the bearings for proper clearance following procedures under Fitting Main and Connecting Rod Bearings.
11. After the bearings have been fitted, apply a light coat of engine oil to the journals and bearings. Install all the bearing caps, except the thrust bearing cap (No. 5 bearing). **Be sure that the main bearing caps are installed in their original locations. Torque the bearing cap bolts to specifications.**
12. Install the thrust bearing cap with the bolts finger tight.
13. Pry the crankshaft forward against the thrust surface of the upper half of the bearing (Figure 50).
14. Hold the crankshaft forward and pry the thrust bearing cap to the rear. This will align the thrust surfaces of both halves of the bearing.
15. Retain the forward pressure on the crankshaft. Torque the cap bolts to specifications.
16. Force the crankshaft toward the rear of the engine.
17. Install a dial indicator so that the contact point rests against the crankshaft flange and the indicator axis is parallel to the crankshaft axis (Figure 56).

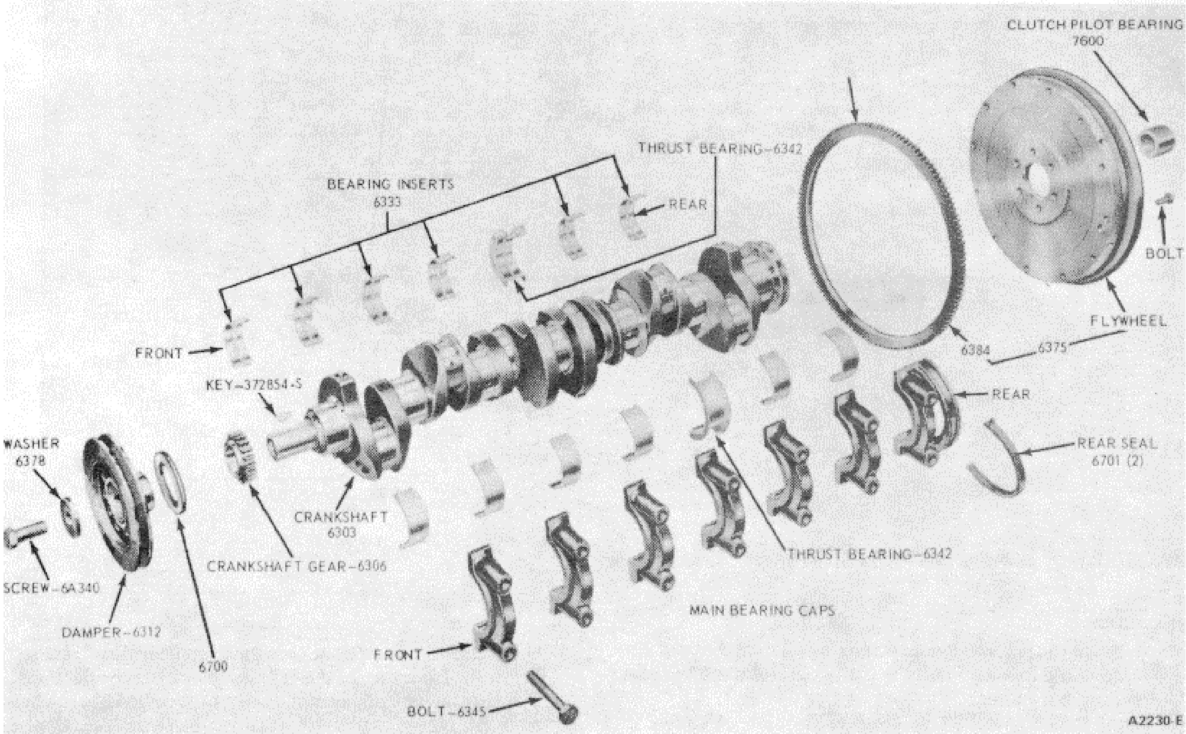


FIG 55 200 CID Six Crankshaft and Related Parts

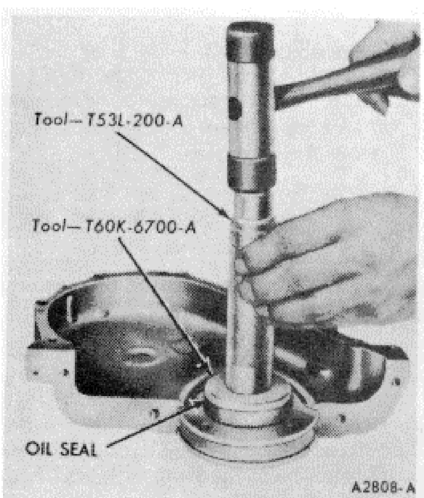


FIG. 56 Crankshaft End Play

18. Zero the dial indicator. Push the crankshaft forward and note the reading on the dial.
19. If the end play exceeds specifications, replace the thrust bearing. If the end play is less than the minimum limit, inspect the thrust bearing faces for scratches. burrs, nicks or dirt. If the thrust faces are not damaged or dirty they probably were not aligned properly. Install the thrust bearing and align the faces following the recommended procedure (steps 12. 1,. i4 and 15). Check the end play.
20. Install new bearing inserts in the connecting rods and caps. Check the clearance of each bearing following the procedure under Connecting Rod Bearings
21. If the bearing clearances are to specifications, apply a light coat of engine oil to the journals and bearings.
22. Turn the crankshaft throw to the bottom of the stroke. Push the piston all the way down until the rod bearing seats on the crankshaft journal.
23. Install the connecting rod cap Torque the nuts to specifications.
24. After the piston and connecting rod assemblies have been installed, check the connecting rod side clearance on each connecting rod crankshaft journal
25. Turn the engine on the work stand so that the front end is up. Install the timing chain and sprockets, cylinder front cover and crankshaft pulley or damper. as detailed under Cylinder Front Cover and Timing Chain Installation.
26. Clean the oil pan. oil pump. and oil pump scr een
27. Prime the oil pump by filling the inlet opening with oil and rotating the pump shaft until oil emerges from the outlet opening. Install the oil pump following steps 1, 2 and 3 under Oil Pump Installation. Install the oil pan following steps 2 through 5 under Oil P-an Installation.
28. Position the flywheel on the crankshaft Apply oil resistant sealer to the flywheel attaching bolts Install and torque the bolts to specifications locate the clutch disc and install the pressure plate.
29. Turn the engine on the work stand so that the engine is in the normal position Install the oil level dipstick Install the accessory drive pulley (if so equipped) Install and adjust the drive belt and accessory belts to specifications.
30. Remove the engine from the work stand.

CAMSHAFT BEARING

The camshaft bearings are available pre-finished to size and require no reaming for standard and 0.015-inch undersize journal diameters

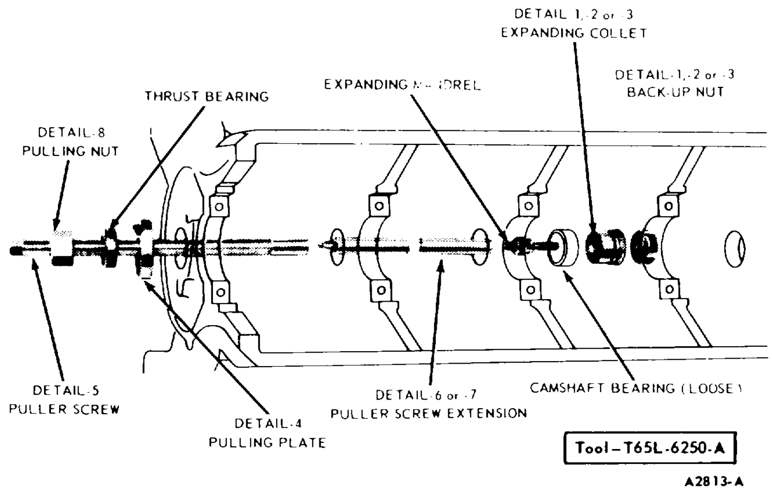


FIG. 57 Typical Camshaft Bearing Replacement

Removal

1. Remove the engine. Place the engine on a work stand and remove the flywheel and the camshaft. Remove the rear bearing bore plug.
2. Remove the camshaft bearings with the tool shown in Figure 57.
3. Select the proper size expanding collet and back-up nut and assemble on the expanding mandrel. With the expanding collet collapsed, install the collet assembly in the camshaft bearing and tighten the back-up nut on the expanding mandrel until the collet fits the camshaft bearing.
4. Assemble the puller screw and extension (if necessary) as shown and install on the expanding mandrel. Wrap a cloth around the threads of the puller screw to protect the front bearing or journal. Tighten the pulling nut against the thrust bearing and pulling plate to remove the camshaft bearing. Be sure to hold a wrench on the end of the puller screw to prevent it from turning.
5. Repeat the procedure for each bearing. To remove the front bearing. install the puller screw from the rear of the cylinder block.

Installation

1. Position the new bearings at the bearing bores, and press them in place with the tool shown in Figure 57. Be sure to center the pulling plate and puller screw to avoid damage to the bearing. **Failure to use the correct expanding collet can cause severe bearing damage**. Align the oil holes in the bearings with the oil holes in the cylinder block when the bearings are installed. **Be sure the front bearing is installed below the front face of the cylinder block to specifications. The rear has two oil holes and must be installed 24Y4 inches from the face of the camshaft thrust plate surface. Check the oil passage that feeds the rocker arm shaft for obstructions by squirting oil into the opening in the cylinder block and observing the flow through the oil hole at the rear camshaft bearing.**
2. Install a new bearing bore plug as detailed on Page 1-21.
3. Install the camshaft, crankshaft, flywheel and related parts, following the appropriate procedures. Do not check connecting rod and main bearing clearances as a part of Camshaft Bearing Replacement.

OIL FILTER

Removal

1. Place a drip pan under the filter. Unscrew the filter from the adapter fitting. Clean the adapter filter recess.

Installation

1. Add one quart of the proper type and grade of oil to the crankcase. Coat the gasket on the replacement filter with oil. Position the filter on the adapter fitting. Hand tighten the filter until the gasket contacts the adapter face, then advance it 1/2 turn.
2. Operate the engine at fast idle and check for oil leaks. If oil leaks are evident, perform the necessary repairs to correct the leakage. Check the oil level and fill the crankcase if necessary.

DISASSEMBLY AND ASSEMBLY

When installing nuts or bolts that must be torqued, oil the threads with light weight engine oil. Do not oil threads that require oil-resistant or water-resistant sealer. Refer to Page 1-07 for cleaning and inspection procedures

VALVE ROCKER ARM SHAFT ASSEMBLY

Disassembly

1. Remove the pin and spring washer from each end of the valve rocker arm shaft.
2. Slide the valve-rocker arms, springs, and supports off the shaft. Be sure to identify the parts.
3. If it is necessary to remove the plugs from each end of the shaft, drill or pierce the plug on end. Use a steel rod to knock out the plug on the opposite end. Working from the open end, knock out the remaining plug.

Assembly

1. All rocker arms and rocker arm shafts are to be lubricated with heavy oil SE before assembly.
2. If the plugs were removed from the ends of the shaft, use a blunt tool or large diameter pin punch and install a plug, cup side out, in each end of the shaft.

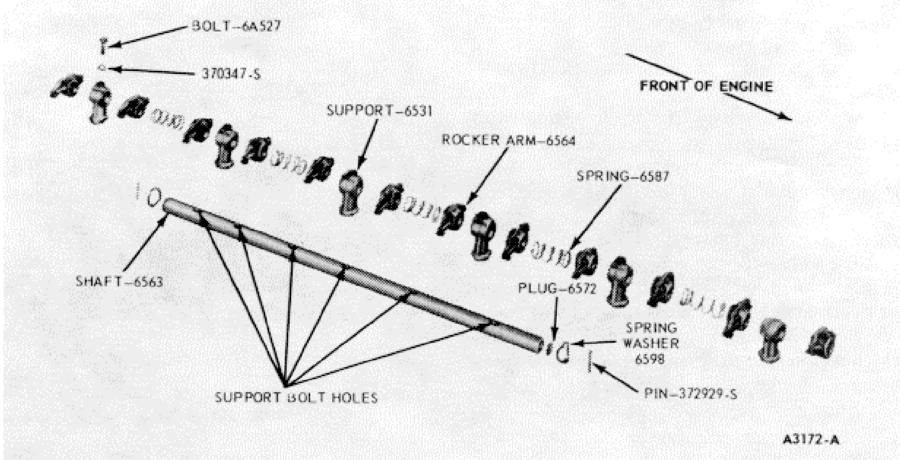


FIG 58 Valve Rocker Arm Shaft Assembly

3. Install the spring washer and pin on one end of the shaft.
4. Install the valve rocker arms, supports, and springs in the order shown in Figure 58. Be sure the oil holes in the shaft are facing downward. Complete the assembly by installing the remaining spring washer and pin.

VALVE LIFTER HYDRAULIC

Each valve lifter is a matched assembly; therefore, the parts are not interchangeable. Disassemble and assemble each lifter carefully, keeping the assemblies in proper sequence so they will be installed in the original bores.

1. Grasp the lock ring with needle nose pliers to release it from the groove. It may be necessary to depress the plunger to fully release the lock ring.
2. Remove the push rod cup, plunger and spring.
3. Invert the plunger assembly and remove the check valve retainer by carefully prying up on it with a screwdriver. Remove the check valve and spring. Refer to cleaning, inspection and testing procedures.

Assembly

A typical hydraulic valve lifter assembly is shown in Figure 59.

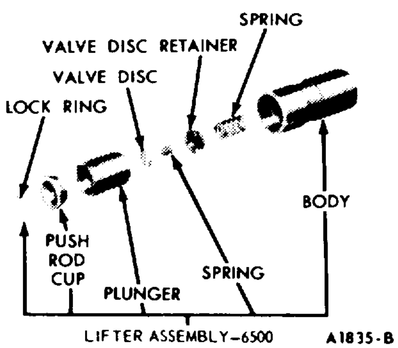


FIG. 59 Typical Valve Lifter Assembly

1. Place the plunger in the inverted position on a clean work bench.
2. Place the check valve in position over the oil hole on the bottom of the plunger. Set the check valve spring on top of the check valve.
3. Position the check valve retainer over the check valve and spring and push the retainer down into place on the plunger.
4. Place the plunger spring and then the plunger (open end up) into the tappet body.
5. Place the push rod seat in the plunger.
6. Depress the plunger and position the closed end of the lock ring in the lifter body groove. Release the plunger; then depress it again to fully seat the lock ring.

CYLINDER HEAD

Disassembly

1. Remove deposits from the combustion chambers and valve heads with a scraper and a wire brush before removing the valves. **Be careful not to scratch the cylinder head gasket surfaces.**
2. Compress the valve springs (Figure 59). Remove the valve retainer locks and release the spring. If the valve locks are stuck, place a piece of steel tubing (¾Y4 inch OD, ½ inch ID and 3 inches long) over the end of the valve stem squarely against the sleeve surface. Tap the tube with a steel hammer to disengage the locks.
3. Remove the sleeve, spring retainer, stem seal and valve. Discard the valve stem seals. Identify all valve parts. If the cylinder head is to be replaced, remove the manifold assembly.

Assembly

1. Clean, inspect and repair all parts before assembly. If the cylinder head is being replaced, install the manifold assembly. Lubricate the valve guides and valve stems with heavy engine oil SE. Apply Lubriplate or equivalent to the tips of the valve stems.
2. Install each valve (Figure 61) in the valve guide from which it was removed or to which it was fitted. Install a new stem seal on the valve.

FIG. 60 Compressing Valve Spring - On Bench

3. Install the value spring assembly over the value. Install the spring retainer and sleeve.
4. Compress the spring and install the retainer locks (Figure 60).
5. Measure the assembled height of the value spring from the surface of the cylinder head spring pad to the underside of the spring retainer with dividers (Figure 62).
6. Check the dividers against a scale. If the assembled height is greater than specifications, install the necessary 0.030 inch thick spacers (s) between the cylinder head spring pad and the valve spring to bring the assembled height to the recommended dimension. Do not install spacers unless necessary. Use of excess spears will result in over stressing the valve springs and overloading the camshaft lobes which would lead to spring breakage and worn camshaft lobes.

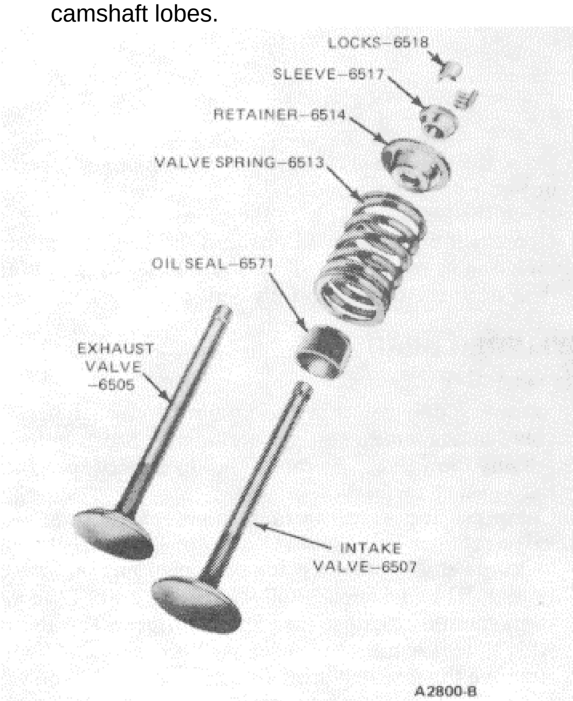


FIG 61 Typical Valve Assembly

PISTON AND CONNECTING ROD

Disassembly

1. Remove the bearing inserts from the connecting rod and cap.
2. Mark the piston and pins to assure assembly with the same rod and installation in the same cylinder from which there were removed.
3. Using an arbor press and the tool shown in Figure 63. Press the piston pin from the piston and connecting rod, Remove the piston rings.

Assembly

The piston, connecting rod and related parts are shown in Figure 64. Check the fit of a new piston in the cylinder bore before assembling the piston and piston pin to the connecting rod. Refer to Page 1-13 for fitting pistons procedure

The piston pin bore of a connecting rod and the diameter of the piston pin must be within specifications. Refer to specification.

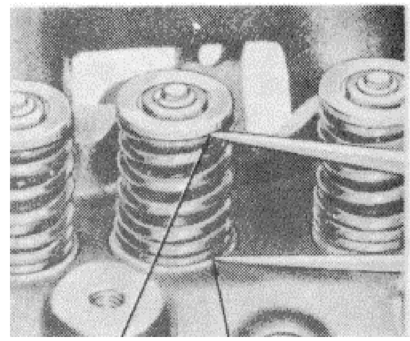


FIG 62 Checking Valve Spring Assembled Height

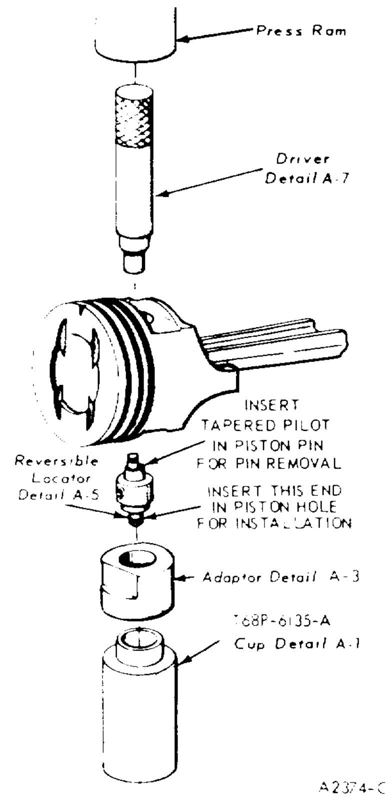


FIG 63 Removing or Installing Piston Pin

1. Apply a light coat of engine oil to all parts. Assemble the piston to the connecting rod with the oil squirt hole in the connecting rod and the indentation in the piston dome positioned as shown in Figure 54.
2. Start the piston pin in the piston and connecting rod (this may require a very light tap with a mallet). Using an arbor press. press the piston pin through the piston and connecting rod until the pin is centered In the piston (Figure 63).

3 Check the end gap and spacing (Figure 57) of all piston rings. They must be within specifications.

4. Follow the manufacturer's instructions (included with the piston ring package) and install the piston rings.

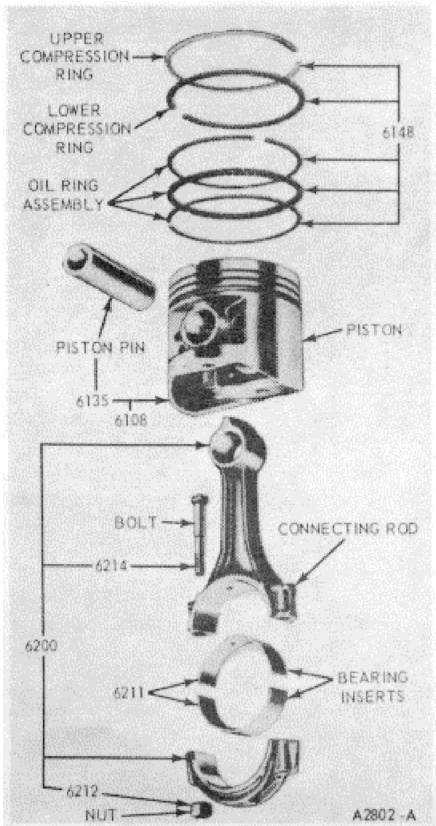


FIG. 64 Typical Piston, Connecting Rod and Related Parts

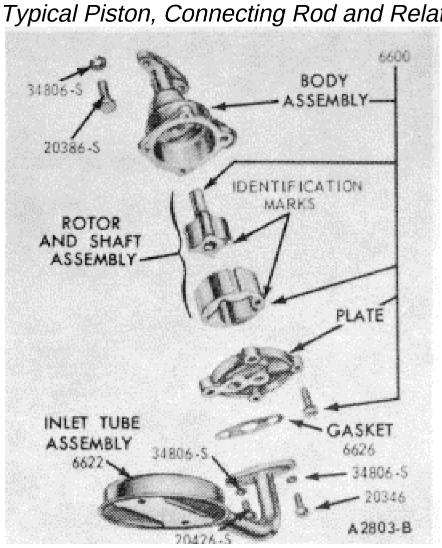


FIG. 66 Oil Pump - Disassembled

5. Check the ring side clearance of the compression rings with a feeler gauge inserted between the ring and the lower land. The gauge should slide freely around the entire ring circumference without binding. Any wear that occurs will form a step at the inner portion of the lower land**. If the lower lands have high steps, the piston should be replaced.**

6. Be sure the bearing inserts and the bearing bore in the connecting rod and cap are clean. Foreign material under the inserts will distort the bearing and cause a failure. Install the bearing inserts in the connecting rod and cap with the tangs fitting in the slots provided.

OIL PUMP

Disassembly

1. Remove the oil inlet tube from the oil pump and remove the gasket.
2. Remove the cover attaching screws and remove the cover. Remove the inner rotor and shaft assembly. and remove the outer race
3. Drill a small hole. then insert a self-threading sheet metal screw of the proper diameter into the oil pressure relief valve chamber cap and pull the clip out of the chamber Remove the spring and plunger.

Assembly

The oil pump assembly is shown in Figure 65.

1. Clean, inspect and oil all parts thoroughly.
2. Install the oil pressure relief valve plunger. spring and a new cap.
3. Install the outer race and the inner rotor and shaft assembly. Be sure the identification mark on the rotor is on the same side as the identification mark on the outer race. The inner rotor and shaft, and the outer race are serviced as an assemble. One part should not he replaced without replacing the other. Install the cover and torque the attaching screws to specification
4. Position a new gasket and the oil inlet tube on the oil pump and install the attaching bolts
5. Prime the oil pump by filling the inlet port with oil Rotate the pump shaft until oil flow(is from the outlet port.

CYLINDER ASSEMBLY

Disassembly

1. Mount the old engine in a work stand and remove all parts not furnished with the new cylinder assembly, following the procedures given under Removal and Installation.
2. Remove the old cylinder assembly from the work stand.

Assembly

1. Clean the gasket and seal surfaces of all serviceable parts and assemblies.
2. Position the new cylinder assembly in a work stand and transfer all serviceable parts removed from the old cylinder assembly. following the procedures given under Removal and Installation.
3. Check all assembly clearances and correct as necessary.

CYLINDER BLOCK

Before replacing a cylinder block. determine if it is repairable. If so, make the necessary repairs

Disassembly

1. Mount in a work stand and completely disassemble the old engine. following the procedures given under Removal and Installation
2. Remember to ridge-ream the cylinder bores before removing piston assemblies.

Assembly

1. Clean the gasket and seal surfaces of all serviceable parts and assemblies.
2. Position the new cylinder block in the work stand and transfer all serviceable parts removed from the old cylinder block, following the instructions given under Removal and Installation.
3. Check all assembly clearances and correct as necessary.

Part 2 Ignition System

IDENTIFICATION

The distributor identification number is stamped on the distributor housing. The basic part number for distributors is 12100/ To procure replacement parts, it is necessary to know the part number prefix and suffix (Figure 1).

Always refer to the Parts Catalog for parts usage and interchangeability before replacing a distributor or a component part for a distributor.

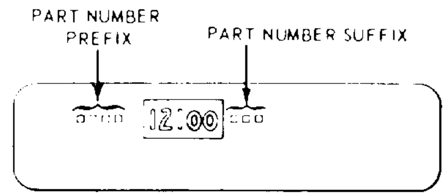


FIG. 1 Distributor Identification

DESCRIPTION

The distributor is located on the right side of the engine. It is equipped with both a vacuum and a centrifugal advance unit to control ignition timing. The vacuum advance governs the ignition timing (spark advance) during low engine speeds (rpm) or low engine loading. The centrifugal advance, in combination with the vacuum advance, controls the ignition timing at higher engine speeds or heavy engine loads to provide the correct ignition timing for maximum engine Performance.

VACUUM SINGLE ADVANCE UNIT

The distributor advance systems are independently operated. The centrifugal advance mechanism (Figure 2), located below the stationary sub-plate assembly, has centrifugal weights that move inward or outward with changes in engine speed. As engine speed increases the centrifugal weights move ahead with respect to the distributor drive shaft. The rate of advance is controlled by calibrated weight springs.

The vacuum single advance has a spring loaded diaphragm connected to the breaker plate assembly. The diaphragm is moved against the spring pressure by vacuum pressures. When the vacuum increases, the diaphragm causes the movable breaker plate to pivot on the stationary sub-plate. The breaker point rubbing block, which is positioned on the opposite side of the cam from the pivot pin, then moves opposite to distributor rotation and advances the spark timing. As the movable breaker plate is rotated from retard position to full-advance position, the breaker point dwell will remain constant due to the breaker point rubbing block and the cam rotating on the same axes of the new design breaker plate and sub-plate.

CONVENTIONAL IGNITION SYSTEM

The ignition system consists of a primary (low voltage) and a secondary (high voltage) circuit (Figure 3).

The primary consists of the:

1 Battery.
2 Ignition switch.
3 Primary circuit resistance wire.
4 Primary windings of the ignition coil.
5 Breaker points.
6 Condenser.

The secondary circuit consists of the:

1 Secondary windings of the ignition coil.
2 Distributor rotor.
3 Distributor cap.
4 High tension wires.
5 Spark plugs.

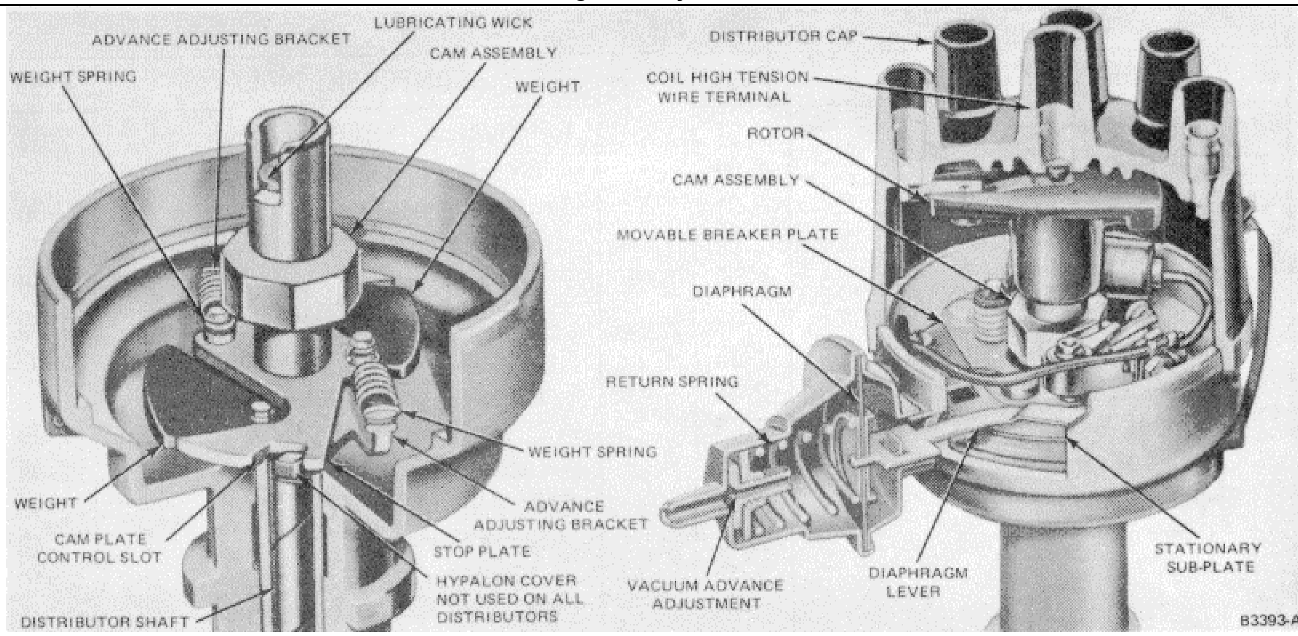
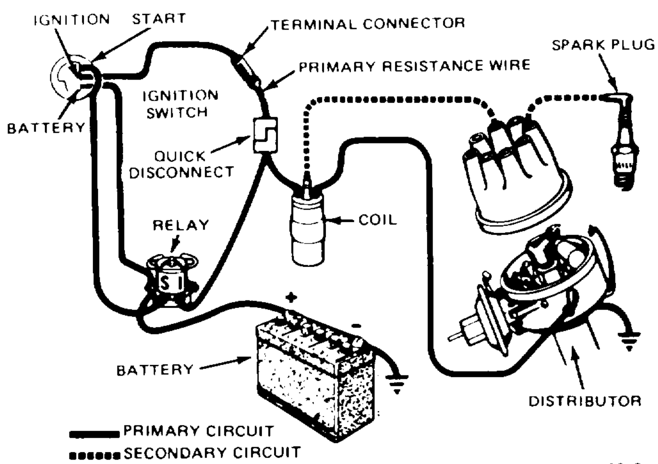


FIG. 2 Advance Mechanisms - Dual Advance Distributor with Single Diaphragm



COVENTIONAL

FIG 3 Typical Conventional Ignition System Circuits

When the breaker points are closed. current flows from the battery through the ignition switch to the primary windings in the coil, then to ground through the closed breaker points. When the breaker points open, the magnetic field built up in the primary windings of the coil moves through the secondary windings of the coil, producing high voltage.

High voltage is produced each time the breaker points open. The high voltage flows through the coil high tension lead to the distributor cap where the rotor distributes it to one of the spark plug terminals in the distributor cap. This process is repeated for every power stroke of the engine.

DIAGNOSIS AND TESTING

Ignition systems troubles are caused by a failure in the primary and/or secondary circuit; incorrect ignition timing; or incorrect distributor advance. Circuit failures may be caused by shorts, corroded or dirty terminals, loose connections, defective wire insulation, cracked distributor cap or rotor, defective distributor points, fouled spark plugs, or by improper dwell angle.

If engine starting or operating trouble is attributed to the ignition system, start the engine and verify the complaint. On engines that will not start, be sure there is gasoline in the fuel tank and that fuel is reaching the carburetor. Then locate the ignition system problem by an oscilloscope test or by a spark intensity test.

SPARK INTENSITY TESTS
Trouble Isolation

1. Connect an auxiliary starter switch in the starting circuit.
2. Remove the coil high tension lead from the distributor cap.
3. Turn on the ignition switch.

4. While holding the high tension lead approximately 3/16 inch from the cylinder head or any other good ground, crank the engine with an auxiliary starter switch.
   If the spark Is good, the trouble lies in the secondary circuit.
   If there is no spark or a weak spark, the trouble is in the primary circuit. coil to distributor high tension lead, or the coil.

Primary Circuit

A breakdown or energy loss in the primary circuit can be caused by: defective primary wiring. or loose or corroded terminals; burned, shorted, sticking or improperly adjusted breaker points; a defective coil; or defective condenser.

A complete test of the primary circuit consists of checking the circuit from the battery to the coil, the circuit from the coil to ground, and the starting ignition circuit.

Excessive voltage drop in the primary circuit will reduce the secondary output of the ignition coil, resulting in hard starting and poor performance.

To isolate a trouble in the primary circuit, use a voltmeter and perform the following tests: Battery to Coil, Starting Ignition Circuit, Resistance Wire, Coil to Ground, or Breaker Points.

Secondary Circuit

A breakdown or energy loss in the secondary circuit can be caused by: fouled or improperly adjusted spark plugs; defective high tension wiring; or high tension leakage across the coil, distributor cap or rotor resulting from an accumulation of dirt.

To check the spark intensity at the spark plugs, thereby isolating an ignition problem to a particular cylinder, proceed as follows:

1. Disconnect a spark plug wire. **Check the spark intensity of one wire at a time.**
2. Install a terminal adapter in the terminal of the wire to be checked. Using insulated pliers, hold the adapter approximately 3/16 inch from the exhaust manifold and crank the engine, using a remote starter switch. The spark should jump the gap regularly.
3 If the spark intensity of all the wires is satisfactory, the coil, condenser, rotor, distributor cap and the secondary wires are probably satisfactory.
   If the spark is good at only some wires, check the resistance of the faulty leads.

If the spark is equal at all wires, but weak or intermittent, check the coil, distributor cap and the coil to distributor high tension wire. The wire should be clean and bright on the conducting ends, and on the coil tower and distributor sockets. The wire should fit snugly and be bottomed in the sockets.

IGNITION SYSTEM TESTS

Battery to Coil Voltmeter Test

1. Connect the voltmeter leads as shown in Figure 4.
2. Connect a jumper wire from the distributor terminal of the coil to a good ground on the distributor housing.
3. Turn the accessories off.
4. Turn the ignition switch on.
5. If the voltmeter reading is between 4.5 and 6.9 volts, the primary circuit from the battery to the coil is satisfactory.
6. If the voltmeter reading is greater than 6.9 volts, check the following:
   - The battery and cables for loose connections or corrosion
   - The primary wiring for worn insulation, broken strands, and loose or corroded terminals
   - If the voltmeter reading is less than 4.5 volts the ignition resistor should be replaced.
   - Check the starter-relay-to-ignition switch for damage.

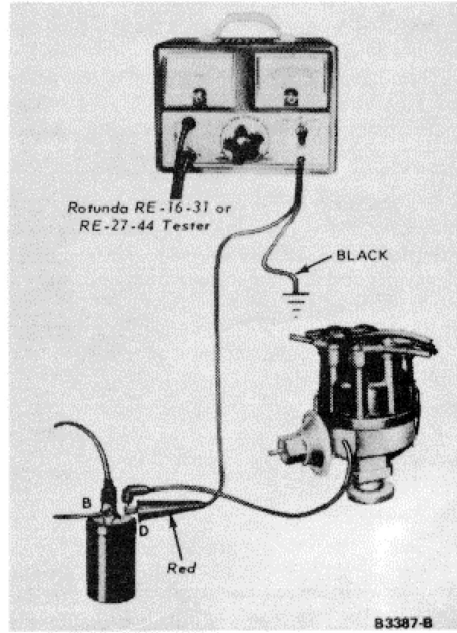


FIG. 4. Battery-to-Coil and Starting Ignition Circuit Test

Starting Ignition Circuit Voltmeter Test

I. Connect the voltmeter leads as shown in Figure 4.
2. Disconnect and ground the coil to distributor high tension lead at the distributor.
3. With the ignition ,witch off, crank the engine with an auxiliary starter switch while observing the voltage drop.
4. If the voltage drop is 0.4 volt or less, the starting ignition circuit is satisfactory.
5. If the voltage drop is greater than 0.4 volt, clean and tighten the terminals in the circuit or replace the wiring as necessary.

Coil to Ground Voltmeter Test - (Conventional - System)

1. Connect the voltmeter leads as shown in Figure 5.
2. Close the breaker points.
3. Turn all accessories off.

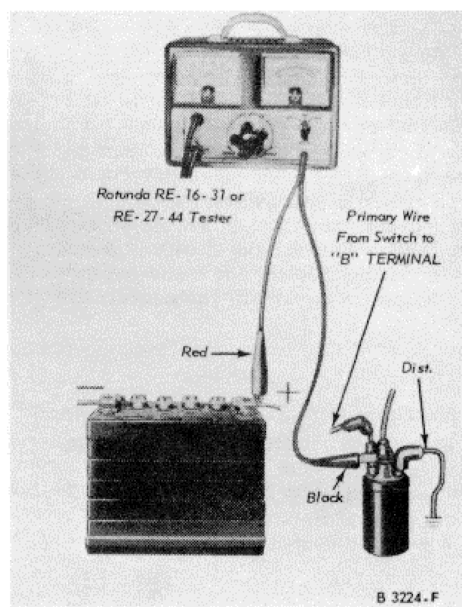


FIG. 5. Coil to Ground Test

4. Turn the ignition switch on.
5. If the voltmeter reading is 0.25 volt or less, the primary circuit from coil to ground is satisfactory.
6 If the voltmeter reading is greater than 0 25 volt. test the voltage drop between each of the following:
   - The coil and the breaker point connections of the coil to distributor primary wire.
   - The movable breaker point and the breaker plate.
   - The breaker plate and the distributor housing.
   - The distributor housing and engine ground.
7. Turn the ignition switch off. Disconnect the voltmeter leads

Coil Test

Check the coil on a coil tester by following the manufacturer's instructions Check for ohms resistance both primary and secondary Also check the amperage draw both with the engine idling and stopped. These checks should all fall within ,specifications

Secondary (High Tension) Wires Resistance Test

The secondary wires include the wires connecting the distributor cap to the spark plugs and the wire connecting the center terminal of the distributor cap to the center terminal of the Ignition coil.

These wires are the radio resistance-type which filter out the high frequency electrical impulses that are the source of ignition noise interference. The resistance of each wire should not exceed 5000 ohms per inch. **When checking the resistance of the wires or setting ignition timing, do not puncture the wires with a probe. The probe may cause a separation in the conductor.**

When removing the wires from the spark plugs, grasp and twist the moulded cap. then pull the cap off the spark plug Do not pull on the wire because the wire connection inside the cap may become separated or the insulator may be damaged.

To check the spark intensity at the spark plugs, proceed as follows:

1. Disconnect a spark plug wire. **Check the spark intensity of one wire at a time**
2. Install a terminal adapter in the terminal of the wire to be checked. Hold the adapter approximately 3/16 inch from the exhaust manifold and crank the engine, using a remote starter switch. The spark should jump the gap regularly.
3. If the spark intensity of all the wires is satisfactory, the coil, condenser, rotor, distributor cap and the secondary wires are probably satisfactory.

If the spark is good at only some wires, check the resistance of the faulty leads.

If the spark is equal at all wires, but weak or intermittent, check the coil, distributor cap and the coil to distributor high tension wire.

Spark Plug Test

Inspect, clean, file the electrodes and gap the plugs. After the proper gap is obtained, check the plugs on a testing machine. Compare the sparking efficiency of the cleaned and gapped plug with a new plug. Replace the plug if it fails to meet 70 percent of the new plug performance.

DISTRIBUTOR TESTS ON VEHICLE
DISTRIBUTOR SHAFT END PLAY

If the shaft end play is not to specifications, check the location of the gear on the shaft. The shaft end play can be checked with the distributor installed on the engine.

1. Mount a dial indicator on the distributor so that the indicator tip rests on the top of the distributor shaft.
2. Push the shaft down as far as it will go and set the dial indicator on zero.
3. Pull the distributor shaft upward as far as it will go and read the end play. The end play should be within specifications with the distributor removed or installed.

TEST CONNECTIONS

1. Disconnect the distributor primary wire at the coil. Connect a short jumper wire to the DIST terminal of the coil and the distributor primary wire Connect the red lead to the jumper wire.
2. Connect the black lead to a good ground on the engine.

Dwell Angle Check

1. Disconnect the distributor vacuum line. Connect the tester.
2. Turn the test control knob to the set position.
3. Adjust the set control knob until the needle on the dwell meter lines up with the set line.
4. Start the engine and let it idle.
5. Turn the cylinder selector to the figure corresponding to the number of lobes on the cam of the distributor.
6. Read the dwell angle on the dwell meter and compare the reading to specifications.
7. Turn off the engine.
8. If the dwell angle was below the specified amount, the breaker point gap is too large. If the dwell angle was above the specified amount, the breaker point gap is too small.

If the dwell is to specifications, turn the test selector knob to the OFF position and disconnect the tester leads and jumper wire: then connect the distributor vacuum line.

Dwell Angle Adjustment

If the dwell angle is not within specifications, proceed as follows:

1. Remove the coil high tension lead from the distributor and ground it
2. Remove the distributor cap and place it out of the way.
3. Connect an auxiliary starter switch in the circuit.
4. Loosen the breaker point assembly retaining screw near the breaker point contacts.
5. With the ignition on, crank the engine with an auxiliary starter switch.
6. Release the auxiliary starter switch and tighten the breaker point assembly attaching screw.
7. Since the adjustrnent may have changed when the attaching screw was tightened, crank the engine again with the auxiliary starter switch and check the dwell. When the dwell is properly adjusted, remove the jumper wire, auxiliary starter switch and tester leads and install the distributor cap and coil high tension lead

   Connect the distributor vacuum line.

DISTRIBUTOR TESTS - OFF VEHICLE

The following instructions indicate the general principles to be followed for testing the distributor.on a tester. The method of testing, however, may vary for machines of different manufacture. For specific instructions refer to the equipment manufacturer's handbook.

1. Mount the distributor on the tester. Check that the distributor is free to rotate.
2. Make the necessary electrical connections and zero the instrument if required.
3. Tighten the drive chuck to the distributor drive shaft securely.
4. Rotate the drive chuck by hand to make sure the distributor shaft turns freely and then tighten the locking screw on the distributor support arm.
5. Connect the Synchograph test lead to the primary wire of the distributor.

Breaker Point Resistance

1. Turn the test selector to the position for checking resistance.
2. Rotate the chuck by hand until the distributor breaker points are closed.
3. The pointer on the cam angle meter should read in the OK zone of the meter scale. If the meter pointer does not fall in the OK zone, there is excessive resistance caused by a faulty contact across the distributor points. a damaged primary lead, or a poorly grounded base plate. A faulty contact across the distributor points indicates improper spring tension or burned or pitted points.

Insulation and Leakage

1. Turn the test selector to the cam angle position and rotate the chuck by hand until the distributor breaker contacts are open.
2. The cam angle meter should show a zero reading. If a zero reading is not obtained, a short circuit to ground exists.

A short could be caused by poor primary wire insulation, a shorted condenser or a short between the breaker arm and breaker plate.

Mechanical Operation

1. Manually check the advance mechanism by turning the rotor in the direction of distributor rotation and then releasing it. The rotor will return to its original position if the mechanism has freedom of movement and the springs are in good condition.
2. Make the necessary connections for the stroboscopic timing light or sparking protractor. (Refer to equipment manufacturer's handbook).
3. Adjust the speed control to vary the distributor speed between 400 and 4000 engine rpm. or at the maximum speed of the engine on which the distributor is used. Erratic or thin faint flashes of light preceding the regular flashes as the speed of rotation is increased can be due to weak breaker arm spring tension or binding of the breaker arm on the pivot pin.
4. Operate the distributor at approximately 2500engine rpm and move the protractor scale so that the zero degree mark on the scale is opposite one of the neon flashes. The balance of all the flashes should come within I degree, plus or minus, evenly around the protractor scale. A variation larger than 1 degree or erratic or wandering flashes may be caused by a worn cam or distributor shaft or a bent distributor shaft.

Dwell Angle

1. Disconnect and plug the distributor vacuum line.
2. Turn the test selector switch to the correct cam angle position and operate the distributor at approximately 1000 engine rpm.
3. Adjust the breaker point gap until the dwell angle is to specifications. Unplug and connect the distributor vacuum line

Breaker Plate Wear

A worn breaker plate on the distributor will cause the breaker point gap and contact dwell to change as engine speed and load conditions are varied.

Adjust the test set to O degree advance, 0 inches vacuum, and 100 rpm. Adjust the dwell angle to 26 degrees. Apply vacuum to the distributor diaphragm and increase it very slowly while observing the indicated dwell angle. The maximum dwell angle variation should not exceed 4 degrees when going from zero to maximum vacuum at constant rpm. If the dwell angle variation exceeds this limit, there is excessive wear at the stationary subplate pin or the diaphragm rod is bent or distorted.

Distributor Spark Advance Test

The spark advance is checked to determine if the ignition timing advances in proper relation to engine speed and load.

1. Check the contact dwell. If the contact dwell is not within specifications, adjust the breaker points.
2. Check the breaker arm spring tension and adjust it or replace the points as necessary.

The dual advance distributor has two independently operated spark advance systems. Each system is adjusted separately. **Adjust the centrifugal advance before adjusting the vacuum advance.**

ADJUSTMENTS

Accurate ignition system adjustments are of great importance in the proper operation and performance of the engine.

After any adjustment of ignition timing and distributor point dwell, check the distributor automatic advance for proper operation.

Centrifugal Advance

1. Operate the distributor in the direction of rotation and adjust the speed to the initial rpm setting listed in the specifications. Move the protractor scale so that one of the flashes lines up with the zero degree mark.
2. Slowly increase the rpm to the setting specified for the first advance reading listed in the specifications.

If the correct advance is not indicated at this rpm, stop the distributor and bend one spring adjustment bracket to change its tension (Figure 6). Bend the adjustment bracket away from the distributor shaft to decrease advance (increase spring tension) and toward the shaft to increase advance (decrease spring tension). After the adjustment is made, identify the bracket.

3. After an adjustment has been made to one spring, check the minimum advance point again.
4. Operate the distributor at the specified rpm to give an advance just below the maximum. If this advance is not to specifications, stop the distributor and bend the other spring bracket to give the correct advance.
5. Check the advance at all rpm settings listed in the specifications. Operate the distributor both up and down the rpm range.

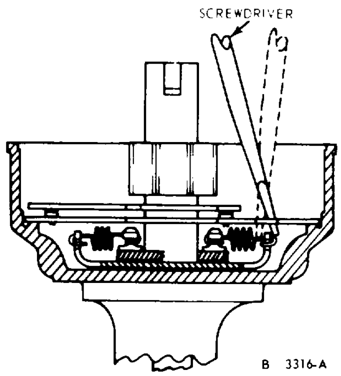


FIG. 6. Centrifugal Advance Adjustment

Vacuum Advance

1. Connect the test set vacuum line to the fitting on the diaphragm.

2. Set the test set at 0 degree advance, 0 vacuum, and at 1000 rpm.

3. Check the advance at the vacuum setting given in the specifications.

4. If the advance is incorrect and adjustment is required, disconnect the vacuum line and insert a 1/8 inch socket head wrench in the end of the diaphragm (Figure 7). Turn the wrench clockwise to increase the vacuum advance or counterclockwise to decrease it. Do not change the original rpm setting when going to a different vacuum setting. If the other settings are not within limits, there is incorrect spring tension. leakage in the vacuum chamber and/or line.

To check the diaphragm for leakage: Install the distributor tester. Do not connect the vacuum line to the distributor.

Adjust the vacuum pressure of the distributor tester to obtain 25 inches Hg. Hold your hand over the end of the tester's vacuum hose and note the reading obtained. **Do not exceed 25 inches Hg**.

If the reading is 25 inches Hg or less, connect the tester's vacuum line to the vacuum fitting on the diaphragm to be tested without changing any of the adjustments.

The gauge reading should not be less than it was above. If it is less, the diaphragm is leaking and should be replaced.

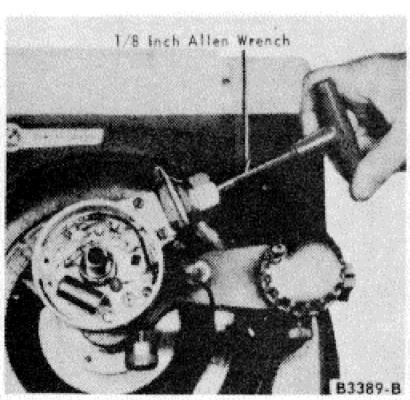


FIG. 7. Vacuum Advance Adjustment

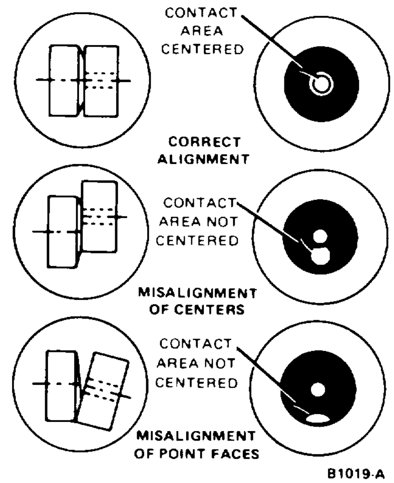


FIG. 8. Checking Breaker Point Alignment

BREAKER POINTS AND/OR CONDENSER

Breaker Point Alignment

The breaker points must be accurately aligned and stroke squarely to assure normal breaker point life. Misalignment of these breaker point surfaces can cause premature wear, overheating and pitting.

1. Turn the cam so that the breaker points are closed and check the alignment of the points (Figure 8). If the distributor is in the engine, close the points by proceeding as follows: I. With the ignition switch off and the primary wire disconnected from the coil. crank the engine with an auxiliary starter switch.
2. Using the tool shown (Figure 9) and exerting very light pressure, align the breaker point bracket. Do not bend the breaker arm.
3. After the breaker points have been properly aligned, adjust the breaker point gap or dwell.

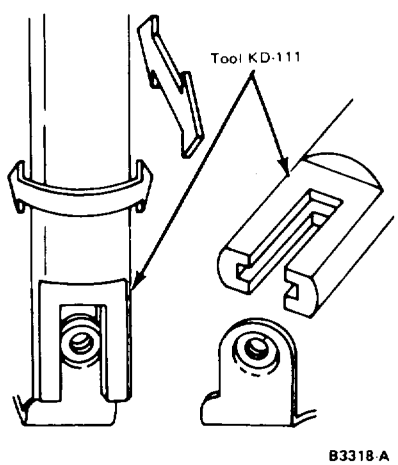


FIG. 9. Using Alignment Tool

Breaker Point Gap Adjustment

A scope, a dwell meter, or a feeler gauge can be used to check the gap of new breaker points.

A scope or a dwell meter should be used to check the gap of used breaker points. Due to the roughness of used points, it is not advisable to use a feeler gauge to check the gap.

To check and adjust the breaker points with a feeler gauge:

1. Check and adjust the breaker point alignment.
2. Rotate the distributor until the rubbing block rests on the peak of a cam lobe.

If the distributor is in the engine, place the rubbing block on the peak of the cam by proceeding as follows:

Crank the engine with an auxiliary starter switch. Insert the correct blade of a clean feeler gauge between the breaker points (Figure 10). Adjust the points to the correct gap and tighten the screws.

Apply a light film of distributor cam lubricant (C4AZ19D530-A) to the cam when new points are installed. **Do not use engine oil to lubricate the distributor cam.**

Set the ignition timing If a scope or a dwell meter is used to adjust new points, be sure the points are in proper alignment Also, set the contact dwell to the low setting.

To check and adjust the breaker points with a scope or a dwell meter. refer to the manufacturer's instructions.

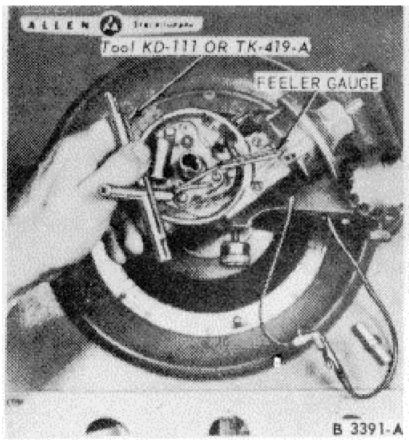


FIG. 10. Adjusting New Breaker Point Gap

Breaker Point Spring Tension Adjustment

Correct breaker point spring tension is essential to proper engine operation and normal breaker point life. If the spring tension is too great, rapid wear of the breaker arm rubbing block will result, causing the breaker point gap to close up and retard the spark timing. If the spring tension is too weak. the breaker arm will flutter at high engine rpm resulting in an engine miss.

To check the spring tension on the breaker points, place the hooked end of the spring tension gauge over the movable breaker point. Pull the gauge at a right angle (90 degrees) to the movable arm until the breaker points just start to open (Figure I 1). If the tension is not within specifications, adjust the spring tension

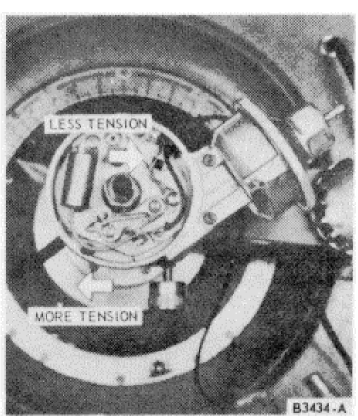


FIG. 11. Checking Breaker Point Spring Tension

To adjust the spring tension (Figure 12):

1. Disconnect the primary lead wire and the condenser lead.
2. Loosen the nut holding the spring in position. Move the spring toward the breaker arm pivot to decrease tension and in the opposite direction to increase tension.
3. Tighten the lock nut: then check spring tension. Repeat the adjustment until the specified spring tension is obtained.
4. Install the primary lead wire and the condenser lead.

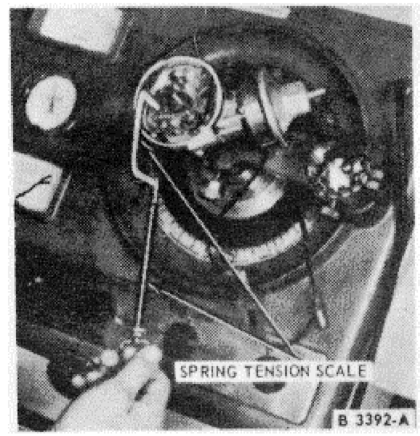


FIG. 12. Adjusting Breaker Point Spring Tension

IGNITION TIMING

Timing Mark Locations The timing marks and their locations are illustrated in Figure 13.

For checking and adjusting the ignition timing with a scope refer to the scope manufacturer's instructions. To check and adjust the timing light, proceed as follows:

Initial Ignition Timing

1. Clean and mark the specified timing mark with chalk or white paint.
2. Disconnect the vacuum line and plug the disconnected vacuum line.
3. Connect a timing light to the No. I cylinder spark plug wire. Connect a tachometer to the engine.
4. Start the engine and reduce the idle speed to 600 rpm to be sure that the centrifugal advance is not operating. Adjust the initial ignition timing to specifications by rotating the distributor in the proper direction.
5. Check the centrifugal advance for proper operation. Start the engine and accelerate it to approximately 2000 rpm. If the ignition timing advances, the centrifugal advance mechanism is functioning properly. Note the engine speed when the advance begins and the amount of advance. Stop the engine.
6. Unplug the vacuum line and connect it to the distributor vacuum advance unit. Start the engine and accelerate it to approximately 2000 rpm. Note the engine speed when the advance begins and the amount of advance. Advance of the ignition timing should begin sooner and advance farther than when checking the centrifugal advance alone. Stop the engine.
7. If the vacuum advance is not functioning properly, remove the distributor and check it on a distributor tester. Replace the diaphragm unit if the vacuum portion is out of calibration.

REMOVAL AND INSTALLATION
BREAKER POINTS AND/OR CONDENSER
Removal

1. Remove the distributor cap and the rotor.
2. Disconnect the primary and the condenser wires from the breaker point assembly.
3. Remove the breaker point assembly and condenser retaining screws. Lift the breaker point assembly and condenser out of the distributor.

Installation

1. Clean the distributor cam thoroughly.
2. Apply a light film of distributor cam lubricant C4AZ19D530-A on the cam. Do not use any type of oil.
3. Place the breaker point assembly and the condenser in position and install the retaining screws. Be sure to place the ground wire in the same location as the original installation.
4. Align and adjust the breaker point assembly.
5. Connect the primary and condenser wires to the breaker point assembly.
6. Install the rotor and the distributor cap.

SPARK PLUG WIRE

When removing the wires from the spark plugs, grasp, twist and pull the moulded cap only Do not pull on the wire because the wire connection inside the cap may become separated or the boot may be damaged.

Removal

1. Disconnect the wires from the spark plugs and distributor cap.
2. Pull the wires from the brackets on the valve rocker arm covers and remove the wires.
3. Remove the coil high tension lead.

Installation

1. Insert each wire in the proper socket of the distributor cap. Be sure the wires are forced all the way down into their sockets. The No. I socket is identified on the cap Install the wires in a clockwise direction.
2. Remove the brackets from the old spark plug wire set and install them on the new set in the same relative position. Install the wires in the brackets on the valve rocker arm covers. Connect the wires to the proper spark plugs. Install the coil high tension lead.

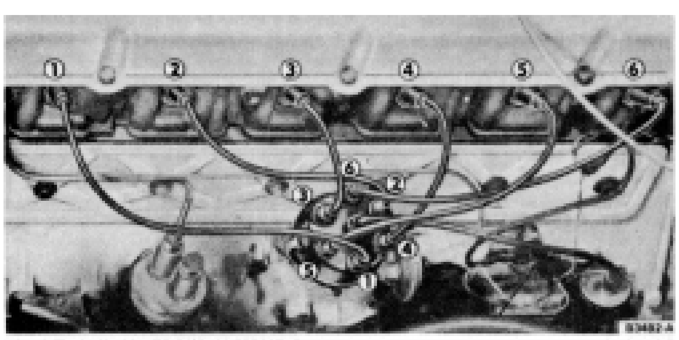


FIG. 13. Engine Timing and Cylinder Firing Order - Typical

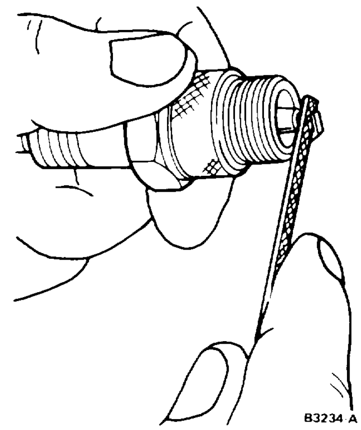


FIG. 14. Filing Spark Plug Electrode

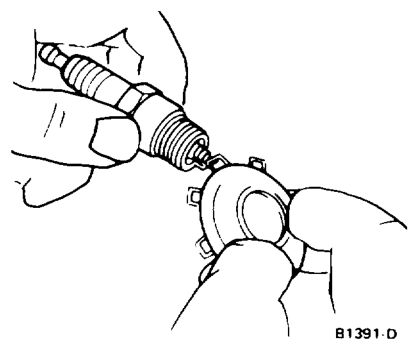
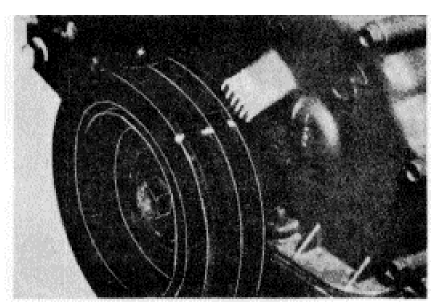


FIG. 15. Checking Spark Plug Gap

SPARK PLUGS
Removal

1. Remove the wires from each spark plug by grasping, twisting and then pulling the moulded cap of the wire only Do not pull on the wire because the wire connection inside the cap may become separated or the weatherseal may be damaged.
2. After loosening each spark plug one or two turns, clean the area around each spark plug port with compressed air, then remove the spark plugs.

After cleaning, dress the electrodes with a small file to obtain flat parallel surfaces on both the center and side electrodes (Figure 14). Set the spark plug gap to specifications by bending the ground electrode (Figure 15): **all spark plugs, new or used, should have the gap checked and reset as required.**



Installation
1. Install the spark plugs and torque each plug to specifications.
2. Connect the spark plug wires.

VACUUM ADVANCE UNIT
Removal
1. Remove the distributor cap and rotor.
2. Disconnect the vacuum line.
3. Remove the spring clip that secures the diaphragm link to the movable breaker plate.
4. Remove the diaphragm unit attaching screws and carefully remove the unit.

Installation
1. Position the diaphragm unit on the distributor and hook the diaphragm link in position.
2. Install the spring clip that secures the diaphragm link to the movable breaker plate. Install the diaphragm unit attaching screws.
3. Connect the vacuum line.
4. Install the rotor and the distributor cap.

BREAKER PLATE AND SUB-PLATE
Removal

1. Remove the distributor cap and rotor.
2. Remove the breaker point assembly and the condenser. Remove the vacuum diaphragm.
3. Working from the inside of the distributor, pull the primary wire through the opening out of the distributor.
4. Remove the sub-plate attaching screws and lift the assembly from the distributor.

Installation
1. Place the breaker plate assembly in position In the distributor.
2. Install the sub-plate hold down screws (the ground wire should be under the sub-plate hold down screw from which it was removed).
3. Insert the primary wire in the distributor. Install the breaker points and the condenser. Connect the primary wire and the condenser wire to the breaker point terminal. Install the vacuum diaphragm.
4. Install the rotor and the distributor cap.

CAM AND CENTRIFUGAL ADVANCE WEIGHTS
Removal
1. Remove the breaker plate and sub-plate from the distributor.
2. Mark one of the distributor weight springs and its brackets. Also mark one of the weights and its pivot pin.
3. Carefully unhook and remove the weight springs.
4. Lift the lubricating wick from the cam assembly. Remove the cam assembly retainer and lift the cam assembly off the distributor shaft. Remove the thrust washer.
5. Remove the weight retainers and lift the weights out of the distributor.

Installation
1. If the weights were removed, fill the grooves in the weight pivot pins with distributor cam lubricant (C4AZ19D530-A).

Position the weights in the distributor (the marked weight is placed on the marked pivot pin) and install the weight retainers.

2. Place the thrust washer on the shaft.
3. Fill the grooves in the upper portion of the distributor shaft with distributor cam lubricant (C4AZ-19D530-A).
4. Install the cam assembly. **Be sure that the marked spring bracket on the cam assembly is near the marked spring bracket on the stop plate.**

If a new cam assembly is being installed, make sure that the cam is installed with the hypalon covered stop in the correct cam plate control slot. Some distributor stops will not be covered with the hypalon covering. The centrifugal advance range determines whether or not a hypalon cover is required. This can be done by measuring the length of the slot used on the old cam and by using the corresponding slot on the new cam. Some of the cams will have the size of the slot in degrees stamped near the slot. If the wrong slot is used, an incorrect maximum advance will be obtained.

Place a light film of distributor cam lubricant (C4AZ19D530-A) on the distributor cam lobes. Install the retainer and the wick. Oil the wick with SAE-IOW engine oil.

5. Install the weight springs. **Be sure that the marked spring is attached to the marked spring brackets.**
6. Install the plate assembly.
7. Install the diaphragm unit.
8. Install the primary wire in the distributor. Connect the primary and condenser wires to the breaker point terminal.
9. Adjust the breaker point gap or dwell as required.

DISTRIBUTOR
Removal
1. Remove the air cleaner. Disconnect the primary wire from the coil.

Disconnect the vacuum advance line at the distributor.

Remove the distributor cap.

2. Scribe a mark on the distributor body and the cylinder block indicating the position of the body In the block, and scribe another mark on the distributor body indicating the position of the rotor. These marks can be used as guides, when installing the distributor in a correctly timed engine.
3. Remove the distributor hold down bolt and clamp. Lift the distributor out of the block.

Do not rotate the crankshaft while the distributor is removed, or it will be necessary to time the engine.

Installation
1. If the crankshaft was rotated while the distributor was removed from the engine, it will be necessary to time the engine. Rotate the crankshaft until No. I piston is on TDC after the compression stroke. Align the TDC mark on the timing pointer with the timing pin on the crankshaft damper. Position the distributor in the block with the rotor at the No. I firing position.

Make sure the oil pump intermediate shaft properly engages the distributor shaft. It may be necessary to crank the engine with the starter, after the distributor drive gear is partially engaged to engage the oil pump intermediate shaft.

Install, but do not tighten, the retaining clamp and bolt. Rotate the distributor to advance the timing to a point where the breaker points are just starting to open. Tighten the clamp.

2. If the crankshaft has not been moved, position the distributor in the block with the rotor aligned with the mark previously scribed on the distributor body and the marks on the distributor body and cylinder block in alignment.
3. Install the distributor cap.
4. Connect the primary wire to the coil.
5. Check the ignition timing with a timing light and adjust to specifications. Connect the vacuum line. and check the advance with the timing light when the engine is accelerated.
6. Install the air cleaner.

CLEANING AND INSPECTION

SPARK PLUGS

Examine the firing ends of the spark plugs, noting the type of deposits and the degree of electrode erosion. Refer to Figure 16 for the various types of spark plug fouling and their causes.

Clean the plugs on a sand blast cleaner, following the manufacturer's instructions. **Do not prolong the use of the abrasive blast as it will erode the insulator and electrodes.**

After cleaning, examine the plug carefully for cracked or broken insulators, badly pitted electrodes, and other signs of malfunction. Replace as required.

DISTRIBUTOR

Soak all parts of the distributor assembly (except the condenser, breaker point assembly, lubricating wick, vacuum diaphragm, distributor base oil seal and electrical wiring) in a mild cleaning solvent or mineral spirits. Do not use a harsh cleaning solution. Wipe all parts that cannot be immersed in a solvent with a clean dry cloth.

After foreign deposits have been loosened by soaking, scrub the parts with a soft bristle brush. Do not use a wire brush, file, or other abrasive object. Dry the parts with compressed air.

Inspect the distributor cam lobes for scoring and signs of wear. If any lobe is scored or worn, replace the cam assembly.

Inspect the breaker plate assembly for signs of distortion. Replace the breaker plate assembly If it is distorted.

Inspect all electrical wiring for fraying, breaks, etc. and replace any that are not in good condition.

Check the distributor base for cracks or other damage.

Check the diaphragm housing. bracket, and rod for damage. Test the vacuum hose connections, case and diaphragm for leakage as explained under Distributor Tests. Replace all damaged parts.

The breaker point assembly consists of the stationary point bracket assembly, breaker arm and the primary wire terminal.

Breaker points should be inspected, cleaned and adjusted as necessary. Breaker points can be cleaned with chloroform and a stiff bristle brush. Replace the breaker point assembly if the contacts are badly burned or excessive metal transfer between the points is evident (Figure 17). Metal transfer is considered excessive when it equals or exceeds the gap setting.

Distributor Cap

Clean the distributor cap with a soft bristle brush and mild cleaning solvent or mineral spirits. Dry the cap with compressed air. Inspect the cap for cracks, burned contacts, permanent carbon tracks or dirt or corrosion in the sockets. Replace the cap if it is damaged as above.

Rotor

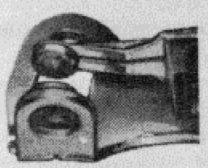
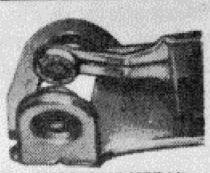
Clean the rotor with a soft bristle brush and mild cleaning solvent or mineral spirits. Dry the rotor with compressed air. Inspect the rotor for cracks or burning. Replace the rotor if it is cracked or burned.

Secondary Wiring

Wipe the wires with a damp cloth and check for breaks or cracked insulation. Inspect the terminals and weatherseals for looseness or corrosion. Replace any wires that are not in good condition.

Coil

Wipe the coil with a damp cloth and check for any cracks or other damage.

CONDITION	CAUSED BY
 BURNED	Incorrect voltage regulator setting. Radio condenser installed to the distributor side of the coil.
 EXCESSIVE METAL TRANSFER OR PITTING	Incorrect alignment. Incorrect voltage regulator setting. Radio condenser installed to the distributor side of the coil. Ignition condenser of improper capacity. Extended operation of the engine at speeds other than normal.

B1443-C

FIG. 17. Breaker Point Inspection

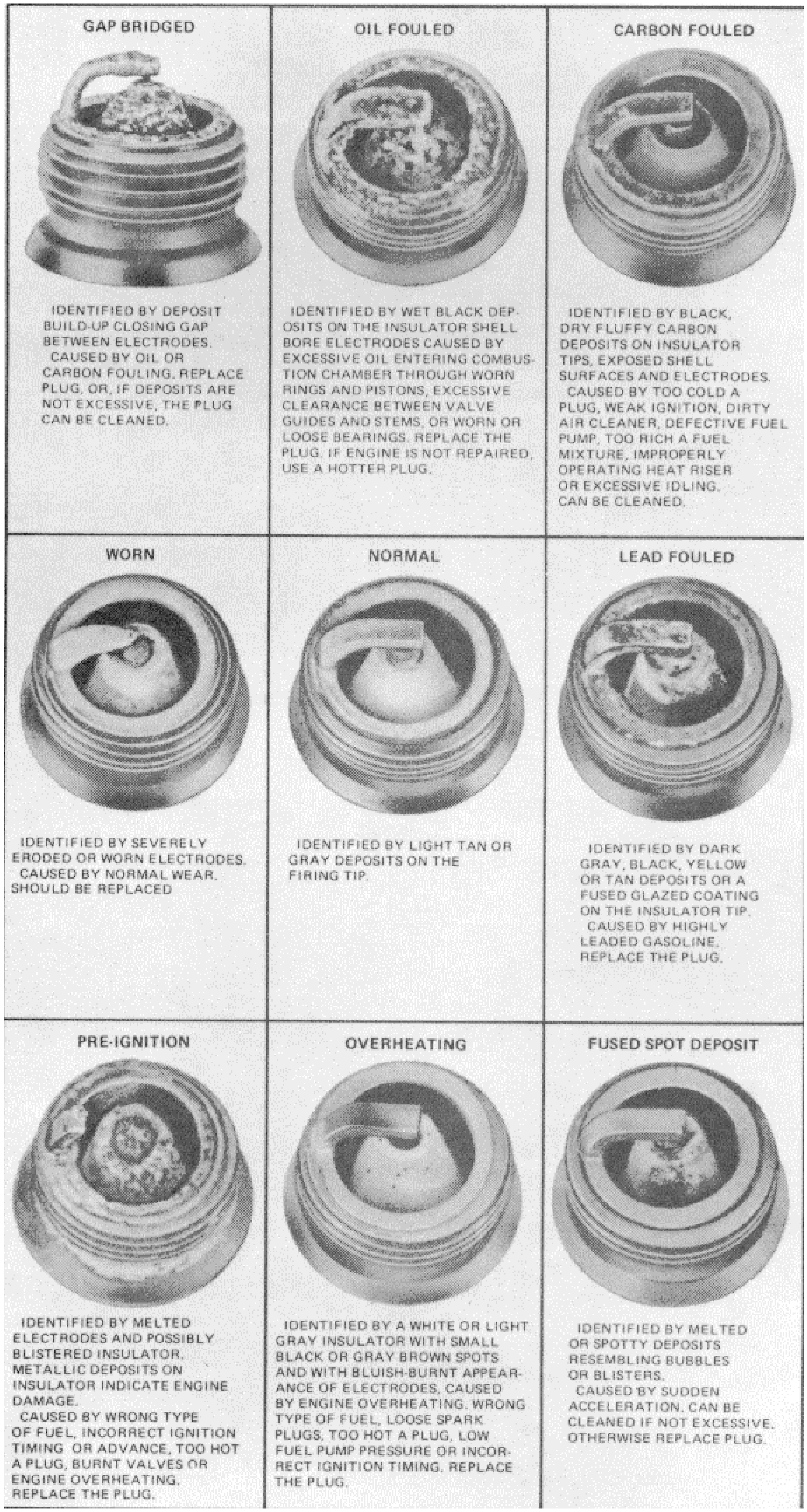


FIG. 16. Spark Plug Inspection

Part 3 -- Fuel System

IDENTIFICATION

The carburetor identification tag is attached to the upper body of the carburetor. The basic part number for all carburetors is 9510. To procure replacement parts, it is necessary to know the part number prefix and suffix.

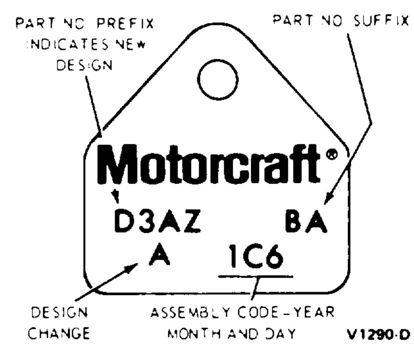


FIG. 1. Typical Carburetor Identification Tag

DESCRIPTION

The fuel system includes a mechanical fuel pump. It is mounted on the lower, left-center of the engine cylinder block. The disposable filter is located on the fuel pump body.

The fuel pumps are mechanically actuated by means of the fuel pump rocker arm and an eccentric on the camshaft.

The 300 CID engines use either a Bendix Zenith one-barrrel carburetor or a Holley 1904 or 1940 carburetor. These are covered in detailed later in this section.

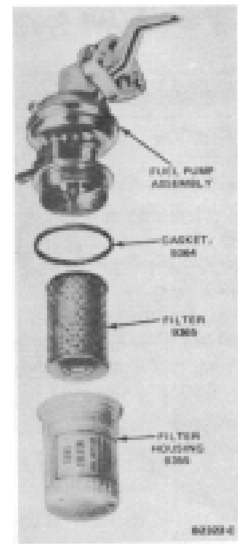


FIG. 2. Fuel Pump - Typical

DIAGNOSIS AND TESTING
GENERAL INFORMATION

Waiter and dirt that accumulate in the fuel tank can cause a restricted fuel line or filter and malfunction of the fuel pump or carburetor Condensation, which is the greatest source of water entering the fuel tank, is formed by moister in the air when it strikes the cold interior walls of the fuel tank.

If the accumulation of dirt and water in the filter is excessive, the fuel tank should be removed and flushed, and the line from the fuel pump to the tank should be removed be blown out.

Air leakage in the fuel inlet line can cause low fuel pump pressure and volume.

A restricted fuel tank vent can cause low fuel pump pressure and volume and can result in collapsed inlet hoses or a collapsed fuel tank.

High or low pressure are the two most likely fuel pump troubles that will affect engine performance Low pressure will cause a lean mixture and fuel starvation at high speeds and excessive pressure will cause high fuel consumption and carburetor flooding Dirt accumulation in the fuel and air passages. improper idle adjustments, and Improper fuel level are the major sources of carburetor troubles.

SYMPTOM	PROBABLE CAUSE	
Low Fuel Pump Pressure	Diaphragm stretched or leaking. Fuel pump diaphragm spring is weak. Cam eccentric worn or undersize. Excessive clearance between rod and fuel pump Fittings loose or cracked Fuel pump screen clogged.	Fuel line cracked or broken. Fuel pump valves seating Improperly. Dirt in fuel tank and/or lines. Fuel tank sent restricted. Diaphragm ruptured.
High Fuel Pump Pressure	Diaphragm spring too strong or improper spring.	
Low Fuel Pump Volume with Normal Pressure	Fuel filter clogged. Fuel pump to carburetor inlet line obstructed, crimped or leaks,	Restriction in fuel supply line to fuel pump.
Fuel Pump Leaks	Diaphragm defective Fittings loose	

SYMPTOM	PROBABLE CAUSE	
Fuel Pump Leaks Oil	Fuel pump retaining bolts loose.	Mounting gasket defective.
Fuel Tank and/or Inlet Line Hoses Collapsed	Fuel tank vent restricted.	
Flooding or Leaking Carburetor	Cracked carburetor body. High fuel level or float setting. Fuel inlet needle not seating properly or worn needle and/ or seat.	Ruptured accelerating pump diaphragm (where applicable). Excessive fuel pump pressure.
Hard Starting	Improper starting procedure causing a flooded engine. Improper carburetor fuel level. Improper idle adjustments. Sticking or incorrectly seating fuel inlet needle.	Incorrect fuel pump pressure. Restrictions or air leaks in the choke vacuum or hot air passages Dirty air cleaner element.
Stalling	Incorrect idle fuel mixture. Engine idle speed too slow. Dirt. water or ice in fuel filter Fuel lines restricted or leaking air. Fuel tank vent restricted Leaking intake manifold or carburetor gaskets.	Carburetor icing (cold, wet or humid weather). Incorrect throttle linkage adjustment to carburetor. Clogged air bleeds or idle passages Defective fuel pump. Excessive looseness of throttle shaft in bore(s) of throttle body.
Rough Idle	Incorrect Idle mixture adjustment. Idle adjusting needles(s) grooved, worn. or otherwise damaged. Idle air bleeds restricted. Accelerating pump discharge check valve not seating properly.	Idle air or fuel passages restricted. Idle discharge holes restricted. Idle discharge holes not in proper relation to throttle plate. Excessive dirt in air cleaner. High or low float setting.
Poor Acceleration	Poor acceleration complaints fall under one of three headings: the engine is sluggish on acceleration. the engine stalls when accelerated, or the engine hesitates or develops a flat spot when accelerated. Poor acceleration is caused by either an excessively lean or rich mixture on acceleration and/or defects of Improper adjustments in the ignition system.	Incorrect accelerating pump stroke adjustment. Accelerating pump fuel inlet or outlet valve not seating Restriction in the accelerating pump discharge passage. Air leak at the accelerating pump cover caused by a defective gasket or warped pump cover
	A LEAN MIXTURE CAN BE CAUSED BY Low fuel pump pressure. Sticking fuel inlet needle. Low fuel level or float setting. Restriction in main fuel passage. Air leak between the carburetor and the manifold caused by loose mounting bolts or defective gasket. Air leak at the throttle shaft caused by a worn throttle shaft. Accelerating pump diaphragm defective.	A RICH MIXTURE CAN BE CAUSED BY: Excessive fuel pump pressure. High fuel level or float setting Fuel inlet needle not seating properly or worn needle and/or seat. Excessively dirty air cleaner. Incorrect accelerating pump stroke adjustment. Restricted air bleeds. Worn or damaged main metering jet. Accelerating pump outlet valve not seating properly.

SYMPTOM	PROBABLE CAUSE	
Inconsistent Engine Idle Speed	Incorrect throttle linkage adjustment to carburetor. Governor not adjusted properly or faulty. Binding or sticking throttle linkage. Sticking carburetor throttle shaft.	Excessive looseness of throttle shaft in bores of throttle body Incorrectly installed throttle plates. Sticking fuel inlet needle. Defective spark valve or gasket (manual choke carburetor)
Surging Above Idle Speed	Clogged main jets. Improper size main jets. Low fuel level or float setting. Low fuel pump pressure or volume.	Clogged fuel filter or fuel pump filter screen. Distributor vacuum passage Clogged. Defective spark valve or gasket
Reduced Power Output	Float setting too high or too low. Fuel pump pressure too high or too low. Improper size or obstructed main jets. Restricted air bleeds.	Restriction in main fuel passages. Excessive dirt in air cleaner. Throttle plate not fully open. Faulty choke operation. Improper throttle linkage or Governor adjustment.

PRESSURE AND CAPACITY (VOLUME) TESTING

To determine that the fuel pump is in satisfactory operating condition, tests for both fuel pump pressure and fuel pump capacity (volume) should be performed.

The tests are performed with the fuel pump installed on the engine and the engine at normal operating temperature at idle speed.

Before the tests, make sure the replaceable fuel filter has been changed within the recommended maintenance interval. When in doubt, install a new filter.

Pressure Tests

Refer to the fuel pump specification and note the fuel pump pressure and capacity (Volume) design tolerances.

1. Remove the air cleaner assembly. Disconnect the fuel inlet line or the fuel filter at the carburetor. Use care to prevent combustion due to fuel spillage.
2. Connect a pressure gauge, a restrictor and a flexible hose (Figure 3) between the fuel filter and the carburetor. **NOTE: Inside diameter of smallest passage in test now circuit must not be smaller than .220.**
3. Position the flexible fuel outlet hose and the restrictor so the fuel can be discharged into a suitable graduated container (Figure 3).
4. Before taking a pressure reading, operate the engine at the specified idle rpm and vent the system into the container by opening the hose restrictor momentarily 5. Close the hose restrictor. allow the pressure to stabilize, and note the reading (Refer to the Specifications in Part 8)

If the pump pressure is not within specifications. and the fuel lines and filter are in satisfactory condition. the pump should be replaced.

If the pump pressure is within specifications, perform the tests for fuel capacity (volume).

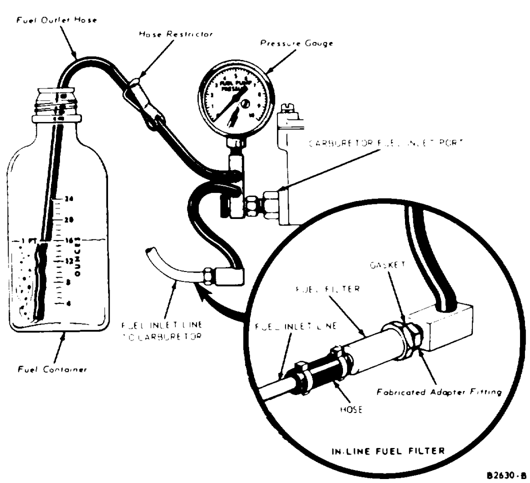


FIG. 3. Typical Fuel Pump Pressure and Capacity Test Equipment

Capacity (Volume) Test

With the fuel pump pressure within specifications. Test the capacity (volume) as follows:

I. Operate the engine at the specified idle rpm.

2. Open the hose restrictor and expel the fuel into the container (Figure 3), while observing the time required to expel one pint. Close the restrictor One pint or more of fuel should be expelled within the specified time limit

If the pump volume is below specifications, repeat the test using an auxiliary fuel supply and a new fuel filter. If the pump volume meets specifications while using the auxiliary fuel supply. Check for a restriction in the fuel supply from the tank and for the tank not venting properly

REMOVAL AND INSTALLATION
FUEL PUMP ASSEMBLY
Removal

1. Disconnect the inlet and outlet lines at the fuel pump.
2. Remove the pump attaching screws, then remove the pump and the gasket Discard the gasket.

Installation

1. Remove all the gasket material from the mounting pad and pump flange. Apply oil-resistant sealer to both sides of a new gasket and to the threads on the attaching bolts.
2. Position the new gasket on the pump in position against the mounting pad Make sure the rocker arm is riding on the camshaft eccentric (Turn the engine over until the fuel pump eccentric is on the low side of the stroke.)
3. Press the pump tight against the pad. install the attaching screws and alternately torque them to specifications
4. Connect the fuel inlet and outlet lines.
5. ()perate the engine and check for leaks

HOLLEY 1940 ONE-BARREL CARBURETOR
DESCRIPTION AND OPERATION

The Holley 1940 one-barrel carburetor used on the 300 CID engines includes four basic fuel metering systems. The idle system provides a reasonable rich mixture for smooth idle and a transfer system that operates during low speeds The main metering system provides the most economical mixture for normal cruising conditions The accelerator pump system mechanically provides additional fuel during acceleration. The power enrichment s stem provides a richer mixture when high power output is desired In addition to these four basic systems, there is a fuel inlet system that constantly supplies the fuel to the metering system.

The choke system supplies a rich mixture to start the engine when cold and a slightly richer than normal mixture for cold engine operation The 1940 carburetor is equipped with a hand choke located on the dash.

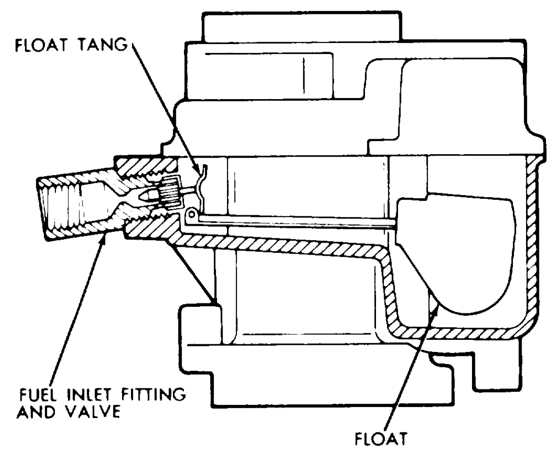


FIG. 4. Fuel Inlet System, Model 1940

FUEL INLET SYSTEM (FIG. 4)

All fuel enters the fuel bowl through the fuel inlet fitting in the carburetor body. The 'viton" tipped fuel inlet needle seats directly in the fuel inlet fitting. The needle is retained by a cap that permits the fuel to flow out of holes in the side of the cap. The design of the fuel bowl eliminates the need for a fuel baffle. The fuel inlet needle is controlled by a dual lung nitrophyl (a closed cellular buoyant material which cannot collapse or leak) float and a stainless steel float lever which is hinged by a stainless steel float shaft.

The fuel inlet system must constantly maintain the specified level of fuel as the basic fuel metering systems are calibrated to deliver the proper mixture only when the fuel is at this level. When the fuel level in the bowl drops, the float also drops permitting additional fuel to flow past the fuel inlet needle into the bowl.

The float chamber is vented internally into the air horn. At idle speed the float may be vented externally to the fuel canister.

IDLE SYSTEM (FIG. 5)

Fuel used during curb and low speed operation flows through the main jet into the main well.

An angular connecting idle well intersects the main well. An idle tube Is installed in the idle well. Fuel travels into the idle well and through the restriction into the idle tube. This metered fuel mixes with air which enters through the idle air bleed located in the fuel bowl cover.

At curb idle the air and fuel mixture flows down the idle channel and is further mixed or broken up by air entering the Idle channel through the transfer slot which is above the throttle valve at curb idle.

During low speed operation the throttle valve moves, exposing the transfer slot to manifold vacuum and fuel begins to flow through the transfer slot as well as the idle port. As the throttle valve is opened further .d engine speed increases. the air flow through the carburetor also increases. This increased air flow creates a vacuum or depression in the venturi and booster nozzle and the main metering system begins to discharge air and fuel.

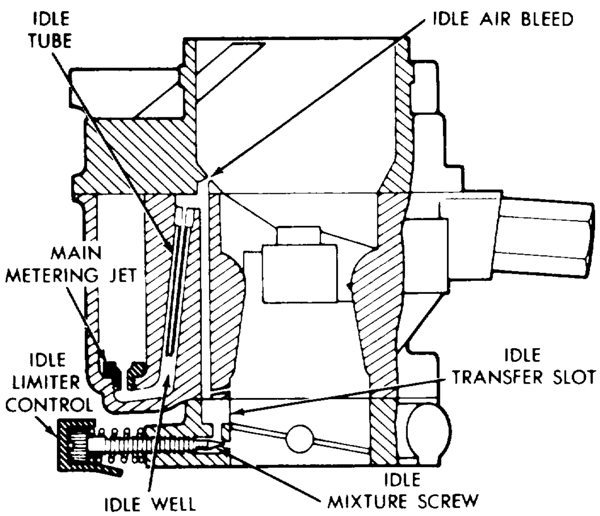


FIG. 5. Idle System. Model 1940

MAIN METERING SYSTEM (FIG. 6)

As the engine approaches cruising speed. the increased air flow through the ,venturi creates a greater vacuum (low pleasure area, in the venturi of the carburetor Near atmospheric pressure present In the bowl above the fuel causes the fuel to flow to the lower pressure area created by the venturi and is magnified by the dual booster venturi.

Fuel flows through the main jet into the main w ell. air enters through the main well air bleed and into the main well through holes in the main well tube The mixture of air and fuel being lighter than raw fuel responds faster to changes in venturi vacuum and is also more readily vaporized when discharged into the venturi.

The main discharge nozzle passage is a part of the dual booster venturi. which is an integral part of the main body casting. Distribution tabs in the main venturi provide the proper distribution of the air-fuel mixture between cylinders for specific engine applications

The main metering system is calibrated to deliver a lean mixture for best overall economy. When additional power is required, a vacuum-operated power system enriches the air-fuel mixture.

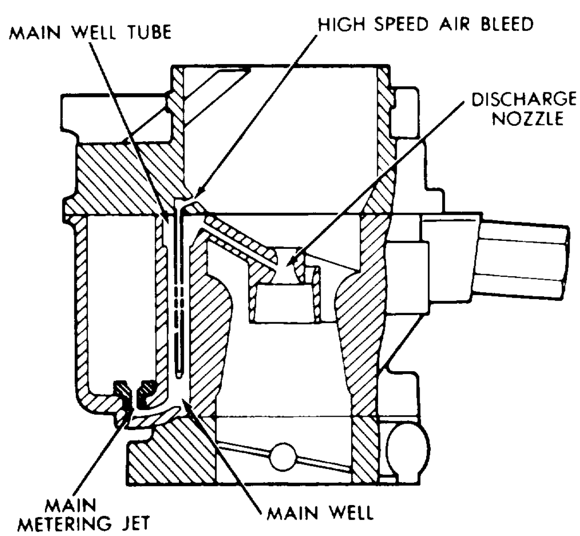


FIG. 6. Main Metering System. Model 1940

POWER ENRICHMENT SYSTEM MODEL 1940 (FIG. 7)

The power enrichment system consists of a power valve Installed near the center of the carburetor body and a vacuum piston installed in the bowl cover. A vacuum passage leads from the top of the piston down to the manifold flange.

When the manifold vacuum is high, the vacuum piston is raised to the top of its cylinder and the spring on the piston is compressed.

When the manifold vacuum drops to a predetermined level. the spring overcomes the vacuum and pushes the piston stem down. The piston stem In turn pushes the power valve down. opening the power *valve and permitting fuel to flow through the power valve. through the power valve channel restriction and into the main well located near the power valve.

The power valve originally used in the model 1940 is a three-piece valve sold as an assembly Later model 1940 carburetors used a one-piece, two-stage power valve (Figure 7).

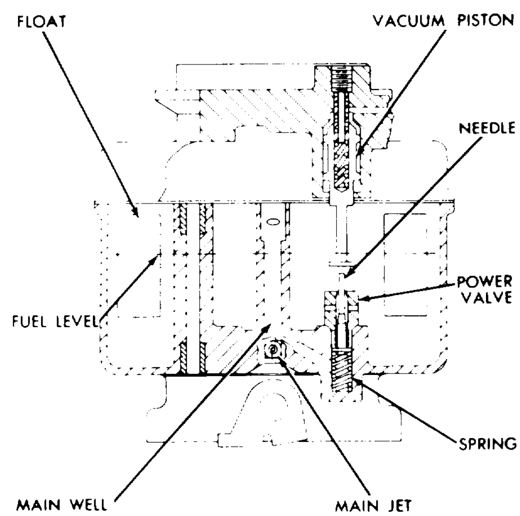


FIG. 7. Power Enrichment System

ACCELERATOR PUMP SYSTEM (FIG. 8)

When the throttle plates are opened suddenly, the air flow through the carburetor increases almost immediately; however. there is a brief time interval or lag before the fuel can overcome its inertia and attain required flow to maintain the desired air-fuel ratio.

The piston type accelerating pump system mechanically supplies the fuel necessary to overcome this deficiency for a short period of time.

Fuel enters the pump cylinder from the fuel bowl through the pump cup stem clearance hole when the pump is lifted to a refill position. The fuel level is above the normal position of the pump piston. This is known as a wet pump system.

As the throttle lever is moved. the pump link operating through a system of levers and a drive spring, pushes the pump piston down seating the pump cup against the face of the stem. Fuel is forced through a passage around the pump discharge jet which is drilled in the main body.

When the pump is not in operation, vapors or bubbles forming in the pump cylinder can escape through the stem clearance hole of the floating piston cup and past the pump stem.

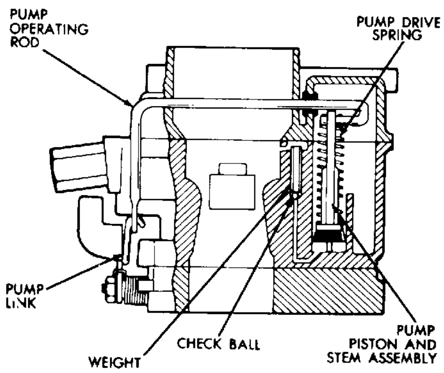


FIG.8. Accelerator Pump System

ADJUSTMENTS

REPLACING IDLE MIXTURE SCREW

Reinstall the idle mixture screw and turn screw lightly against its seat with the fingers. Back off the exact number of turns recorded during disassembly. With the idle speed screw backed off and throttle plate completely closed, check the PUMP PISTON STROKE ADJUTMENT (distance from the vacuum passage casting to the center of the hole in pump operating rod).

IDLE SPEED ADJUSTMENT

A stop screw controls the engine idle speed Run the engine until normal operating temperature has been reached Turn the idle stop screw "in" to increase the engine speed and "out" to decrease the engine speed.

CARBURETOR IDLE MIXTURE ADJUSTMENT (ON ENGINE)

CAUTION: Idle speed and fuel mixture adjustments must he made with the ENGINE AT NORMAL OPERATING TEMPERATURE and engine air cleaner in place.

1. Connect tachometer to engine. Tachometer must be I%-2% accurate and have expanded scale of 1-1000 or 400-800 RPM.
2. Be sure engine is thoroughly warmed up. Adjust "idle speed" screw to specified RPM per idle speed adjustment.

Turn the mixture adjusting needle in until the engine begins to run rough from the lean mixture. Slowly turn the needle out until the engine begins to "roll" from the rich mixture. Then slowly turn the needle in until the engine runs smoothly. Always favor a slightly rich mixture rather than a lean setting.

It may be necessary to reset the idle speed stop screw after the correct idle mixture is obtained.

DISASSEMBLY

The model 1940 carburetor is assembled of three major sub-assemblies. These assemblies are the air horn or bowl cover, carburetor body assembly and throttle body assembly. Servicing of the carburetor can be simplified if these sub-assemblies are disassembled and kept together in their respective groups.

THE FOLLOWING PROCEDURES APPLY TO THE MODEL 1940

1. Remove nut and lockwasher retaining the pump rocker arm and pump link.
2. Remove the bowl cover screws.

NOTE: The position of the link in the rocker arm slots and the position of the throttle return spring or the positive throttle return spring on some model applications for proper reassembly (Figure 9).

3. Separate the bowl cover from the carburetor body. Do not pry. Tap gently from side to side with a plastic hammer or screwdriver handle.
4. Remove the accelerating pump operating rod retainer screw and retainer.
5. Rotate the pump operating rod and disconnect the pump drive spring and accelerating pump assembly (Figure 10). Set the pump assembly aside. Do not immerse in cleaner. A new pump cup is in the kit.
6. Rotate the pump operating rod and remove the rod and grommet from the bowl cover (Figure 11).
7. With a hearing scraper or a scraper ground from an old triangle file remove all the staking from the vacuum piston retainer (Figure 12).
8. With a suitable puller or long nosed pliers and support, remove the vacuum piston assembly (Figure 13).
9. Remove bowl vent valve from rod if so equipped. The rod cannot be removed.
10. Remove hot idle compensator valve cover, valve and gasket from cover. if so equipped.

This normally completes disassembly of the bowl cover. If the carburetor is equipped with a mechanical power valve modulator rod It cannot be removed.

CAUTION: Unless the choke valve is bent or damaged DO NOT REMOVE the choke salve screws, valve or shaft for normal service.

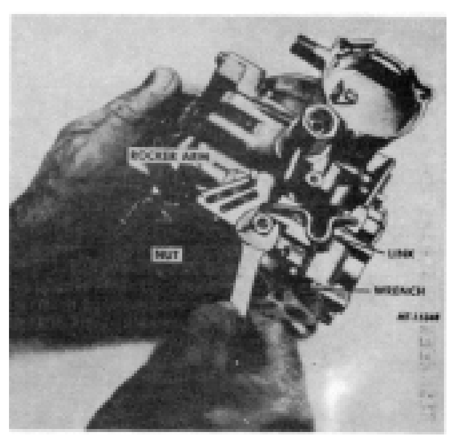


FIG.9. Remove or Install Accelerator Pump Rocker Arm.

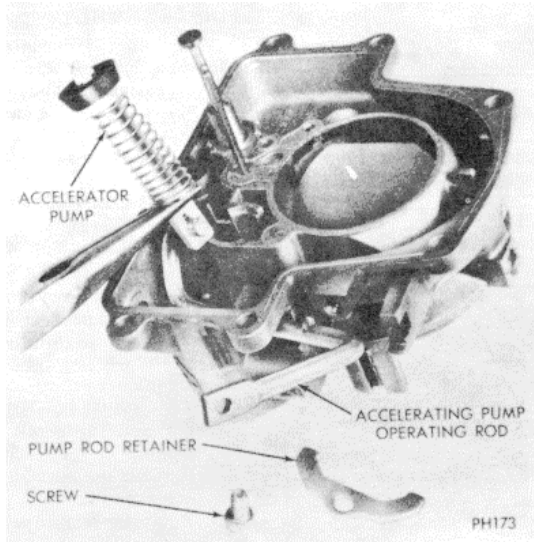


FIG. 10. Remove or Install Accelerator Pump Assembly

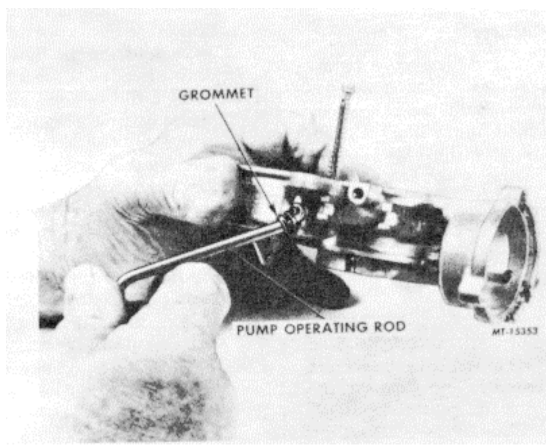


FIG. 11. Remove or Install Accelerator Pump Operating Rod and Grommet

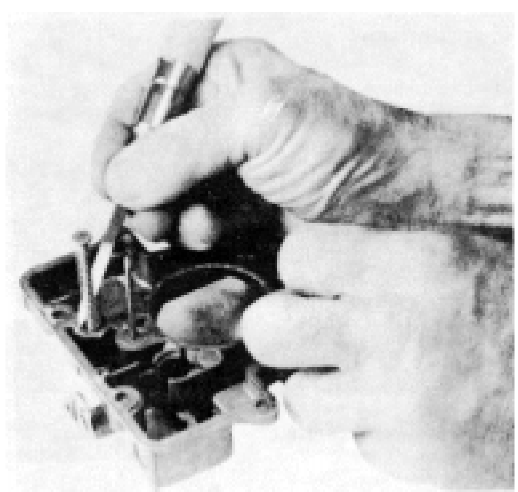


FIG. 12. Remove Staking from Vacuum Piston Retainer

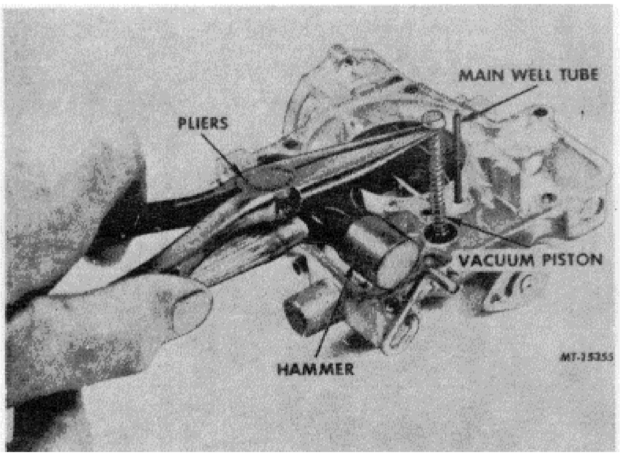


FIG. 13. Removing the Vacuum Piston Assembly

CARBURETOR BODY DISASSEMBLY

1. Turn the carburetor body upside down and remove the pump discharge ball and weight (Figure 14). Save the old ball in case the seat needs staking (Figure 22).
2. Remove the fuel inlet valve and fitting assembly: remove gasket. Remove spring float shaft retainer, float shaft and float (Figure 15).

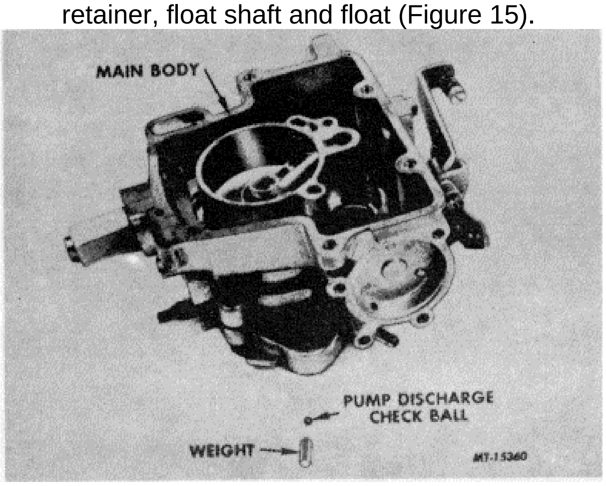


FIG. 14. Remove or Install the Pump Discharge Ball and Weight

3. Remove the main jet with a jet wrench. A 3/8" wide square point screwdriver may be used (Figure 16).

4. Remove the power valve assembly with a proper socket or a 3/8" wide screwdriver blade with a 1/16" x 3/8" deep slot sawed in the center of the blade. The slot will clear the power valve stem and prevent damage (Figure 17).

This completes the disassembly of the carburetor body. Remove the three carburetor body to throttle body screws. Tap gently and separate the throttle body from the main body (Figure 18).

THROTTLE BODY DISASSEMBLY

1. Gently turn the idle mixture screw clockwise until It seats Record the starting position of the slot and the exact number of turns required to seat the screw. This procedure is necessary to reinstall it in the same position after cleaning.
2. Remove the curb idle screw and spring. low idle screw and spring and fast idle screw and spring. Certain applications may not have all of these screws (Figure 19).
3. Carefully inspect the throttle valve for nicks or burrs and the throttle shaft for wear. **Do not remove the throttle valve**. If damage or wear Is evident, the throttle body or carburetor must be replaced. If the idle mixture screw is bent or grooved it must also be replaced. Correct idle adjustment cannot be achieved with a grooved or damaged idle mixture needle or screw.

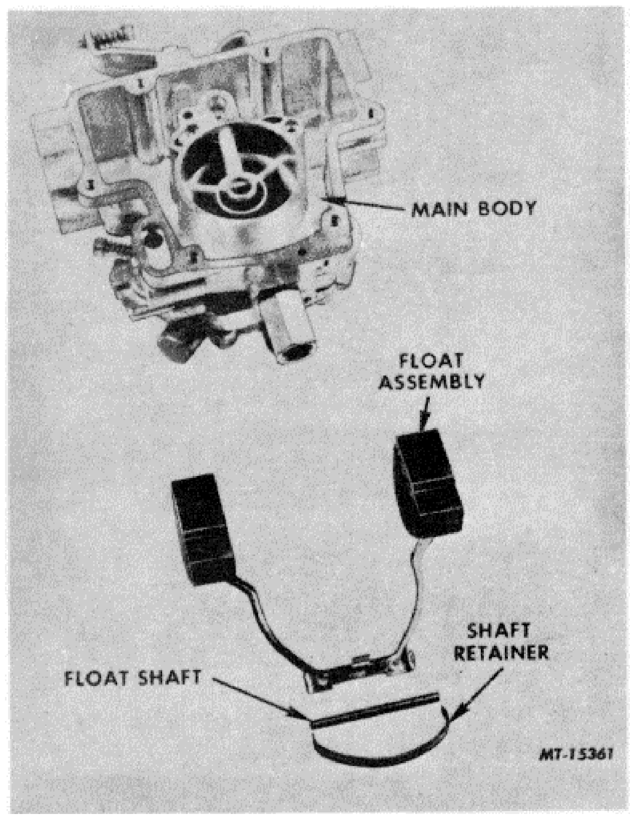


FIG. 15. Remove or Install the Float Assembly

CLEANING

Carburetor cleaning is thoroughly covered in a previous section. During cleaning the bowl cover should be placed on top of the other parts in the basket with the main well tube projecting upward and protected. It is a part of the bowl cover and cannot be replaced. Blow out passages as shown (Figure 20).

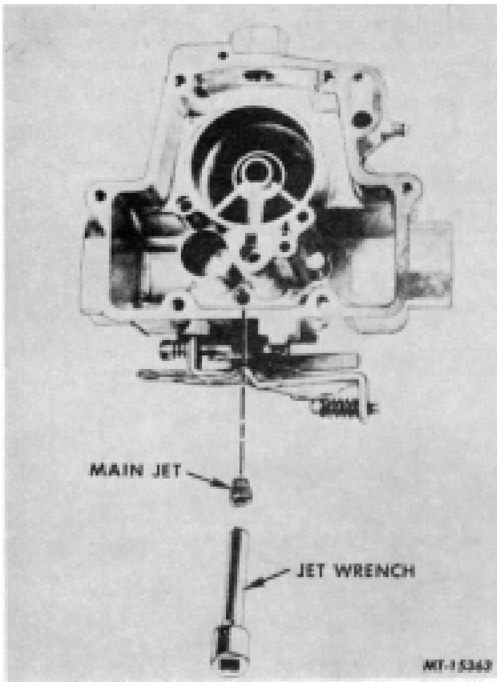


FIG. 16. Remove or Install Main Jet

ASSEMBLY

Except for the following vacuum piston staking operation (Figure 21), and testing the pump discharge valve (Figure 22), reassembly 1i the reverse if disassembly Follow Figures No. 19 back to No. 1.

NOTE: Before installing the vacuum piston assembly, be sure to remove all previous staking from the retainer recess. Install the piston in the vacuum cylinder and stake lightly with a suitable tool.

Test the pump discharge valve prior to assembly by filling the pump cylinder with clean fuel. Hold the pump discharge ball and weight down with a small punch or drift and operate the pump plunger by hand. If the valve and seat are leaking fuel will rise around the valve weight and spill over (Figure 22).

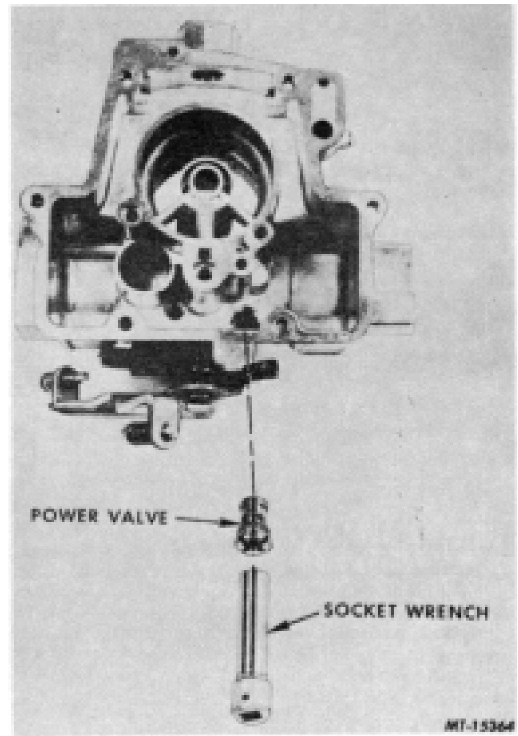


FIG. 17. Remove or Install Power Valve

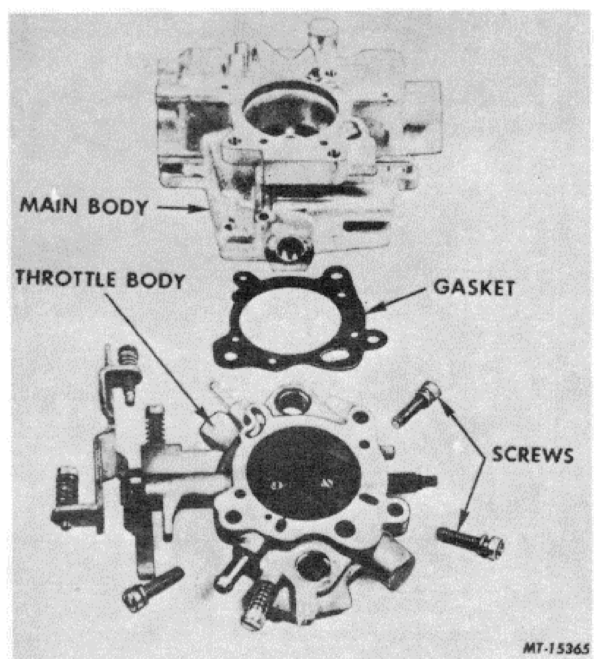


FIG. 18. Separate Throttle Body from Main Body

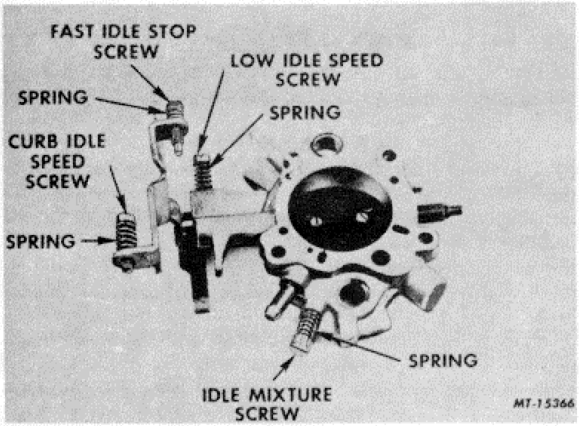


FIG. 19. Throttle Body and Idle Adjustment Screws

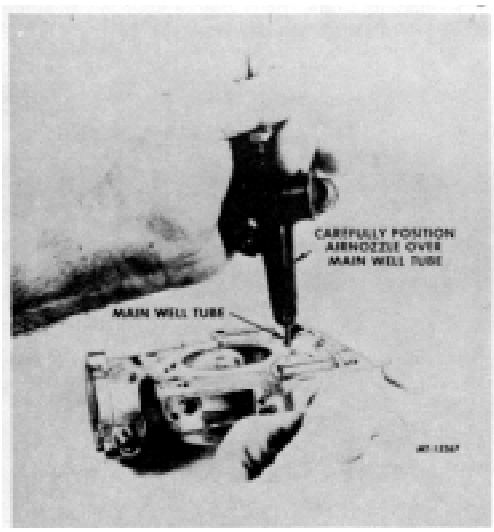


FIG. 20. Blowing Out Main Well Tube

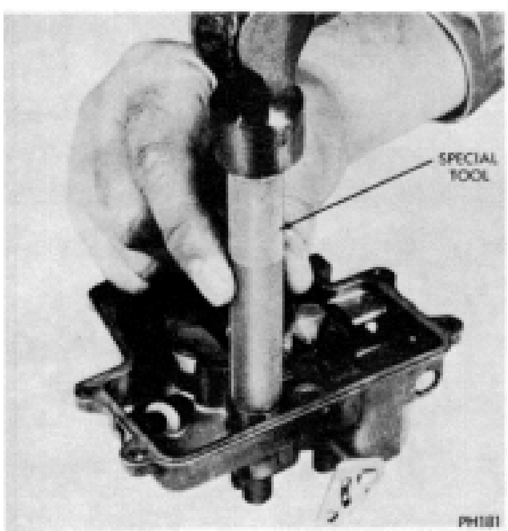


FIG. 21. Staking the Vacuum Piston

ADJUSTMENTS DURING ASSEMBLY

Assemble the throttle body, and assemble the throttle body to the main body. Use a new gasket and torque the screws to 30 in-lbs. in three even steps. Install the main jet and power valve with the proper tools.

If the valve is leaking remove the hexagon weight and lightly stake the seat with the old ball using a suitable punch or drift. Throw the old ball valve away and install the new ball from the kit, at the proper time during reassembly.

Install the float shaft in the float lever and insert assembly in the float shaft cradle. Insert the retaining spring.

Install a new gasket on the new fuel inlet valve (needle and seat).

Hold the retaining spring with the fingers and invert the bowl. A straight edge placed across the surface of the bowl should just touch the toes of the float (The portion of the float hangs farthest from the fuel inlet.) If necessary bend the float hang to obtain this adjustment (Figure 23). Complete the reassembly.

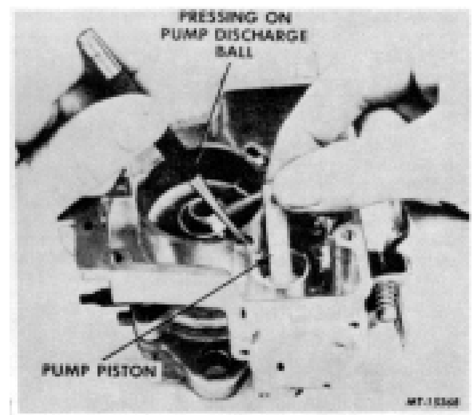


FIG. 22. Testing the Accelerator Pump System

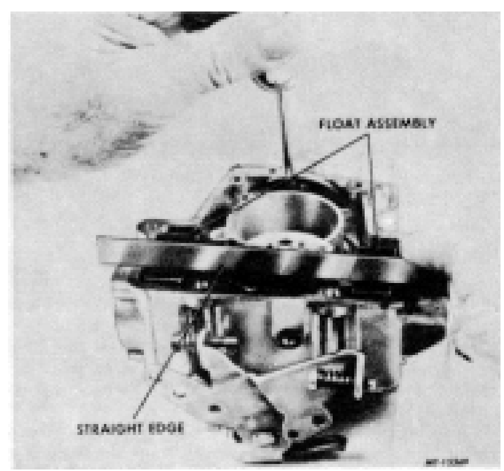


FIG. 23. Testing Dry Float Adjustment

HOLLEY MODEL 1904 ONE-BARREL CARBURETOR

DESCRIPTION

The Holley model 1904 single-barrel carburetor (Figure 24) is used on the 300 CID engines. It consists of two main assemblies. the main body and the throttle body.

The main body contains the float, fuel-inlet valve, fuel bowl, the carburetor air inlet, the main and booster venturi, the choke plate, the main well body. the power fuel assembly, and the accelerating pump assembly. The main well body contains the majority of the fuel passages and the fuel metering parts.

The throttle body houses the throttle plate, the Idle discharge ports, the idle speed screw. and the Idle fuel mixture adjustment needle.

OPERATION

The carburetor has four fuel metering systems to provide the correct fuel-air mixture for all phases of engine operation. The four systems are: the idle fuel system, the main fuel system, the accelerating system. and the power fuel system. In addition, a fuel inlet system regulates the fuel supply to the various systems, and a manual choke provides an enriched mixture to aid In starting and running a cold engine.

FUEL INLET SYSTEM

Fuel under pressure from the fuel pump enters the float chamber through the fuel inlet needle valve and seat assembly (Figure 25).

Movement of the needle valve in relation to the seat is controlled by the float and lever assembly which rises and falls with the fuel level. As the fuel level drops. the float lowers, opening the needle valve to admit fuel. When the fuel in the float chamber reaches a pre-set level. the float moves the needle valve to a position where it restricts the

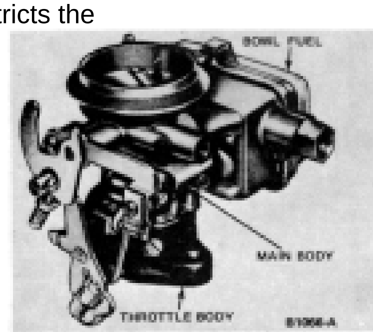


FIG. 24. Holley Single-Barrel Carburetor

flow of fuel into the float bowl. Changes In the fuel level cause a corresponding movement of the float which opens or closes the needle valve to maintain the pre-set fuel level. This level must be maintained because the carburetor is calibrated to deliver the proper mixture only when the fuel Is at this level.

A spring and pin are located in the hollow needle valve to cushion the valve against vibrations. A clip, to assure reaction of the valve to any float movement, is attached to the valve and float.

IDLE FUEL SYSTEM

During Idle, fuel passes through the main jet into the bottom of the main well (Figure 26). High manifold vacuum acting through the idle passages draws fuel from the main well through a short horizontal passage into the idle well.

The fuel is metered through a calibrated restriction, at the top of the idle well, on its way into the Idle channel. Air Is introduced through an idle air bleed at the top of the Idle channel. The air bleed also acts as a vent to prevent siphoning at high speeds or when the engine is stopped. The fuel-air mixture travels down the idle channel past two Idle transfer holes in the throttle body and is discharged through the idle discharge hole below the closed throttle plate. As the throttle plate is moved past the two transfer holes, during off idle, each hole begins to discharge fuel as it is exposed to manifold vacuum. The transfer holes act as additional air bleeds at idle.

Fuel discharge at idle is controlled by an Idle adjusting needle which seats in the discharge hole.

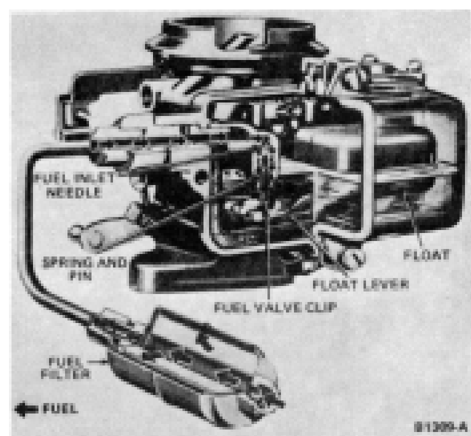


FIG. 25. Fuel Inlet System

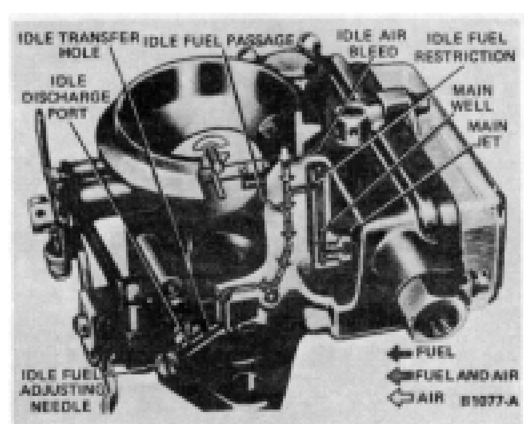


FIG. 26. Idle Fuel System

MAIN FUEL SYSTEM

The velocity of air flow through the carburetor increases as the throttle plate opens. When this causes a great enough pressure drop in the venturi the main metering system starts flowing. Fuel from the idle system tapers off as the main system begins discharging fuel. At this time, there is a definite blend of the idle and main systems.

Fuel passes through the main Jet into the bottom of the main well and flows up the main well (Figure 27). Filtered air from the carburetor air inlet passes through the high speed air bleed into the air bleed well and enters the fuel in the main well through three short horizontal air passages. This mixture of fuel and air, being lighter than raw fuel, responds faster to any change in venturi pressure and also vaporizes more readily when it is discharged. The fuel continues up the main well and flows into the main discharge nozzle where it is sprayed onto the open choke plate and the walls of the booster venturi. Here, the mixture Is vaporized and mixed with the air stream passing through the booster venturi. It then passes the throttle plate into the intake manifold.

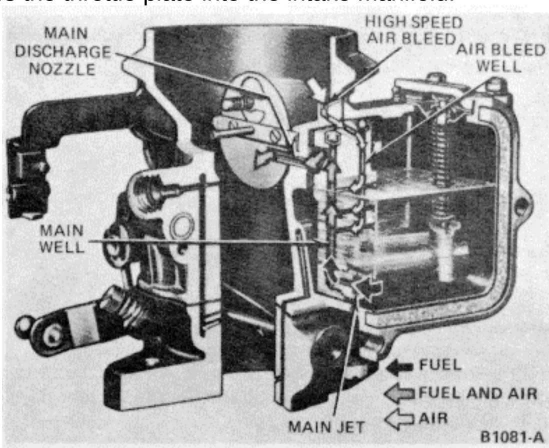


FIG. 27. Main Fuel System

ACCELERATING SYSTEM

During periods of sudden acceleration, the air flow through the carburetor responds very quickly to a sudden throttle opening. However, there is a brief interval before the heavier fuel-air mixture in the narrow passages can gain speed and maintain the desired balance of fuel and air. The accelerating system (Figure 28) operates during this interval to supply fuel until the other systems can provide the proper mixture.

When the throttle is suddenly opened, the diaphragm, which is connected by linkage to the throttle, forces fuel from the pump chamber into the pump discharge passage The fuel under pressure forces the pump discharge ball check valve and weight up. The fuel then passes into the pump discharge nozzle where it is sprayed into the air stream of the venturri. The discharge nozzle is vented to prevent siphoning at high engine speeds.

When the throttle is closed, the pump return spring forces the pump diaphragm toward the back of the pump chamber. drawing fuel into the chamber through the pump inlet. A ball check valve in the pump inlet opens to admit fuel from the float chamber and closes when the pump is operated to prevent a reverse flow of fuel. The outlet ball check valve prevents air from entering when the diaphragm draws fuel into the pump chamber.

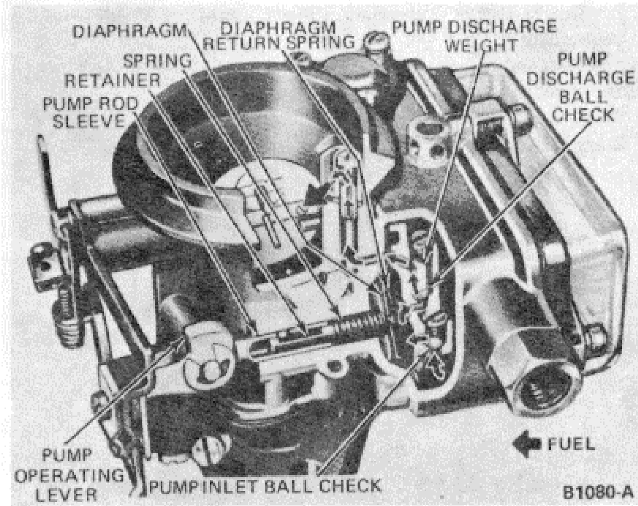


FIG. 28. Accelerating System

POWER FUEL SYSTEM

The power fuel system (Figure 29) operates when additional fuel is required for a richer mixture during high speed, heavy loads, and for low speeds at full throttle.

Manifold vacuum is transmitted from below the throttle plate through the vacuum passage to the vacuum chamber on top of the diaphragm. At idle and normal speeds the manifold vacuum is great enough to hold the diaphragm up against the tension of the diaphragm spring. This raises the diaphragm stem clear of the power valve. The power, . valve is held closed by the tension of its spring

When high power places a greater load on the engine, manifold vacuum is reduced. When the vacuum drops below 7-6 inches of mercury, the diaphragm can no longer overcome the tension of the diaphragm spring and the diaphragm stem is forced down on the power valve This 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 restriction into a horizontal passage which leads to the main well A here It is added to the fuel from the main fuel system

ADJUSTMENTS

IDLE FUEL MIXTURE ADJUSTMENT

The idle fuel mixture is controlled by the idle mixture adjustment needle (Figure 30). Turn the screw "in" to lean the mixture, and "out" to enrich the mixture. Make the initial mixture adjustment by turning the needle "in" until it lightly touches the seat Then back off the screw one turn.

Do not turn the needle against the seat tight enough to groove the point. If the needle is damaged, it must be replaced before proper mixture adjustment can be obtained.

Run the engine for 20 minutes at fast Idle speed to bring it to normal operating temperature

Turn the mixture adjusting needle in until the engine begins to run rough from the lean mixture. Slowly turn the needle out until the engine begins to "roll" from the rich mixture.

Then slowly turn the needle in until the engine runs smoothly. Always favor a slightly rich mixture rather than a lean setting.

It may be necessary to reset the idle speed stop screw after the correct idle mixture is obtained.

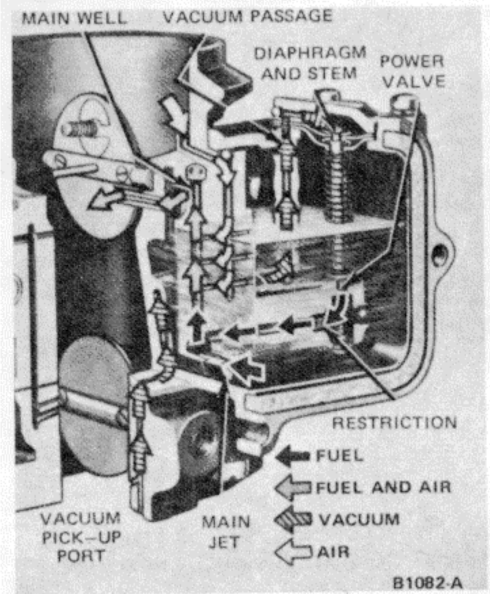


FIG. 29. Power Fuel System

IDLE SPEED ADJUSTMENT

A stop screw controls the engine Idle speed. Run the engine until normal operating temperature has been reached. Turn the idle stop screw "in" to increase the engine speed and "out" to decrease the engine speed.

ADJUSTING THE ACCELERATING PUMP STROKE AND CHECKING THE PUMP

The quantity of fuel discharged by the accelerating pump is controlled by changing the position of the pump link in the throttle lever holes. The inner hole is for average or hot weather operation, and the outer hole is for cold weather operation.

To check the accelerating pump, remove the air cleaner, then operate the throttle and observe the fuel flow from the

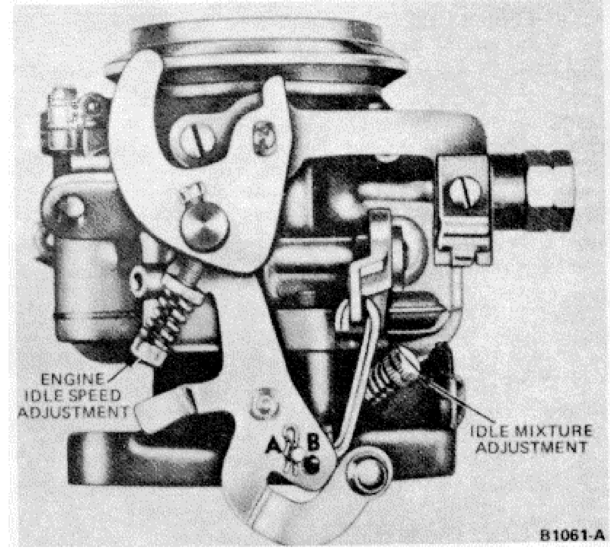


FIG. 30. Idle Fuel Mixture Adjustment

discharge outlet. If the system is in good condition, a quick steady stream will flow from the outlet when the throttle is opened.

CHECKING AND ADJUSTING FUEL LEVEL

To check the fuel level, remove the power valve diaphragm cover and valve assembly. Place the 6" depth gauge In this opening and crank the engine. Measure the distance from the machined surface to the exact fuel surface.

If the fuel level is not to specifications, remove the fuel bowl and carefully bend the tab on the float to correct the fuel level setting.

REMOVAL

Remove the air cleaner. Disconnect the accelerator rod, choke wire, fuel line, and the distributor vacuum line. Remove the carburetor hold-down nuts, then remove the carburetor and gasket from the manifold.

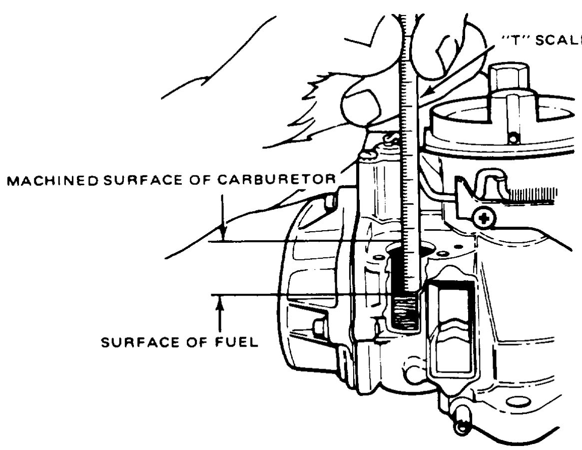


FIG. 31. Testing Wet Fuel Level

DISASSEMBLY

Use a separate container for the component parts of the sub-assemblies to facilitate cleaning, inspection, and assembly.

1. Remove the accelerator pump link cotter pin and slide the upper end of the link out of the pump operating lever. Remove the two throttle body screws and lock washers. Separate the throttle body and main body, and remove the gasket.
2. Remove the fuel inlet fitting with a box wrench, and remove the gasket. Remove the four float bowl retainer screws, lockwashers, and clamps. Remove the retainer, retainer gasket, float bowl, and bowl gasket.
3. Remove the fuel inlet seat screw and gasket located in the fuel inlet opening. Remove the fuel inlet needle valve and float assembly, and the gasket from inside the main body. Remove the float shaft, releasing the float. Slide the fuel inlet needle assembly off the float lever tab. Remove the wire clip, spring, and plunger from the fuel inlet needle. Remove the three power valve diaphragm screws and lockwashers, then lift the power valve diaphragm and stem assembly out of the main body. Separate the cover from the diaphragm and stem assembly.
4. Remove the five main well screws and lock washers, then remove the main well. Remove the pump return spring from the metal disc on the accelerating pump piston. then remove the spacer gasket. Pull the accelerating pump diaphragm out of the main body. Remove the pump operating lever retainer, then slide the lever off the stud. Remove the choke bracket screw and lockwasher. the choke plate screw and lockwasher, and the choke shaft locating screw and lockwasher. Slide the choke shaft and lever assembly out of the main body, then remove the choke bracket. Slide the main discharge nozzle out of the main body, then remove the choke plate and valve assembly. Invert the main body and remove the distributor passage ball retainer and the distributor passage ball.
5. Remove the main jet, the pump inlet check valve retainer, and the pump discharge valve retainer from the main well body. Invert the body, allowing the pump inlet check ball, pump outlet check ball weight and check ball to fall out into the hand.
6. Press the pump rod sleeve toward the diaphragm until the pump rod sleeve retainer ball drops out. Remove the pump rod sleeve and spring.
7. Remove the idle adjusting needle and spring. Remove the pump link cotter pin and link.

On carburetors equipped with a dashpot, remove the dashpot lever.

At times it may be necessary to remove the throttle plate and shaft to accomplish a thorough cleaning job. If this is done, be sure to mark the throttle plate before removal so it can be installed in exactly the same position. Throttle plates and shafts cannot be interchanged between carburetors, nor are they serviced as separate parts.

CLEANING AND INSPECTION

Many carburetor troubles are the result of deposits accumulating in the carburetor. A thorough cleaning must be performed to assure satisfactory carburetor performance.

CLEANING

Soak all castings and metal parts in a cleaning solution to soften and loosen all foreign deposits. If a commercial carburetor cleaning solvent is not available, lacquer thinner or defatured alcohol may be used.

INSPECTION

Replace the float if it leaks or if the assembly is damaged in any way. Replace the main body if the protective plating is damaged exposing bare metal to corrosion. Check the action of the poppet valve in the choke plate, and free it up if necessary. Replace the choke lever and shaft assembly if the threads in the shaft are stripped or if it is not securely riveted to the lever.

ASSEMBLY

Always install new gaskets when rebuilding the carburetor. A carburetor overhaul kit is available for service. A disassembled view of the carburetor is shown in Figure 32.

1. Install the pump link in the throttle lever, then secure it with a cotter pin. Install the idle adjusting needle and spring. Turn the needle in gently with the fingers until it seats, then back it off 1/2 turns for a preliminary idle adjustment. To avoid grooving the tip of the needle, do not force the needle against its seat.
2. Install the distributor passage ball and ball retainer. Place the choke bracket in position on the main body and install the choke bracket screw and lockwasher. Insert the choke plate and valve assembly into the main body. The poppet valve stem should be pointing down. Install the main discharge nozzle. Slide the choke shaft in position and install, but do not tighten. the choke plate screw. Close the choke plate and hold the main body up to the light. Little or no light should show between the choke plate and the walls of the bore. Make sure the choke plate does not bind, then tighten the choke plate screw. Install the choke shaft locating screw and lockwasher.
3. Place the pump operating lever on the stud in the main body, and fit the pump operating lever retainer on the stud. Place the spring on the pump diaphragm rod, and press the pump rod sleeve into the rod to compress the spring. Drop the pump rod sleeve retainer ball into the hole in the sleeve. Be sure the main discharge nozzle gasket is in place in the main body, then position the pump assembly in the main body. Place the main well spacer gasket, over the pump assembly.
4. Insert the pump inlet check ball, and the pump outlet check ball in the main well body. The pump inlet check ball is slightly larger than the pump outlet check ball. Be sure they are installed in their proper chamber. Seat the check balls with one gentle tap of a light hammer and a soft brass drift. Be sure the check balls move freely in their chambers, then install the pump inlet check ball retainer, and the outlet check ball weight and retainer. Install the main jet in the main well body.
5. Seat the large end of the pump return spring in the metal disc on the accelerating pump diaphragm. Position the main well body screws and lock washers in the body. The two long screws are placed in the center top and center bottom holes; the short screws are used in the three remaining holes. Insert the power valve end of the main well body into the main body, then press the main well body into position against the spacer gasket as follows:

Apply pressure with the index finger against the protruding end of the pump rod sleeve, to fully compress the pump return spring, as the thumb presses the main well body into position. This will prevent the pump return spring pressure from disturbing the alignment of the holes in the diaphragm, spacer gasket, and main body. Before releasing the pump rod sleeve, tighten the five main well body screws.

6. Position the power valve gasket, power valve diaphragm stem assembly, and the power valve body cover in the main body. Install the three power valve body cover screws and lockwashers.

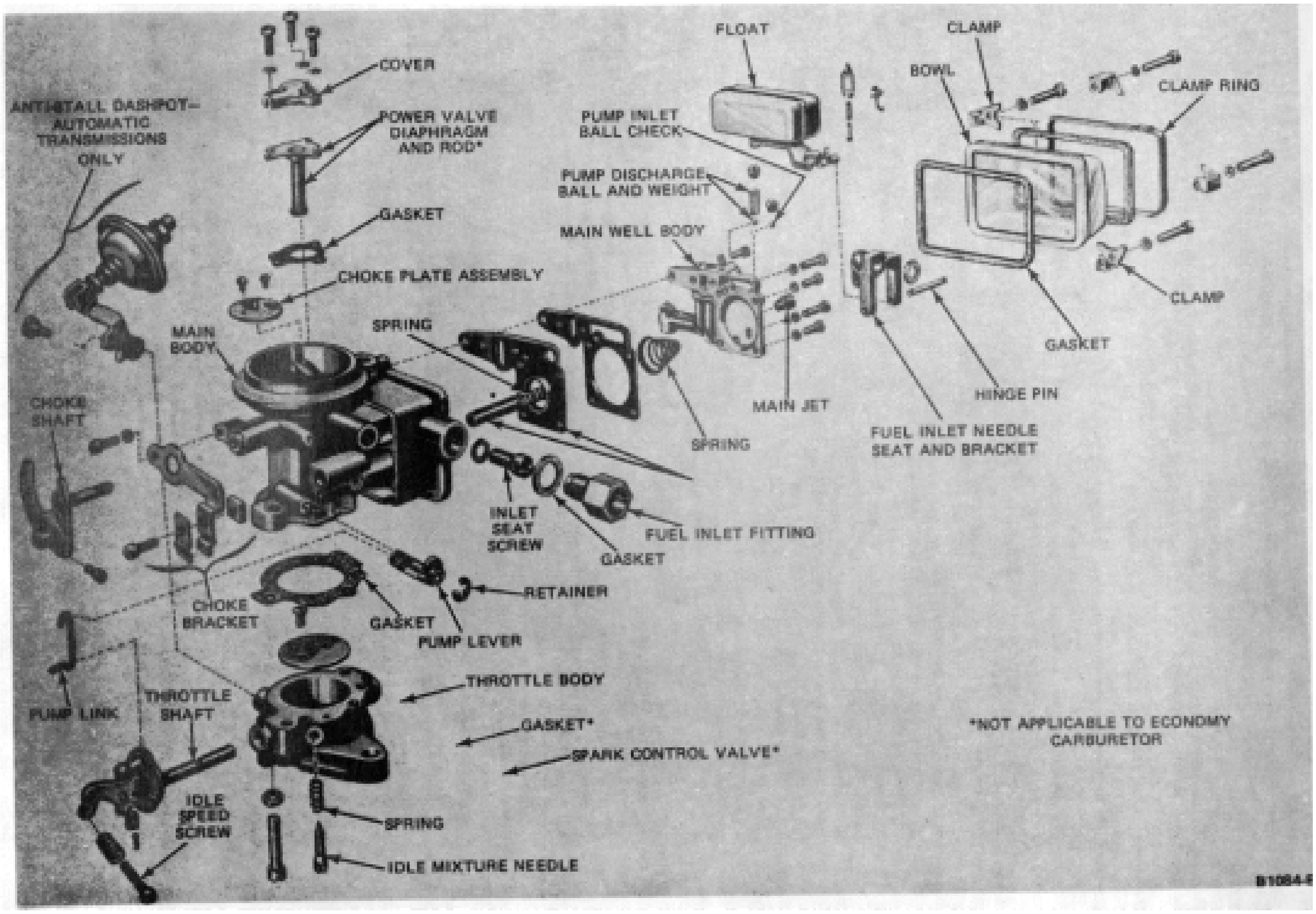


FIG. 32. Holley Single-Barrel Carburetor

7. Place the inlet needle spring over the fuel inlet needle plunger, and insert these parts, spring first, into the hollow fuel inlet needle. Install the wire fuel valve clip on the fuel inlet needle. Clip the needle on the float lever tab. Guide the needle into the inlet needle seat, and position the float lever between the two float hinge bracket arms. Install the float lever shaft. Do not attempt to interchange fuel inlet needles or seats; they are matched assemblies.
8. Install the fuel inlet seat screw gasket on the screw, and insert the screw through the fuel inlet fitting boss in the main body. Place the seat gasket on the threaded end of the inlet seat screw which protrudes into the fuel bowl. Set the float and fuel inlet valve assembly into position, and install the carburetor float gauge under the float hinge bracket to prevent the assembly from tilting when the seat screw is tightened. Tighten the screw securely, then remove the gauge. Install the fuel inlet fitting and gasket.
9. Invert the min body assembly, and check the setting of the float with a 6" steel ruler. If necessary, bend the tab on the float arm to bring the float setting within limits. This should provide the proper fuel level.
10. Install a new float bowl gasket into the recess in the main body. Install the retainer gasket over the bowl. Place the retainer on the bowl, and set the bowl into position. Install the four clamps, screws, and lockwashers. Tighten the two center screws, then the two end screws, alternately. to evenly compress the gasket (approximately 8-10 inch-pounds torque). Do not overtighten these screws as the bowl may crack. Install the dashpot if so equipment.
11. Place a new throttle body to main body gasket on the throttle body, and check the alignment of all holes in the gasket with the corresponding holes in the throttle body. Insert the two throttle body screws and lockwashers through the throttle body and gasket to maintain gasket alignment, then set the main body on the throttle body. Invert the carburetor, and tighten the two throttle body screws evenly. Insert the upper end of the pump link through the hole at the end of the pump operating lever, and install the cotter pin.

INSTALLATION

If the carburetor to intake manifold gasket is not serviceable, install a new one. Place the carburetor on the manifold. and secure it with the lockwashers and nuts. Tighten the nuts evenly. Connect the choke and throttle linkage to the carburetor, and adjust if necessary. Connect the fuel line and the distributor vacuum line. Install the air cleaner and tighten the clamp. Be sure the air cleaner gasket is in place. Adjust idle fuel mixture and engine idle speed. Check the fuel level, and adjust it if necessary.

Part 4 Charging System

DESCRIPTION AND OPERATION

ALTERNATOR

The Alternator charging system is a negative ground system, and consists of an alternator, a regulator, a charge indicator, a storage battery, and associated wiring.

The alternator is belt driven from the engine. Current is supplied from the alternator-regulator system to the rotating field of the alternator through two brushes to two slip rings.

The alternator produces power in the form of alternating current. The alternating current is rectified to direct current by six diodes. The alternator regulator automatically adjusts the alternator field current to maintain the alternator output voltage within prescribed limits to correctly charge the battery.

If a charge indicator lamp is used in the charging system (Figure 1) the system operation is as follows: When the ignition switch is turned ON, a small electrical current flows through the lamp filament (turning the lamp ON) and through the alternator regulator to the alternator field. When the engine is started, the alternator field rotates and produces a voltage in the stator winding. When the voltage at the alternator stator terminal reaches about 3 volts, the regulator field relay closes. This puts the same voltage potential on both sides of the charge indicator lamp causing it to go out. When the field relay has closed, current passes through the regulator A terminal and is metered to the alternator field.

If an ammeter is used in the charging system (Figure 2), the regulator I terminal and the alternator stator terminal are not used. When the ignition switch is turned ON, the field relay closes and electrical current passes through the regulator A terminal and is metered to the alternator field. When the engine is started, the alternator field rotates causing the alternator to operate. The ammeter indicates current flow into (charge) or out of (discharge) the vehicle battery.

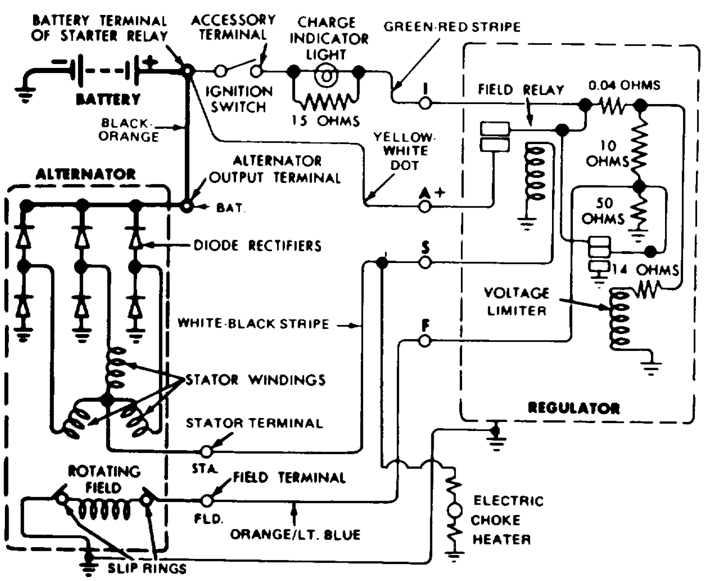


FIG. 1. Alternator Charging System - Indicator Light

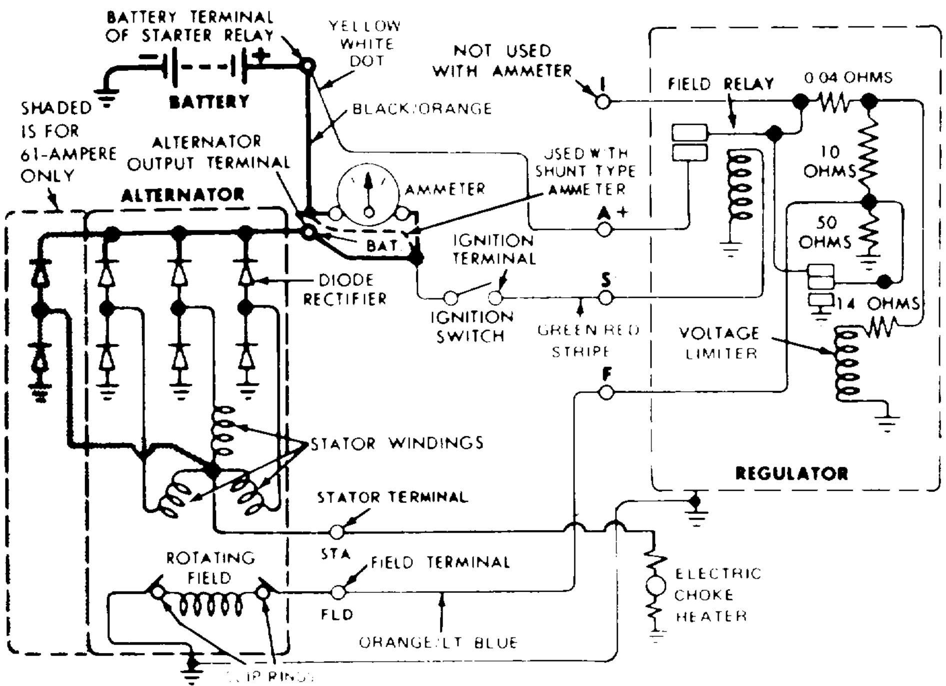


FIG. 2. Alternator Charging System Ammeter

DIAGNOSIS AND TESTING - MOTOROLA

Before performing charging system tests on the engine, note the complaint such as slow cranking, battery dead or using an excessive amount of water, top of battery wet, ammeter shows charge at all times. This information will aid In isolating the part ot the system causing the problem. The battery must be in the proper state of charge (at least 1.200 specific gravity).

The following tests are made with the alternator in the engine with output and regulator connections maintained to the alternator except as noted in Steps 3 and 5 The field lead and voltage regulator are disconnected for these tests.

Test precautions

--DO NOT disconnect alternator output lead while alternator is operating

--DO NOT disconnect voltage regulator while alternator is operating

--DO NOT ground field terminal.

--Check battery condition. Use a fully charged battery when testing alternator

--Disconnect ground cable of battery when removing and installing the installing and alternator.

All readings indicated are for correct operation.

TEST 1 - IGNITION ON - ENGINE NOT RUNNING
(Refer to Figure 3)

Correct voltage at regulator terminal is approximately 1.5 to 2.5 volts. This test evaluates excitation circuit. If voltage at regulator terminal is

5.0 to 7.0 volts = open rotor (field circuit

.75 to 1.1 volts = grounded rotor circuit

8 5 to 10.0 volts = open in regulator's load circuit

0 volts = open ignition switch or excitation resistor

If test results are uncertain, make Test 2.

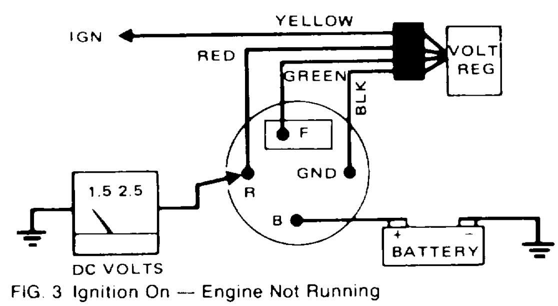


FIG. 3. Ignition On - Engine Not Running

TEST 2-- IGNITION ON - ENGINE NOT RUNNING
(Refer to Figure 4)

The voltage regulator may he by passed with a short jumper between the regulator and field terminals. Jumper provides approximate correct voltage, fault is in the regulator No change from high voltage indicates that the defect is in the brush or rotor circuit

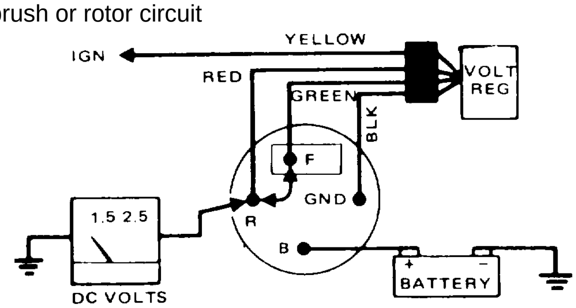


FIG. 4. Ignition On - Engine Not Running

TEST 3 - FIELD DRAW TEST - IGNITION OFF
(Refer to Figure 5)

This test evaluates complete field circuit, independent of voltage regulator. Circuit is through brushes, slip rings, field coil to ground Current should be 2 to 2 5 amps.. If less than this, check brushes and slip rings. It Is desirable to use a field rheostat in series with meter for protection of the meter.

If field is shorted. excessive current would for through meter and possible damage would result

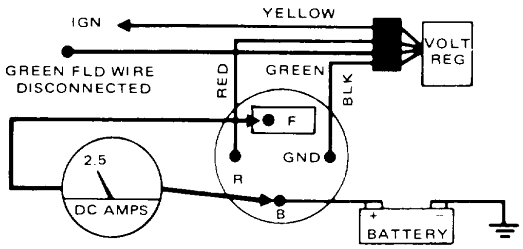


FIG. 5. Field Draw Test - Ignition Off

TEST 4 - IGNITION ON - ENGINE RUNNING AT FAST IDLE
(Refer to Figure 6)

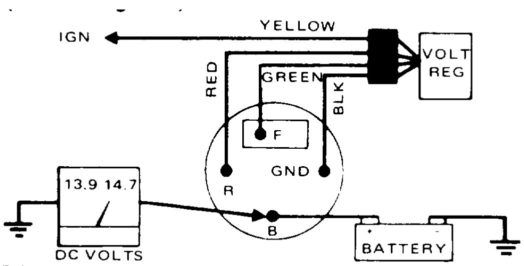


FIG. 6. Ignition On-Engine Running at Fast Idle

Voltage indicated is usually 13.9 to 14 7 volts depending on regulator ambient temperature High voltage may be due to a poor ground connection. If ground connection is not faulty, regulator will require replacement.

TEST 5 - FIELD TERM DISCONNECTED
VOLTAGE REGULATOR PLUG DISCONNECTED
BATTERY TERMINAL SHORTED TO FIELD TERMINAL
IGNITION ON - ENGINE RUNNING AT IDLE

This test isolates defect to either the alternator or regulator If voltage alt iuxiir5 terminal rises to 15-16 volts now, when it did not in Test 4 with regulator connected, then defect is in regulator and it should be replaced. If voltage does not rise at auxiliary terminal. defect is in alternator stator or rectifier diodes. If field circuit checked out properly For defects in stator or diodes, remove, alternator.

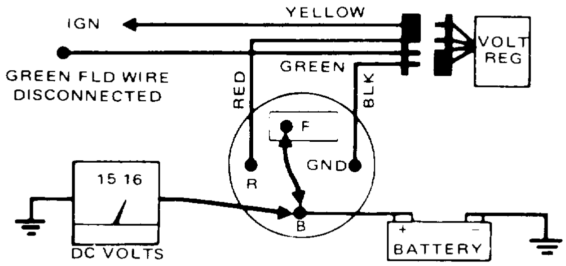


FIG 7. Field Term Disconnected Volt Reg Plug Disconnected Bat Term Shorted to Fld Term Ignition On Engine Running at Idle

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ADJUSTMENTS
BELT ADJUSTMENTS

1. Check the belt tension with Tool 1'63L-8620-A The belt should be within specifications (Specifications Section).
2. If the belt is not within specifications. loosen the alternator mounting bolt to a snug position and loosen the adjusting arm bolts.
3. **Apply pressure on the alternator front housing only** and tighten the adjusting arm to alternator bolt
4. Check the belt tension using Tool T631L-8620-A. Adjust the belt for specified tension.
5. Tighten all mounting bolts.

REMOVAL AND INSTALLATION

Removal

1. Disconnect the battery ground cable
2. Loosen the alternator mounting bolts and remove the adjustment arm-to-alternator attaching bolt.
3. Remove the electrical connectors from the alternator.
4. Disengage the alternator belt Remove the alternator mounting bolt, and remove the , alternator

Installation

1. Install the alternator wiring harness Position the alternator to the engine. and install the spacer (fused} and the alternator mounting bolt. Tighten the bolt only finger tight.
2. Install the adjustment arm-to-alternator attaching bolt.
3. Position the belt on the pulley and adjust the belt tension using Tool T631.-8620-A Apply pressure on the alternator front housing only, when tightening the belt Tighten the adjusting arm bolt and the mounting bolt.
4. Connect the battery ground cable.

Part 5 Starting System

DESCRIPTION AND OPERATION

The function of the starting system is to crank the engine at a speed fast enough to permit the engine to start. Heavy cables, connectors, and switches are used in the starting system because of the large current required by the starter while it is cranking the engine. The amount of resistance in the starting circuit must be kept to an absolute minimum to provide maximum current for starter operation. Loose or corroded connections, relay contacts. or partially broken cables will result in slower than normal cranking speeds, and may even prevent the starter from cranking the engine.

POSITIVE ENGAGEMENT STARTER

The starter used on these engines is the positive engagement starter. The starting system includes the starter motor with an integral positive-engagement drive, the battery, a remote control starter switch, the starter relay, and heavy circuit wiring.

Turning the ignition key to the START position or pressing the start button actuates the starter relay through the starter control circuit. The starter relay then connects the battery to the starter. When the starter is not in use, one of the field coils is connected directly to ground through a set of contacts (Figure 1). When the starter is first connected to the battery, a large current flows through the grounded field coil, actuating a movable pole shoe. The pole shoe is attached to the starter drive plunger lever and thus the drive is forced into engagement with the flywheel.

When the movable pole shoe is fully seated, it opens the field coil grounding contacts and the starter is then in normal operation. A holding coil is used to maintain the movable pole shoe in the fully seated position during the time that the starter is turning the engine.

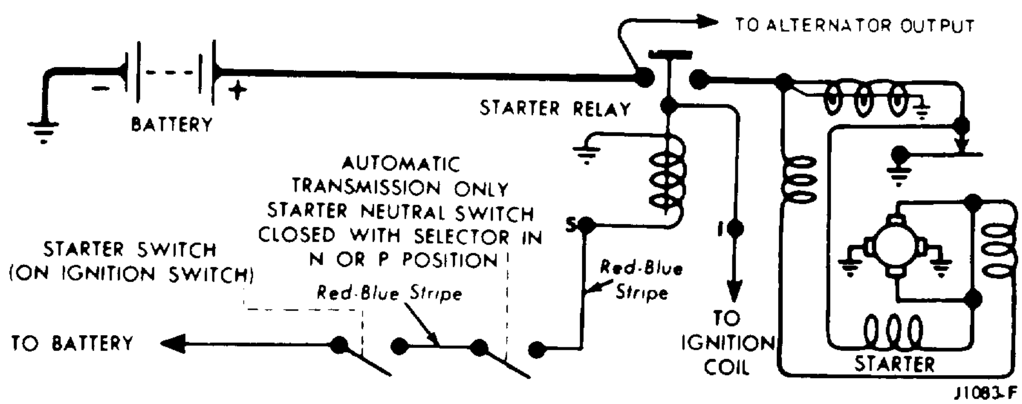


FIG. 1. Starting Circuit Positive Engagement

TESTING

BOOSTER BATTERY

You should connect a booster battery to the starting system for cases of a starter that will not crank the engine or a starter that cranks the engine very slowly, for you may have run sour battery down while trying to get the engine started. If the starter does not turn the engine over, even with the booster battery attached. refer to the following tests Be certain that correct batter) polarity is observed when using a booster batters; positive to positive, and negative to negative connection of the auxiliary cables.

ON VEHICLE TESTING

Starter Drive and Starter Test

Flood the engine by pumping the throttle eight to ten times. Turn the ignition key to start and hold it in the start position. The engine should fire immediately, but should not start and run. The starter should continue to crank the engine. This indicates a normal, acceptable starter drive. If the engine stops turning and the starter spins at high speed, the drive is not operating properly and should be replaced. Whenever possible, remove the plunger cover to observe if the plunger pole is operating while the starter is one the vehicle. **Do not damage the exposed switch during starter removal or installation.**

Alternate Starter Drive Test

1. Pull the push-on connector from the ignition coil primary terminal. Place the connector loosely on the coil terminal.
2. Connect a remote control starter switch to the starter relay.
3. Turn the ignition switch delay to the ON position and depress the remote control starter switch. As soon as the engine begins to run, pull the push-on connector from the coil terminal while holding the remote control switch in the start position. Pulling the wire off the coil kills the ignition, and the dead engine should now be cranked by the starter.
4. Observe to see If the starter begins to crank the dead engine and if it continues to crank the engine until the remote control switch is released If the starter does not crank the dead engine. the drive assembly is slipping.
5. Repeat the test at least three times in succession to detect intermittent operation.

Starter Cranking Circuit Test

Excessive resistance in the starter circuit can be determined from the results of this test Make the test connections as shown in Figure 3. Crank the engine with the ignition OFF. This is accomplished by disconnecting a grounding the high tension lead from the ignition coil and by connecting a jumper from the battery terminal of the starter relay to the S terminal of the relay.

The voltage drop in the circuit will be indicated by the voltmeter (0 to 2 volt range). Maximum allowable voltage drop should be:

1. With the voltmeter negative lead connected to the starter terminal and the positive lead connected to the battery positive terminal (Figure 2, connection (l)) . .0 5 volt.
2. With the voltmeter negative lead connected to the battery terminal of the starter relay and the positive lead connected to the positive terminal of the battery (Figure 2. connection (2)) . 0.1 volt.

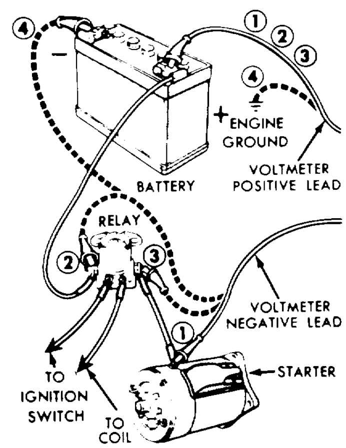


FIG. 2. Starting Cranking Circuit Test

FIG. 3. Starter Load Test

3. With the voltmeter negative lead connected to the starter terminal of the starter relay and the positive lead connected to the positive terminal of the battery (Figure 2, connection (3))...0.3 volt.
4. With the voltmeter negative lead connected to the negative terminal of the battery and the positive lead connected to the engine ground (Figure 2,. connection (4)) , 0. I volt.

Starter Load Test

Connect the test equipment as shown in Figure 3 Be sure that no current is flowing through the ammeter and heavy-duty carbon pile rheostat portion of the circuit (rheostat at maximum counterclockwise position) Crank the engine with the ignition OFF. and determine the exact reading on the voltmeter. This test is accomplished by disconnecting and grounding the high tension lead from the ignition coil, and by connecting a jumper from the battery terminal of the starter relay to the ignition switch terminal of the relay.

Stop cranking the engine. Then reduce the resistance of the carbon pile until the voltmeter indicates the same reading as that obtained while the starter cranked the engine. The ammeter will indicate the starter current draw under load.

BENCH TESTS

Starter No-Load Test

The starter no-load test will uncover open or shorted windings, rubbing armature. and bent armature shaft. The starter can be tested, at no-load, on the test bench only Make the test connections as shown in Figure 4 The starter will run at no-load. Be sure that no current is flowing through the ammeter (rheostat at maximum counterclockwise position). Determine the exact reading on the voltmeter.

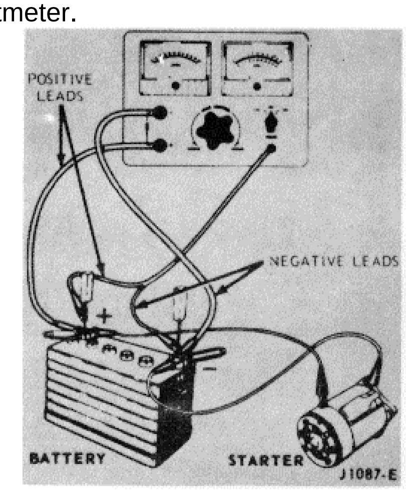
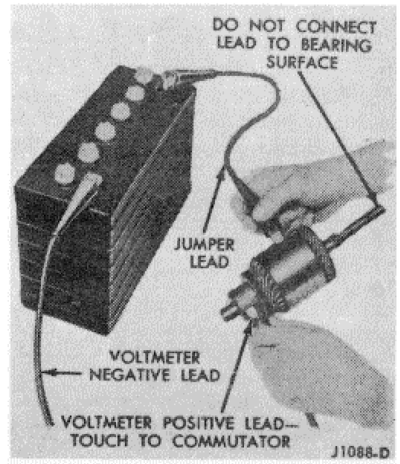


FIG. 4 Starter No-Load Test on Test Bench

Disconnect the starter from the battery. Then, reduce the resistance of the rheostat until the voltmeter indicates the same reading as that obtained while the starter was running. The ammeter will indicate the starter no-load current draw.

Armature Open Circuit Test

An open circuit armature may sometimes be detected by examining the commutator for evidence of burning. A spot burned on the commutator is caused by an arc formed every time the commutator segment, connected to the open circuit winding, passes under a brush.



Armature and Field Grounded Circuit Test

This test will determine If the winding insulation has been damaged, permitting a conductor to touch the frame or armature core.

To determine if the armature windings are grounded make the connections as shown in Figure 5. If the voltmeter indicates any voltage, the windings are grounded.

Grounded field windings can be detected by making the connections as shown in Figure 6 If the voltmeter indicates any voltage, the field windings are grounded.

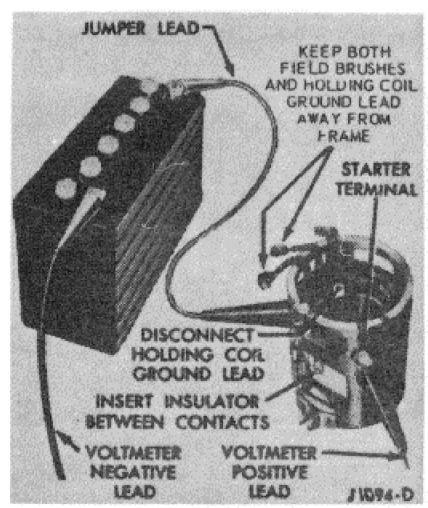


FIG 6 Field Grounded Circuit Test

REMOVAL AND INSTALLATION
STARTER
Removal

1. Raise the engine on a hoist.
2. Disconnect the starter cable at the starter terminal.
3. Remove the starter mounting bolts Remove the starter assembly (Figure 7).

Installation

1. Position the starter assembly to the flywheel housing, and start the mounting bolts.
2. Snug all bolts while holding the starter squarely against its mounting surface and fully insert into the pilot hole. Torque the bolts to specification.
3. Connect the starter cable.
4. Lower the engine. Check the operation of the starter

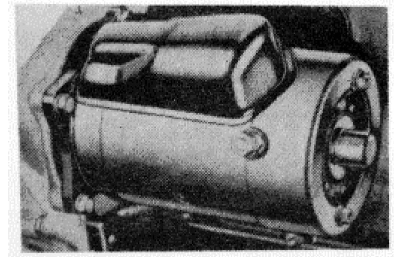


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FIG 7 Starter Mounting

OVERHAUL
STARTER

Use the following procedures when it becomes necessary to completely overhaul the starter. Figure 8 illustrates a partially disassembled starter.

Disassembly

1. Loosen the brush cover band retaining screw and remove the brush cover band and the starter drive plunger lever cover. Observe the lead positions for assembly and then remove the commutator brushes from the brush holders.
2. Remove the through bolts, starter drive end housing, and the starter drive plunger lever return spring.
3. Remove the pivot pin retaining the starter gear plunger lever and remove the lever and the armature.
4. Remove the stop ring retainer. Remove and discard the stop ring retaining the starter drive gear to the end of the armature shaft. and remove the starter drive gear assembly.
5. Remove the brush end plate.
6. Remove the two screws retaining the ground brushes to the frame.
7. On the field coil that operates the starter drive gear actuating lever, bend the tab up on the field coil retaining sleeve and remove the sleeve.
8. Remove the three coil-retaining screws, using Tool 10044-A and an arbor press (Figure 9). The arbor press prevents the wrench from slipping out of the screw. Unsolder the field coil leads from the terminal screw, and remove the pole shoes and coils from the frame. Use a 300-watt solder Iron.
9. Cut (or unsolder) the insulated brush leads from the field coils, as close to the field connection point as possible.
10. Remove the starter terminal nut, washer, insulator and terminal from the starter frame. Remove any excess solder from the terminal slot.

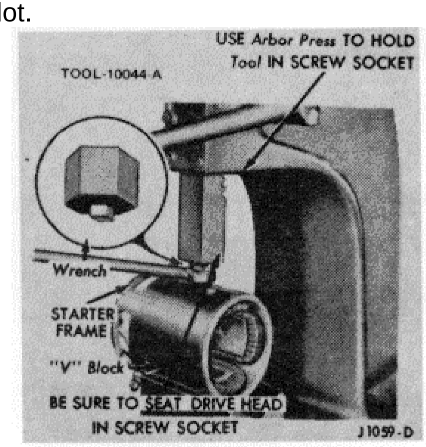

FIG. 9 Pole Shoe Screw Removal

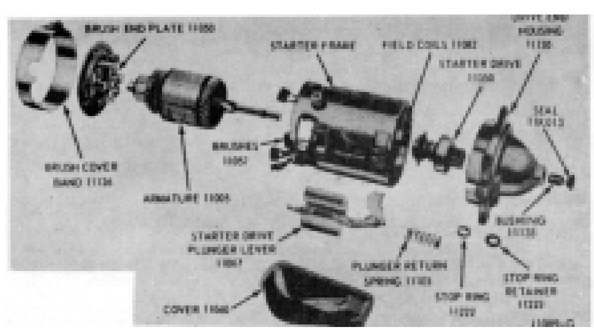

FIG. 8 Starter Disassembled

Cleaning and Inspection

1. Use a brush or air to clean the field coils, armature, commutator, armature shaft, brush end plate, and drive end housing. Wash all other parts in solvent and dry the parts.
2. Inspect the armature windings for broken or burned insulation and unsoldered connections.
3. Check the armature for open circuits and grounds.
4. Check the commutator for runout (Figure 10). Inspect the armature shaft and the two bearings for scoring and excessive wear. If the commutator is rough, or more than 0.005 inch out-of-round, turn it down.
5. Check the brush holders for broken springs and the insulated brush holders for shorts to ground. Tighten any rivets that may be loose. Replace the brushes if worn to 1/4 inch in length.
6. Check the brush spring tension. Replace the springs if the tension is not within specified limits (40 ounces minimum).
7. Inspect the field coils for burned or broken insulation and continuity. Check the field brush connections and lead insulation. A brush kit and a contact kit are available. All other assemblies are to be replaced rather than repaired.
8. Examine the wear pattern on the starter drive teeth. The pinion teeth must penetrate to a depth greater than 1/2 the ring gear tooth depth (Figure 11), to eliminate premature ring gear and starter drive failure.
9. Replace starter drives and ring gears with milled, pitted or broken teeth or that show evidence of inadequate engagement (Figure I 1).

Assembly

1. Install the starter terminal, insulator, washers, and retaining nut in the frame (Figure 12). Be sure to position the slot in the screw perpendicular to the frame end surface.

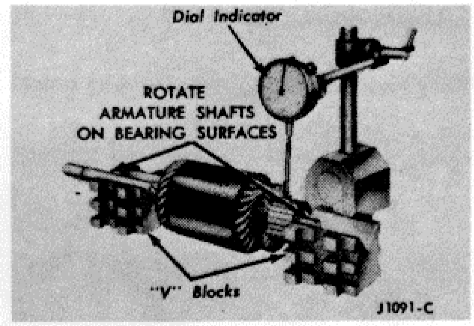

FIG. 10 Checking Commutator Runout

2. Position the coils and pole pieces, with the coil leads in the terminal screw slot, and then install the retaining screws (Figure 8). As the pole shoe screws are tightened, strike the frame several sharp blows with a soft-faced hammer to seat and align the pole shoes, then stake the screws.
3. Install the solenoid coil and retainer and bend the tabs to retain the coils to the frame.
4. Solder the field coils and solenoid wire to the starter terminal using rosin core solder. Use a 300-watt iron.
5. Check for continuity and grounds in the assembled coils.
6. Position the new insulated field brushes lead on the field coil terminal. Install the clip provided with the brushes to hold the brush lead to the terminal. Solder the lead, clip, and terminal together, using rosin core solder (Figure 12). Use a 300-watt iron.
7. Position the solenoid coil ground terminal over the nearest ground screw hole.
8. Position the ground brushes to the starter frame and install the retaining screws (Figure 12).

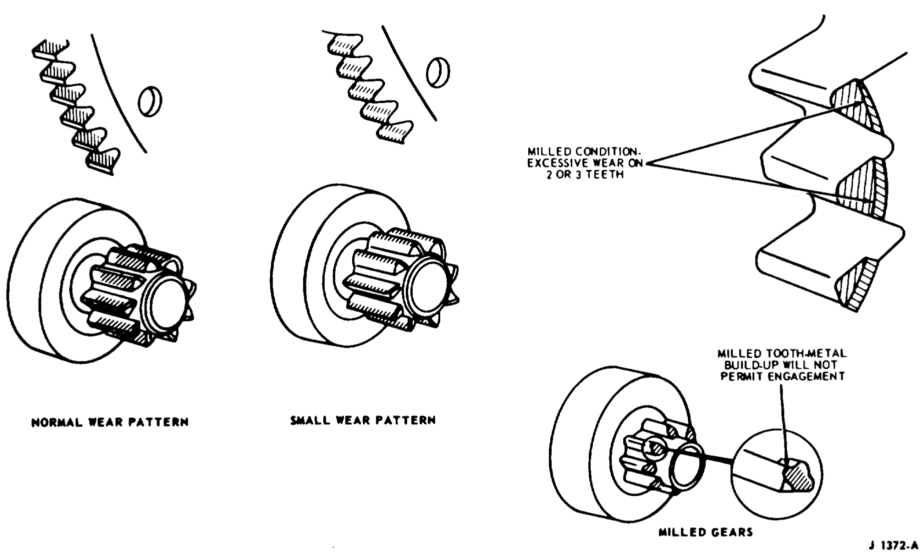

FIG. 11 Pinion and Ring Gear Wear Patterns

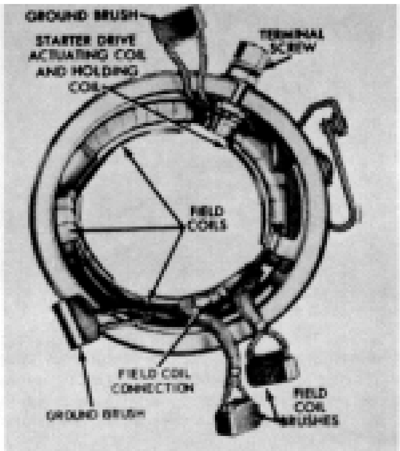

FIG 12 Coil Assembly

9. Position the starter brush end plate to the frame with the end plate boss in the frame slot.
10. Apply a thin coating of Lubriplate 777 on the armature shaft splines. Install the starter motor drive gear assembly to the armature shaft and install a new retaining stop ring. Install a new stop retainer.
11. Position the fiber thrust washer on the commutator end of the armature shaft and position the armature in the starter frame.
12. Partially fill the drive end housing bearing bore with grease (approximately 1/4 full). Position the starter drive gear plunger lever to the frame and starter drive assembly, and install the pivot pin.

13. Position the starter drive plunger lever return spring and the drive end housing to the frame and install and tighten the through bolts to specification (55-75 inch pounds). **Do not pinch the brush leads between the brush plate and the frame**. Be sure that the stop ring retainer is seated properly in the drive housing.

14. Install the brushes in the brush holders. Be sure to center the brush springs on the brushes.
15. Position the drive gear plunger lever cover on the starter and install the brush cover band with a gasket. Tighten the band retaining screw.
16. Check the starter no-load current draw.

Starter Drive Replacement

1. Loosen and remove the brush cover band and the starter drive plunger lever cover (Figure 8).
2. Loosen the through bolts enough to allow removal of the drive end housing and the starter drive plunger lever return spring.
3. Remove the pivot pin retaining the starter drive plunger lever and remove the lever.
4. Remove the drive gear stop ring retainer and stop ring from the end of the armature shaft and remove the drive gear assembly.
5. Apply a thin coating of Lubriplate 777 on the armature shaft splines. Install the drive gear assembly on the armature shaft and install a new stop ring.
6. Position the starter gear plunger lever on the starter frame and install the pivot pin. **Be sure that the plunger lever properly engages the starter drive assembly.**
7. Install a new stop-ring retainer. Partially fill the drive end housing bearing bore with grease (approximately 1/4 full). Position the starter drive plunger lever return spring and drive end housing to the starter frame, and then tighten the through bolts to specifications 55-75 inch pounds).
8. Position the starter drive plunger lever cover and the brush cover band, with its gasket, on the starter. Tighten the brush cover band retaining screw.

BRUSH REPLACEMENT

Replace the starter brushes when they are worn to ¼ inch. Always install a complete set of new brushes.

1. Loosen and remove the brush cover band, gasket, and starter drive plunger lever cover. Remove the brushes from their holders.
2. Remove the two through bolts from the starter frame.
3. Remove the drive end housing, and the plunger lever return spring.
4. Remove the starter drive plunger lever pivot pin and lever, and remove the armature.
5. Remove the brush end plate.
6. Remove the ground brush retaining screws from the frame and remove the brushes.
7. Cut the insulated brush leads from the field coils, as close to the field connection point as possible.
8. Clean and inspect the starter motor.
9. Replace the brush end plate if the insulator between the field brush holder and the end plate is cracked or broken.
10. Position the new insulated field brushes lead on the field coil connection. Position and crimp the clip provided with the brushes to hold the brush lead to the connection. Solder the lead. clip, and connection together, using rosin core solder(Figure 12). Use a 300-watt iron II. Install the ground brush leads to the frame with the retaining screws.
12. Clean the commutator with 00 or 000 sandpaper.
13. the brush end plate to the starter frame, with the end plate boss in the frame slot.
13. Position the brush end plate to the starter frame. with the end plate boss in the frame slot.
14. Install the armature in the starter frame.
15. Install the starter drive gear plunger lever to the frame and starter drive assembly, and install the pivot pin.
16. Partially fill the drive end housing bearing bore with grease (approximately 1/4 full). Position the return spring on the plunger lever, and the drive end housing to the starter frame. Install the through bolts and tighten to specified torque (55-75 inch pounds). Be sure that the stop ring retainer is seated properly in the drive end housing.
17. Install the commutator brushes in the brush holders. Center the brush springs on the brushes.
18. Position the plunger lever cover and the brush cover band, with its gasket on the starter. Tighten the band retaining screw.
19. Connect the starter to a battery to check its operation.

ARMATURE REPLACEMENT

1. Loosen the brush cover band retaining screw and remove the brush cover band, gasket, and the starter drive plunger lever cover. Remove the brushes from their holders.
2. Remove the through bolts, the drive end housing, and the drive plunger lever return spring.

3. Remove the pivot pin retaining the starter gear plunger lever, and remove the lever.
4. Remove the armature. If the starter drive gear assembly is being reused. remove the stop ring retainer and the stop ring from the end of the armature shaft. and remove the drive.
5. Place the drive gear assembly on the new armature with a new stop ring.
6. Install the armature in the starter frame.
7. Position the drive gear plunger lever to the frame and drive gear assembly and install the pivot pin.
8. Partially fill the drive end housing bearing bore with grease (approximately 1/4 full). Position the drive plunger lever return spring. the drive end housing and the front end plate to the starter frame. and then install and tighten the through bolts to specification Be sure that the stop ring retainer is seated properly in the drive housing.
9. Place the brushes in their holders. and center the brush springs on the brushes.
10. Position the plunger lever cover and the brush cover band, with its gasket. and then tighten the retaining screw.
11. Connect the starter to a batters to check its operation.

STARTER TERMINAL

Removal

1. Loosen the brush cover band retaining screw and remove the brush cover band and the starter drive plunger lever cover. Observe the lead positions for assembly and then remove the commutator brushes from the brush holders.
2. Remove the through bolts. starter drive end housing, starter drive plunger lever return spring. and the brush end plate.
3. Remove the pivot pin retaining the starter gear plunger lever and remove the lever and the armature assembly.
4. Unsolder the field coil and solenoid wire leads from the terminal screw. Use a 300-watt soldering iron. Remove the starter terminal nut, washer. insulator and terminal from the starter frame.

Installation

1. Install the new starter terminal. insulator, washers, and retaining nut in the frame (Figure 8). Be sure to position the slot in the screw perpendicular to the frame end surface.
2. Solder the field coils and solenoid wire to the starter terminal using rosin core solder Use a 300-vatt iron.
3. Check for continuity and grounds in the assembled coils.
4. Position the starter brush end plate to the frame with the end plate boss in the frame slot 5. Position the armature in the starter frame.
6. Position the starter drive gear plunger lever to the frame and starter drive assembly. and install the pivot pin.
7. Partially fill the drive end housing bearing bore with grease (approximately 1,4 full) Position the starter drive plunger lever return spring and the drive end housing to the frame and install and tighten the through bolts to specification (55-75 in-lbs) Do not pinch the brush leads between the brush plate and the frame. Be sure that the stop ring retainer is seated properly in the drive housing.
8. Install the brushes in the brush holders. Be sure to center the brush springs on the brushes.
9. Position the drive gear plunger lever cover on the starter and install the brush cover band with a gasket. Tighten the band retaining screw.
10. Check the starter no-load current draw.

Part 6 Governors

DESCRIPTION AND OPERATION

VELOCITY GOVERNOR

The velocity governor (Figure 1) is a single unit mounted between the carburetor and the intake manifold. There is no provision for repair of this governor. It should be replaced when damaged.

The governor is operated by a combination of manifold vacuum and the air flow past the governor valves. The governor throttle valves are offset in the throttle bore so that the combined force of manifold vacuum and the fuel air flow through the bores has greater effect on the larger, upstream area of the valves. This forces the throttle valves to move toward the closed position restricting fuel-air flow. The closing action of the throttle valves is opposed by the control spring. The control spring is attached to the throttle valve shaft cam. The cam provides a balance between the closing action of the throttle valves and the action of the control spring at all engine speeds.

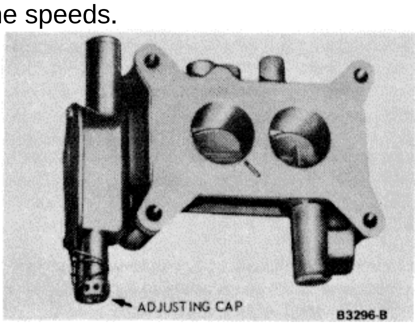

FIG. 1 Typical Velocity Governor

Under operating conditions, the governor throttle valves do not close, but remain open enough to allow the required quantity of the fuel-air mixture to flow into the manifold to maintain the governed engine speed.

To maintain the proper vacuum to the distributor, the governor has two interconnected vacuum transfer ports and a vacuum transfer plunger. When the governor throttle valves are forced toward the closed position, vacuum from the lower port is supplied to the distributor to maintain sufficient spark advance. When the governor throttle valves are open wide enough, the plunger shuts off the bottom port and the top port supplies vacuum to the carburetor distributor vacuum passage for sufficient vacuum to the distributor.

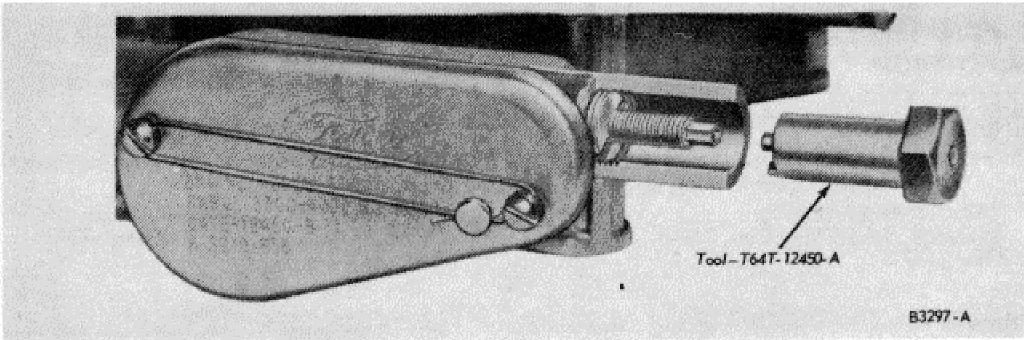

FIG. 3 Altitude Compensation Adjustment

VELOCITY GOVERNOR

RPM ADJUSTMENT

Adjustment of the velocity governor is made with a tachometer attached and the engine at normal operating temperature.

Operate the engine at wide open throttle and check the rpm.

If adjustment is required or desired. remove the governor seal.

To increase the rpm, turn the cap counterclockwise.

When the adjustment is complete. stop the engine, seal the cap and remove the tachometer.

ALTITUDE COMPENSATOR

The characteristic of velocity-type governor is that the regulated engine speed increases in direct proportion to any increase in the altitude is which the engine is operated. This also causes a proportionate increase in the spread between full load and no load setting. A normal seal level no load setting of 3000 engine rpm becomes 3300 engine rpm at 5000 feet above sea level. The 300 engine rpm spread at sea level becomes a 500 engine rpm spread at 5000 feet above sea level.

The altitude compensating governor can be adjusted to compensate for variations due to altitude. With the exception to the altitude compensating adjustment (Figure 3). the description and operation of this governor is the same on the conventional velocity governor.

Varying Altitude Adjustment

On units equipped with an Altitude Compensating governor, the Varying Altitude Adjustment is made on engines that are operating at or near sea level and altitudes above 2000 feet. First make the no load adjustment as previously explained. Then, using the adjusting cap only, adjust the no load speed for the anticipated altitude by turning the adjustment cap 1/4 turn in the clockwise direction for each 1000 foot difference between the altitude. The adjustment is made and the maximum anticipated operating altitude.

Constant Altitude Adjustment

The Constant Altitude Adjustment is made on engines that are going to be operated at a constant altitude above 2000 feet. Cut the governor seal wire and remove the adjusting cap. Do not rotate the adjusting cap during removal.

Use a mirror and a light to observe the position of the slots in the adjusting bushing. Hold the tool in the proper position to engage the adjusting bushing slots and carefully insert the hex-shaped center post of the tool in the hex-head of the adjusting of the adjusting screw. Push the tool inward until the tangs on the tool engage the slots in the adjusting bushing. If the tool will not engage in the adjusting bushing slots, note the position of the tool and rotate the tool slightly in either direction until engagement is achieved. If it is necessary to rotate the tool more than 1/6 turn (I flat of the hex head) to accomplish engagement. rotate the tool back to its insertion position and pull the tool out. Rotate the tool 1/6 turn in the direction required to achieve engagement and re-insert it

ADJUSTMENT TABLE

The altitude adjustment table specifies the amount from the factory setting that the tool should be rotated to adjust the velocity governor for altitude operation. For an increase in the average altitude of operation, rotate the tool the specified amount in the counterclockwise direction.

Remove the tool and install the adjusting cap. Do not turn the adjusting cap. Install the tachometer and check and adjust the no load setting of the governor with the adjusting cap. It the altitude adjustment was done properly. the no load and full load spread will be within specifications. Seal the adjusting cap to the governor body.

Trouble shooting is using the proper adjusting procedure. If the governor cannot be adjusted it will have to be replaced.

However. be sure the proper governor has been installed for the engine application and rpm it is to operate at.

Average Operating Altitude — Feet	Amount of ① Tool Rotation
2000	1/3 turn (120°)
3000	1/2 turn (180°)
4000	2/3 turn (240°)
5000	5/6 turn (300°)
6000	1 turn (360°)

① 60° or 1/6 turn rotation is equivalent to one flat of the tool hex head.

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FIG. 4 Altitude Adjustment Table

REMOVAL AND INSTALLATION
VELOCITY GOVERNOR
Removal

1. Remove the air cleaner.
2. Cut the governor seal wire.
3. Remove the carburetor to governor vacuum line.
4. Remove the carburetor and gasket.
5. Remove the governor, spacer (if so equipped) and gaskets. Discard the gaskets.

Installation

1. Position a new gasket over the studs on the intake manifold.
2. Install the governor and gasket.
3. Install the spacer and gasket (if so equipped).
4. Install the carburetor.
5. Install the governor to carburetor vacuum line.
6. Install a new governor wire and seal.
7. Install the air cleaner.

Part 7 Cooling

DESCRIPTION AND OPERATION

The cooling system has two stages of operation and uses one thermostat. In stage one the coolant flow is restricted for minimum circulation through the engine. In the second stage the thermostat opens and permits coolant flow through the radiator to maintain proper operating temperatures.

COOLANT

Correct coolant level is essential for maximum circulation and adequate cooling. In addition, for the cooling system to perform its function, it must receive proper care. This includes keeping the radiator fins clean and a periodic inspection of the cooling system for leakage.

Use care when removing the radiator cap to avoid injury from excaping steam or hot water.

When the cooling system is drained, fill the radiator with specified coolant. In production, the cooling system is filled with a 45-55 (50-50 for Canada and export) solution of Ford Permanent Antifreeze and water which prevents corrosion, keeps the cooling system clean, provides anti-freeze protection to -20 (-35 for Canada and export) degrees F in winter and provides for higher summer operation temperatures.

For the most effective cooling system operation, this mixture strength should be maintained all year round and in all climates.

All coolant added should be the specified mixture of Ford permanent anti-freeze and water. If Ford Permanent Anti-freeze is not available, another reputable permanent anti-freeze may be used and diluted with an equal quantity of water.

Ordinary tap water may be used in an emergency except in areas where the water is known to be exceptionally hard or to have a high alkali content. The cooling system should be drained and flushed and the proper mixture of anti-freeze added as soon as possible, however.

To avoid possible overheating in very hot weather, do not use mixtures with more than 50 percent anti-freeze except in areas where anti-freeze protection below -35 degrees F is required. In this case, refer to the coolant mixture chart on the Ford Permanent Anti-freeze container.

A standard ethylene glycol hydrometer can be used to check the protection level of the long-life coolant.

To prevent damage to the cooling system during periods of below freezing ambient temperature, when water or antifreeze is added to the supply tank, always operate the engine at fast idle for 30 minutes before letting the engine set in the OFF position for prolonged periods. This will allow a uniform mixture throughout the cooling system and prevent damage by freezing, when sufficient anti-freeze is used.

DRAINING AND FILLING THE SYSTEM

To prevent loss of anti-freeze when draining the radiator, attach a hose on the radiator drain cock and drain the coolant from the radiator into a clean container.

To drain the radiator, open the drain cock located at the bottom of the radiator and remove the radiator or supply tank cap. The cylinder block is drained by removing the drain plugs located on both sides of the block.

To fill the cooling system, install the cylinder block drain plug(s) and close the radiator drain cock.

After the initial fill, the coolant level will drop approximately 1 quart after the engine has been operated about 20 minutes at 2000 rpm. This is due to the displacement of entrapped air. Refill radiator as required.

TESTING

PRESSURE TEST

It is recommended that a cooling system pressure test gauge be used to properly test the system for:

a. Blown or leaking cooling system sealing gaskets.
b. Internal or external cooling leakage.
c. Pressure cap malfunction.

Some modification of existing pressure testers may be required in order to use this procedure.

1. Shut the engine off. To prevent loss of coolant and to avoid the danger of being burned, place a cloth over the cap and rotate the cap slowly counterclockwise to first stop and allow pressure to escape completely. Then, turn cap again slowly counterclockwise to remove.
2. After the cooling system pressure has been released, remove the radiator cap, wet the rubber sealing surface and re-install cap tightly on the radiator.
3. Disconnect the electrical connector from the engine temperature sending unit and remove the temperature sending unit from the manifold.

With the radiator cap installed, only a small amount of coolant will be lost when the sending unit is removed.

4. Install an adaptor fitting tightly (3/8 N.P.T. male thread on one end, and a hose connection on the other end to accommodate the tester hose) into the intake manifold or cylinder head in place of the sending unit.
5. Remove the radiator overflow hose from the retainer clips. Make sure the hose is firmly installed on the radiator overflow tube and is in good condition. Insert the free end of the overflow hose into a container of water.
6. Attach the pressure pump and gauge to the adapter fitting and pressurize the cooling system until bubbles are observed in the water container. Discontinue pumping when bubbles appear.

When the bubbles cease, read the pressure gauge. The gauge reading is the pressure relief of the cap and should be within specifications. If the pressure reading exceeds the specified limit, replace the radiator cap.

7. If bubbles continue and the pressure drops below 10 psi for engines with a 13 psi system, or below 5 psi for a 7 psi system, the radiator cap is not holding pressure. Release pressure and wash cap in clean water to dislodge any foreign matter from the valves. Check the rubber sealing surface of the cap and also the cap sealing surface in the radiator neck. Inspect the cam lock flanges on both sides of the filler neck for maximum cap engagement.
8. Re-check the cooling system as outlined in Step 6. If the cap still does not hold pressure, the cap is damaged and must be replaced. Recheck system after a new cap is installed to assure that the system will now hold pressure.
9. If the bubbles in the water container cease and the radiator cap is within pressure specifications, observe gauge reading for approximately two minutes. Pressure should not drop during this time.
10. If pressure drops, check for leaks at engine to radiator hoses, by-pass hose, thermostat housing gasket, etc.

ADJUSTMENTS

DRIVE BELT

The fan drive belt should be properly adjusted at all times. A loose drive belt can cause Improper alternator, fan and water pump operation. A belt that is too tight places a severe strain on the water pump and alternator bearings.

A properly tensioned drive belt minimizes noise and also prolongs the service life of the belt. Therefore, it is recommended that a belt tension gauge be used to check and adjust the belt tension. **Any belt that has been operated for a minimum of 10 minutes is considered a used belt, and when adjusted, it must be adjusted to the used tension shown in the specifications.**

BELT TENSION

1. Install the belt tension tool on the drive belt (Figure 1) and check the tension.
2. If adjustment is necessary, loosen the alternator mounting bolts and move the alternator adjusting arm bolts. Move the alternator toward or away from the engine until the correct tension is obtained. Remove the gauge.

Tool-T63L-8620-A

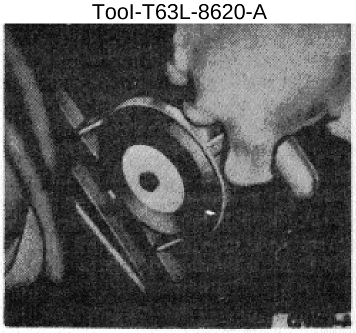


FIG. 1 Belt tensioning

CLEANING AND INSPECTION

COOLING SYSTEM

To remove rust, sludge and other foreign material from the cooling system. use either FoMoCo Regular Cooling System Cleanser or in severe cases use Heavy Duty Cleanser. Removal of such material restores cooling efficiency and avoids overheating.

In severe cases where cleaning solvents will not properly clean the cooling system for efficient operation, it will be necessary to use the pressure flushing method.

Any leaks which are found must be corrected and the system re-checked.

11. If the system holds pressure, remove the radiator cap to release the pressure; then, reinstall the cap.
12. Remove the adapter from the manifold or cylinder head and reinstall the temperature sending unit. Check coolant level and replenish, if necessary, with the correct coolant solution.

THERMOSTAT TEST

It is good practice to test new thermostats before installing them in the engine.

Remove the thermostat and immerse it in boiling water. Replace the thermostat if It does not open more than 1/4 inch.

If the problem being investigated is insufficient heat, the thermostat should be checked for leakage. This may be done by holding the thermostat up to a lighted background. Light leakage around the thermostat valve (thermostat at room temperature) is unacceptable and the thermostat should be replaced. It is possible, on some thermostats, that a slight leakage of light at one or two locations on the perimeter of the valve may be detected. This should be considered normal.

THERMOSTAT REPLACEMENT

Do not attempt to repair the thermostat. It should be replaced if it is not operating properly. Check the thermostat before installing it, following the procedure under Thermostat Testing.

Removal

1. Drain the radiator so that the coolant level is below the thermostat.
2. Remove the water outlet housing retaining bolts. Bend the radiator upper hose upward and remove the thermostat and gasket.

Installation

1. Clean the water outlet housing gasket surfaces. Coat a new water outlet housing gasket with water-resistant sealer. Position the water outlet housing gasket to the head opening.
2. Install the thermostat in the intake manifold opening with the copper pellet or element toward the engine and the thermostat flange positioned in the recess. If the thermostat is Improperly installed, it will cause a retarded flow of coolant.
3. Position the water outlet housing against the head. Install and torque the retaining bolts to specifications. Install the water bypass line and tighten hose connections.
4. Fill and bleed the cooling system. Operate the engine until normal operating temperature is reached: then check the coolant level and check for leaks.

Various types of flushing equipment are available. If pressure flushing is used, make sure the cylinder head bolts are properly tightened to prevent possible water leakage into the cylinders.

Always remove the thermostat prior to pressure flushing.

A pulsating or reversed direction of flushing water flow will loosen sediment more quickly than a steady flow in the normal direction of coolant flow.

Part 8 Specifications

GENERAL SPECIFICATIONS

Bore and Stroke
200 .... 3.68 x 3.13
Firing Order 1-5-3-6-2-4
Idle Speed (rpm) 550
Oil Capacity with Filter (Approx.) .... 4.5 Qts.

CYLINDER HEAD

Gasket Surface Flatness .... 003 inch in any 6 inches or 0.006 inch overall
Valve Guide Bore Diameter 0.3115-0.3125
Valve Seat Width -
Intake 0.060-0.080
Exhaust 0.070-0.090
Valve Seat Angle .... 45°
Valve Seat Runout - Maximum 0.0012

VALVE MECHANISM

Valve Stem Diameter
Intake
Standard 0.3100-0.3107
0.003 Oversize 0.3130-0.3137
0.015 Oversize 0.3250-0.3257
0.030 Oversize 0.3400-0.3407
Exhaust
Standard 0.3098-0.3105
0.003 Oversize 0.3128-0.3135
0.015 Oversize 0.3248-0.3255
0.030 Oversize 0.3398-0.3405
Valve Face Angle 440
Valve Stem to Valve Guide Clearance
Intake 0.0008-0.0025
Wear Limit 0.0055
Exhaust 0.0010-0.0027
Valve Head Diameter
Intake 1.642-1.660
Exhaust 1.381-1.399
Valve Face Runout .... Wear Limit 0.0020
Valve Spring Free Length - Approximate 1.79
Valve Spring Out of Square - Maximum 0.078
Valve Spring Pressure
- Lbs. at Specified Length
200 Int.-Exh. .... 51-57 at 1.590
142-158 at 1.222
142-158 at 1.18
(Wear Limit - 10% Pressure Loss)
Valve Spring Assembled Height -
Pad to Retainer
200 Int. & Exh. and 250 Int .... 1-9/16 -1-19/32
Hydraulic Valve Lifter Leak Down
Rate - Seconds 5-50
Valve Push Rod Runout - Maximum 0.020
Valve Tappet Diameter - Standard 0.8740-0.8745

VALVE MECHANISM (CONT'D)

Valve Tappet to Tappet
Bore Clearance 0.0007-0.0027
Wear Limit 0.0050
Rocker Arm Shaft O.D 0.7830-0.7845
Rocker Arm Bore Diameter........ 0.7830-0.7845
Rocker Arm Lift Ratio........1.52:1
Valve Tappet - Collapsed
Valve Clearance
200........ 085- .185

CAMSHAFT AND TIMING GEARS

Camshaft Journal Diameter - Standard 1.8095-1.8105
Camshaft Journal Runout........0.008
Camshaft Journal to Bearing Clearance........ 0.001-0.003
Wear Limit 0.006
Camshaft Journal Out-of-Round........0.0005
Camshaft End Play 0.001-0.007
Wear Limit 0.009
Camshaft Lobe Lift
Intake........0.245
Exhaust 0.245
Maximum Allowable Lobe Lift Loss 0.005
Assembled Gear Face Runout - Maximum 0.005
Timing Chain Deflection - Maximum........0.500

CAMSHAFT BEARINGS

Inside Diameter........ 1.8115-1.8125
Location in Relation to Front Face
of Block Cam Bearing Bore Face -
No. 1 Bearing Only - Below........ 0.030-0.050

FLYWHEEL

Flywheel Clutch Face Runout (T.I.R.)........0.010
Assembled Flywheel O.D. Runout (T.I.R.)
Auto. Trans........0.060
Std. Trans........030

CRANKSHAFT

Main Bearing Journal Diameter-
200........ 2.2482-2.2490
Main Bearing Journal Runout 0.002
Wear Limit 0.005
Main Bearing Journal Thrust Face Runout 0.001
Thrust Bearing Journal Length
200........ 1.275-1.277
Connecting Rod and Main Bearing Journals
Out-of-Round - Maximum........0.0006
Connecting Rod and Main Bearing Journals
Taper - Maximum 0.0006/inch
Connecting Rod Journal Diameter........ 2.1232-2.1240
Crankshaft Free End Play........ 0.004-0.008
Wear Limit 0.012
Journal Taper Max........0.0006 per Inch

MAIN BEARINGS

Journal Clearance

Desired 0.0008-0.0015

Allowable 0.0008-0.0024

Wall Thickness - Standard

200 CID 0954-.0957

CONNECTING ROD

Piston Pin Bushing ID - Standard 0.9104-0.9112

Bearing Bore Diameter 2.2390-2.2398

Bearing Bore Out-of-Round or Taper 0.0004

Connecting Rod Length - Center to Center

200........ 4.7135-4.7165

Twist Total Difference - Maximum*........ 0.024

Bend Total Difference - Maximum *........ 0.012

Connecting Rod Assembly - Assembled to

Crankshaft Side Clearance 0.0035-0.0105

Wear Limit 0.014

*Pin bushing and crankshaft bearing bore must be parallel and in the same vertical plane within the specified total difference at ends of 8-inch long bar measured 4 inches on each side of rod.

CONNECTING ROD BEARINGS

Bearing to Crankshaft Clearance

Desired 0.0008-0.0015

Allowable 0.0008-0.0026

Wall Thickness - Standard 0.0569-0.0574

PISTON

Piston Diameter

Coded Red 3.6784-3.6790

Coded Blue........ 3.6796-3.6802

0.003 Oversize 3.6808-3.6814

Piston to Bore Clearance*........ 0.0013-0.0021

*Measured 90° to pin centerline and at pin centerline height.

PISTON PIN

Piston Pin Diameter - Standard 0.9119-0.9124

0.001 Oversize 0.9130-0.9133

0.002 Oversize 0.9140-0.9143

Piston Pin Length........ 3.010-3.040

Piston Pin to Piston Clearance 0.0003-0.0005

Wear Limit 0.0008

To Connecting Rod Bushing

Clearance .... Interference Fit

PISTON RINGS

Top Compression Ring Width........ 0.077-0.078

Bottom Compression Ring Width 0.077-0.078

Top Compression Ring Side Clearance 0.002-0.004

Bottom Compression Ring Side Clearance 0.002-0.004

Compression Ring Side Clearance........ Wear Limit 0.006

Oil Ring Side Clearance........ Snug

Top Compression Ring - Standard Bore -

Ring Gap Width 0.008-0.016

Bottom Compression Ring - Standard

Bore - Ring Gap Width 0.008-0.016

Oil Ring - Standard Bore -

Ring Gap Width 0.015-0.055

CYLINDER BLOCK

Cylinder Bore Diameter........ 3.6800-3.6848
Cylinder Bore Out-of-Round
Maximum........ 0.0015
Wear Limit 0.0050
Cylinder Bore Taper........ 0.001
Wear Limit 0.010
Head Gasket Surface Flatness........ 0.003 inch in any 6
.... inches or 0.006 inch overall
Main Bearing Bore Diameter
200........ 2.4012-2.4020

OIL PUMP

Relief Valve Spring Tension -
Lbs. at Specified Length
200........ 29.0-10.1 at 1.078
Relief Valve Clearance........ 0.0015-0.0030
Drive Shaft to Housing Bearing Clearance........ 0.0015-0.0030
Rotor Assembly End Clearance -
Pump Assembled........ 0.001-0.004
Outer Race to Housing - Radial Clearance........ 0.001-0.013
Oil Pressure - Hot at 2000 rpm
200 CID........ 30-50

IGNITION SYSTEM

Ignition Timing - B.T.C. - Recommended........ 6°
Breaker Arm Spring Tension (Ounces)........ 17-21
Contact Spacing........ 0.027
Contact Dwell at Idle Speed........ 35-39°
Shaft End Play Clearance........ 0.022-0.033
Condenser
Capacity (Microfarads)........ 0.21-0.25
Maximum Leakage (Megohms)........ 10
Maximum Series Resistance (Ohms)........ 1
Coil
Primary Resistance (Ohms)........ 1.40-1.54 (75SF.)
Secondary Resistance (Ohms)........ 7600-8800 (75SF.)
Amperage Draw
Engine Stopped........ 4.5
Engine Idling........ 2.5
Primary Circuit Resistor (Ohms)........ 1.30-1.40 (75°F.)
Spark Plugs
Type........ Autolite BRF-82
Size........ 18 mm
Gap (Inches)........ 0.034
Torque (ft.-lbs.)........ 15-20

DISTRIBUTOR ADVANCE CHARACTERISTICS

CENTRIFUGAL ADVANCE. Set the test stand to 0° at 250 rpm and 0 inches of vacuum.

rpm (Distributor)	**Advance (Degrees)**	**Vacuum (Inches of Mercury)**
500	½-1 /2	0
750	4½-6½2	0
1000	6-8	0
1500	8-10	0
2000	81/2-11	0

VACUUM ADVANCE. Set the test stand to 0° at 1000 rpm and O inches of vacuum.

rpm (Distributor)	Advance (Degrees)	Vacuum (Inches of Mercury)
1000	0-13/4	5
1000	2-6	10
1000	63/4-9/4	12½

CARBURETOR SPECIFICATIONS

Carburetor No. (9510)	**C9JJ A 200 w/Mech. Gov.**	**D0JJ B 200 Veloc. Gov.**	**D0JJ F 200 Hand Choke**	**D0JJ G 200/250 Veloc. Gov.**	**D5JL C 200**
Carburetor Size					
Throttle Bore Dia.	1-11/16	1-9/16	1-11/16	1-11/16	1-7/16
Venturi Dia.	1-3/8	1-1/4	1-11/32	1-11/32	1.220
Air Flow (CFM) c3''Hg	215	180	210	210	150
Fuel System					
Fuel Level (Wet)	11/16	11/16	N/A	N/A	N/A
Fuel Setting (Dry)	13/64	13/64	①	①	①
Main Metering System					
Main Jet	#64	#66	#68	#68	#66
Power Valve Timing	7-5	7-5	7-5	7-5	7.5-5.5
Accelerator Pump System					
Capacity — cc/10 Strokes	11-14	11-14cc	17-21	17-21	17-21
Pump Rod Location	②	#1	#2	#2	#2
Idle Speed					
Curb Idle RPM	550	550-575	550-575	550-575	550-575
Fast Idle RPM	1500	1500	1500	1500	1500
Holley List #	4062 1904	4711 1904	6123-1 1940	6133-1 1940	7458 1940

①Refer to Shop Manual for float setting procedure.

②Vacuum operated accelerator pump.

TORQUE LIMITS - FOOT-POUNDS

Camshaft Sprocket to Camshaft	35-45
Camshaft Thrust Plate to Block	12-15
Connecting Rod Nuts	21-26
Cylinder Front Cover	7-9
Cylinder Head Bolts - Oiled Threads	
Step 1	50-55
Step 2	60-65
Step 3	70-75
Damper or Pulley to Crankshaft	85-100
Exhaust Pipe to Manifold	25-35
Flywheel to Crankshaft	75-85
Main Bearing Cap Bolts - Oiled Threads	60-70
Manifold to Cylinder Head	18-24
Oil Filter	Gasket contact plus ½/2 turn
Oil Filter Adapter to Cylinder Block	10-15
Oil Pan to Cylinder Block	7-9
Oil Pan Drain Plug	15-25
Oil Pick-up Tube to Oil Pump	10-15
Oil Pump to Cover Plate	9-12
Oil Pump to Cylinder Block	10-15
Valve Rocker Arm Cover	3-5
Water Outlet Housing	12-15
Water Pump to Cylinder Block	12-15

TORQUE LIMITS FOR VARIOUS SIZE BOLTS

CAUTION: In the event that any of the torque limits below are in disagreement with any of those listed above, the above limits prevail.

Size (inches)	Torque (Ft.-Lbs.)
1/4-20	6-9
1/4-28	6-9
5/16-18	12-18
5/16-24	15-18
3/8-16	22-32
3/8-24	30-35
7/16-14	40-55
7/16-20	50-6 0
1/2-13	55-80
1/2-20	70-80
9/16-18	85-120
5/8-18	130-145

BELT TENSION

All Except Governor	
New	140 Lbs.
Used	110 Lbs.
Governor	
New	70 Lbs.
Used	50 Lbs.

A used belt is one that has been in operation for ten minutes or more.

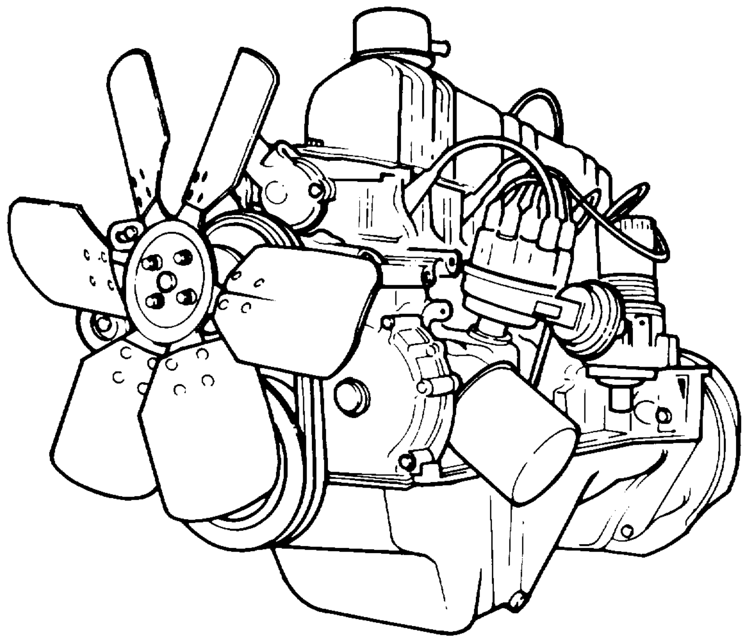
POSITIVE ENGAGEMENT STARTER

Positive Engagement Starter Motor						Starter Brushes				
Dia. (Inches)	Current Draw Under Normal Load (Amps)	Normal Engine Cranking Speed (rpm)	Min. Stall Torque @ 5 Volts (Ft-Lbs.)	Max. Load (Amps)	No Load (Amps)	Mfg. Length (Inches)	Wear Limit (Ounces)	Spring Tension (In-Lbs.)	Through Bolt Torque (Ft-Lbs.)	Mounting Bolt Torque
4	150-200	180-250	9.0	460	70	0.50	0.25	40	55-75	15-20
4½	150-180	150-290	15.5	670	80	0.50	0.25	80	55-75	15-20

Maximum commutator runout is 0.005 inch. Maximum starting circuit voltage drop (battery positive terminal to starter terminal) at normal engine temperature is 0.5 volt.

PARTS LIST

FORD INDUSTRIAL GASOLINE ENGINE 3.3 LITRE (200 CID)



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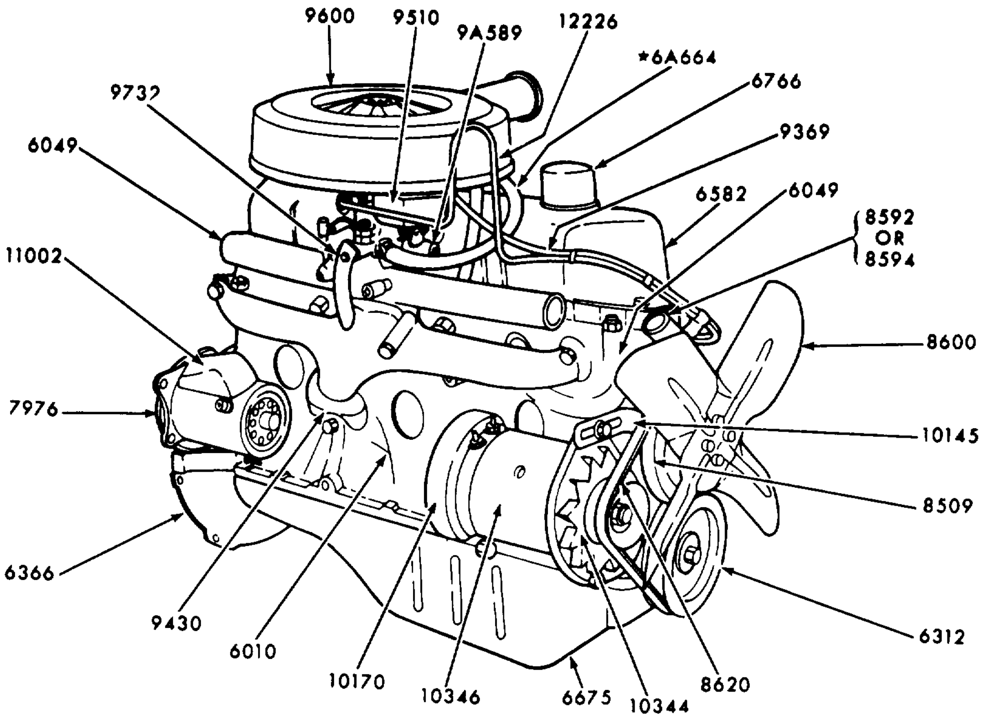
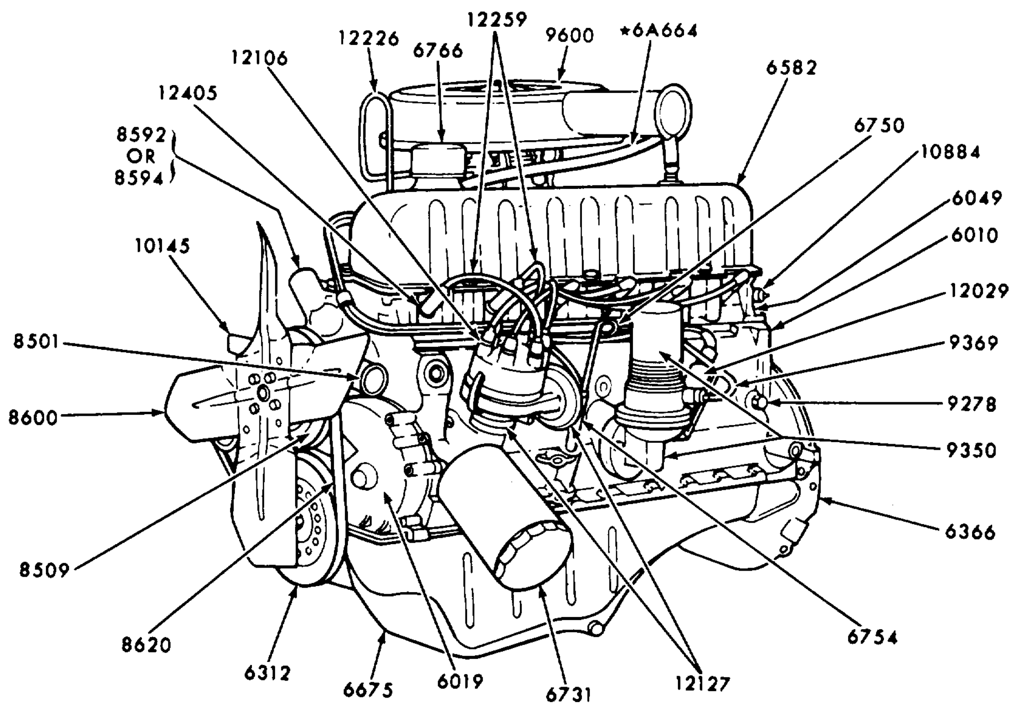


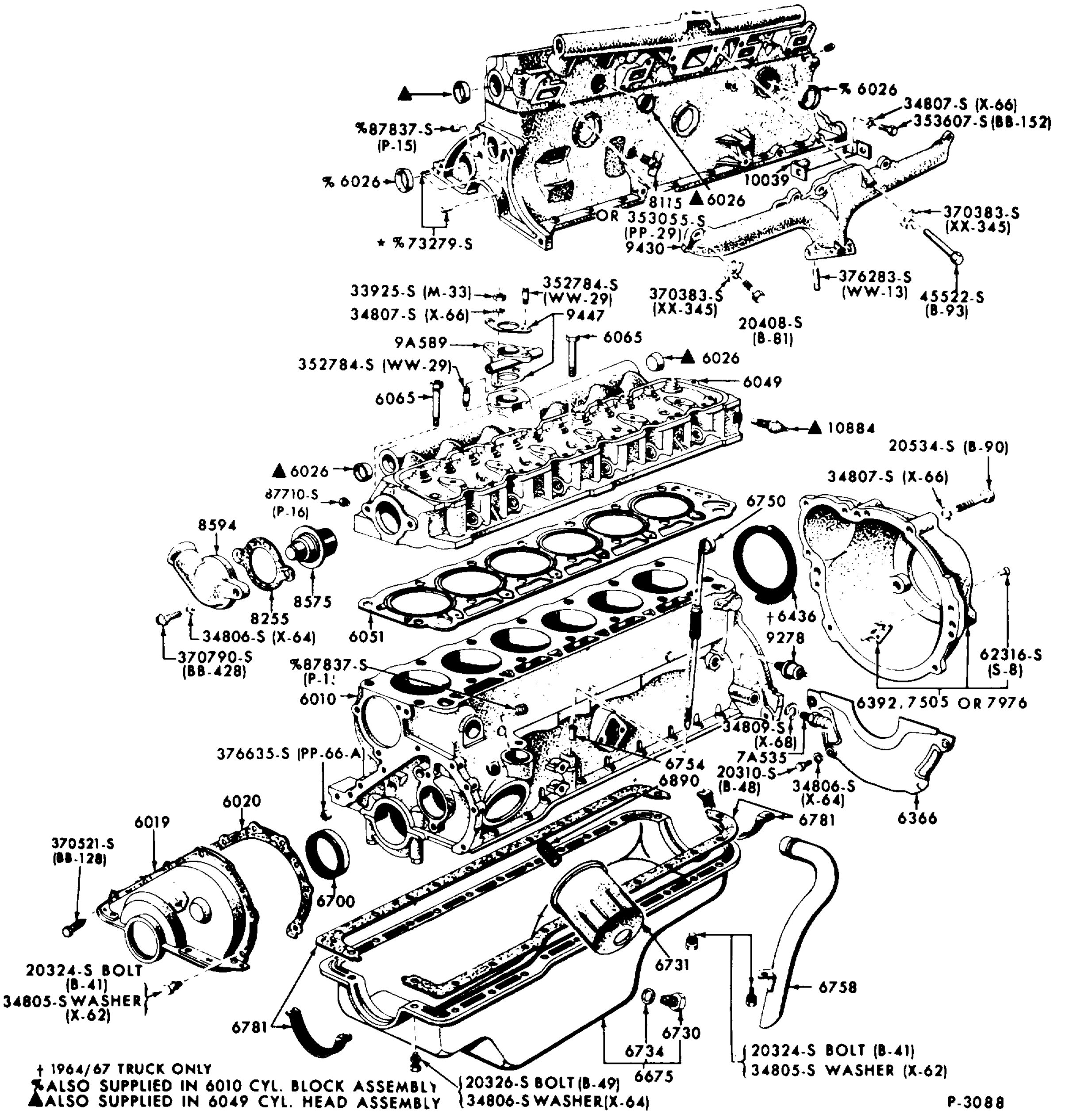
RIGHT-FRONT VIEW



LEFT-FRONT VIEW

P-8398

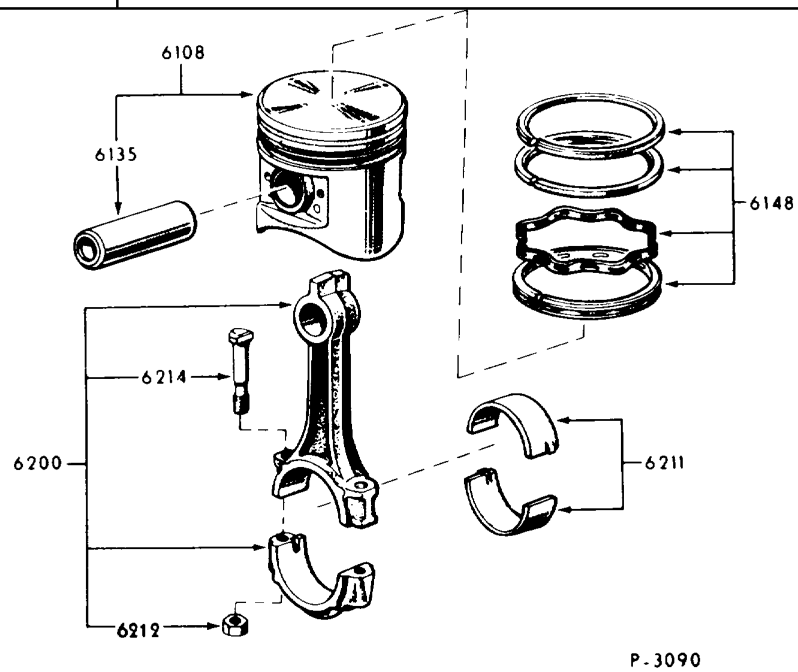
ENGINE ASSY.-TYPICAL



CYLINDER BLOCK and RELATED PARTS-TYPICAL

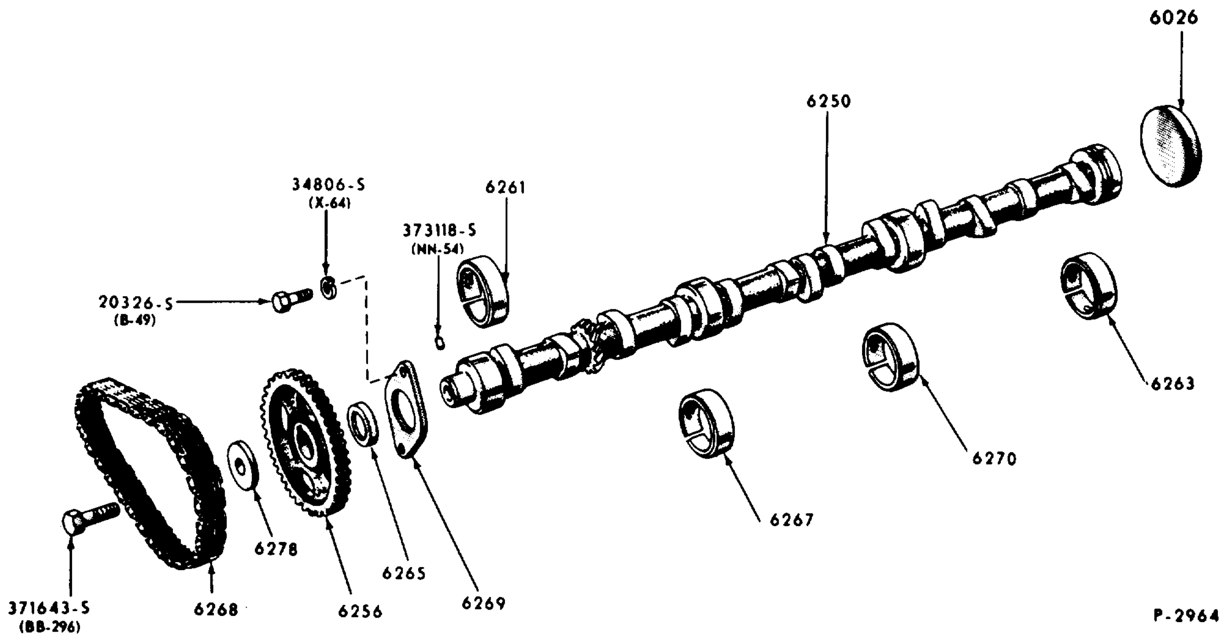
YEAR	PART NUMBER	DESCRIPTION	QTY REQD.
		CYLINDER ASSEMBLY	
68/	D7JE-6009-KA	Cylinder Assembly - Includes cylinder block with all internal parts of the engine but does not include cylinder heads, tappets, oil pan or cylinder front cover unless indicated	1
		BLOCK - CYLINDER	
68/	D7BZ-6010-A	Block	1
68/	87837-S	Plug - 1/4 - 18 Pipe - Oil Galley in Block and Water Drain in Block	2
68/	C8AZ-6026-A	Plug - Cup Type - 1-3/4 - Core Holes in Block	5
68/	376635-S	Plug - Cup Type - 29/64 - Oil Passage in Block	1
68/	C5AZ-6026-G	Plug - Cup Type - 2.072 Block Core Hole and Rear Cam	2
		FRONT COVER KIT	
68/	D2DZ-6019-A	Kit 1 Consists of: (1) CODE-6020-B Gasket (1) D2DE-6059-CA Cover (2) 55247-S Bolts (7) 377387-S Bolts	
68/	55247-S	Bolt - 1/4 - 20 x 3/8 - Cover to Block	2
68/	377387-S	Bolt - 1/4 - 20 x 1.82 - Cover to Block	5
		GASKET - FRONT COVER	
68/	CODE-6020-B	Gasket	1
		HEAD - CYLINDER	
68/	D7BZ-6049-A	Head	1
68/	D7JE-6049-AA	Head - Includes exhaust valve seat inserts	1
68/	C8DZ-6026-A	Plug (water jacket in head and ends of intake) 1.015 cup type	6
68/	C8AZ-6026-A	Plug (core hole in head) 1-3/4 cup type	1
68/	87837-S100	Plug (intake manifold below carburetor) 1/4 - 18 pipe	1
68/	87838-S	Plug - 3/8 - 18 pipe	1
		GASKET - CYLINDER HEAD	
68/	D7BZ-6051-A	Gasket - Steel	1
		INSERTS - EXHAUST VALVE SEAT	
68/	C8JE-6057-A	Inserts - Use with hardened exhaust valves	6
		BOLT - CYLINDER HEAD	
68/	ClDZ-6065-E	Stud - Hex Shoulder - Right Front - 3/8-16-7/16-14 x 4.43	1
68/	ClDZ-6065-B	Bolt - Except Right Front - 7/16-14 x 3.16	13

YEAR	PART NUMBER	DESCRIPTION	QTY REQD.
68/	D5PZ-6E078-H	'GASKET SET - LOWER ENGINE Gasket Set Consists of: 1-CODE 6020-B Gasket (front cover) 1-CODZ 6626-A Gasket (oil inlet tube) 1-CODE 6700-A Seal (front cover) 1-C9DE 6710-C Gasket (oil pan R.H.) 1-C9DE 6711-C Gasket (oil pan L.H.) 1-D3DE-6722-AA Seal (oil pan front) 1-D3DE 6723-AA Seal (oil pan rear) 1-C20Z 6734-A Gasket (oil pan drain plug) 1-CODE 8507-A Gasket (water pump) 1-A8TZ 9417-A Gasket (fuel pump) 2-C90Z 6701-A Seal (crankshaft rear)	1
68/	C30Z-6079-B	GASKET SET - VALVE GRIND Gasket Set Consists of: (1) C9DZ-6051-A Gasket (1) DODZ-6584-A Gasket (12) D2DZ-6571-A Seal (1) C9AZ-8255-A Gasket	1



ENGINE PISTON, CONNECTING ROD & RELATED PARTS-TYPICAL

YEAR	PART NUMBER	DESCRIPTION	QTY REQD.



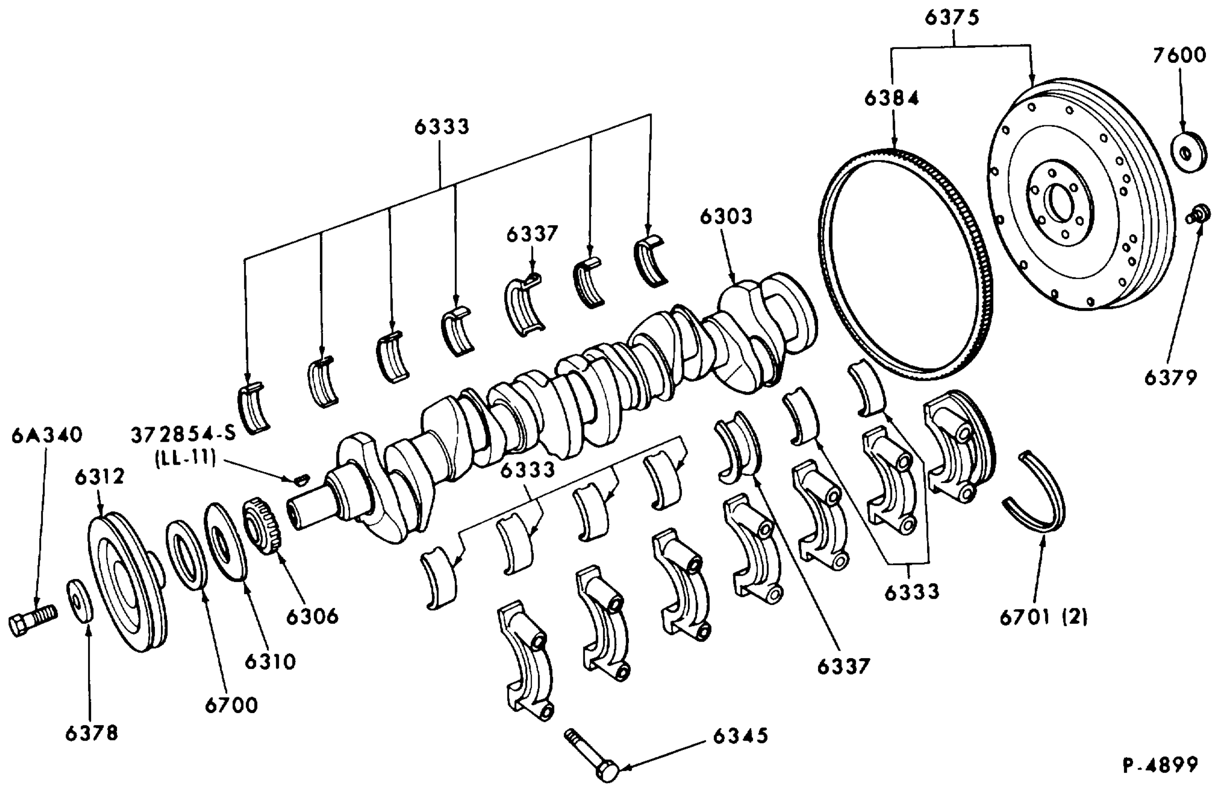
ENGINE CAMSHAFT, GEAR, BEARINGS and RELATED PARTS-TYPICAL

YEAR	PART NUMBER	DESCRIPTION	QTY REQD.
		PISTON ASSEMBLY	
68/	C9DZ-6108-A	Piston - Standard	6
68/	C9DM-6108-C	Piston - .003 O/S	A/R
68/	C9DZ-6108-D	Piston - .020 O/S	A/R
68/	C9DZ-6108-E	Piston - .030 O/S	A/R
68/	C9DZ-6108-F	Piston - .040 O/S	A/R
		PIN - PISTON	
68/	B2AZ-6135-A	Pin- Standard	6
68/	B2AZ-6135-B	Pin - .001 O/S	A/R

YEAR	PART NUMBER	DESCRIPTION	QTY REQD.
		RINGS - PISTON	
68/	C30Z-6148-E	Rings - Standard	3
68/	C30Z-6148-F	Rings - .020 O/S	A/R
68/	C30Z-6148-G	Rings - .030 O/S	A/R
68/	C30Z-6148-H	Rings - .040 O/S	A/R
		ROD ASSEMBLY - CONNECTING	
68/	C30Z-6200-B	Rod Assembly	6
		BEARINGS - CONNECTING ROD	
68/	D5DZ-6211-A	Bearing- Standard	12
68/	D5DZ-6211-C	Bearing - .002 U/S	A/R
68/	D5DZ-6211-D	Bearing - .010 U/S	A/R
68/	D5DZ-6211-E	Bearing - .020 U/S	A/R
68/	D5DZ-6211-F	Bearing - .030 U/S	A/R
		NUT - CONNECTING ROD	
68/	C3DZ-6212-A	Nut - 5/16 - 24	12
		BOLT - CONNECTING ROD	
68/	C3AZ-6214-A	Bolt - 5/16 - 24 x 2.08	12
		CAMSHAFT ASSEMBLY - LESS GEAR	
68/	C70Z-6250-A	Camshaft Assembly - Less gear - Hydraulic tappets	1
		CAMSHAFT BEARING KIT - STANDARD	
68/	C90Z-6A251-A	Camshaft Bearing Kit - Standard	1
		Consists of:	
		(1) C9DZ-6261-B Front (1) CODZ-6267-B Front Inter-mediate	
		(1) CODE-6263-B Rear (1) CODE-6270-B Rear	
		(1) C5AZ-6026-G Plug	
		SPROCKET - SHAFT	
68/	CODE-6256-A	Sprocket - Cast iron - 38 teeth	1
68/	373118-S	Pin - Dowel (sprocket to camshaft) 1/4 dia. x .31	1
68/	371643-S	Bolt (sprocket to camshaft) 7/16-14 x 1-1/8	1
		BEARING - CAMSHFT	
68/	C9DZ-6261-B	Bearing - Front - Standard	1
68/	C9DZ-6261-C	Bearing - Front - .015 U/S	A/R
68/	CODE-6267-B	Bearing - Front Intermediate - Standard	1
68/	CODE-6267-C	Bearing - Front Intermediate .015 U/S	A/R
68/	CODE-6270-B	Bearing - Rear Intermediate - Standard	1
68/	CODE-6270-C	Bearing - Rear Intermediate .015 U/S	A/R
68/	CODE-6263-B	Bearing - Rear - Standard	1
68/	CODE-6263-C	Bearing - Rear .015 U/S	A/R
		SPACER - CAMSHAFT SPROCKET	
68/	CODZ-6265-A	Spacer - 1.010 ID - 1.36 OD - .165 Thick	1
		CHAIN - TIMING	
68/	CODE-6268-A	Chain - 50 links	1

YEAR	PART NUMBER	DESCRIPTION	QTY REQD.
		PLATE - CAISHAFT THRUST	
68/	CODE-6269-A	Plate - (2) 11/32 bolt holes - (1) 1.43 dia. center hole 3.52 overall length - .160 thick	1
68/	20326-S7	Bolt (camshaft thrust plate to cylinder block) - 5/16 - 18 x 5/8	2
		WASHER - CAMSHAFT SPROCKET	
68/	C3AZ-6278-A	Washer - 1.26 OD - .46 ID - .25 Thick	1
		PIN - CRANKSHAFR REAR OIL SEAL	
68/	CODZ-6A302-A	Pin - .095 OD - .31 long - pointed	1
		CRANKSHAFT ASSEMBLY	
68/	C50Z-6303-A	Crankshaft Assembly	1
		SPROCKET - CRANESHA	
68/	COOZ-6306-A	Sprocket - 19 teeth - Used with or without slinger	1
68/	372854-S	Key - 3/16 x 1.75	1
		PULLEY ASSEMBLY - CRANKSHAFT	
68/	D2DZ-6312-B	Pulley Assembly - D2DE-6316-BA - double sheave - 5 7/8 dia	1
68/	354566-S8	Bolt - 9/16 - 18 x 1 1/2	1
68/	CODZ-6378-A	Washer	1
		PULEY - CRANKSHAFT OUTER FOR HIGH FAN ENGINE - POWER UNIT	
68/75	C9JJ-6A312-A	Pulley - Crankshaft - Fan drive	1
68/75	304803-S8	Bolt - 9/16 - 18 x 1.75	1
68/75	42997-S8	Screw and Lockwasher - 3/8 - 16 x 7/8	3

YEAR	PART NUMBER	DESCRIPTION	QTY REQD.



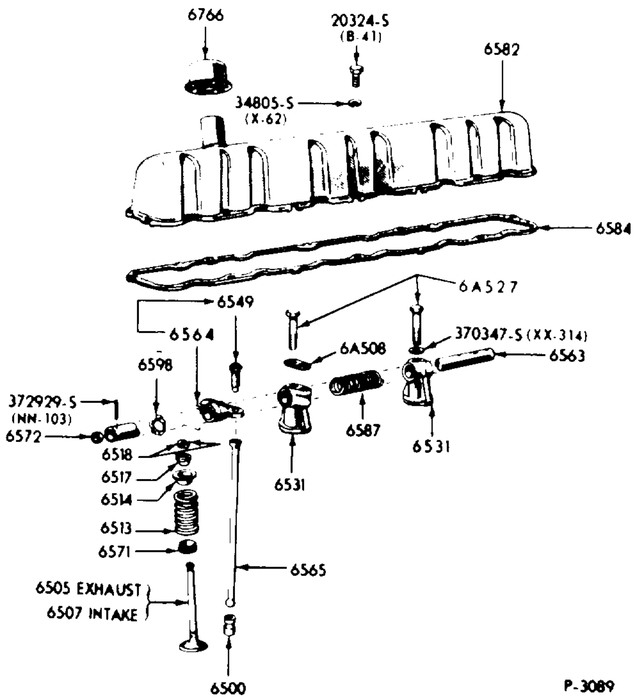
ENGINE CRANKSHAFT, FLYWHEEL & RELATED PARTS-TYPICAL

		MAIN BEARING - UPPER AND LOWER Front, Front Intermediate, Center, Rear Intermediate, Rear	
68/	ClDZ-6333-A	Standard	12
68/	CDZ- 6333-C	.002 Undersize	A/R
68/	ClDZ-6333-D	.010 Undersize	A/R
68/	ClDZ-6333-E	.020 Undersize	A/R
68/	ClDZ-6333-F	.030 Undersize	A/R
		Rear Intermediate	
68/	C1DZ-6337-A	Standard	2
68/	ClDZ-6337-C	.002 Undersize	A/R
68/	C1DZ-6337-D	.010 Undersize	A/R
68/	ClDZ-6337-E	.020 Undersize	A/R
68/	ClDZ-6337-F	.030 Undersize	A/R
		BOLT - CRANKSHAFT MAIN_BEARING CAP	
68/	D2DZ-6345-A	Bolt	14

YEAR	PART NUMBER	DESCRIPTION	QTY REQD.
		PIATE - FLYWHEEL REINFORCING	
68/	CODE-6A366-A	Plate - 3-5/8 OD - 23/64 ID - 5/64 Thick - (6) 29/64 holes	1
		FLYWHEEL ASSEMBLY - 10.00 OVER CENTER CLUTCH POWER TAKE OFF	
68/	C9JJ-6375-A	Flywheel Assembly	1
68/	C5AZ-6384-A	Gear - Flywheel ring - 184 teeth	1
68/	43067-S8	Bolt - 7/16 - 20 x 1.25 Self locking	6
68/	C5JZ-7599-A	Bearing adaptor	1
68/	43001-S8	Bolt - 3/8 - 16 x 1-3/8 Self locking	3
		FLYWHEEL ASSEMBLY - FLAT FACE 11.00 CLUTCH	
68/	C9JJ-6375-C	Flywheel Assembly	1
68/	C5AZ-6384-A	Gear - Flywheel ring - 184 teeth	1
68/	43072-S2	Bolt - 7/16 - 20 x 1-7/8 - self locking	6
		CLUTCH HOUSING - SPLIT TYPE WITH FEET (Use with C9JJ-7007-D Rear Engine Plate and Dowels)	
68/	C9JJ-6392-A	Housing - Clutch	1
68/	EAD-6397-A	Dowel Pin - .50 OD - 1.00 - Assembly in dowel hole above starting motor hole	1
68/	C9JJ-6397-A	Dowel - Groove pin special	1
68/	43040-S8	Bolt - 7/16 - 14 x 1.00 Self locking - Attaches clutch housing to rear engine plate	6
68/	20524-S8	Bolt - 7/16 - 14 x 2.00	2
68/	34808-S8	Washer - 7/16 Lock	2
68/	34670-S8	Nut - 7/16 - 14	1
68/	34098-S8	Nut - 7/16 - 14 Square	1
68/	18-6397	Dowel - Clutch housing to transmission	2
		FLYWHEEL HOUSING - SAE 4 WITH FEET (Use with C9JJ-7007-D Rear Engine Plate and Dowels)	
68/	C5JZ-6392-A	Housing - Flywheel	1
68/	EAD-6397-A	Dowel Pin - .50 OD x 1.00	1
68/	C9JJ-6397-A	Dowel - Groove pin special	1
68/	43040-S8	Bolt - 7/16 - 14 x 1.00 Locking - Housing to engine plate	6
68/	20470-S8	Bolt - 7/16 - 14 x 1.50	2
68/	34808-S8	Washer - 7/16 Lock	2
68/	34670-S8	Nut - 7/16 - 14	1
68/	34098-S8	Nut - 7/16 - 14 Square	1
68/	C5JZ-7518-A	Cover - Inspection hole	1
68/	57631-S8	Screw and Washer Assembly - 5/16 - 18 x 1/2 Cover to housing	4
		CLUTCH HOUSING - FULL BELL WITH FEET (Use with C9JJ-7007-D Rear Engine Plate and Dowels)	
68/	C9JJ-7500-A	Housing - Clutch	1
68/	EAD-6397-A	Dowel Pin - .50 OD x 1.00	2
68/	43040-S8	Bolt - 7/16 - 14 x 1.00 Locking - Housing to engine plate	6

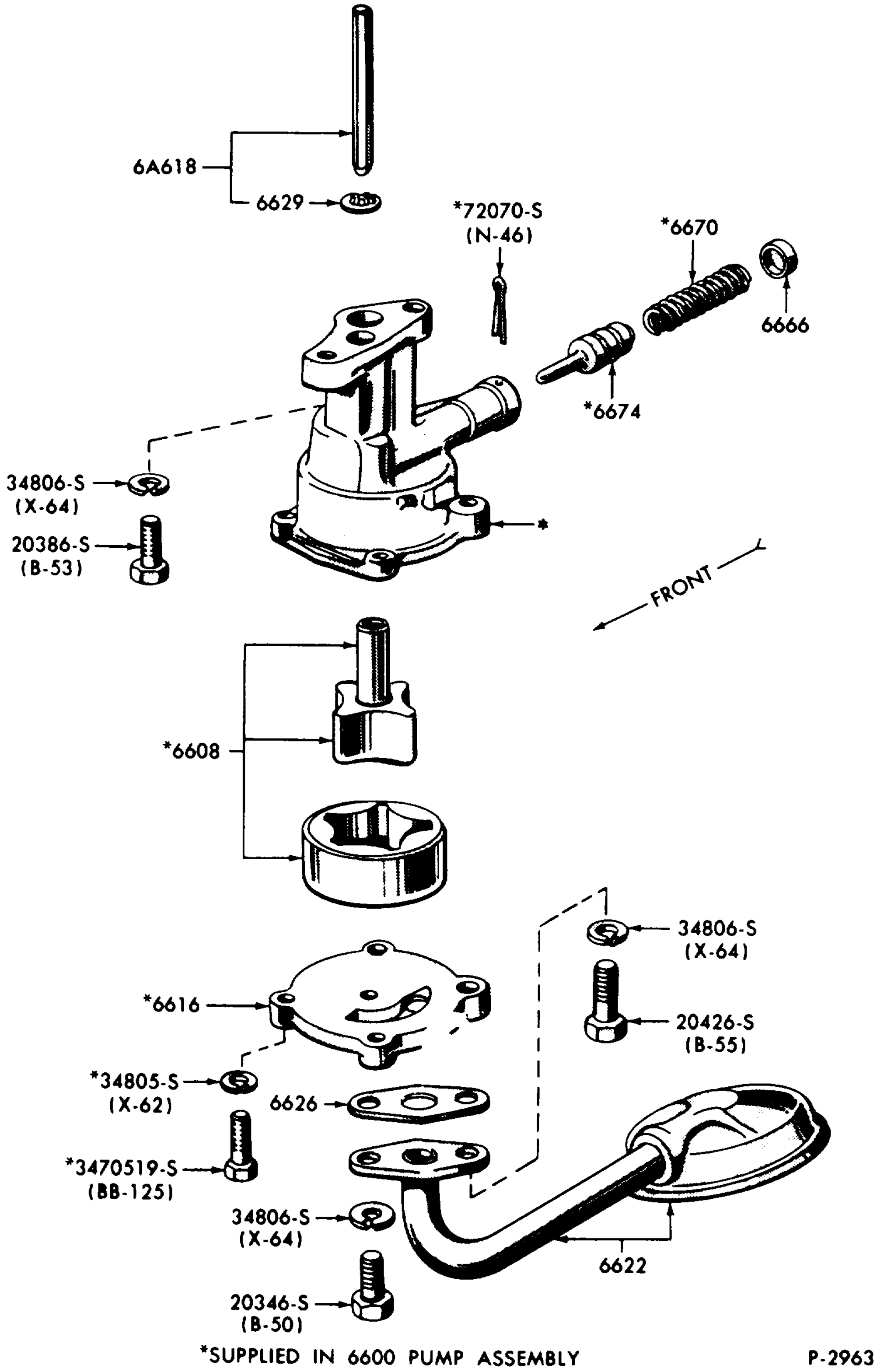
YEAR	PART NUMBER	DESCRIPTION	QTY REQD.
		CLUTCH HOUSING - FULL BELL WITH FEET (continued)	
68/	20524-S8	Bolt - 7/16 - 14 x 2.00	2
68/	34808-S8	Washer - 7/16 Lock	2
68/	34670-S8	Nut - 7/16 - 14 Hex	1
68/	34098-S8	Nut - 7/16 - 14 Square	1
68/	C3JZ-7518-A	Cover - Inspection Hole	1
68/	57471-S	Bolt - 1/4 - 20 x 3/8 Cover to housing	2
68/	34805-S8	Washer 1/4 Lock	2
68/	C4TZ-7513-C	Shield - Clutch Release Lever - Dust	1
68/	B8C-7515-A	Lever - Clutch Release	1
68/	354320-S8	Stud 9/16 - 12 - 16 x 2.56	2
68/	34810-S8	Washer - 9/16 Lock	2
68/	33848-S8	Nut - 9/16 - 18	2
		TAPPET ASSEMBLY - VALVE	
68/	C8AZ-6500-A	Tappet Assembly - Valve - hydraulic 1.82 Long	12
		INTAKE AND EXHAUST VALVE	
		Exhaust Valve - 4.19 Length - 1.39 Head Dia.	
68/	D2JE-6505-AA	Standard	6
68/	D2JE-6505-BA	003 Oversize	A/R
68/	D2JE-6505-DA	030 Oversize	A/R
		Exhaust Valve - Used with Valve Seat Inserts - 4.19 Length - 1.39 Head Dia. LPG	
68/	D2JE-6505-EA	Standard	6
68/	D2JE-6505-FA	003 Oversize	A/R
68/	D2JE-6505-HA	030 Oversize	A/R
		Intake Valve - 4.19 Length - 1.65 Head Dia.	
68/	D7BZ-6507-A	Standard	6
68/	D7BZ-6507-B	0033 Oversize	A/R
68/	D7BZ-6507-C	015 Oversize	A/R
68/	D7BZ-6507-D	030 Oversize	A/R
		SPRING - VALVE	
68/	C3DZ-6513-A	Spring - Valve - 1.79 Long - 1.014 ID - Light Red - Intake	6
68/	C8JE-6513-A	Exhaust	6
		RETAINER - VALVE SPRING	
68/	D2DZ-6514-A	Retainer - Valve Spring - Exhaust - 1.32 flange OD - .411 overall height	6
68/	D2DZ-6514-B	Retainer - Valve Spring - Intake	6
		SLEEVE - VALVE SPRING RETAIN	
68/	CODE-6517-A	Sleeve - Valve Spring Retainer	6
		KEY - VALVE SPRING RETAINER	
68/	CODE-6518-A	Key - Valve Spring Retainer	24
		BOLT - VALVE ROCKER ARM SHAFT SUPPORT	
68/	ClDZ-6A527-C	Bolt - Valve Rocker Arm Shaft Support - 3/8 - 16 x 2-31/32	6
68/	372702-S	Washer - 3/8 Flat	6

YEAR	PART NUMBER	DESCRIPTION	QTY REQD.



ENGINE VALVES, PUSH RODS, ROCKER ARM COVER & RELATED PARTS-TYPICAL

YEAR	PART NUMBER	DESCRIPTION	QTY REQD.
		SUPPORT KIT - VALVE ROCKER ARM SHAFT	
68/	ClDZ-6531-A	Support Kit - Valve Rocker Arm Shaft	6
		Consists of: (1) D2DE-6531-AA Support	
		(1) 370347-S Flat washer 3/8	
		SHAFT - VALVE ROCKER ARM	
68/	C3DZ-6563-A	Shaft - Valve Rocker Arm - Use with hydraulic tappets	
		Includes (2) EAA-6572-A plugs	1
		ARM - VALVE ROCKER	
68/	C4DZ-6564-A	Arm - Valve Rocker	12
		ROD - VALVE PUSH	
68/	C4DZ-6565-A	Rod - Valve Push - Standard - 8.35 Long	12
68/	C4DZ-6565-B	Rod - .060 Oversize	A/R
68/	C4DZ-6565-C	Rod - .060 Undersize	A/R
		SEAL - VALVE STEM	
68/	D ijZ-6571-A	Seal - Valve Stem - Rubber - Use with standard size valves	12
68/	D2DZ-6571-B	Seal - Valve Stem - Rubber - Use with oversize valves	A/R
		PLUG - VALVE ROCKER ARM SHAFT	
68/	EAA-6572-A	Plug - Valve Rocker arm Shaft - Cup Shaped - .536 dia	2
		COVER ASSEMBLY - VALVE ROCKER ARM	
68/	DIDZ-6582-A	Cover Assembly - Valve Rocker Arm	1
68/	356748-S	Screw and Washer - 1/4 - 20 x 5/8 (Attach 6582 to 6049)	7
		GASKET - VALVE ROCKER ARM COVER	
68/	DODZ-6584-A	Gasket - Valve Rocker Arm Cover - Cork and Rubber	1



ENGINE OIL PUMP & RELATED PARTS-TYPICAL

YEAR	PART NUMBER	DESCRIPTION	QTY REQD.
		SPRING - VALVE ROCKER ARM TO SHAFT LOCATING	
68/	CODE-6587-A	Spring - Valve Rocker Arm to Shaft Locating - 2.10 free length - 6 coils - .80 ID	5
		WASHER - VALVE ROCKER ARM SHAFT	
68/	CODE-6598-A	Washer - Valve Rocker Arm Shaft - Spring 1.12 OD - .80 ID .015 Thick	2
		PUMP ASSEMBLY - OIL	
68/	C5DZ-6600-A	Pump Assembly - Oil - Less screen tube and cover - Includes and used with (1) CODZ-6626-A Gasket	1
68/	57635-S2	Screw and Washer (Pump to block) 5/16 - 18 x 1	2
68/	378644-S	Dowel - Split (pump to block) 1/2 x 13/32	1
		ROTOR AND SHAFT ASSEMBLY - OIL PUMP DRIVE	
68/	C5DZ-6608-A	Rotor and Shaft Assembly - Oil Pump Drive - 5/16 Drive - 2.53 Long - Use with C5DZ-6A618-A	1
		PLATE - OIL PUMP BODY	
68/	C3DZ-6616-A	Plate - Oil Pump Body	1
68/	370519-S	Bolt (cover plate to body) 1/4 - 20 x 7/8	3
		SHAFT ASSEMBLY - OIL PUMP IMMEDIATE	
68/	C5DZ-6A618-A	Shaft Assembly - Oil Pump Intermediate - 5.14 Long - 5/16 Hex Drive	1
		SCREEN, TUBE AND COVER ASSEMBLY - OIL PUMP	
68/	C5DZ-6622-A	Screen, Tube and Cover Assembly - Oil Pump	1
68/	358805-S	Screw and Washer (screen and cover to pump) 5/16 - 18 x 1-1/4	1
68/	42789-S8	Screw and Washer (screen and cover to pump) 5/16 - 18 x 3/4	1
		GASKET - OIL PUMP SCREEN COVER AND INLET TUBE	
68/	CODZ-6626-A	Gasket - Oil Pump Screen Cover and Inlet Tube - .010 Thick	1
		SPRING - OIL PUMP BODY RELIEF VALVE	
68/	B8A-6670-A	Spring - Oil Pump Body Relief Valve - Rotor type pump - 14 coils - approx. 1.89 free length .468 OD	1
		PLUNGER - OIL PUMP BODY RELIEF VALVE	
68/	B9AE-6674-B	Plunger - Oil Pump Body Relief Valve	1
		PAN ASSEMBLY - ENGINE OIL	
68/	D5DZ-6675-A	Pan Assembly - Engine Oil - Includes (1) D5DZ-6750-A and (1) C2DZ-6754-A	1
68/	356748-S	Screw and Lockwasher (oil pan to block and front cover) 1/4 - 20 x 5/8	20
68/	42847-S7-8	Screw and washer (oil pan to block and front cover) 5/16 - 18 x 1	4

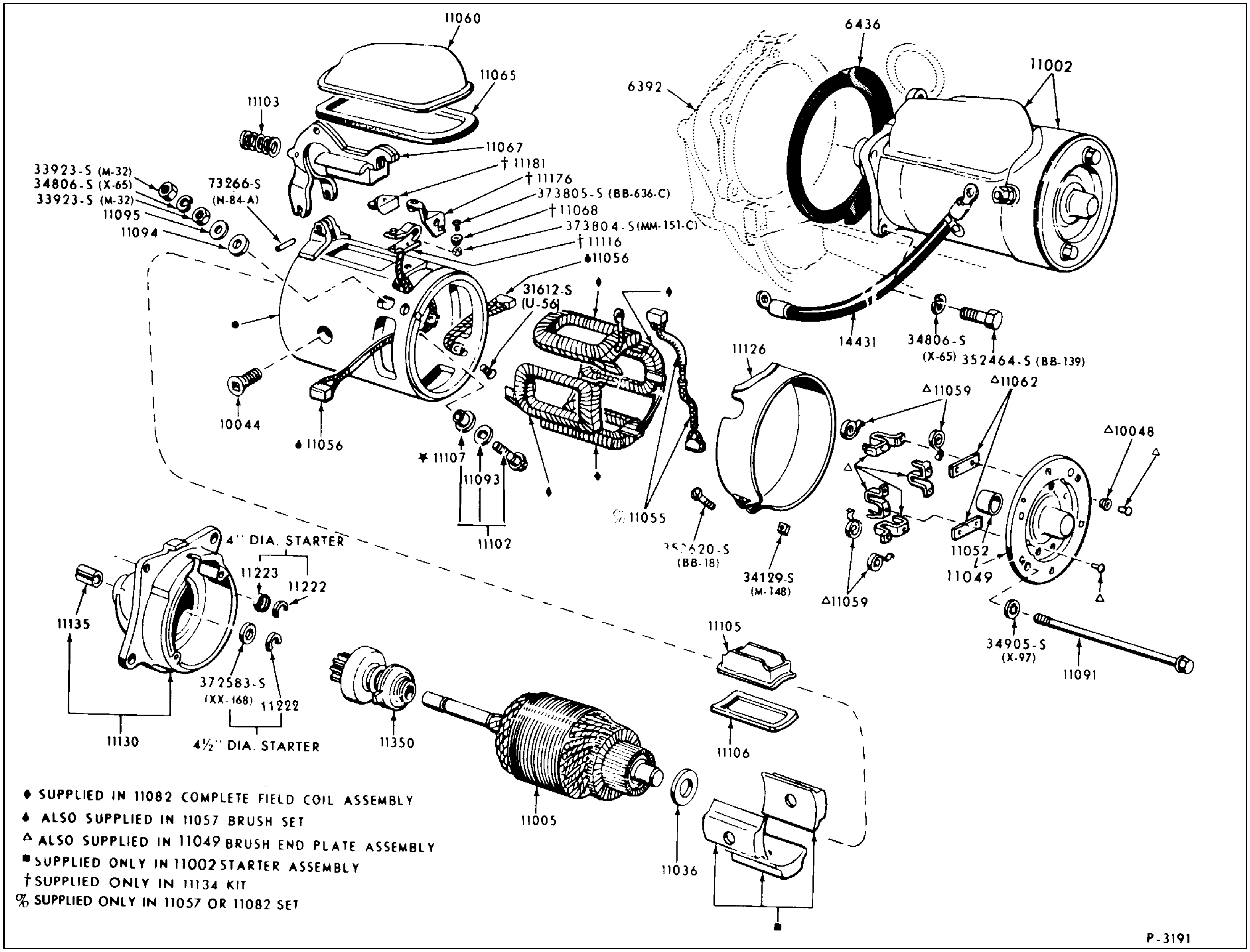
YEAR	PART NUMBER	DESCRIPTION	QTY REQD.
		OIL SEAL - CYLINDER FRONT COVER	
68/	CODE-6700-A	Oil Seal - Cylinder Front Cover - 2.378 OD - 1.750 ID - .437 Thick	1
		SEAL - CRANKSHAFT - REAR MAIN	
68/	C9AZ-6701-B	Seal - Split Lip Type	2
68/	C90Z-6701-A	Seal - Rope Type	2
		PLUG - ENGINE OIL PAN DRAIN	
68/	D6TZ-6730-A	Plug - Includes (4) C20Z-6734-A Gaskets	1
		OIL FILTER - SPIN ON TYPE	
68/	ClAZ-6731-A	Filter	1
		GASKET - ENGINE OIL PAN DRAIN PLUG	
68/	C20Z-6734-A	Gasket - Nylon	1
		INDICATOR ASSEMBLY - OIL LEVEL	
68/74	C2DZ-6750-B	Indicator - Use with C4DZ-6675-B Oil Pan	1
75/	D5DZ-6750-A	Indicator - Use with D5DZ-6675-A Oil Pan	1
		TUBE ASSEMBLY - OIL LEVEL INDICATOR	
68/	C2DZ-6754-A	Tube Assembly	1
		PIPE ASSEMBLY - OIL FILLER	
68/	C6JZ-6763-C	Pipe	1
68/	381898-S	Grommet	1
		CAP ASSEMBLY - OIL FILLER AND BREATHER	
68/	B6AZ-6766-A	Cap	1
68/	D2AE-6766-MA	Cap	1
		GASKET SET - OIL PAN	
68/	DODZ-6781-A	Gasket Set - Oil Pan Consists of: (1) C9DE-6710-C Gasket (RH) (1) C9DE-6711-C Gasket (LH) (1) C20Z-6734-A Gasket (oil drain plug) (1) D3DE-6722-AA Seal (front) (1) D3DE-6723-AA Seal (rear)	1
		INSERT - OIL FILTER MOUNTING BOLT	
68/	B8A-6890-A	Insert - Oil Filter Mounting Bolt	1

YEAR	PART NUMBER	DESCRIPTION	QTY REQD.
		REAR ENGINE PLATE - FOR SAE, FULL BETL, AND SPLIT HOUSINGS	
68/	C9JJ-7007-D	Plate - Rear engine	1
68/	73269-S	Dowel Pin 3/8 Dia x 11/16	2
68/	42997-S8	Bolt 3/8 - 16 x .88 Self locking	4
68/	C9JJ- 16969-A	Plug - Dust Cover	5
		DRAIN COCK ASSEMBLY - ENGINE BLOCK	
68/	8A-8115	Drain Cock	1
		WATER PUMP ASSEMBLY	
68/	D6JL-8501-A	Water Pump Assembly - Less pulley	1
68/	CODE-8507-A	Gasket - Water Pump	1
68/	C4DZ-8509-A	Pulley - Water Pump - 2 Sheave	1

YEAR	PART NUMBER	DESCRIPTION	QTY REQD.
		WATER PUMP ASSEMBLY (continued)	
68/	370790-S	Bolt - 5/16 - 18 x 3/4 - Water Pump to Cylinder Block	1
68/	379862-S8	Bolt - 5/16 - 18 x 2.0 - Water Pump to Cylinder Block	2
68/	87710-S	Plug - 3/8 - 18 Pipe - Water Pump	1
68/75	B7T-3538-A	Clamping Ring	1
68/75	C6DZ-9B464-A	Pulley - Exhaust Air Supply - Use as mechanical governor drive - with high fan front end arrangement	1
68/75	304649-S36	Bolt - 5/16 - 24 x .75	4
68/75	34791-S36	Washer - 5/16 Lock	4
		WATER OUTLET, CONNECTION, BRACE AND THERMOSTAT - WITHOUT GOVERNOR MOUNTING BRACKET AND RADIATOR BRACE - HIGH FAN	
68/75	C9JJ-8594-B	Connection Assembly - Water Outlet	1
68/75	D3DE-8255-AA	Gasket - Water Outlet Conn.	1
68/75	C2UZ-8575-B	Thermostat Assembly (160° F)	1
68/75	42958-S8	Bolt - 5/16 - 18 x 1.25	2
68/75	351385-S8	Washer - 3/8 Flat	2
68/75	55738-S	Nut - 3/8 - 16 Washer head	1
68/75	C9JJ-8A592-A	Brace - Water Outlet - High Fan Mounting	1
,68/75	42955-S8	Bolt - 5/16 - 18 x .88 - Attach brace to cylinder block	2
68/75	20390-S8	Bolt - 7/16 - 18 x .88 - Attach brace to water outlet connection	1
68/75	34848-S8	Washer - 7/16 Lock	1
		FAN BLADE ASSEMBLY AND BRACKET AND PULLEY ASSEMBLY - 18" 6 BLADE SUCTION FAN	
68/75	C5JZ-8600-N	Blade Assembly	1
68/75	C5JZ-8625-C	Bracket and Pulley	1
68/75	42760-S8	Screw and Washer Assembly - 5/16 - 18 x .88 - Attach 8600 to 8625	4
68/75	C5JZ-8633-A	Guide - Fan Bracket	1
68/75	88423-S8	Stud - 7/16 - 14-20 x 1-3/4	2
68/75	351L28-S8	Washer - 7/16 Flat	2
68/75	34372-S8	Nut - 7/16 - 20 Lock	2
		FAN BRACKET, PULLEY AND ATTACHING HARDWARE	
68/75	C5JZ-8625-C	Bracket and Pulley - Fan	1

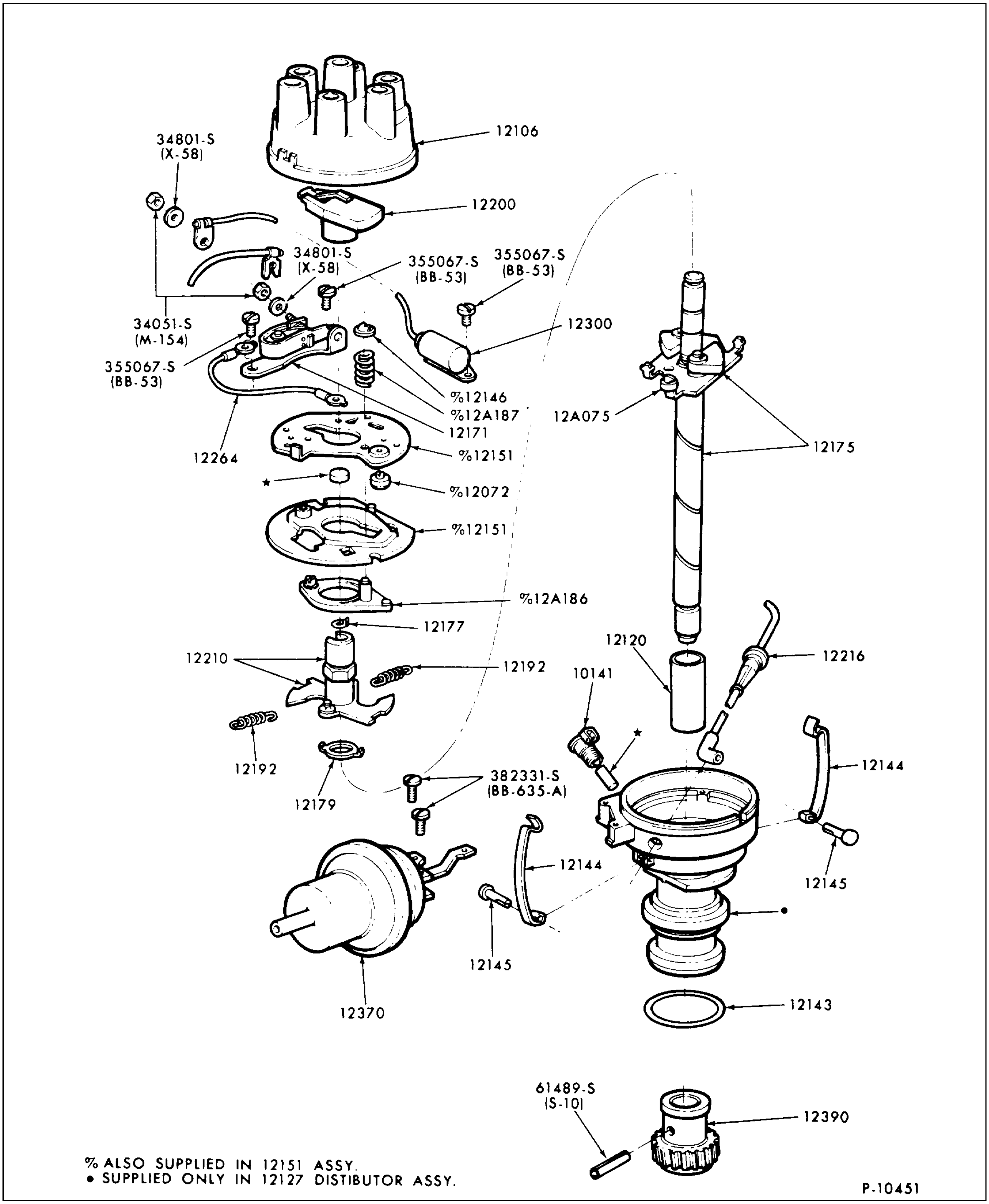
YEAR	PART NUMBER	DESCRIPTION	QTY REQD.
		FAN BRACKET, PULLEY AND ATTACHING HARDWARE (continued)	
68/75	57632-S2	Screw and Washer Assembly - 5/16 - 18 x 5/8 Attach 8600 to 8625	4
68/75	C5JZ-8633-A	Guide - Fan Bracket	1
68/75	88423-S8	Stud - 7/16 - 14-20 x 1-3/4 Long	2
68/75	351428-S8	Washer - 7/16 Flat	2
68/75	34372-S8	Nut - 7/16 - 20 Lock - Attach 8625 to 8592 water outlet connection	1
		BELT	
68/75	C7JZ-8620-H	Belt - Hi Fan Drive	1
68/	C9PZ-8620-E	Belt - Water Pump and Alt. Drive	2
		FUEL PIMP ASSEMBLY	
68/	C30Z-9350-D	Fuel Pump Assembly	1
68/	57636-S2	Screw and Washer Assembly - 5/16 - 18 x 1-1/4	2
68/	A8TZ-9417-A	Gasket - Fuel Pump Mounting	1
68/	87972-S	Fitting - Fuel Pump	1
		FUEL LINE ASSEMBLY - USE WITH C9JJ-9510-A CARBURETOR	
68/	C9JJ-9369-D	Tube Assembly - Fuel Pump to Carburetor	1
68/	B2AZ-9A317-A	Clip - Fuel Line to Vac. Line	2
68/	87972-S	Fitting	1
		FUEL LINE ASSEMBLY - USE WITH DOJJ-9510-B CARBURETOR	
68/	DOJJ-9369-C	Fuel Line Assembly	1
68/	B2AZ-9A317-A	Clip - Fuel Line to Vac. Line	2
		EXHAUST MANIFOLD	
68/	D7JE-9430-AA	Manifold Exhaust	1
68/	382951-S	Bolt - 3/8 - 16 x 1.12 Exhaust Manifold to Cylinder Head	6
68/	373139-S	Bolt - 3/8 - 16 x 2-5/8 " “ “ “ “	5
		CARBURETOR ASSEMBLY - MANUAL CHOKE NOT FOR MECHANICAL GOVERNOR	
68/	DOJJ-9510-B	Carburetor	1
68/	C9DZ-9447-A	Gasket - Spacer to Intake Manifold	1
68/	B6A-9447-B	Gasket - Carburetor to Adaptor	1
68/	DODZ-9A589-B	Spacer - Carburetor to Intake Manifold	1
68/	C4AZ-9C639-B	Cap - Hose Connection	1
68/	97203-S	Clamp - 8A500 to 9A589	1
68/	304648-S8	Bolt - 5/16 - 18 x .75	2
68/	34826-S8	Lockwasher - 5/16 - Attach 9A589 to intake manifold	2
68/	88392-S8	Stud 3/8 - 16-24 x 1.30	2
68/	355571-S8	Nut - 3/8 - 24	2
68/	C9JJ-9502-A	Carburetor Gasket Kit	1
68/	CT-883	Carburetor Tune Up Kit	1

YEAR	PART NUMBER		DESCRIPTION	QTY REQD.
			ALTERNATOR - MOTOROLA - 12 VOLT - 37 AMP	
75/	D3JL-10346-A		Alternator Assy. - Less Pulley	1
75/	D3JL-10A352-D		Pulley - 2 Sheave	1
75/	382469-S2		Bolt - 7/16 - 14 x 4.12 - Alternator to Bracket	1
75/	352981-S8		Washer - 3/8 Flat - Adj. Arm to Alternator	1
75/	381649-S2		Bolt 3/8 - 16 x 1.00 Washer Hd. Adj. Arm to Alternator	1
75/	C5TZ-lOA313-D		Mounting Bracket	1
75/	C5TZ-10145-A		Adjusting Arm	1
75/	42997-S36		Screw & Washer - 3/8 - 16 x 7/8 - Alt. Bracket to Block and Front Cover	2
75/	379862-S8		Bolt - 5/16 - 18 x 2 - Alternator Arm and W/Pump to Block	1
75/	D3JL-10316-A		Regulator - Voltage	1
75/	38204-S36	*	Screw - No. 10-32 x .50	3
75/	34656-S	*	Nut and lockwasher - No. 10-32	3
			* Attach 10316 to 16924	
			STARTING MOTOR ASSEMBLY - 12V - 2 BOLT PATTERN	
68/	D60Z-11002-A		Starting Motor Assembly - 12V	1
68/	376587-S8	*	Bolt - 3/8 - 16 x 1.12	2
68/	34782-S8	*	Washer 3/8 Lock	2
68/	33825-S8	*	Nut - 3/8 - 16	2
			* Attach starting motor to rear engine plate	
	D60Z- 11002-A- - - - - - -		Consists of:	
	D0AZ-11005-A		Armature	1
	D0AZ-11K013-A		Seal (rear housing bearing)	1
	C0DZ-11036-A		Washer (armature thrust) asbestos	1
	C6VY-11036-A		Washer (Armature Thrust) Steel	1
	C4TZ-11049-A		Plate and Bushing (brush end)	1
	D3AZ-11052-A		Bushing (brush end plate) 5/8 ID x 3/4 OD x 9/16 long	1
	C0DZ-11057-B		Brush Set Consists of: (1) C5AF-11055-A Brush (1) CODF-11056-B Brush (1) 18-11056 Brush (1) 25247-S7 Screw	1
	D1AZ-11059-A		Spring (brush)	4
	C0DZ-11060-C		Cover (plunger)	1
	C0DF-11065-A		Gasket (plunger cover)	1



STARTER and DRIVE ASSY. - POSITIVE ENGAGEMENT

YEAR	PART NUMBER	DESCRIPTION		QTY REQD.
	D60Z-11002-A	Consists of (continued)		
	C0DF-11067-B	Lever (Drive)		1
	C2DZ-11068-A	Insulator (Switch)		1
	C6VY-11082-A	Coil - Field - Complete		1
	C3AZ-10120-A	Bolt (thru)		2
	34905-S7	Lockwasher		2
	C0DZ-11102-C	Terminal Kit (field)		1
		Consists of:		
		(1) B5A-11093-A Washer	(1) 18-11107-B Bushing	
		(1) 384661-S Washer	(2) 384660-S Nut	
		(1) 44722-S Washer	(1) 34971-S Lockwasher	
		(1) C9AF-11102-B Terminal	(1) B5A-11095-A 1Washer	
	C1VF-11103-A	Spring (plunger return)		1
	C0DF-11105-A	Sleeve Coil Retaining		1
	27185-S2	Screw - Round Head - Slotted - No. 10-32 x 1-5/8		1
	34079-S7	Nut - No. 10-32 Square		1
	D1AZ-11130-C	Housing Kit (drive end)		1
		Consists of:		
		(1) DOAZ-11K013-A Seal	(1) DLPF-11A130-AA Lubricant	
		(1) C2DZ-11223-A Retainer	(1) C2DZ-11222-A Ring	
		(1) D2AF-11130-EA Housing	(1) C6VF-11383-A Washer	
		(1) Instruction Sheet		
	C20Z-11134-B	Point Kit (contact)		1
		Consists of:		
		(1) C2DZ-11068-A Insulator	(1) C20Z-11181-A Insulator	
		(1) C20F-11116-B Spring	(1) 57013-S Screw No. 8 - 32 x 3/8	
		(1) C20Z-11176-B Post		
		(1) Instruction Sheet		
	D0AZ-11135-B	Bearing or Bushing (drive housing)		1
	C20Z-11181-A	Insulator (switch spring)		1
	C2DZ-11222-A	Ring (drive stop ring)		1
	C2DZ-11223-A	Retainer (drive stop ring)		1
	D6PZ-11350-B	Drive Assembly - Includes Attaching Parts		1
		HEAT SHIELD - STARTER MOTOR		
68/75	C9JJ-11006-A	Shield Assembly		1
68/75	20330-S8	Bolt - 7/16 - 14 x 5/8		1
68/75	34808-S8	Washer - 7/16 Lock		1
		IGNITION COIL AND RELATED ASSEMBLIES		
68/	B6A-12029-B	Coil Assembly - Ignition		1
68/	B5A-12044-A	Strap Assembly - Ignition Coil		1
68/	42718-S2	Bolt - 5/16 - 18 x .50 - Coil to Block		2
68/	57021-S2	Bolt - 8 - 32 x 1.75 - Strap to Coil		1
68/	34052-S36	Nut - 8 - 32 - Strap to Coil		1
68/	B8A-12250-A	Resistor - Ignition Coil		1
68/	D6DZ-12298-A	Suppressor Assembly		1



DISTRIBUTOR-TYPICAL

YEAR	PART NUMBER	DESCRIPTION	QTY REQD.
		DISTRIBUTOR	
68/	D3JF-12127-BA	Distributor Assembly - Less Terminal Housing & Rotor	1
	D3JF-12127-BA - - - - - -	Consists of:	
68/	C5AZ-12000-D	Repair Kit - Distributor Consists of: (1) C9AZ-12171-B Point Set (1) C5TZ-12200-B Rotor (1) C9AZ-12300-A Condenser	1
68/	C2AZ-12A075-A	Sleeve - Shaft Plate	1
68/	7HA-12106	Housing Assembly - Distributor Terminal (Cap)	1
68/	’C5AZ-12120-A	Bushing - Distributor Housing	1
68/	7RA-12144	Clamp - Terminal Housing Hold Down	1
68/	D2PZ-12151-B	Plate Assembly - Distributor - Less Points	1
68/	C9AZ-12171-B	Point Set Assy. - Breaker Arm and Contact-Pivot Type	1
68/	34801-S7	Lockwasher - No. 6	1
68/	34051-S36	Nut - No. 6 - 32	1
68/	D2TZ-12175-A	Shaft and Cam Assembly	1
68/	B7A-12177-A	Retainer - Cam	1
68/	C8AZ-12179-A	Washer - Distributor Shaft Thrust - Upper	1
68/	C5AZ-12188-A	Weight Assembly - Distributor	2
68/	351825-S	Washer - "C" Type	2
68/	C5TZ-12200-B	Rotor Assembly	1
68/	C7VY-12216-A	Wire Assembly - Primary Terminal	1
68/	34801-S7	Lockwasher - No. 6	1
68/	34051-S7	Nut - No. 6-32	1
68/	D2AZ-12264-A	Wire Assembly - Distributor Breaker - Ground	1
68/	50507-S8	Screw - No. 8 - 32 x 3/8 - Pan Head	2
68/	C3AZ-12270-A	Clamp - Distributor to Cylinder Head	1
68/	42955-S2	Bolt - 5/16 - 18 x 7/8 Clamp to Block	1
68/	C9AZ-12300-A	Condenser Assembly	1
68/	382331-S2	Screw - No. 8 - 32 x 1.00	1
68/	351826-S	Retainer - "C" Type Washer (Diaphragm Rod)	1
68/	D3JF-12370-AA	Diaphragm Assembly - Distributor	1
68/	C5TZ-12390-A	Gear - Distributor Driven	1
68/	61489-S(S-10)	Pin - 1/8 x 1/4 Coiled	1
		DISTRIBUTOR VACUUM HOSE	
68/	C8DE-12226-G	Hose	1
		SPARK PLUG WIRE SET	
68/	D1AZ-12259-B	Spark Plug Wire Set	1
		SPARK PLUG ASSEMBLY	
68/	C3TZ-12405-A	Spark Plug Assembly	6

SUPPLEMENTAL
OPERATING, MAINTENANCE
AND
REPAIR PARTS
INSTRUCTIONS

AUGER, EARTH, SKID MOUNTED, TYPE I
TEXOMA MODEL 254-9
REED TOOL COMPANY
NSN 3820-01-068-4078

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PART I
INTRODUCTION

1-1. SCOPE

The instructions in this Supplemental Operating, Maintenance and Repair Parts Instruction (SOMARPI) are for:

a. The user of the Construction Equipment (CE), Auger Earth, Skid Mounted, Type I, Reed Tool Company, Texoma Incorporated, Model 254-9.

b. Maintenance personnel responsible for maintaining and/or repairing the Auger Earth.

c. Supply personnel responsible for requisitioning and stockage of repair parts.

1-2. REPORTING

Reports of errors, omissions, and recommendations for improving the publication by the individual user is encouraged. Reports should be submitted on DA Form 2028, Recommended Changes to Publications, and forwarded direct to Commander, US Army Tank-Automotive Materiel Readiness Command, ATTN: DRSTA-MBA(S), Warren, Michigan 48090.

PART II
MAINTENANCE SUPPORT DATA

2-1. PURPOSE

The Auger is designed for use in boring holes in the earth for construction purposes such as fence, power line, anchor post holes, or for explosives.

2-2. DESCRIPTION

a. General. The Texoma Incorporated Earth Auger Model 254-9, in figures 1-1 and 1-2, is a self-contained, skid mounted, earth boring assembly, driven by a gasoline engine, Ford Model 200-(GF-6006E). All operations of the boring assembly are controlled by a hydraulic system. The Auger is capable of boring holes 9 to 24 inches in diameter and to a depth of 9 feet. The boring assembly can be operated from vertical downward to 60° away from truck, 45° to the right or left of truck, or 10° toward the truck.

b. Engine. The engine is a Ford Motor Company Model 200-(GF-6006E) in-line, 6 cylinder, pressure lubricated, gasoline engine.

c. Transmission. The transmission is a Funk Manufacturing Company Model 4050A055BP, with four speeds forwarded and reverse.

d. Auger Assembly. The Auger assembly consists of the Auger, kelly bar, final drive assembly, and right angle drive assembly. Operation of the Auger assembly is controlled by the shuttle control and the hand or foot operated throttle control. The shuttle is used to engage and disengage the drive assembly.

e. Warning/Safety Devices. The hydraulic system incorporates load look valves on both the elevating and leveling cylinders. These valves prevent the cylinders from retracting in event of hydraulic system pressure loss.

f. Electrical System. The Auger has a 12 volt electrical starting system.

g. Alternator. The Auger is equipped with water proof gauges and switches. The following instruments are on the panel.

(1) Engine Water Temperature Gage
(2) Tachometer/Hourmeter
(3) Ammeter 0 to 15 AMPS
(4) Transmission Oil Pressure Gage 140 PSI
(5) Transmission Oil Temperature Gage 220°F
(6) Engine Oil Temperature Gage 220°F

(7) Engine Oil Pressure Gage 30-60 PSI
(8) Fuel Gage
(9) Safety Switch
(10) Ignition Switch (pull-on, push-off) (east shut-down)
(11) Starter Button
(12) Choke Handle

h. Battery. One (1) 12 volt battery 55 AMP, is installed to provide 12 volts for the starting system. The battery is located on the left side of the Auger assembly, Just below the fuel tank.

i. Lubricants.

(1) Engine - MIL-L2104 lubricating oil is recommended for use in this engine when the ambient temperature is above minus 10 degrees Fahrenheit. MIL-2104 oils are available under the following NSN:

NSN	QUANTITY	WEIGHT
9150-00-189-6727	1 Qt	10
9150-00-186-6668	5 Gal	10
9150-00-191-2772	55 Gal	10
9150-00-186-6681	1 Qt	30
9150-00-188-9858	5 Gal	30
9150-00-189-6729	55 Gal	30

(2) Hydraulic System - (260 Qt), MIL-L-2104 O/E/DO 10. See above listing for NSN and quantity.

(3) Transmission - (13 Qt), OE SAE 10 MIL-L-2104. See above listing for NSN and quantity.

(4)

Lubrication Oil Gear	NSN
Right Angle (3 Qt) G090	9150-00-001-9395
Final Drive (3-1/2 Qt) G90	Quantity - 5 Gal
Winch (1 Qt) G90	Grade - 90

Operational and maintenance procedures are covered in the Manufacturer's Manual overpacked with the equipment (see appendix). The category of maintenance for the loader will be in accordance with the Maintenance Allocation Chart (MAC) (see appendix) of this SOMARPI. Refer to paragraph of this SCKARPI for requisitioning of repair parts and support

2-3. PROCUREMENT STATUS

a. This is a one year (1 yr) procurement.

b. The procurement was awarded under contract DSA 700-77-C-8457, to Reed Tool Company, P. O. Box 998, Sherman, Texas 75090.

2-4. CONDITIONS OF EMPLOYMENT

a. The Earth Auger is capable of being operated or stored in intermediate, hot, dry, warm, cold, or wet climate conditions.

b. The Earth Auger has a mission duration of eight per shift with two shift operations on an occasional basis, and one-half hour operational and preventive maintenance each shift.

2-5. MAINTENANCE CONCEPT

a. The introduction of this Auger will not introduce any new requirements for special consideration. The existing organizations will be utilized for support.

(1) Operator/Crew Maintenance. Operator and crew maintenance is limited to daily preventive maintenance services.

(2) Organization Maintenance. Organizational maintenance consists of scheduled preventive maintenance services, minor repairs, and adjustments.

(3) Direct Support Maintenance. Direct support maintenance consists of all the repairs required to restore an unserviceable end item or assembly to a serviceable condition.

(4) General Support Maintenance. General support maintenance will repair those assembled modules which overflow from or exceed the capabilities of direct support maintenance.

(5) Depot Maintenance. Depot maintenance is not authorized for the Earth Auger 254-9.

b. The Government may enter into an overhaul and/or rebuild contract with the loader manufacturer when determined to be more economical or feasible.

c. Maintenance expenditure limit is 65% throughout its life expectancy of 12 years, TB 43-0002-28.

2-6. SUPPORT EQUIPMENT

This equipment must be installed into proper truck chasis for SAFE operation both on and off roads. Use truck, cargo, 5 ton, 6 x 6 M54A2 w/w (national stock No. 2320-00-055-9265).

2-7. REPAIR PARTS AND SUPPORT

a. Repair parts support. The basic policies and procedures in AR711-2 and AR725-50 are generally applicable to repair parts management for CE items.

b. Manufacturer's parts manuals are furnished with this CE item 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, i.e., engines, transmissions, etc. Additional NSNs are assigned by the supply support activities and demands warrant.

d. Automated processing (AUTODIN) of Federal Supply Code Manufacturer (FSCM) part number requisitions, without edit for matching NSNs and exception data, is authorized.

e. Proper use of Direct Support System (DSS) project codes and weapon systems designator codes on parts requisitions is essential.

f. Repair parts are available from commercial sources for CONUS units and may be purchased locally in accordance with AR 710-2 and AR 735-110.

g. Initial recommend Prescribed Load List (PLL) and Authorized Package List (ASL) will be distributed by Tank-Automotive Materiel Readiness Command (TARCOM) DRSTA-MVB, (see appendix I).

(1) Prescribed Load List (PLL): The PLL prepared and distributed by TARCOM 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. An initial stock of PLL parts will be shipped 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 TARCOM prepared list. Organizations and activities in CONUS will establish PLL stock through normal requisitioning process.

(2) Authorized Stockage List (ASL): The ASL prepared and distributed by TARCOM is an estimated 45 days supply of repair parts for support units and activities. An initial stock of ASL parts will be shipped to designated end items. The parts shipped will be selected according to the recommendations of the receiving commands, after they have reviewed the initial list distributed by TARCOM. Support units and activities in CONUS will establish ASI stocks through normal requisitioning process.

h. Requisitioning Repair Parts:

(1) Using Units/Organization: Requisitions (DA Form 2765 Series) will be prepared according to AR 710-2 and local command directives. All requi-sitions will have the Weapons System Designator Code "37" (see appendix H of AR 719-2) entered in the 2nd and 34d positions of Block 18. Units in CONUS will use the appropriate DSS code (see appendix C) in Block 19. Units OCONUS will enter in Block 19 project code "JZC", see appendix D.

(2) Support Units And Activities:

(a) General: All MILSTRIP -requisitions (DD Form 1348 Series) prepared for repair parts support of CCE items will include distribution and project codes, see appendixes C, D, and E.

(b) Distribution Code: Supply customers in CONUS will use code “F”' in card column 54. Customers OCONUS will use the appropriate code from appendix P, paragraph P-3a(i) of AR 725-50. Weapons System Designator Code “37” (appendix H, of AR 710-2), will be entered in card column 55 and 56 of all requisitions for parts support for the Model 254-9 Earth Auger.

(c) Project Codes: The applicable DSS project code (appendix C) will be entered in card columns 57-59 of requisitions for NSN parts, whether CONUS or OCONUS customers. The DSS code will also be used by the CONUS customers when requisitioning part numbered parts. Supply customers OCONUS will use project code “JZC” for part numbered parts.

i. Submitting Requisitions:

(1) Using units and organizations will submit DA Form 2765 Series requisitions to designated support units or activities in accordance with local procedures.

(2) Support units and activities will forward MILSTRIP requisitions for NSN parts through the Defense Automated Addressing System (DAAS) to the Man-aging Supply Support Activity (see appendix E). Requisitions for part numbered parts will be forwarded through DAAS to the Defense Construction Supply Center (DCSC) (see appendix D).

NOTE: When the manufacturer’s part number and Federal Supply Code Manufacturer (FSCM) exceed the space in card columns 8 through 22 of A02/A03 requisitions, prepare an A05/A03 requisition (DD Form 1318-6) and mail it to Commander. Defense Construction Supply Center. ATTN: DCSC-OSR. Columbus, Ohio 43215.

2-8. PERSONNEL AND TRAINING

a. MOS Requirements

(1) Operators: Earth Auger operator, MOS 62B20.
(2) Organizational: Engineer equipment repairman, MOS 62B20.
(3) Direct/General Support: Engineer equipment repairman, MOS 62B30.

b. New Equipment Training. New Equipment Training Teams (NETTS) are available to major field commands. Requests for NETTs should be forwarded to Commander, US Army Tank-Automotive Materiel Readiness Command (TARCOM), ATTN: DRSTA-MLT, Warren, Michigan 48090. Training teams should be requested only when trained personnel are not available in the command to operate and/or maintain the Earth Auger.

2-9. EQUIPMENT PUBLICATIONS

a. Equipment publications initially will be manufacturer's commercial manual. See appendix A. Five manuals are overpacked and shipped with each end item.

b. After initial distribution, manuals normally will be Department of the Army (DA) authenticated and become available from the Adjutant General (TAG).

c. NOT APPLICABLE

d. The Army Equipment Maintenance System (TAMMS) applies as follows:

(1) Army Equipment Log Book Binder NSN 7510-0o-889-3494.

(2) Case, Maintenance and Operational Manuals, NSN 7520-00-559-5618.

(3) DA Form 2407, Maintenance Request.

(4) DA Form 2408, Equipment Log Book Assembly (Records).

(5) DA Form 2408-1, Equipment Daily and Monthly Log.

(6) DA Form 2408-5, Equipment Modification Record.

(7) DA Form 2408-9, Equipment Control Record.

(8) DA Form 2408-10, Equipment Component Register.

(9) DA Form 2408-14, Uncorrected Fault Record.

(10) DA Form 2409, Equipment Maintenance Log (Consolidated).

2-10. FACILITIES

No special maintenance facilities are required for the loader.

2-11. LOGISTICS ASSISTANCE (AR 700-4)

US Army Tank-Automotive Materiel Readiness Command's Field Maintenance Technicians stationed at CONUS and OCONUS installations are available to furnish on-site training and/or technical assistance. When training or technical assistance is required, contact the appropriate Logistics Assistance Office (LAO) listed in appendix B, AR 700-4.

2-12. WARRANTY

The contractor warrants for one year after acceptance, all supplies furnished under this contract will be free from defects in design (except to the extent that design is specified by the contract specifications), material and workmanship, and will conform with the specifications and all other requirements of the contract. The contractor will include a copy of all such warranties in the operator's manual, furnished for each Earth Auger. Failure of defective components, parts, or assemblies covered by the manufacturer's warranty will be processed by the using unit under the warranty claims actions published in TM 38-75), paragraph 3-7.4.2.

COMMERCIAL VEHICLE WARRANTY

a. Definitions

(1) Acceptance. The word "acceptance" means the completion of the acceptance block and signing the DD Form 25) by an authorized Government representative.

(2) Supplies. The word "supplies" means the end item furnished by the contractor and any related services required under the contract; however, technical data is not included.

b. Warranty. The contractor warrants for one year after acceptance, all supplies furnished under this contract will be free from defects in design (except to the extent that design is specified by the contract specifications), material, and workmanship, and will conform with the specifications and all other requirements of the contract; except that with respect to Government furnished property, the contractor's warranty shall extend only to its proper installation, unless the contractor per-forms some modification or other work on such property, in which case the contractor's warranty shall extend to such modification or other work.

c. Remedies

(1) Right to Corrective or Replacement Action. If the warranty provided herein is breached, the Government at no increase in pay may (1) require the contractor at the CONUS place of delivery specified in the contract (irrespective of the f.o.b. point or the point of acceptance) or at the contractor's plant to repair or replace (at the contractor's option) defective or nonconforming supplies, or (2) require the contractor to furnish at the CONUS delivery point such materials or parts and installation instructions as may be necessary to accomplish the required correction. When supplies are returned to the contractor, the contractor shall bear transportation costs from the CONUS delivery point specified in the contract (irrespective of the f.o.b. point or the point of acceptance) to the contractor's plant and return. The contractor shall be liable for reasonable cost of disassembly/reassembly of larger items necessary to remove the supplies to be inspected and/or returned for correction or replacement.

(2) Right to Equitable Adjustment. If the Government does not re-quire correction or replacement of defective or nonconforming supplies, the Government shall be entitled to an equitable reduction in the price of such supplies.

d. Notification. The Government shall notify the contractor in writing of any breach of the warranty provision within one year after the last delivery made by the contractor under this contract. Within 20 days after receipt of notice, the contractor shall submit to the contracting officer a written recommendation as to the corrective action required to remedy the breach. Within a reasonable time after receipt of the con-tractor's recommendation for corrective action, the contracting officer may in writing direct correction or replacement as provided in © above, and the contractor shall comply with such directive, not withstanding any disagreement regarding the existence of a breach of warranty. If it is later determined that the contractor did not breach the warranty the con-tract price will be equitably adjusted in accordance with the procedure prescribed by ASPR 7-103.2 entitled "changes."

e. If the contractor fails to respond to the Government's notice of breach of this warranty or fails to comply with the Government's directive to correct or replace, and does not cure such failure within a period of ten days after receipt of notice from the contracting officer specifying such failure, the contracting officer, by contract or otherwise, may either correct or replace the nonconforming supplies and charge the cost thereof to the contractor, or demand an equitable adjustment in price as provided in paragraph (c) (2) above.

f. Any supplies or parts thereof corrected or furnished in replacement pursuant to this clause shall also be subject to all the provisions of this clause to the same extent as supplies initially delivered. The warranty with respect to such supplies or parts thereof shall be equal in duration to that set forth in paragraph (b) above, and shall run from the date of delivery of such corrected or replaced supplies.

g. All implied warranties of "merchantability" and "fitness for a particular purpose" are hereby excluded from any obligation contained in this contract.

h. The rights and remedies of the Government provided in this pro-vision shall not be affected in any way by any other provision of this contract concerning the conclusiveness of inspection and acceptance and are in addition to, and do not limit any rights afforded to the Government by any other provisions of this contract.

i. In addition to the marking requirements of this contract, either the package of each warranted item or each warranted item itself must be marked by the contractor by affixing a cloth tag or durable label which will state the contract number and that "this item is warranted for (insert number of days required by this provision) after (indicate acceptance date." The DD 250, MIRR, accompanying each shipment must include the words "warranted item" in the next preprinted line following the line item description in Block 16 thereof.

j. Offerors must indicate below the amount included in the unit price of each item to cover the cost of warranty. If no amount is indicated, it will be assumed that no charge is made therefor. Offers will be evaluated without regard to any warranty charge indicated below, however, if the low responsive offer indicates a charge, the Government reserves a right to reduce the offered price by the amount of the warranty charge and to waive the warranty.

2-13. EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIRs)

Submit EIR8 in accordance with instructions contained in TM 38-750.

2-14. DESTRUCTION TO PREVENT ENEMY USE

Refer to TM 750-244-3, procedures for destruction of equipment to prevent enemy use.

2-15. FIRE PROTECTION

a. A hand operated fire extinguisher can be installed at the discretion of the Commander.
b. For usage refer to TM 5-4200-200-10, Hand Portable Fire Extinguisher Approved for Army Users.

2-16. SHIPMENT AND STORAGE

a. See TM 740-97-2, preservation of USAMEC Mechanical Equipment for shipment and storage.
b. See TM 740-90-1 for administration storage of equipment.

2-17. MANUFACTURER'S FIELD CAMPAIGNS AND MODIFICATIONS

Modifications will be corrected by the Auger manufacturer after the approval of the field campaigns or modification plan by TARCOM (see appendix H).

2-18. BASIC ISSUE ITEM LIST (BILL)

A list of items which accompany the Auger or are required for installation, operation, or operator's maintenance (see appendix G).

2-19. MAINTENANCE AND OPERATING SUPPLY LIST

A listing of maintenance and operating supplies required for initial operation (see appendix L).

APPENDIX A

MAINTENANCE ALLOCATION CHART

Section I. Introduction

D-1. General

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. The Maintenance Allocation Chart (MAC) in section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

c. Section III lists the special tools and test equipment required for each maintenance function as referenced from section II.

d. Section IV contains supplemental instructions on explanatory notes for a particular maintenance function.

D-2. Maintenance Functions

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 failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an 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 pre-scribed 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 equipments 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 an 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, sub-assembly, or module (component or assembly) for an unserviceable counterpart.

i. Repair. The application of maintenance services[1] or other maintenance actions[2] to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), and item, or system.

j. Overhaul. That maintenance effort (services/actions) necessary to restore an item to a completely serviceable/ operational condition as prescribed by maintenance standards (i.e., DMWR) 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. Re-build is the highest degree of materiel maintenance applied to Army equipment.

[1]Services-inspect, test, service, adjust, align, calibrate, or replace.
[2]Action-welding, grinding, riveting, straightening, facing, remachining, or resurfacing.

SECTION I. Introduction (contd.)

The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipments/components

D-3.Column Entries Used in the MAC

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Functions. Column 3 lists the functions to be per-formed on the item listed in column 2. (For detailed explanation of these functions, see para. D-2.)

d. Column 4, Maintenance Level. Column 4 specifies, by the listing of a "work time" figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform the maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance levels, appropriate "work time" figures will be shown for each level. The number of manhours 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 maintenance allocation chart. The symbol designations for the various maintenance levels are as follows:

C ....Operator or crew.
O ....Organization maintenance.
F ....Direct support maintenance.
H .... General support maintenance.
D ....Depot maintenance (not applicable).

e. Column 5, Tools and Equipment. Column 5 specifies, by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated function.

f. Column 6, Remarks. Column 6 contains an alphabetic code which leads to the remark in Section IV, Remarks, which is pertinent to the item opposite the particular code.

MAINTENANCE ALLOCATION CHART
SECTION II - ASSIGNMENT OF MAINTENANCE FUNCTIONS

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND TEST EQUIPMENT	(6) REMARKS
01	Engine								
0100	Engine Assy								
	Engine, Gasoline							1.	A
		Test			0.5				
		Service		0.1					
		Adjust			1.0				
		Replace			10.0				
		Repair			6.0				
		Overhaul				16.0			
	Support, Engine	Replace			2.0				
0101	Crankcase, Block								
	Cylinder Block	Replace				16.0		1. 2.	
		Repair				8.0			
	Cylinder Head	Replace			3.0				
		Overhaul				1.0			
0102	Crankshaft								
	Bearing, Main							1. 3. 4.	
		Replace				4.0			
	Crankshaft								
		Replace				12.0			
		Overhaul				6.0			
	Pully, Groove	Replace			5.0				
0103	Flywheel Assy	Replace			0.8				C
		Repair			1.5			1.	
0104	Pistons & Connecting Rods							1.2	
	Pistons	Replace				2.0			
		Repair				1.0			
	Connecting Rod	Replace				2.0			
		Repair				1.0			
	Bearings, Connecting Rod	Replace				2.0			
0105	Valves, Camshaft & Timing Systems								
	Rocker Arm Assy	Adjust			1.0			1. 9.	
		Replace			3.0				
		Repair			1.0				
	Valves	Replace			3.0				
		Repair			4.0				
	Camshaft	Replace				6.0			D
	Timing Gears	Replace			2.0				

MAINTENANCE ALLOCATION CHART
SECTION II - ASSIGNMENT OF MAINTENANCE FUNCTIONS

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND TEST EQUIPMENT	(6) REMARKS
			C	O	F	H	D		
0106	Engine Lub System								
	Pump Oil	Replace			2.0			1.	
		Repair			1.0				
	Oil Filter	Replace		0.3					
02	Clutch								
	Clutch Assy	Adjust		.5				1.	
		Replace			1.5				
		Repair			1.0				
0202	Shuttle Release Mech								
	Linkage	Adjust		1.5					
		Replace		.5					
03	Fuel System							1.	
0301	Carburator								
		Adjust		0.3					E
		Replace		0.7					
		Repair			2 0				
0302	Fuel Pumps	Test		0.3				1.	
		Replace		0.4					
		Repair			1.0				
0304	Air Cleaner Hose Air Cleaner								
		Replace		0.2					
	Air Cleaner Assy	Service		0.2				1.	
		Replace		0.4					
		Repair		0.2					
0306	Tanks, Lines, Fittings								
	Hose, Fuel	Replace		0.1					
	Tank, Fuel	Service		0.2					
		Replace		1.5					
		Repair			2.0				
0308	Engine Speed Governor							1.	
	& Controls	Adjust		0.2					
		Replace		0.4					
0309	Fuel Filter							1.	
		Replace		0.3					

MAINTENANCE ALLOCATION CHART
SECTION II - ASSIGNMENT OF MAINTENANCE FUNCTIONS

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND TEST EQUIPMENT	(6) REMARKS
0312	Accellerator, Throttle or Choke								
	Throttle Control							1.	
		Adjust		0.3					
		Replace		1.0					
04	Exhaust System								
0401	Muffler & Pipes							1.	
		Replace		0.3					
05	Cooling System								
0501	Radiator	Test			0.3				
		Service	0.2						
		Replace		2.0				1.	
		Repair			2.0				
0503	Lines, Hoses, & Fittings								
	Thermostat							1.	
		Replace		0.5					
	Hose, Rubber	Inspect		0.2					
		Replace		0.5					
0504	Water Pump							1.	
		Replace		0.6					
0505	Fan Assy								
	Belt, V								
		Adjust		0.2					
		Replace		0.2					
	Fan	Replace		0.5					
06	Electrical System							1.	
0601	Generator Alternator	Replace		0.5					
		Repair			2.0				
0602	Generator, Regulator	Test		0.5					
		Replace		0.5				1.	
		Repair			1.0				
0603	Starting Motor								
		Replace		0.5					F
		Repair			1.5				
0605	Ignition Components								
	Distributor								G
	Ignition							1.	

MAINTENANCE ALLOCATION CHART
SECTION II - ASSIGNMENT OF MAINTENANCE FUNCTIONS

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND TEST EQUIPMENT	(6) REMARKS
		Adjust		0.2				1.	
		Replace		0.5					
		Repair		1.0					
	Spark Plugs, Shielded	Adjust		0.3					
		Replace		0.4					
	Lead, Spark Plug	Replace		0.2					
	Coil, Ignition	Test		0.2					
		Replace		0.2					
0607	Engine Control Panel							1.	
	Gage, Electrical	Replace		0.2					
0612	Batteries, Storage							1.	
		Test		0.2					
		Service	0.2						
		Replace		0.3					
0615	Radio Interference								
	Suppression							1.	
	Lead, Electrical	Replace		0.2					
	Capacitor, Filter	Test		0.1					
	Replace			0.2					
07	Transmission							1.	
0700	Transmission Assy	Service		0.7					
	Replace				8.0				
	Repair					12.0		1. 9.	
	Overhaul					16.0			
0704	Transmission Top								
	Cover Assembly	Replace		1.4					
		Repair		1.5					
15	Frame, Towing Attach-ments, Drawbar, & Articulated Systems								1.
1501	Frame Assy							1.	
		Replace				16.0			
		Repair			6.0				
18	Body, Cab, Hood & Hull								
1801	Acoustical Panels							1.	
		Replace		1.0					
1806	Seat	Replace		0.5					
		Repair		1.0					
1808	Tool Box	Replace		0.5					
Repair					0.5			1.	

MAINTENANCE ALLOCATION CHART
SECTION II - ASSIGNMENT OF MAINTENANCE FUNCTIONS

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND TEST EQUIPMENT	(6) REMARKS
20	Hoist, Winch, Capstan, Windlass, Power Control Unit, & Power Take-Off							1.	
2001	Winch Assy							1.	
	Reel, Wire	Replace		1.0					
		Repair		.5					
	Winch Assy	Adjust		0.3					
		Replace		2.5					
		Repair			1.0				
22	Body, Chassis & Hull Accessary Items							1.	
2210	Transportation Plate								
	Plate Instruction	Replace		0.2					
	Plate, Identification		Replace		0.2				
24	Hydraulic & Fluid Systems							1.	
2401	Hydraulic Motor								
		Replace		1.5					
		Repair			1.5				
	Hydraulic Pump	Replace		0.6					
		Repair			1.5			1.	
2402	Control Valve	Adjust		0.1					
		Replace		1.5					
		Repair			1.0				
2403	Hydraulic Controls and/ or Manual Controls							1.	
	Handle, Control								
		Replace		0.2					
	Gage, Pressure	Adjust			0.2				
		Replace		0.1					
2406	Strainers, Filters, Hose, Pipe Fittings, Tubing etc.								
	Strainer Assy								
		Service	0.1						
		Replace		0.2					
	Hose Assy								
		Replace		1.0					
2407	Hydraulic Cylinders	Replace		1.5				1.	
		Repair			2.0				

MAINTENANCE ALLOCATION CHART
SECTION II - ASSIGNMENT OF MAINTENANCE FUNCTIONS

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND TEST EQUIPMENT	(6) REMARKS
2408	Liquid Tank & Reservoirs								
	Cap, Breather	Service		0.1					
		Replace		0.1					
	Tank, Oil								
		Replace		1.0					
		Repair			0.5				
74	Cranes, Shovels & Earth Moving Equipment Components							1.	
7473	Lift & Swing Mech								
	Polesetter	Replace			3.0				
		Repair			2.5				
7474	Drive Mechanism								
	Drive, right angle								
		Service		1.1				1.	
		Adjust			0.5				
		Replace			4.0				
		Repair			3.0				
	Shaft, Drive	Service		0.1					
		Replace			1.0				
		Repair			.5				
	Drive, Main Drill Head	Service		0.2					
		Adjust			0.5				
		Replace			4.0				
		Repair			3.0				
7475	Spindle & Cutter								
	Auger, Bits & Points	Replace		0.6				1.	
		Repair			1.0				
7476	Feed & Leveling								
	Arm Cylinder Brace		1.						
		Replace		0.5					
	Barrel, Ram Feed								
		Replace			3.0				
	Shaft, Feed Ram Kelly	Replace			3.0				
7477	Hand Controls & Linkage							1.	
		Replace		1.0					
		Repair		0.5					

MAINTENANCE ALLOCATION CHART

SPECIAL TOOL AND SPECIAL TEST EQUIPMENT REQUIREMENTS

Reference Code	Maintenance Category	Nomenclature	Tool P/N
8	F	Ratcheting Chain Wrench	887-D (45225)

REMARKS

REFERENCE CODE	REMARKS
A-B	Compression and Operation.
B-I	Repair of Crankshaft includes, metalizing, alineing and grinding.
C-I	Repair of Flywheel includes replacing ring gear.
D-I	Repair of Valve includes refacing.
E-C	Service of Carburator includes replacing gasket set.
F-I	Repair of Starter includes replacing brushes only.
G-I	Repair of Distributor includes replacing contact set, condenser and rotor only.

MAINTENANCE ALLOCATION CHART

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
	1	Unless otherwise noted, all maintenance function can be accomplished with the tools contained in the following common tool sets		
	F,H	Shop Equip Contact Maint Truck Mounted	4940-00-294-9518	LTN T10138
	F,H	Shop Equip Gen Purp Repair Semitrir MTD	4940-00-287-4894	LIN T10549
	F,H	Shop Equip Org Repair Light Truck MTD	4940-00-29)4-9516	LIN T13152
	F,H	Tool Kit Automotive Fuel and Elec Sys Repair	4910-00-75)4-0655	LIN W32456
	O,F,H	tool Kit Auto Maint: ORG Maint Common #1	4910-00-754-0654	LIN W32593
	F,H	Tool Kit Auto ¥Yint: ORG Maint Common #2	4910-00-754-0650	LIN W32730
	O,F,H	Tool Kit Auto Mech: Light 5180-00-177-7033 Weight		LIN W33004
	F,H	Tool Kit Master Mech: Equip la9int & Repair	5180-00-699-5273	LIN W45060
	F,H	Wrench Set Socket: 3/4" Drive Hex Type	5130-00-357-5135	LIN Y75239
	F,H	Wrench Torque: 3/4" Drive 100-50o lb Capacity	5120-00-542-5577	LIN Y84966
	F,H	Shop Eqp Fuel & Elec Sys Engine	4910-00-754-0714	T30414
	F,H	Shop Set Fuel & Elec Sys Supp No. 2	4910-00-390-7775	T30688
	F,H	Test Set DSL InJ	4910-00-317-8265	V737L2

MAINTENANCE ALLOCATION CHART

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
	F,H	Shop Eqp Auto Maint & Repair Org Suppl No. 1 Less Power	4910-00-754-9653	W32867
	F,H	Shop Eqp Machine Shop	3740-00-754-0708	T15644
	F,H	Tool Kit Machinist	5280-0-511-1950	W44512
	F,H	Shop Eqp Welding	3740-01-357-7268	T16714
	F,H	Tool Kit Body & Fender Repair	518)-00-754-0643	W33689
	F,H	ILAltimeter	6625-00-999-7465	M89242
2	H	Conn Rd Bushing Removal & Instal-ling Tool		PLT-544-1
3	F	Vibration Dnmper Rub with Wear Sleeve & Damper		PLT-542
4	H	Crank Shaft Gear Nut Torque Wrench Adapter		PLT-518
5	F	Fan Drive Pulley Puller		PLT-506
6	H	Cyl Sleeve Puller		PLT-502-3
7	E	Rear Crank Shaft Oil Seal		PLT-51 3-7A
8	F,H	Ratohing Chain' Wrench		P/N 887-D (45225)

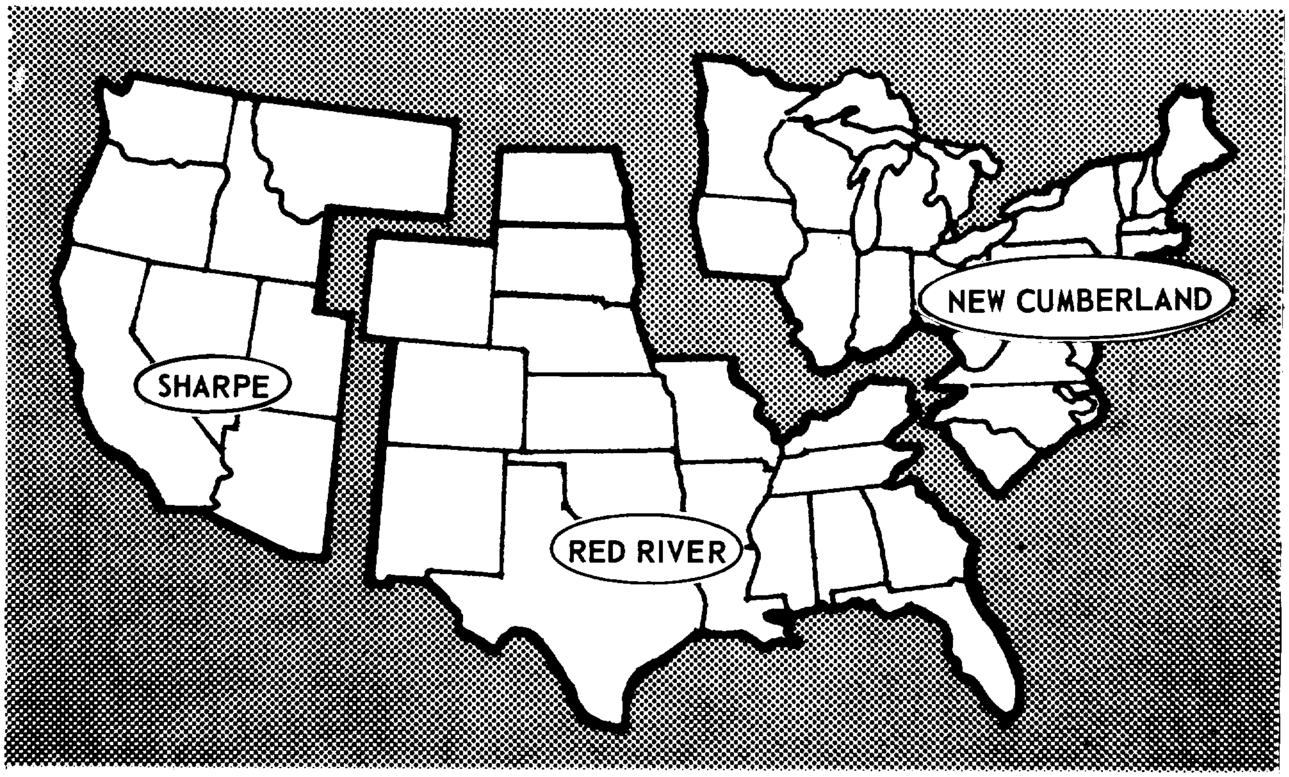
MAINTENANCE ALLOCATION CHART

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
9	F,H	Torque Wrench, 250) Ft lb Model PD2501	5120-00-482-2543	Y81747
10	H,D	Compression Test Adapter		PLT-521-8
11	H	Cylinder Head Water Test Kit		PLT-518
12	F	Spring Load Tester Valve & Clutch Spring Tester		PLT-100

DSS PROJECT CODES

Geographic Location	ASL	NSL
CONUS (Eastern US)	XDC	NSC
CONUS (Central US)	XDA	NSA
CONUS (Western US)	XDB	NSB

Designated Distribution Depot Support Areas.

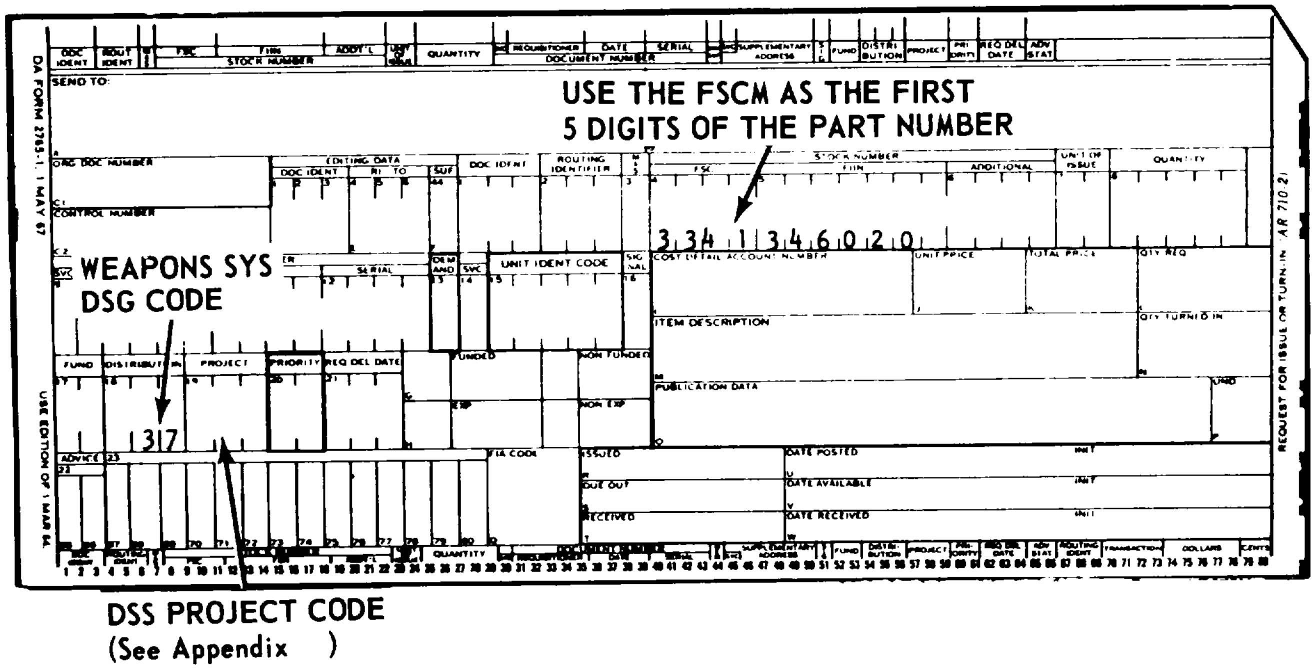


TA 126339

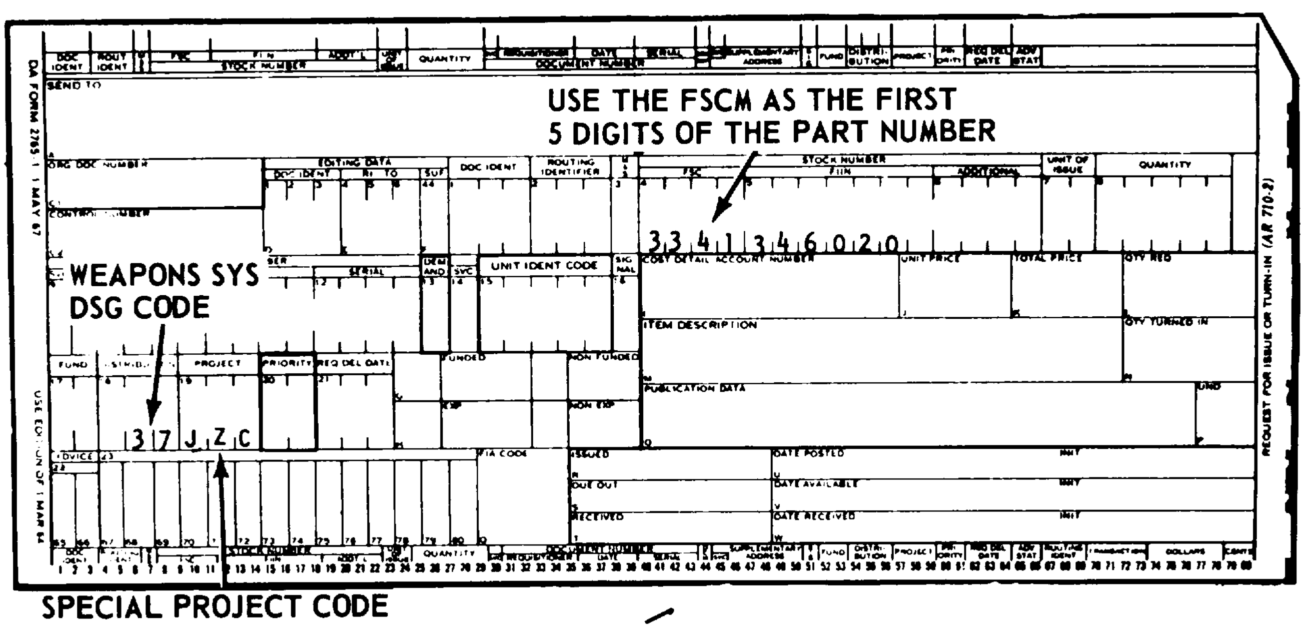
SAMPLE FORMAT

DA FORM 2765 PART NUMBER REQUEST

(CONUS REQUESTOR)

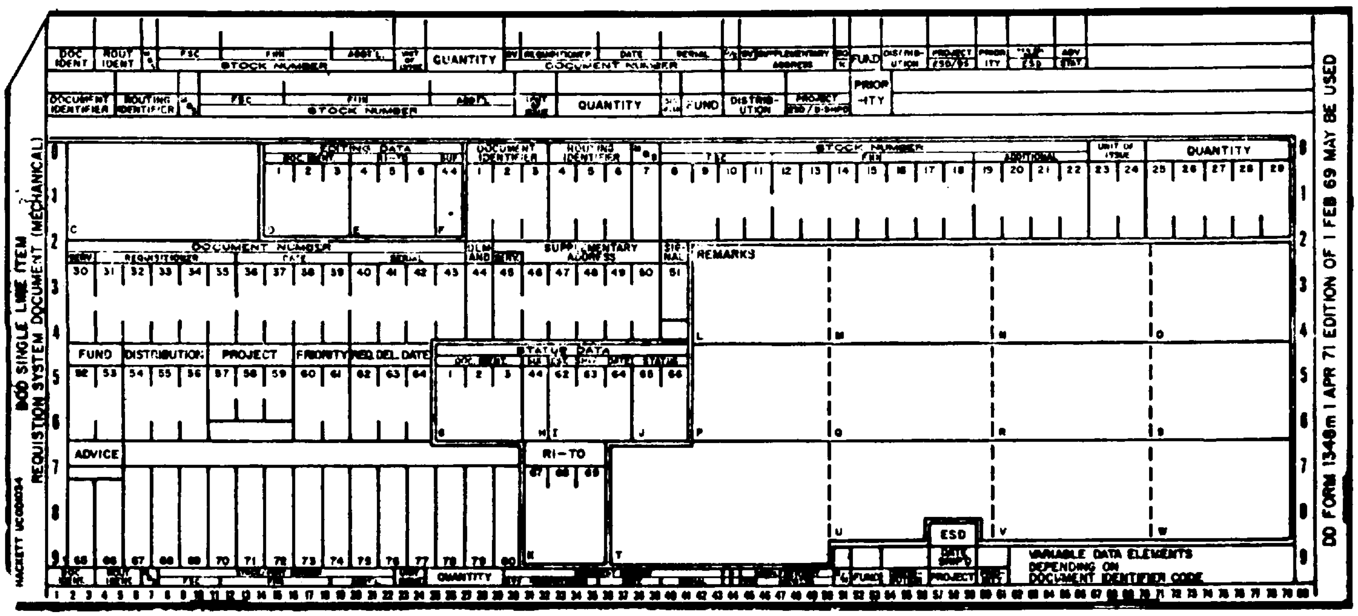


(OCONUS REQUESTOR)



TA 126340

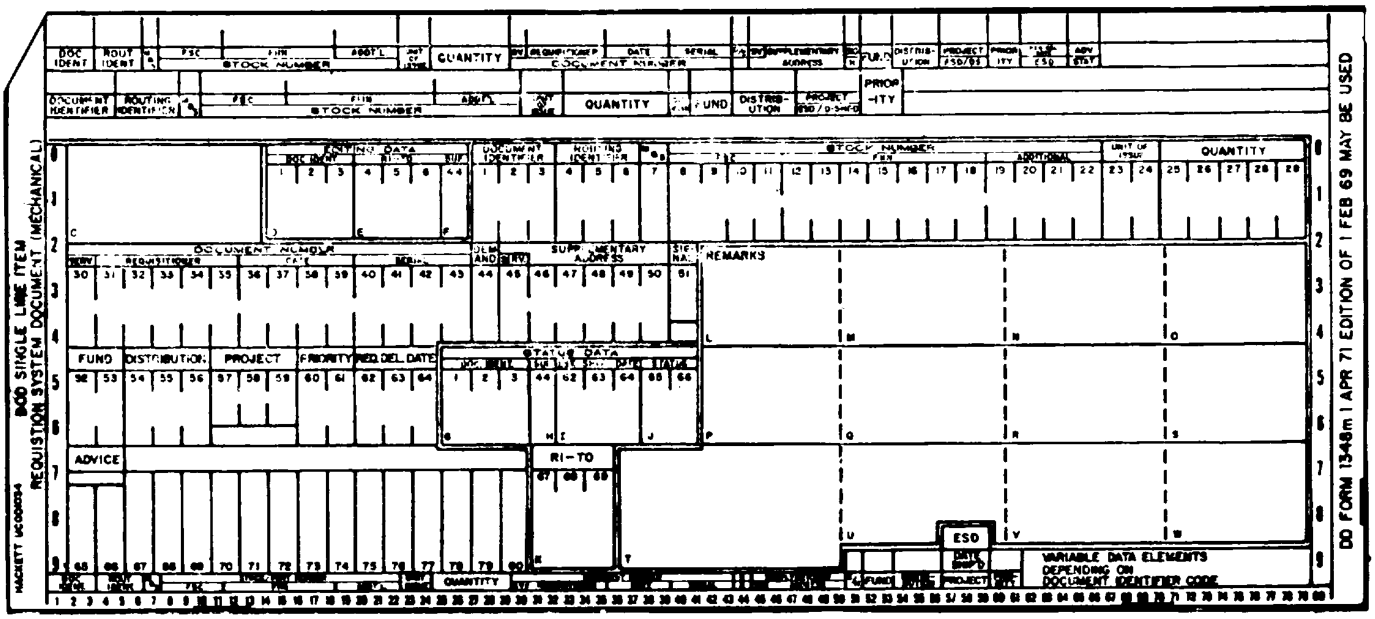
SAMPLE FORMAT - MILSTRIP REQUISITION FOR CCE (NSN)



CARD COLUMN	DESCRIPTION OF DATA	MANDATORY ENTRY FOR CCE
1-3	Document Identifier Code	AOA - CONUS Al1 - 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

SAMPLE FORMAT - MILSTRIP REQUISITION FOR CCE (NON-NSN)



CARD COLUMN	DESCRIPTION OF DATA	MANDATORY ENTRY FOR CCE
1-3	Document Identifier Code	AOB - 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	

APPENDIX D (Continued)

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)

DOCUMENT IDENTIFIER			ROUTING IDENTIFIER			M & S	MANUFACTURER'S CODE AND PART NUMBER * (FSCM)					(PART NUMBER)										UNIT OF ISSUE		QUANTITY					DOCUMENT NUMBER (SERV)	(REQUISITIONER)					(DATE)				(SERIAL)			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43

DEMAND	SUPPLEMENTARY ADDRESS (SERV)						SIGNAL	FUND CODE		DISTRIBUTION CODE			PROJECT CODE			PRIORITY		REQUIRED DELIVERY DATE			ADVICE CODE		BLANK															REJECT CODE (FOR USE BY SUPPLY SOURCE ONLY)	
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80		65	66

IDENTIFICATION DATA

* 1. MANUFACTURER'S CODE & PART NO. *(When they exceed Card Columns 8 thru 22)*	2. MANUFACTURER'S NAME
3. MANUFACTURER'S CATALOG IDENTIFICATION AND DATE	4. TECHNICAL ORDER NUMBER
5. TECHNICAL MANUAL NUMBER	6. NAME OF ITEM REQUESTED
7. DESCRIPTION OF ITEM REQUESTED	7a. COLOR 7b. SIZE
8. END ITEM APPLICATION AND SOURCE OF SUPPLY	

8a. MAKE	8b. MODEL NUMBER	8c. SERIES	8d. SERIAL NUMBER

9. REMARKS

FOLD LINE

FOLD LINE

DD FORM 1 JAN 71 1348-6 NON-NSN REQUISITION *(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
1 - 3	Document Identifier Code	AOE - CONUS A05 - 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	"F" for CONUS. (See AR 725-50 for overseas).
	CC-56	Weapon System Code
57 - 59	Project Code	Appropriate CCE Project Code
60 - 61	Priority Code	
62 - 64	Required Delivery Date	
65 - 66	Advice Code	
67 - 80	Blank	

IDENTIFICATION DATA - Lower half of DD Form 1348-6, complete blocks 1 thru 9.

TA 162337

APPENDIX F

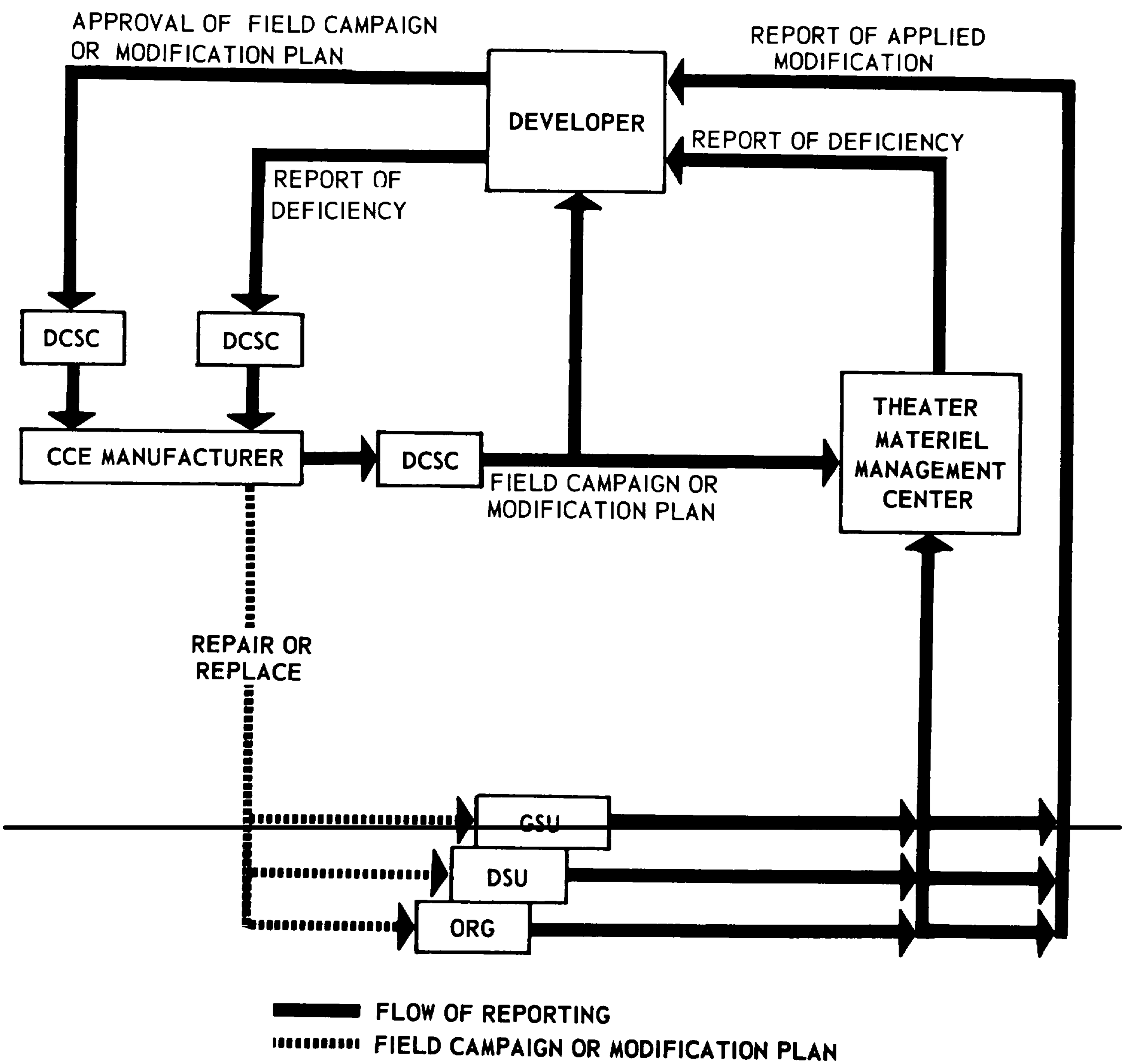
BASIC ISSUE ITEMS LIST

END ITEM NAME: Auger, Earth Skid Mounted, Type I	NSN: 3820-01-068-4078
MAKE/MODEL: Texoma 254-9	SERIAL NO. RANGE ALL TO ________

SMR CODE	NSN	DESCRIPTION MFG P/N (FSCM)	UNIT OF ISSUE	QTY INCL IN EQUIP
PFOZZ	7520-00-559-9618	Case Maintenance and operational Manual	Each	1
PFOZZ	7510-00-889-3494	Binder, Log Book	Each	1

APPENDIX G

CCE MANUFACTURER FIELD CAMPAIGNS
AND
MODIFICATION PROCEDURES



TA 162338

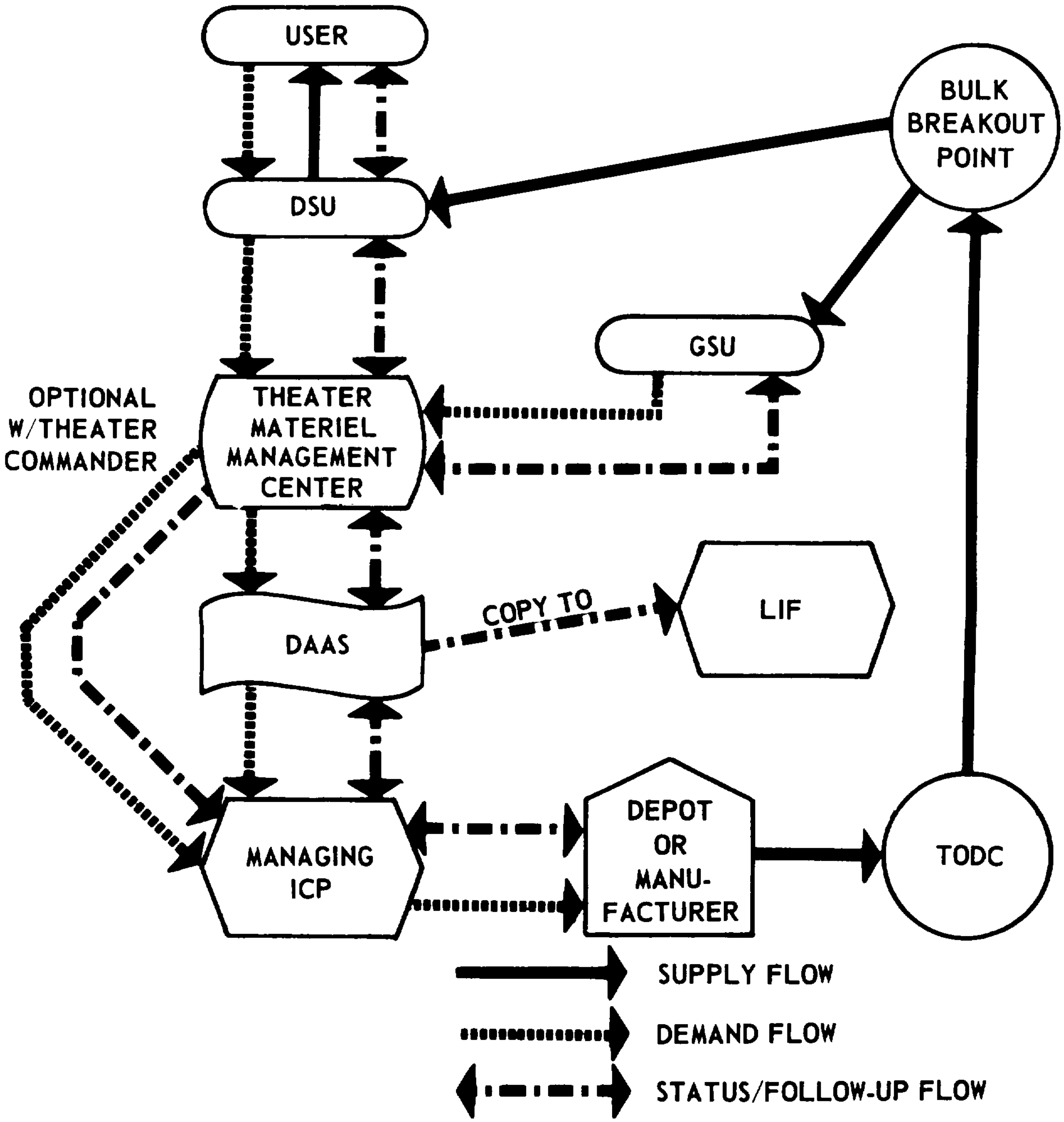
APPENDIX H

END ITEM: Auger, Earth, Skid Mounted, Type I	MAKE: Texoma	MODEL: 254-9

PCCN: DSA 700-77-C-8457	NSN: 3820-01-068-4078	SERIALNUMBER RANGE ALL TO ______	DATE:

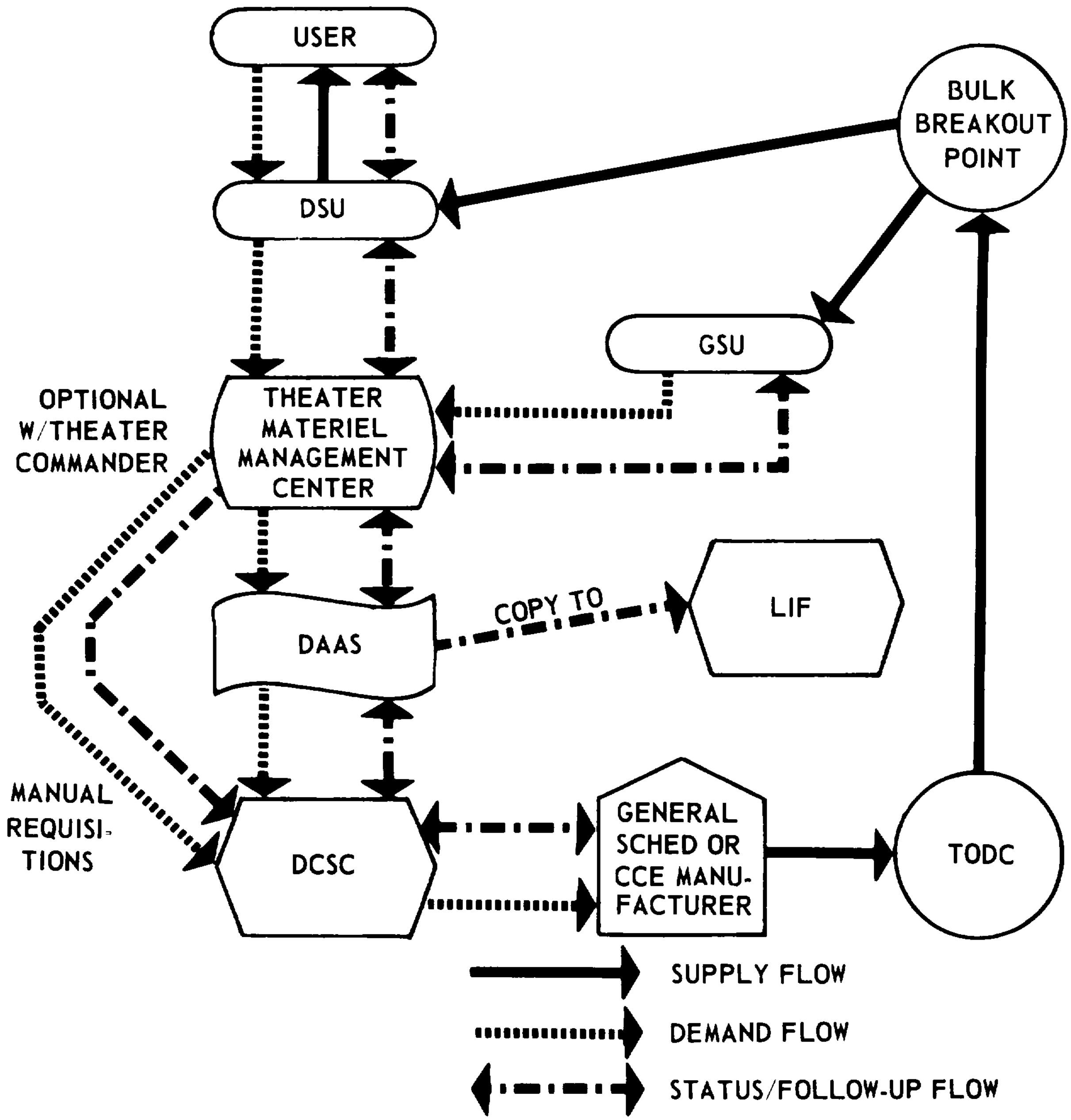
SMR CODE	NSN	PART NUMBER	FSCM	PART DESCRIPTION	U/M	QTY OF PARTS REQ'D FOR NO. OF END ITEMS PLL	ASL		
						1-5	1-5	6-20	21-50
PAOZZ	2940-00-986-0276	C1AZ6731A	90927	Element, Filter Engine	EA	1	3	6	
PAOZZ	2910-00-820-2355	369988R91	31007	Strainer, Fuel	EA	1	3	6	
PAOZZ	2910-00-119-0644	C5DE9350B	90927	Pump Assy, Fuel	EA	1	2	3	
PAOZZ	2910-00-347-4080	C3AZ9417B	90927	Gasket, Fuel Pump	EA	1	3	6	

FLOW OF REQUISITIONS AND MATERIEL
CCE PARTS (NSN)



TA 126332

FLOW OF REQUISITIONS AND MATERIEL
CCE PARTS (NON-NSN)



TA 126333

APPENDIX K

MAINTENANCE AND OPERATING SUPPLY LIST (CCE)

NOMENCLATURE:	MAKE:	MODEL:
Auger, Earth, Skid Mounted, Type I	Texoma	254-9

MFR PART NO:	NSN:	SERIAL NO. RANGE:	DATE:
M-254-9	3820-01-068-4078	——— TO ———	31 Jan 79

(1) COMPONENT APPLICATION	(2) MFR PART NO. OR NAT'L STOCK NO.	(3) DESCRIPTION	(4) QTY REQ F/INITIAL OPN	(5) QTY REQ F/8 HRS OPN	(6) NOTES
Engine Transmission Torque Converter Hydraulic System Grease Lubrication Points		See Auger Operator and Maintenance Instructions, Section XV Page 4-28 & 4-29, Lubrication and Oil Specifications and Diagram. Also, See Part II, Page 5 of this SOMARPI for Lubrication NSNs.			

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

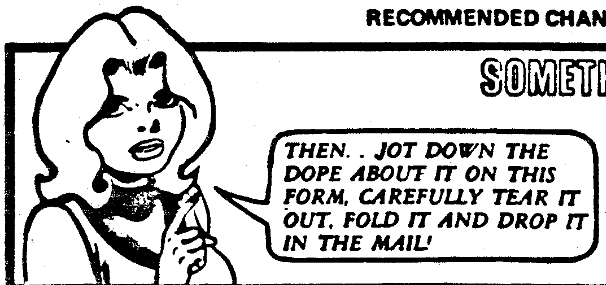
J. C. PENNINGTON
Major General, United States Army
The Adjutant General

Distribution:
To be distributed in accordance with DA Form 12-25B, Operator maintenance requirements for Earth Drilling Machine.

* U. S. GOVERNMENT PRINTING OFFICE: 1991--281-504/42377

TEAR ALONG PERFORATED LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



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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.

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

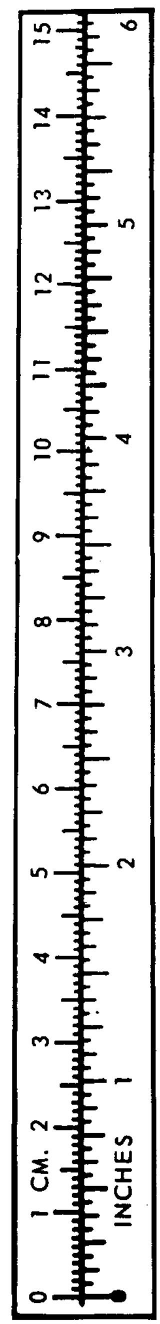
TEMPERATURE

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
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
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
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
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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