FIATALLIS®

FUEL INJECTION PUMP

(ROOSA MASTER DM Series)

service manual and parts catalog

FIATALLIS®

AVOID ACCIDENTS

Most accidents, whether they occur in industry, on the farm, at home or on the highway, are caused by the failure of some individual to follow simple and fundamental safety rules or precautions. For this reason MOST ACCIDENTS CAN BE PREVENTED by recognizing the real cause and doing something about it before the accident occurs.

Regardless of the care used in the design and construction of any type of equipment there are conditions that cannot be completely safeguarded against without interfering with reasonable accessibility and efficient operation.

A careful operator is the best insurance against an accident.
The complete observance of one simple rule would prevent many
thousand serious injuries each year.
That rule is:

Never attempt to clean, oil or adjust a machine while it is in motion.

WARNING

On machines having hydraulically, mechanically, and/or cable controlled equipment (such as shovels, loaders, dozers, scrapers, etc.) be certain the equipment is lowered to the ground before servicing, adjusting and/or repairing. If it is necessary to have the hydraulically, mechanically, and/or cable controlled equipment partially or fully raised to gain access to certain items, be sure the equipment is suitably supported by means other than the hydraulic lift cylinders, cable and/or mechanical devices used for controlling the equipment.

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Form 73112988 English

⚠ WARNING

STUDY THE OPERATION AND MAINTENANCE INSTRUCTION MANUAL THROUGH BEFORE STARTING. OPERATING, MAINTAINING, FUELING OR SERVICING THIS MACHINE.

⚠ The Operation and Maintenance Instruction Manual provides the instructions and procedures for starting, operating, maintaining, fueling, shutdown and servicing that are necessary for properly conducting the procedures for overhaul of the related components outlined in this Service Manual.

⚠ This symbol is your safety alert sign. It MEANS ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED.

⚠ Read and heed all safety instructions carrying the signal words WARNING and DANGER.

⚠ Machine mounted safety signs have been color coded yellow with black borders and lettering for warning and red with white borders and lettering for danger points.

FIAT-ALLIS

SUPPLEMENT NO. 5
FUEL INJECTION PUMP
(ROOSA-MASTER DM SERIES)
SERVICE MANUAL AND PARTS CATALOG
FORM 73112988

(1-81)

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or
Fiat-Allis M.M.T. S.p.A. - MAGAZZINO STAMPATI - Viale Torino, 0 STUPINIGI (Torino) - Italy

Replace the following like pages:

1-7 (No change)
1-8 (Revised)

6-3 (Revised)
6-4 (Revised)

6-5 (Revised)
6-6 (Revised)

9-1 (Revised)
9-2 (No change)

9-5 (Revised)
9-6 (Revised)

9-7 (Revised)
9-8 (No change)

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(No change)

12-13 (No change)
12-14 (Revised)

12-25 (Revised)
12-26 (No change)

12-31 (Revised)
12-32 (Revised)

12-35 (No change)
12-36 (Revised)

NOTICE
THESE CHANGES ARE INCLUDED IN THIS COPY

REASON: Add spring colors to text; delete (not-used) speed light load advance information; add timing information, page 9-1; include additional calibration data, pages 9-5, 9-6, 9-7; add Fiat-Allis tool part numbers, page 11-1.

FIAT-ALLIS

SUPPLEMENT NO. 4
FUEL INJECTION PUMP
(ROOSA-MASTER DM SERIES)
SERVICE MANUAL AND PARTS CATALOG
FORM 73112988

(11-79)

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Write in the following changes:

Page 5-16 (after STEP 18)
NOTE: Be sure the governor sprir correct -- compare the color of the spring with color indicat parts catalog.

Page 5-17 (add at bottom of first column -- in STEP 21)
NOTE: Be sure the advance sp correct -- compare the color of the spring with dicated in parts catalog.

NOTICE
THESE CHANGES ARE INCLUDED IN THIS COPY

Page 12-3			
27	74061781	1	SPRIN control (Black - Brown)
Page 12-7			
27	74061836	1	SPRING, governor control (Green - Blue)
Page 12-8			
97	74059667	1	SPRING, outer advance (Yellow - Yellow)
Page 12-13			
27	74061836	1	SPRING, governor control (Blue - Blue)
Page 12-14			
97	74059662	1	SPRING, outer advance (Black - Green)
Page 12-19			
27	74061836	1	SPRING, governor control (Blue - Blue)
Page 12-20			
97	74059662	1	SPRING, outer advance (Black - Green)
Page 12-25			
27	74061836	1	SPRING, governor control (Blue - Blue)

(Continued)

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SUPPLEMENT NO. 3
FUEL INJECTION PUMP
(ROOSA-MASTER DM SERIES)
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FORM 73112988

(6-79)

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Replace the following like pages:

9-1	(Revised)	12-7	(Revised)	12-33	(Revised)
9-2	(No change)	12-8	(No cha[illegible])	12-34	(Added)
9-3	(No change)	12-9	(No[illegible]	12-35	(Added)
9-4	(Revised)	12-10	([illegible]	12-36	(Added)
9-5	(Revised)	12-2[illegible]	[illegible]	12-37	(Added)
9-6	(Revised)	12[illegible]	[illegible]	12-38	(Added)
9-7	(Added)		[illegible]ised)		
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NOTICE
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Reason: Add Service Manual data for new series engines.

FIAT-ALLIS

SUPPLEMENT NO. 2
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(3-79)

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Write in the following changes:

Page 9-6			
Timing B.T.D.C.	16° Static	~~18°~~ 14° Static	~~18°~~ 14° Static
Page 12-13			
USAGE: 645-B Wheel Loader (Model ~~11000~~ 3500 MK II			

NOTICE
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SUPPLEMENT NO. 1
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Replace the following pages:

V (Revised)
VI (No change)

8-1 (Revised)
8-2 (Revised)

8-3 (Revised)
8-4 (Revised)

8-5 (Added)
Blank

9-1 (Revised)
9-2 (Revised)

9-3 (Revised)
9-4 (Revised)

9-5 (Added)
9-6 (Added)

12-3 (Revised)
12-4 (Revised)

12-5 (Revised)
12-6 (Revised)

12-7 (Revised)
12-8 (Revised)

12-9 (Revised)
12-10 (Revised)

12-11 (Added)
12-12 (Added)

12-13 (Added)
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12-15 (Added)
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12-29 (Added)
12-30 (Added)

12-31 (Added)
12-32 (Added)

12-33 (Added)
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NOTICE
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Reason: To provide complete fuel injection pump service, calibration and parts information, for the "DM" series pump as applicable to the 262-B, 263-B Scrapers, 545-B, 605-B, 645-B and 745-C Wheel loaders and the 100-C, 150-C and 200-C Graders.

SAFETY RULES

GENERAL

Study the Operation and Maintenance Instruction Manual before starting, operating, maintaining, fueling, or servicing machine.

Read and heed all machine-mounted safety signs before starting, operating, maintaining, fueling or servicing machine.

Machine-mounted safety signs have been color coded yellow with black border and lettering for ***WARNING*** and red with white border and lettering for ***DANGER*** points.

Never attempt to operate the machine or its tools from any position other than seated in the operator's seat. Keep head, body, limbs, hands and feet inside operator's compartment at all times to reduce exposure to hazards outside the operator's compartment.

Do not allow unauthorized personnel to operate service or maintain this machine.

Always check work area for dangerous features. The following are examples of dangerous work areas: slopes, over hangs, timber, demolitions, fire, high walls, drop off, back fills, rough terrain, ditches, ridges, excavations, heavy traffic, crowded parking, crowded maintenance and closed areas. Use extreme care when in areas such as these.

An operator must know the machine's capabilities. When working on slopes or near drop offs be alert to avoid loose or soft conditions that could cause sudden tipping or loss of control.

Do not jump on or off machine. Keep two hands and one foot, or two feet and one hand, in contact with steps grab rails and handles at all times.

Do not use controls or hoses as hand holds when climbing on or off machine. Hoses and controls are movable and do not provide a solid support. Controls also may be inadvertently moved causing accidental machine or equipment movement.

Keep operator's compartment, stepping points, grab-rails and handles clear of foreign objects, oil, grease, mud or snow accumulation to minimize the danger of slipping or stumbling. Clean mud or grease from shoes before attempting to mount or operate the machine.

Be careful of slippery conditions on stepping points, hand rails, and on the ground. Wear safety boots or shoes that have a high slip resistant sole material.

For your personal protection. Do not attempt to climb on or off machine while machine is in motion.

Never leave the machine unattended with the engine running.

Always lock up machine when leaving it unattended. Return keys to authorized security. Heed all shut down procedures of the Operation and Maintenance Instruction Manual. Always set the parking brake when leaving the machine for any reason.

Do not wear rings, wrist watches, jewelry, loose or hanging apparel, such as ties, torn clothing, scarves, unbuttoned or unzipped jackets that can catch on moving parts. Wear proper safety equipment as authorized for the job. Examples: hard hats, safety shoes, heavy gloves, ear protectors, safety glasses or goggles, reflector vests, or respirators. Consult your employer for specific safety equipment requirements.

Do not carry loose objects in pockets that might fall unnoticed into open compartments. Do not use machine to carry loose objects by means other than attachments for carrying such objects.

DO NOT CARRY RIDERS unless the machine is equipped for carrying people to reduce personal exposure to being thrown off.

Do not operate machinery in a condition of extreme fatigue or illness. Be especially careful towards the end of the shift.

Roll Over Protective Structures are required on wheel loaders, dozer tractors, track type loaders, graders and scrapers by local or national requirements. *DO NOT* operate this machine without a Roll Over Protective Structure.

Do not operate a machine without a falling object protective structure (FOPS).

Do not operate this machine without a rear canopy screen when machine is equipped with rear mounted towing winch.

Seat belts are required to be provided with roll over protective structures or roll protection cabs by local or national regulations. Keep the safety belt fastened around you during operation.

Where noise exposure exceeds 90 dBA for 8 hours, wear authorized ear protective equipment per local or national requirements that apply.

Keep clutches and brakes on machine and attachments such as power control units, winches and master clutches adjusted according to Operation and Maintenance Instruction Manuals of the manufacturers at all times. *DO NOT* adjust machine with engine running except as specified.

Do not operate a machine with brakes out of adjustment. See the Operation and Maintenance Instruction Manual.

Move carefully when under, in or near machine or implements. Wear required protective equipment, such as hard hat, safety glasses, safety shoes, ear protectors.

To move a disabled machine, use a trailer or low boy truck if available. If towing is necessary, provide warning signals as required by local rules and regulations and follow Operation and Maintenance Instruction Manual recommendations. Load and unload on a level area that gives full support to the trailer wheels. Use ramps of adequate strength, low angle and proper height. Keep trailer bed clean of clay, oil and all materials that become slippery. Tie machine down securely to truck or trailer bed and block tracks (or wheels) as required by the carrier.

SAFETY RULES

To prevent entrapment in cabs or mounted enclosures, observe and know the mechanics of alternate exit routes.

On machines equipped with suction radiator fans, be sure to periodically check all engine exhaust parts for leaks as exhaust gases are dangerous to the operator. Keep a vent open to outside air at all times when operating within a closed cab.

STARTING FLUID IS FLAMMABLE. Follow the recommendations as outlined in the Operation and Maintenance Instruction Manual and as marked on the containers. Store containers in cool, well-ventilated place secure from unauthorized personnel. *DO NOT PUNCTURE OR BURN CONTAINERS.*

Follow the recommendations of the manufacturer for storage and disposal.

Wire rope develops steel slivers. Use authorized protective equipment such as heavy gloves, safety glasses when handling.

OPERATION

Before starting machine, check, adjust and lock the operator's seat for maximum comfort and control of the machine.

DO NOT START OR OPERATE AN UNSAFE MACHINE. Before working the machine, be sure that any unsafe condition has been satisfactorily remedied. Check brakes, steering and attachment controls before moving. Advise the proper maintenance authority of any malfunctioning part or system. Be sure all protective guards or panels are in place, and all safety devices provided are in place and in good operating condition.

Check instruments at start-up and frequently during operation.

Do not run the engine of this machine in closed areas without proper ventilation to remove deadly exhaust gases.

Be sure exposed personnel in the area of operation are clear of the machine before moving the machine or its attachments. *WALK COMPLETELY AROUND* the machine before mounting. Sound horn. Obey flag man, safety signals and signs.

Know the principles of cross steering of crawler tractors. Read section in Operation and Maintenance Instruction Manual on cross steering.

Keep engine exhaust system and exhaust manifolds clear of combustible material. Equip machine with screens and guards when working under conditions of flying combustible material.

If engine has a tendency to stall for any reason under load or idle, report this for adjustment to a proper maintenance authority immediately. Do not continue to operate machine until condition has been corrected.

Never use bucket as a man-lift.

Use recommended bucket for machine and material load ability and heaping characteristics of material, terrain, and other pertinent job conditions.

Avoid abrupt starts and stops when transporting a loaded bucket.

Inspect your seat belt webbing and hardware at least twice a year for signs of fraying, wear or other weakness that could lead to failure.

Use only designated towing or pulling attachment points. Use care in making attachment. Be sure pins and locks as provided are secure before pulling. Stay clear of draw bars, cables or chains under load.

When pulling or towing through a cable or chain, do not start suddenly at full throttle. Take up slack carefully. Guard against kinking chains or cables. Inspect carefully for flaws before using. Do not pull through a kinked chain or cable due to the high stresses and possibility of failure of the kinked area. Always wear heavy gloves when handling chain or cable.

Be sure cables are anchored and the anchor point is strong enough to handle the expected load. Keep exposed personnel clear of anchor point and cable or chain. *DO NOT PULL OR TOW UNLESS OPERATOR'S COMPARTMENT OF MACHINES INVOLVED ARE PROPERLY GUARDED AGAINST POTENTIAL CABLE OR CHAIN BACKLASH.*

During operation always carry ripper in full raised position when not in use and lowered to ground when parked.

When counterweights have been provided, do not work machine if they have been removed unless their equivalent weight has been replaced. See the Operation and Maintenance Instruction Manual.

When operating a machine know what clearances will be encountered, overhead doors, wires, pipes, aisles, roadways; also the weight limitations of ground, floor, and ramps.

Know bridge and culvert load limits and do not exceed them. Know machine's height, width, and weight. Use a signal person when clearance is close.

Be sure that the exact location of gas lines, utility lines, sewers, overhead and buried power lines, and other obstructions or hazards are known. Such locations should be precisely marked by the proper authorities to reduce the risk of accidents. Obtain shut-down or relocation of any such facilities before starting work, if necessary.

Be certain to comply with all local, state, and federal regulations regarding working in the vicinity of power lines.

When roading find out what conditions are likely to be met - clearances, congestion, type of surface, etc. Be aware of fog, smoke or dust element that obscure visibility.

When backing, always look to where the machine is to be moved. Be alert to the position of exposed personnel. *DO NOT OPERATE* if exposed personnel enter the immediate work area.

SAFETY RULES

Never travel a machine on a job site, in a congested area, or around people without a signal person to guide the operator.

In darkness, check area of operation carefully before moving in with machine. Use all lights provided. Do not move into area of restricted visibility.

Maintain clear vision of all areas of travel or work. Keep cab windows clean and repaired. Carry blade low for maximum visibility while traveling. Obtain and use fan blast deflectors where tractors are used a pusher tractors in tandem.

Transport a loaded bucket with the bucket as far tipped back and in as low a position as possible for maximum visibility, stability, and safest transport of the machine. Carry it at a proper speed for the load and ground conditions.

Carry the bucket low when traveling with a load.

Maintain a safe distance from other machines. Provide sufficient clearance for ground and visibility conditions. Yield right-of-way to loaded machines.

Avoid going over obstacles such as rough terrain, rocks, logs, curbs, ditches ridges, and railroad tracks whenever possible. When obstructions must be crossed, do so with extreme care at an angle if possible. Reduce speed - down-shift. Ease up to the break over point - pass the balance point slowly on the obstruction and ease down on the other side.

Cross gullies or ditches at an angle with reduced speed after insuring ground conditions will permit a safe traverse.

Be alert to soft ground conditions close to newly constructed walls. The fill material and weight of machine may cause the wall to collapse under the machine.

Operate at speeds slow enough to insure complete control at all times. Travel slowly over rough ground, on slopes or near drop offs, in congested areas or on ice or slippery surfaces.

Be alert to avoid changes in traction conditions that could cause loss of control. *DO NOT* drive on ice or frozen ground conditions when working the machine on steep slopes or near drop offs.

Keep the machine well back from the edge of an excavation.

Be especially careful when traveling up or down slopes. Position the bucket in such a way as to provide a possible anchorage on the ground in case of a slide.

When proceeding across a hill side proceed slowly. Never turn sharply up hill or down hill.

Avoid side hill travel whenever possible. Drive up and down the slope. Should the machine start slipping sideways on a grade, turn it immediately downhill.

In steep down hill operation, do not allow engine to over speed. Select proper gear before starting down grade.

There is no substitute for good judgement when working on slopes.

The grade of slope you should attempt will be limited by such factors as condition of the ground, load being handled, the type of machine, speed of machine and visibility.

NEVER COAST the machine down grades and slopes with the transmission in neutral on power shift machines, or clutch disengaged on manually shifted machines.

To reduce the danger of uncontrolled machine, choose a gear speed before proceeding down grade that will hold machine to proper speeds for conditions.

Operating in virgin rough terrain that includes previously mentioned hazards is called pioneering. Be sure you know how this is done. Danger from falling branches and upturning roots is acute in these areas.

When pushing over trees, the machine must be equipped with proper over head guarding. Never allow a machine to climb up on the root structure particularly while the tree is being felled. Use extreme care when pushing over any tree with dead branches.

Avoid brush piles, logs or rocks. *DO NOT DRIVE THE MACHINE ONTO BRUSH PILES, LOGS, LARGE ROCKS* or other surface irregularities that break traction with the ground especially when on slopes or near drop offs.

Avoid operating equipment too close to an over hang or high wall either above or below the machine. Be on the look out for caving edges, falling objects and slides. Beware of concealment by brush and under growth of these dangers.

Park in a non-operating and non-traffic area or as instructed. Park on firm level ground if possible. Where not possible, position machine at a right angle to the slope, making sure there is no danger of uncontrolled sliding movement. Set the parking brake.

Never park on an incline without carefully blocking the machine to prevent movement.

If parking in traffic lanes cannot be avoided, provide appropriate flags, barriers, flares and warning signals as required. Also provide advance warning signals in the traffic lane of approaching traffic.

Move the machine away from pits, trenches, overhangs and over head power lines before shutting down for the day.

When stopping operation of the machine for any reason, always return the transmission or hydrostatic drive control to neutral and engage the control lock to secure the machine for a safe start up. Set parking brake, if so equipped.

Never lower attachments or tools from any position other than seated in operator's seat. Sound the horn. Make sure the area near the attachment is clear. Lower the attachment slowly. *DO NOT USE* float position to lower hydraulic equipment.

SAFETY RULES

Always before leaving the operator's seat and after making certain all people are clear of the machine, slowly lower the attachments or tools flat to the ground in a positive ground support position. Move any multi purpose tool to positive closed position. Return the controls to hold. Place transmission control in neutral and move engine controls to off position. Engage all control locks, set parking brake, and open and lock the master (key, if so equipped) switch. Consult Operation and Maintenance Instruction Manual.

Always follow the shut down instructions as outlined in the Operation and Maintenance Instruction Manual.

MAINTENANCE

Do not perform any work on equipment that is not authorized. Follow the Maintenance or Service Manual procedures.

Machine should not be serviced with anyone in the operator's seat unless they are qualified to operate the machine and are assisting in the servicing.

Shut off engine and disengage the Power Take Off lever if so equipped before attempting adjustments or service.

Always turn the master switch (key switch if so equipped) to the *OFF* position before cleaning, repairing, or servicing and when parking machine to forestall unintended or unauthorized starting.

Disconnect batteries and *TAG* all controls according to local or national requirements to warn that work is in progress. Block the machine and all attachments that must be raised per local or national requirements.

Never lubricate, service or adjust a machine with the engine running, except as called for in the Operation and Maintenance Instruction Manual. Do not wear loose clothing or jewelry near moving parts.

Do not run engine when refueling and use care if engine is hot due to the increased possibility of a fire if fuel is spilled.

Do not smoke or permit any open flame or spark near when refueling, or handling highly flammable materials.

Always place the fuel nozzle against the side of the filler opening before starting and during fuel flow. To reduce the chance of a static electricity spark, keep contact until after fuel flow is shut off.

Do not adjust engine fuel pump when the machine is in motion.

Never attempt to check or adjust fan belts when engine is running.

When making equipment checks that require running of the engine, have an operator in the operator's seat at all times with the mechanic in sight. Place the transmission in neutral and set the brakes and lock. *KEEP HANDS AND CLOTHING AWAY FROM MOVING PARTS.*

Avoid running engine with open unprotected air inlets. If such running is unavoidable for service reasons, place protective screens over all inlet openings before servicing engine.

Do not place head, body, limbs, feet, fingers, or hands near rotating fan or belts. Be especially alert around a pusher fan.

Keep head, body, limbs, feet, fingers, or hands away from bucket, blade or ripper when in raised position.

If movement of an attachment by means of machine's hydraulic system or winches is required for service or maintenance, do not raise or lower attachments from any position other than when seated in the operator's seat. Before starting machine or moving attachments or tools, set brakes, sound horn and call for an all clear. Raise attachments slowly.

Never place head, body, limbs, feet, fingers, or hands into an exposed portion between uncontrolled or unguarded scissor points of machine without first providing secure blocking.

Never align holes with fingers or hands - Use the proper aligning tool.

Disconnect batteries before working on electrical system or repair work of any kind.

Check for fuel or battery electrolyte leaks before starting service or maintenance work. Eliminate leaks before proceeding.

BATTERY GAS IS HIGHLY FLAMMABLE. Leave battery box open to improve ventilation when charging batteries. Never check charge by placing metal objects across the posts. Keep sparks or open flame away from batteries. Do not smoke near battery to guard against the possibility of an accidental explosion.

Do not charge batteries in a closed area. Provide proper ventilation to guard against an accidental explosion from an accumulation of explosive gases given off in the charging process.

Be sure to connect the booster cables to the proper terminals (+ to +) and (- to -) at both ends. Avoid shorting clamps. Follow the Operation and Maintenance Instruction Manual procedure.

Due to the presence of flammable fluid, never check or fill fuel tanks, storage batteries or use starter fluid near lighted smoking materials or open flame or sparks.

Rust inhibitors are volatile and flammable. Prepare parts in well ventilated place. Keep open flame away - *DO NOT SMOKE.* Store containers in a cool well ventilated place secured against unauthorized personnel.

Do not use an open flame as a light source to look for leaks or for inspection anywhere on the machine.

DO NOT pile oily or greasy rags - they are a fire hazard. Store in a closed metal container.

SAFETY RULES

Never use gasoline or solvent or other flammable fluid to clean parts. Use authorized commercial, non-flammable, non-toxic solvents.

Never place gasoline or diesel fuel in an open pan.

Shut off engine and be sure all pressure in system has been relieved before removing panels, housings, covers, and caps. See Operation and Maintenance Instruction Manual.

Do not remove hoses or check valves in the hydraulic system without first removing load and relieving pressure on the supporting cylinders. Turn radiator cap slowly to relieve pressure before removing. Add coolant only with engine stopped or idling if hot. See Operation and Maintenance Instruction Manual.

Fluid escaping under pressure from a very small hole can almost be invisible and can have sufficient force to penetrate the skin. Use a piece of card board or wood to search for suspected pressure leaks. *DO NOT USE HANDS.* If injured by escaping fluid, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered immediately.

Never use any gas other than dry nitrogen to charge accumulators. See Operation and Maintenance Instruction Manual.

When making pressure checks use the correct gauge for expected pressure. See the Operation and Maintenance Instruction Manual or Service Manual for guidance.

For field service, move machine to level ground if possible and block machine. If work is absolutely necessary on an incline, block machine and its attachments securely. Move the machine to level ground as soon as possible.

Brakes are inoperative when manually released for servicing. Provision must be made to maintain control of the machine by blocking or other means.

Block all wheels before bleeding or disconnecting any brake system lines and cylinders.

Never use make shift jacks when adjusting track tension. Follow the Undercarriage Service Manual.

Know your jacking equipment and its capacity. Be sure the jacking point used on the machine is appropriate for the load to be applied. Be sure the support of the jack at the machine and under the jack is appropriate and stable. Any equipment up on a jack is dangerous. Transfer load to appropriate blocking as a safety measure before proceeding with service or maintenance work according to local or national requirements.

Always block with external support any linkage or part on machine that requires work under the raised linkage, parts, or machine per local or national requirements. Never allow anyone to walk under or be near unblocked raised equipment. Avoid working or walking under raised blocked equipment unless you are assured of your safety.

When servicing or maintenance requires access to areas that cannot be reached from the ground, use a ladder or step platform that meets local or national requirements to reach the service point. If such ladders or platforms are not available, use the machine hand holds and steps as provided. Perform all service or maintenance carefully.

Shop or field service platforms and ladders used to maintain or service machinery should be constructed and maintained according to local or national requirements.

Lift and handle all heavy parts with a lifting device of proper capacity. Be sure parts are supported by proper slings and hooks. Use lifting eyes if provided. Watch out for people in the vicinity.

In lifting and handling heavy parts, slings must be of adequate strength for the purpose intended and must be in good condition.

Handle all parts with extreme care. Keep hands and fingers from between parts. Wear authorized protective equipment such as safety glasses, heavy gloves, safety shoes.

When using compressed air for cleaning parts use safety glasses with side shields or goggles. Limit the pressure to 207 kPa (30 psi) according to local or national requirements.

Wear welders protective equipment such as dark safety glasses, helmets, protective clothing, gloves and safety shoes when welding or burning. Wear dark safety glasses near welding. *DO NOT LOOK AT ARC WITHOUT PROPER EYE PROTECTION.*

Replace seat belts every two years on open canopy units and every three years on machines with cabs or at change of ownership.

Wear proper protective equipment such as safety goggles or safety glasses with side shields, hard hat, safety shoes, heavy gloves when metal or other particles are apt to fly or fall.

Use only grounded auxiliary power source for heaters, chargers, pumps and similar equipment to reduce the hazards of electrical shock.

Keep maintenance area *CLEAN* and *DRY.* Remove water or oil slicks immediately.

Remove sharp edges and burrs from reworked parts.

Be sure all mechanics tools are in good condition. *DO NOT* use tools with mushroomed heads. Always wear safety glasses with side shields.

Do not strike hardened steel parts with anything other than a soft iron or non-ferrous hammer.

Do not rush. Walk, do not run.

Know and use the hand signals used on particular jobs and know who has the responsibility for signaling.

SAFETY RULES

Face the access system when climbing up and down.

Apply the parking device and place the transmission in neutral before starting the machine.

Do not bypass the starter safety switch. Repair the starter safety controls if they malfunction.

Fasten seat belt before operating.

Steering should be checked to both right and left. Brakes should be tested against engine power. Clutch and transmission controls should be moved through or to neutral positions to assure disengagement. Operate all controls to insure proper operation. If any malfunctions are found, park machine, shut off engine, report and repair before using machine.

If the power steering or the engine ceases operating, stop the machine motion as quickly as possible. Lower equipment, set parking device and keep machine securely parked until the malfunction is corrected or the machine can be safety towed. Never lift loads in excess of capacity.

Should the machine become stuck or frozen to the ground, back out to avoid roll over.

Know and understand the job site traffic flow patterns.

Keep the machine in the same gear going down hill as used for going up hill.

When roading a machine, know and use the signaling devices required on the machine. Provide an escort for roading where required.

Always use the recommended transport devices when roading the machine.

Do not attempt repairs unless proper training has been provided.

Use extreme caution when removing radiator caps, drain plugs, grease fittings or pressure taps. Park the machine and let it cool down before opening a pressurized compartment.

Release all pressure before working on systems which have an accumulator.

When necessary to tow the machine, do not exceed the recommended towing speed, be sure the towing machine has sufficient braking capacity to stop the towed load. If the towed machine cannot be braked, a tow bar must be used or two towing machines must be used - one in front pulling and one in the rear to retard. Avoid towing over long distances.

Observe proper maintenance and repair of all pivot pins, hydraulic cylinders, hoses, snap rings and main attaching bolts.

Always keep the brakes and steering systems in good operating condition.

Replace all missing, illegible or damaged safety signs. Keep all safety signs clean.

Do not fill the fuel tank to capacity. Allow room for expansion.

Wipe up spilled fuel immediately.

Always tighten the fuel tank cap securely. Should the fuel cap be lost, replace it only with the original manufacturers approved cap. Use of a non-approved cap may result in overpressurization of the tank.

Never drive the machine near open fires.

Use the correct fuel grade for the operating season.

FOREWORD

Always furnish serial number if making an inquiry to dealer or factory about this machine.

Many equipment owners employ the Dealer Service Department for all work other than routine lubrication and minor service. This practice is encouraged, as our Dealers are well informed and equipped to render efficient service by factory trained mechanics.

Illustrations show standard and optional items.

IMPORTANT

The information in this manual was current at the time of publication. It is our policy to constantly improve our product and to make available additional items. These changes may affect procedures outlined in this manual. If variances are observed, verify the information through your Dealer.

Fiatallis is not responsible for any liability arising from any damage resulting from defects caused by parts and/or components not approved by Fiatallis for use in maintaining and/or repairing products manufactured or merchandized by Fiatallis.

In any case, no warranty of any kind is made or shall be imposed with respect to products manufactured or merchandized by Fiatallis when failures are caused by the use of parts and/or components not approved by Fiatallis.

TABLE OF CONTENTS

NOTICE

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GENERAL

A. PURPOSE OF THE MANUAL

This manual is expressly intended to provide sufficient information for qualified technicians, experienced in diesel engines and diesel injection equipment, to disassemble and reassemble the Roosa Master DM Type Fuel Injection Pump and to make such adjustments and parts replacements as may be needed. It is recommended that an inexperienced person refrain from making adjustments and repairs, as such action may result in very extensive damage to the pump and possibly to the engine.

No service should be performed on the pump before making a careful study of this manual and becoming familiar with the principles and instructions which follow. Since several critical adjustments of the injection pump are required which cannot readily be made on the engine, it is also necessary that the service be performed in a facility equipped with the proper special tools and an approved, motorized test stand.

This manual completely describes the operating principles of the pump and most accessories. Only through a thorough knowledge of these principles can the serviceman locate and correct possible operational defects.

B. MODEL NUMBER SYSTEM

It is necessary to understand the model number system for reference to the proper sections of this manual covering operation and maintenance of the pump.

EXAMPLE: Model Number

a	b	c	d	e	f
DM	2	6	33	JN	2580

a. DM - "M" version of "D" series pump.
b. 2 - Number of Plungers (2 or 4 plunger versions).
c. 6 - Number of Cylinders (available in 2, 3.4.6 and 8 cylinder configuration).
d. 33 - Abbreviation of Plunger Diameter.
   25 - .250" (6.35mm) 33 - .330" (8.38mm)
   27 - .270" (6.86mm) 35 - .350" (8.89mm)
   29 - .290" (7.37mm) 37 - .370" (9.40mm)
   31 - .310" (7.87mm) 39 - .390" (9.91mm)
e. JN - Accessory Code.
   The code pertains to combinations of special accessories such as electrical shut-off, automatic advance, variable speed droop adjustment, etc. See the proper manual section for operation and construction of these accessories. Include this in any reference to the pump.
f. 2580 - Specification Number.
   Determines selection of parts and adjustments within a given accessory code. Must be included in any reference to the pump.

C. GENERAL INFORMATION

In a diesel engine, air is drawn into the cylinder through the intake valve and compressed. A metered quantity of fuel is then injected into the cylinder, producing a combustible misture. This mixture ignites from heat of compression, and the expanding gases force the piston downward.

The function of a diesel fuel injection pump is to accurately meter and deliver fuel to a nozzle in each cylinder and to inject it at high pressure into the combustion chamber at precisely timed intervals. The extreme precision necessary can well be appreciated since this cycle must be repeated thousands of times per minute with virtually no variation in timing or amount of fuel injected.

MODEL DM PUMP

The models DM2 and DM4 are described as opposed plunger, inlet metering, distributor type pumps. The DM2 incorporates a single pumping chamber, whereas the DM4 has 2 pumping chambers.

The necessity for cost reduction is more apparent in the small diesel engine where the injection equipment represents a greater percentage of the cost. Since the basic model has but 100 odd parts, and only four main rotating members, there is less chance of part failure. Repairs are generally very inexpensive. Today's small high output engines have created a need for improved, yet low cost injection equipment capable of higher speed operation, quieter running and lower exhaust emissions.

Precise distribution between cylinders, inherent in the pump design, and the ability to preset fuel flow eliminates lengthy periods on the test stand. The pump is self lubricated (with the exception of the drive shaft ball bearing), contains essentially the same number of parts regardless of the number of cylinders served, and operates in any position.

NEW DESIGN FEATURES

This addition to the line of fuel injection equipment incorporates many design improvements, and has been durability tested for more than 200,000 hours prior to release for production.

New Design Features include:

1. Housing and Drive
   - A. Housing strengthened in the neck area.
   - B. Rugged mounting flange.
   - C. Drive shaft supported by a heavy duty ball bearing.
   - D. Increased diameter drive shaft with larger tang drive. The drive shaft is retained in the pump.
   - E. Drive shaft roll pin for gear hub alignment.
   - F. Spring-loaded, steel-backed, lip type drive shaft seals.

2. Head and Rotor
   - A. Integral, angled discharge fittings.
   - B. Threaded transfer pump cap.
   - C. Shear groove in the rotor.

3. Governor
   - A. Weight retainer hub press fitted to the rotor.
   - B. Cushioned weight retainer with rubber compression members fully enclosed within the assembly.
   - C. Low mass governor weights.
   - D. Larger diameter metering valve.

4. Transfer Pump
   - A. Larger area inlet screen.

5. Automatic Advance
   - A. Advance circuit direct from transfer pump.
   - B. Reed check valve.

TOPIC 1 CONSTRUCTION AND OPERATION

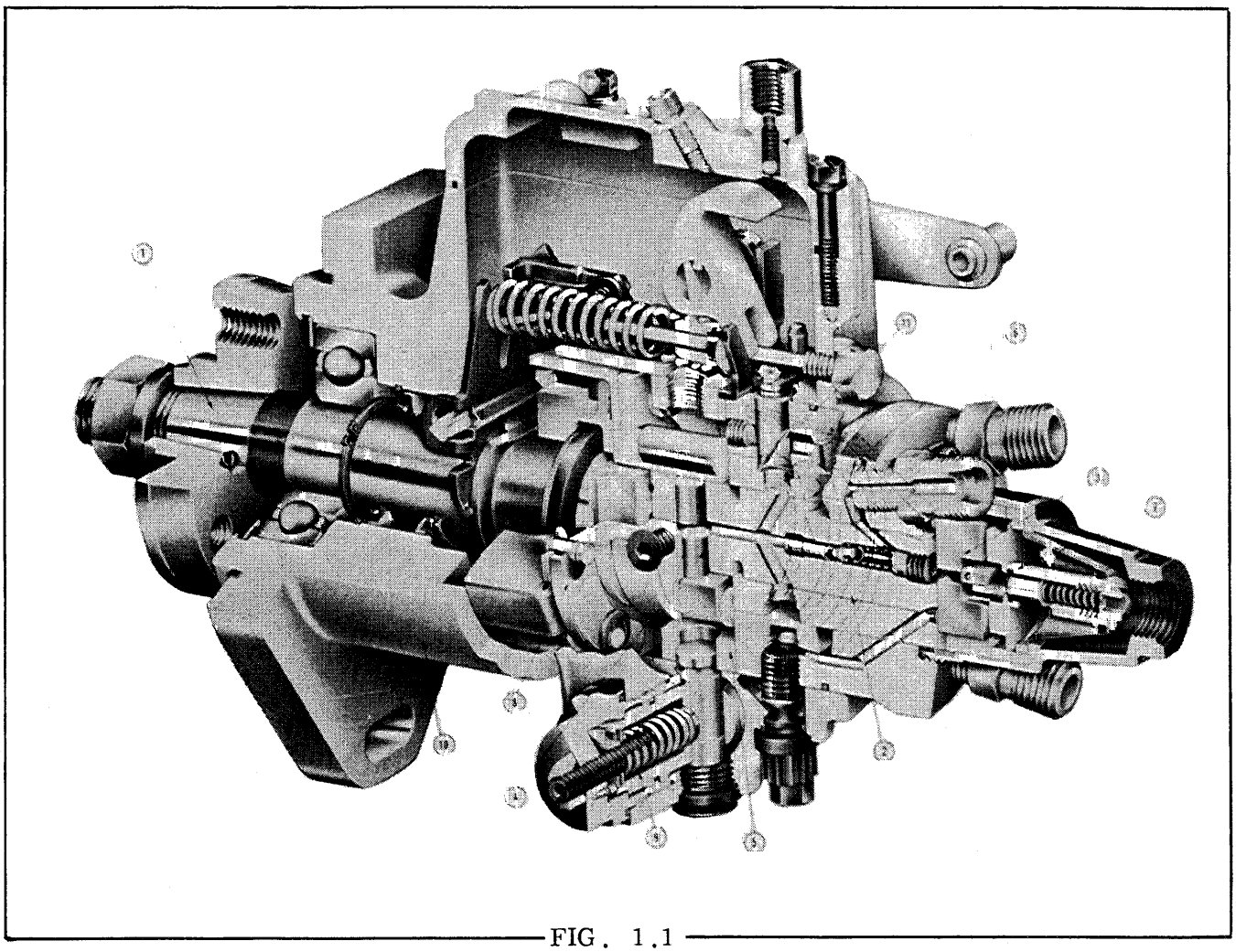

FIG. 1.1

A. COMPONENTS AND FUNCTIONS

It is necessary to become familiar with the function of the main components to understand the basic operating principles of the DM pump. See cutaway view (Fig. 1.1) for construction details.

MAIN COMPONENTS

1. Drive Shaft
2. Distributor Rotor
3. Transfer Pump Blades
4. Pumping Plungers
5. Internal Cam Ring
6. Hydraulic Head
7. Pressure Regulator Assembly
8. Governor
9. Automatic Advance
10. Housing
11. Metering Valve

The main rotating components are the drive shaft (1), distributor rotor (2), transfer pump blades (3), governor (8).

With reference to Fig. 1.1, the drive engages the distributor rotor in the hydraulic head. The drive end of the DM2 rotor incorporates two pumping plungers and the DM4 incorporates four.

The plungers are actuated toward each other simultaneously by an internal cam ring through rollers and shoes which are carried in slots at the drive end of the rotor. The number of cam lobes normally equals the number of engine cylinders.

The transfer pump at the rear of the rotor is of the positive displacement vane type and is enclosed in the end cap. The end cap also houses the fuel inlet strainer and transfer pump pressure regulator. The

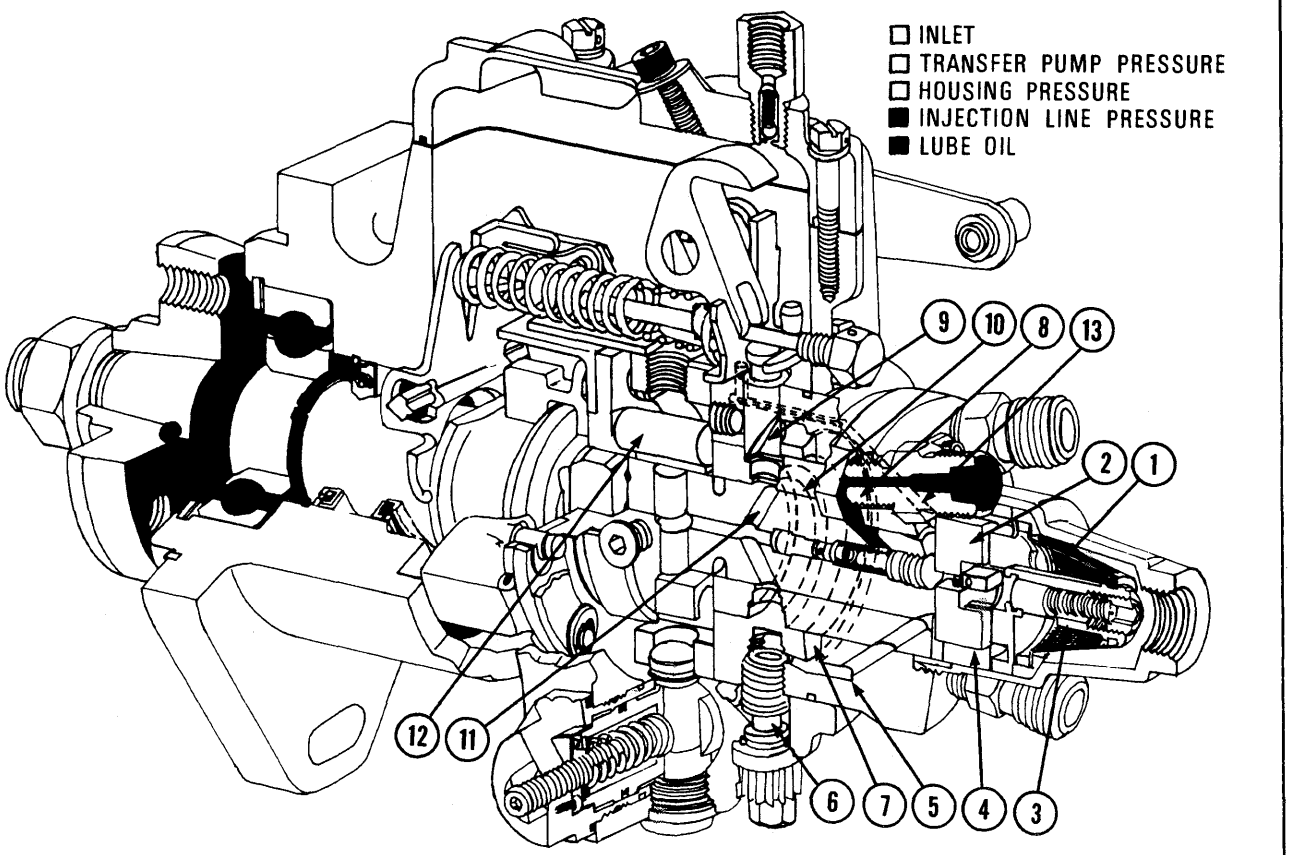

FIG. 1.2

face of the regulator assembly is compressed against the distributor rotor and forms an end seal for the transfer pump.

The distributor rotor incorporates two charging ports and a single axial bore with one discharge port to serve all head outlets to the injection lines. The weight retainer hub is a shrink fit to the drive end of the rotor.

The hydraulic head contains the bore in which the rotor revolves,the metering valve bore, the charging ports and the head discharge fittings. The high pressure injection lines to the nozzles are fastened to these discharge fittings.

The DM pump contains its own mechanical governor, capable of close speed regulation . The centrifugal force of the weights in their retainer is transmitted through a sleeve to the governor arm and through a positive linkage to the metering valve. The metering valve can be closed to shut off fuel through a solid linkage by an independently operated shut-off lever.

The automatic advance is a hydraulic mechanism which advances or retards the beginning of fuel delivery from the pump.

B. FUEL FLOW

The operating principles of the pump can be understood more readily by following the fuel circuit during a complete pump cycle (Fig. 1.2). The fuel flow for the DM4 (Fig. 1.3) is basically the same as that of the DM2 (Fig. 1.4) with the exception of the charging of two additional plungers. Fuel is drawn from the supply tank through filters into the pump through the inlet filter screen (1) by the vane type fuel transfer pump (2). Some fuel is by-passed through the pressure regulator assembly (3) to the suction side.

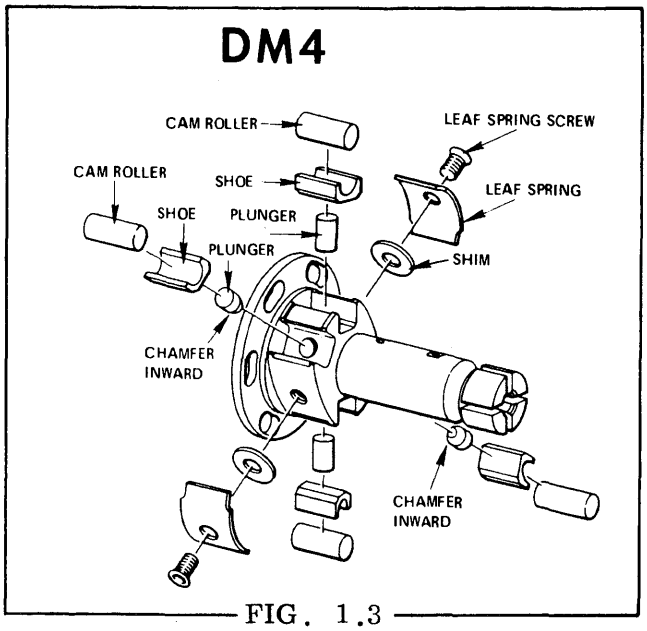

FIG. 1.3

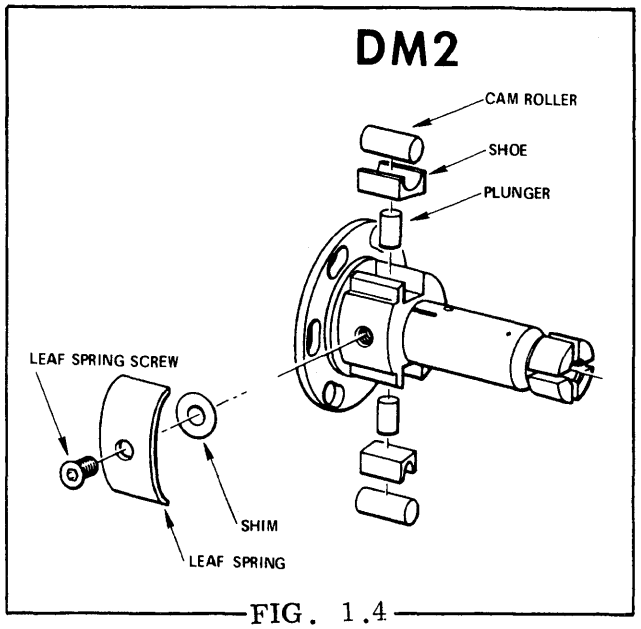

FIG. 1.4

Fuel under transfer pump pressure flows past the rotor retainers (4) into an annulus on the rotor. It then flows through a connecting passage (5) in the head to the advance (6) and also to the charging circuit (7). The fuel flows around the annulus (8) through a connecting passage to the metering valve (9). The radial position of the metering valve, controlled by the governor, regulates the flow of fuel into the charging annulus (10) which incorporates the charging ports.

As the rotor revolves, the two inlet passages (11) register with the charging ports in the hydraulic head, allowing fuel to flow into the pumping chamber. With further rotation, the inlet passages move out of registry and the discharge port of the rotor registers with one of the head outlets. While the discharge port is opened, the rollers (12) contact the cam lobes forcing the plungers together. Fuel trapped between the plungers is then pressurized and delivered by the nozzle to the combustion chamber.

With the exception of the drive shaft bearing, self-lubrication of the pump is an inherent feature of the Roosa Master design. As fuel at transfer pump pressure reaches the charging ports, slots on the rotor shank allow fuel and any entrapped air to flow into pump housing cavity.

In addition, an air vent passage (13) in the hydraulic head connects the outlet side of the transfer pump with the pump housing. This allows air and some fuel to be bled back to the fuel tank via the return line. The fuel thus by-passed fills the housing and lubricates the internal components.

C. TRANSFER PUMP

The positive displacement vane type fuel transfer pump consists of a stationary liner and spring loaded blades which are carried in slots in the rotor. Since the inside diameter of the liner is eccentric to the rotor axis, rotation causes the blades to move in the rotor slots. This blade movement changes the volume between the blade segments.

Transfer pump output volume and pressure increase as pump speed increases. Since displacement of the transfer pump exceeds injection requirements, some of the fuel is recirculated by means of the transfer pump regulator to the inlet side of the transfer pump.

Figure 1.5 illustrates the pumping principle. Blade movement causes a volume increase in the quadrant between blade 1 and 2 (Fig. 1.5a). At this time, the quadrant is in

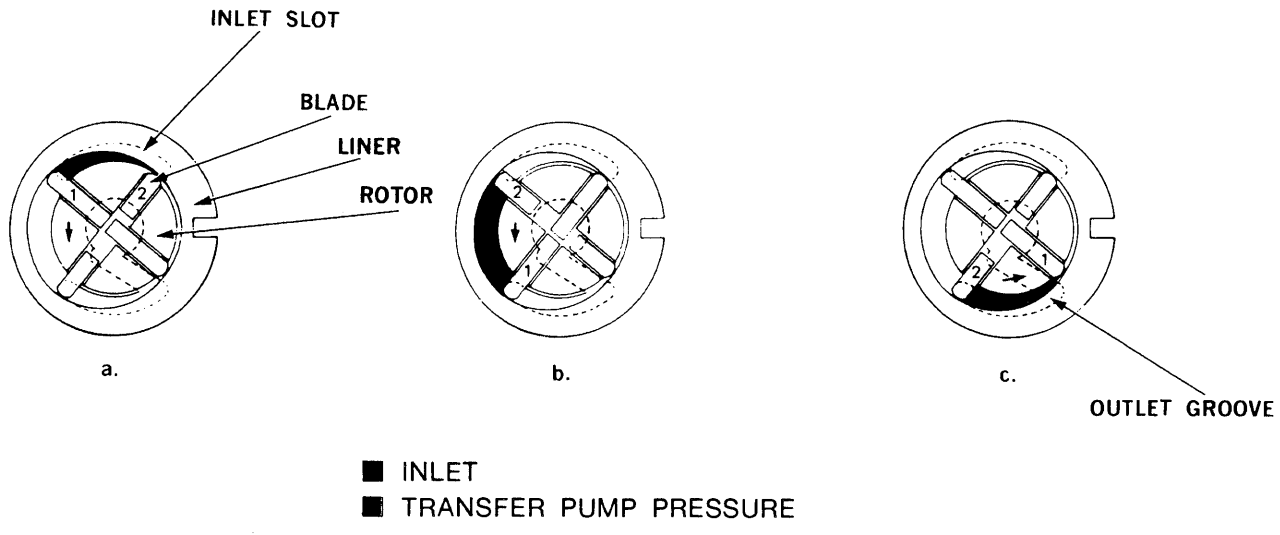

FIG. 1.5

registry with a kidney shaped slot in the top portion of the regulator assembly. The increasing volume causes fuel to be pulled through the inlet fitting and filter screen into the transfer pump liner. Volume between the two blades continues to increase until blade 2 passes out of registry with the regulator slot. At this point the rotor has reached a position where movement of blades 1 and 2 is negligible and volume is not changing (Fig. 1.5b). The fuel between the blades is being carried to the bottom of the transfer pump liner.

As blade 1 passes the edge of the kidney shaped groove in the lower portion of the regulator assembly (Fig. 1.5c), the liner, whose inside diameter is eccentric to the rotor, pushes blades 1 and 2 in a direction opposite to their previous movement (Fig. 1.5a). The volume between the blades is reduced and pressurized fuel is delivered through the groove of the regulator assembly, past the rotor retainers and into an annulus on the rotor leading to the hydraulic head passages. Volume between the blades continues to decrease, pressurizing the fuel in the quadrant, until blade 2 passes the groove in the regulator assembly.

REGULATOR ASSEMBLY OPERATION

Figure 1.6 shows the operation of the pressure regulating piston while the pump is running. Fuel output from the discharge side of the transfer pump forces the piston in the regulator against the regulating spring. As flow increases, the regulating spring is compressed until the edge of the regulating piston starts to uncover the pressure regulating slot "A" (Fig. 1.6a). Since fuel pressure on the piston is opposed by the spring, the delivery pressure of the transfer pump is controlled by the spring rate and size of the regulating slot "A". Therefore pressure increases with speed.

A high pressure relief slot "B" is incorporated in the regulator as part of the pressure regulating slot to prevent excessively high transfer pump pressure, if the engine or pump is accidentally overspeeded.

VISCOSITY COMPENSATION

The DM transfer pump works equally well with different grades of diesel fuel and varying temperatures, both of which affect fuel viscosity. A unique and simple feature of the regulating system offsets pressure changes caused by viscosity difference. Located in the spring adjusting plug is a thin plate incorporating a sharp-edged orifice. The orifice allows fuel leakage past the piston to return to the inlet side of the pump. Flow through a short orifice is virtually unaffected by viscosity changes.

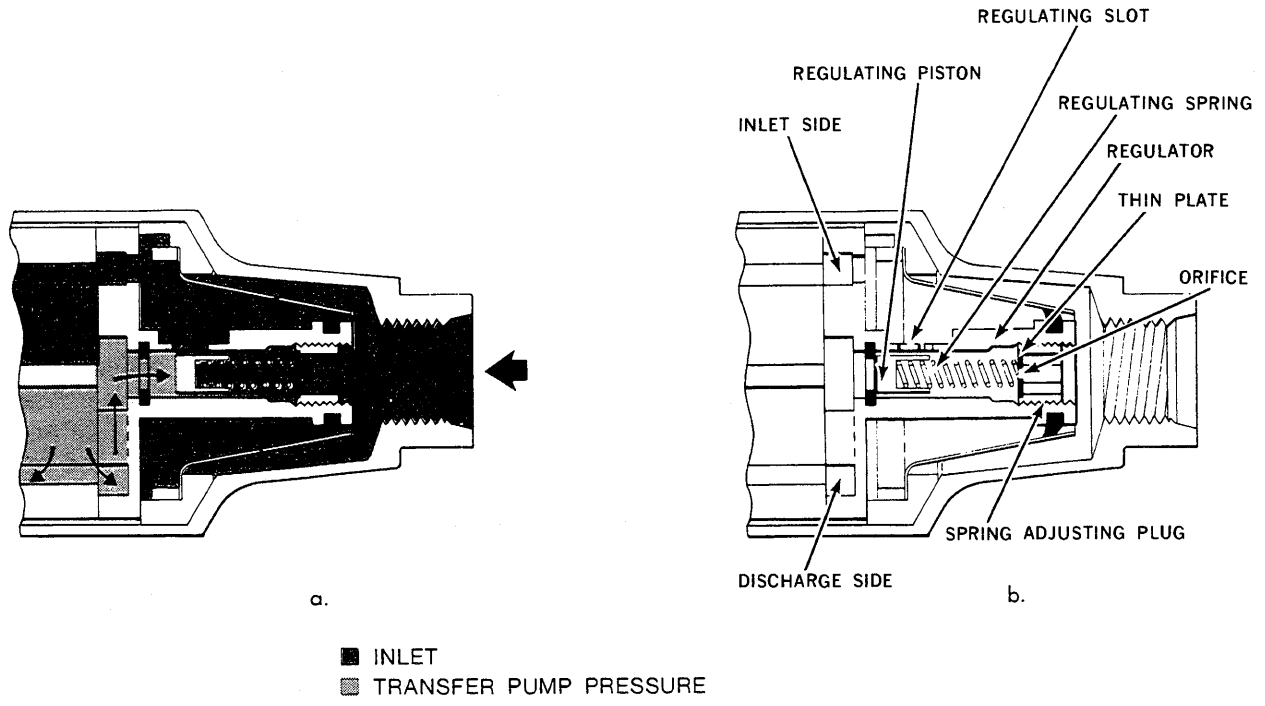

FIG. 1.6

The biasing pressure exerted against the back side of the piston is determined by the leakage past designed clearance of the piston in the regulator bore and the pressure drop through the sharp edged orifice. With cold or viscous fuels, very little leakage occurs past the piston. The additional force on the back side of the piston from the viscous fuel pressure is slight. With hot or light fuels, leakage past the piston increases. Fuel pressure in the spring cavity increases also, since flow through the orifice remains the same as with cold or viscous fuel. The increased fuel pressure assists the regulating spring and moves the piston, reducing opened regulating slot area. This variation in piston position compensates the leakage which would occur with thin fuels and design pressures are maintained over a broad range of viscosity changes.

D. CHARGING AND DISCHARGING

CHARGING CYCLE

As the rotor revolves, (Fig. 1.7) the two inlet passages in the rotor register with ports of the charging annulus. Fuel under pressure from the transfer pump, controlled by the opening of the metering valve, flows into the pumping chamber forcing the plungers apart.

The plungers move outward a distance proportionate to the amount of fuel required for injection on the following stroke. If only a small quantity of fuel is admitted into the pumping chamber, as at idling, the plungers move out a short distance. Maximum plunger travel and, consequently, maximum fuel delivery is limited by a single leaf spring (DM2) or two leaf springs (DM4) which contact the edge of the roller shoes. Only when the engine is operating at full load will the plungers move to the most outward position. Note (Fig. 1.7) that while the angled inlet passages in the rotor are in registry with the ports in the charging annulus, the rotor discharge port is not in registry with a head outlet. Note also that the rollers are off the cam lobes. Compare their relative positions (Fig. 1.7 and 1.8).

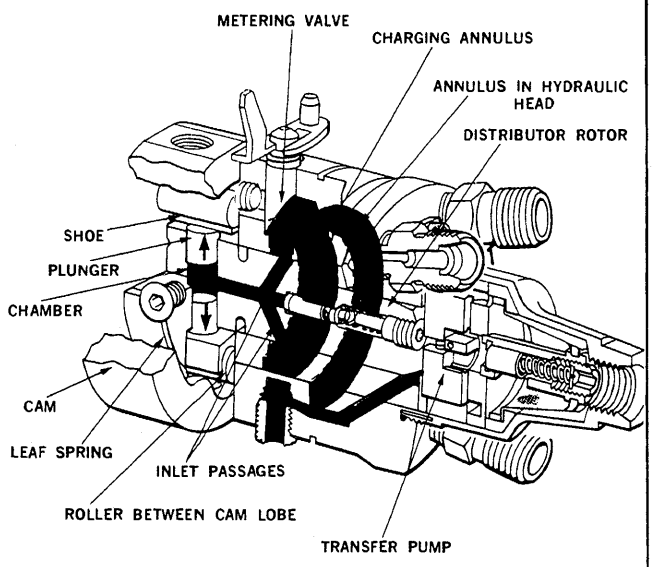

FIG. 1.7

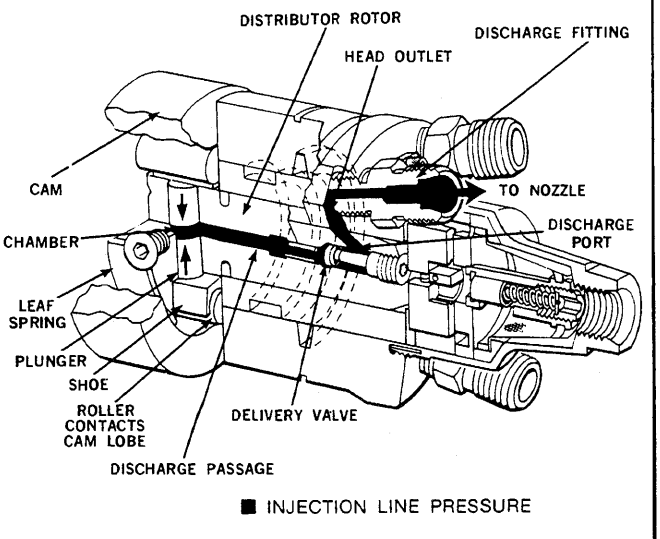

FIG. 1.8

DISCHARGE CYCLE

As the rotor continues to revolve (Fig. 1.8), the inlet passages move out of registry with the charging ports. The rotor discharge port opens to one of the head outlets. The rollers then contact the cam lobes and injection begins. Further rotation of the rotor moves the rollers up the cam lobe ramps pushing the plungers inward. During this stroke the fuel trapped between the plungers flows through the axial passage of the rotor and discharge port to the injection line. Delivery to the injection line continues until the rollers pass the inner-most point on the cam lobe and begin to move outward. The pressure in the axial passage is then reduced, allowing the nozzle to close. This is the end of injection.

E. DELIVERY VALVE FUNCTION

The delivery valve (Fig. 1.9a and 1.9b), rapidly decreases injection line pressure after injection to a predetermined value lower than that of the nozzle closing pressure. This reduction in pressure causes the nozzle valve to return rapidly to its seat, achieving sharp delivery cut-off and preventing improperly atomized fuel from entering the combustion chamber.

The delivery valve operates in a bore in the center of the distributor rotor. Note that the valve requires no seat - only a stop to limit travel. Sealing is accomplished by the close clearance between valve and bore into which it fits. Since the same delivery valve performs the function of retraction for each injection line, the result is a smooth running engine at all loads and speeds.

When injection starts, fuel pressure moves the delivery valve slightly out of its bore and adds the volume of its displacement, section "A", to the delivery valve spring chamber. Since the discharge port is already opened to a head outlet, the retraction volume and plunger displacement volume are delivered under high pressure to the nozzle. Delivery ends when the pressure on the plunger side of the delivery valve is quickly reduced, due to the cam rollers passing the highest point on the cam lobe which allows the plunger to move outward.

Following this, the rotor port closes completely and a residual injection line pressure is maintained. Note that the delivery valve is only required to seal while the discharged port is opened. Once the port is closed, residual line pressures are maintained by the seal of the close fitting head and rotor.

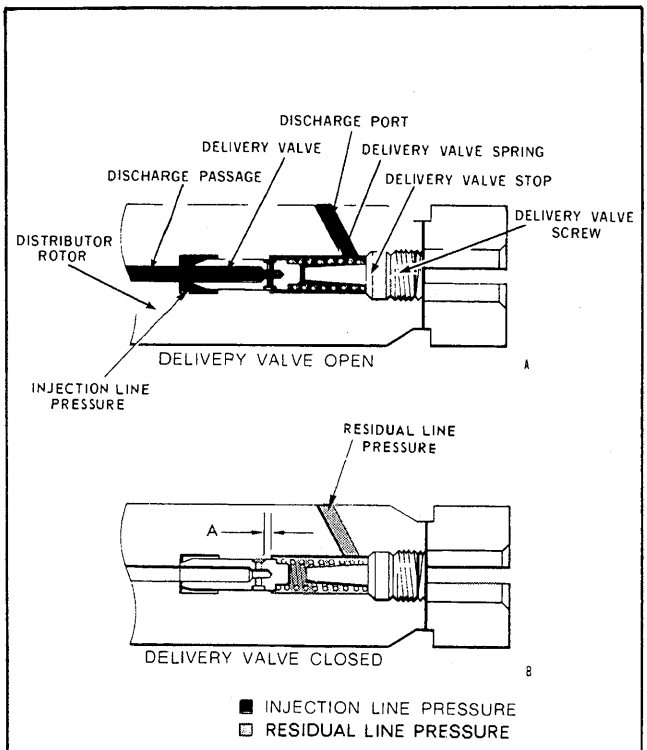

FIG. 1.9

F. RETURN OIL CIRCUIT

Fuel under transfer pump pressure is discharged into a vent passage in the hydraulic head (Fig. 1.10). Flow through the passage is restricted by a wire to prevent excessive return oil and undue pressure loss.

The vent passage is located behind the metering valve bore and connects with a short vertical passage entering the governor compartment.

Should air enter the transfer pump, it immediately passes to the vent passage as shown. Air and a small quantity of fuel then flow from the housing to the fuel tank via the return line.

G. MECHANICAL GOVERNOR

The governor serves the purpose of maintaining the desired engine speed within the operating range under various load settings.

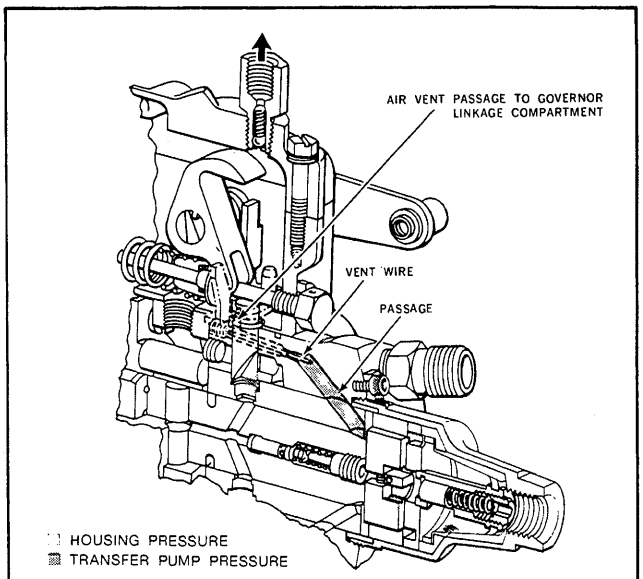

FIG. 1.10

In the mechanical governor (Fig. 1.11), the movement of the weights acting against governor thrust sleeve rotates the metering valve by means of the governor arm and linkage hook. This rotation varies the registry of the metering valve opening to the passage from the transfer pump, thereby controlling the quantity of fuel to the plungers. The governor derives its energy from weights pivoting in the weight retainer. Centrifugal force tips them outward, moving the governor thrust sleeve against the governor arm, which pivots on the knife edge of the pivot shaft and through a simple, positive linkage hook, rotates the metering valve. The force on the governor arm caused by the weights is balanced by the governor spring force, which is controlled by the manually positioned throttle lever and vehicle linkage for the desired engine speed.

In the event of a speed increase due to a load reduction, the resultant increase in centrifugal force of the weights rotates the metering valve clockwise to reduce fuel. This limits the speed increase (within the operating range) to a value determined by governor spring rate and setting of the throttle.

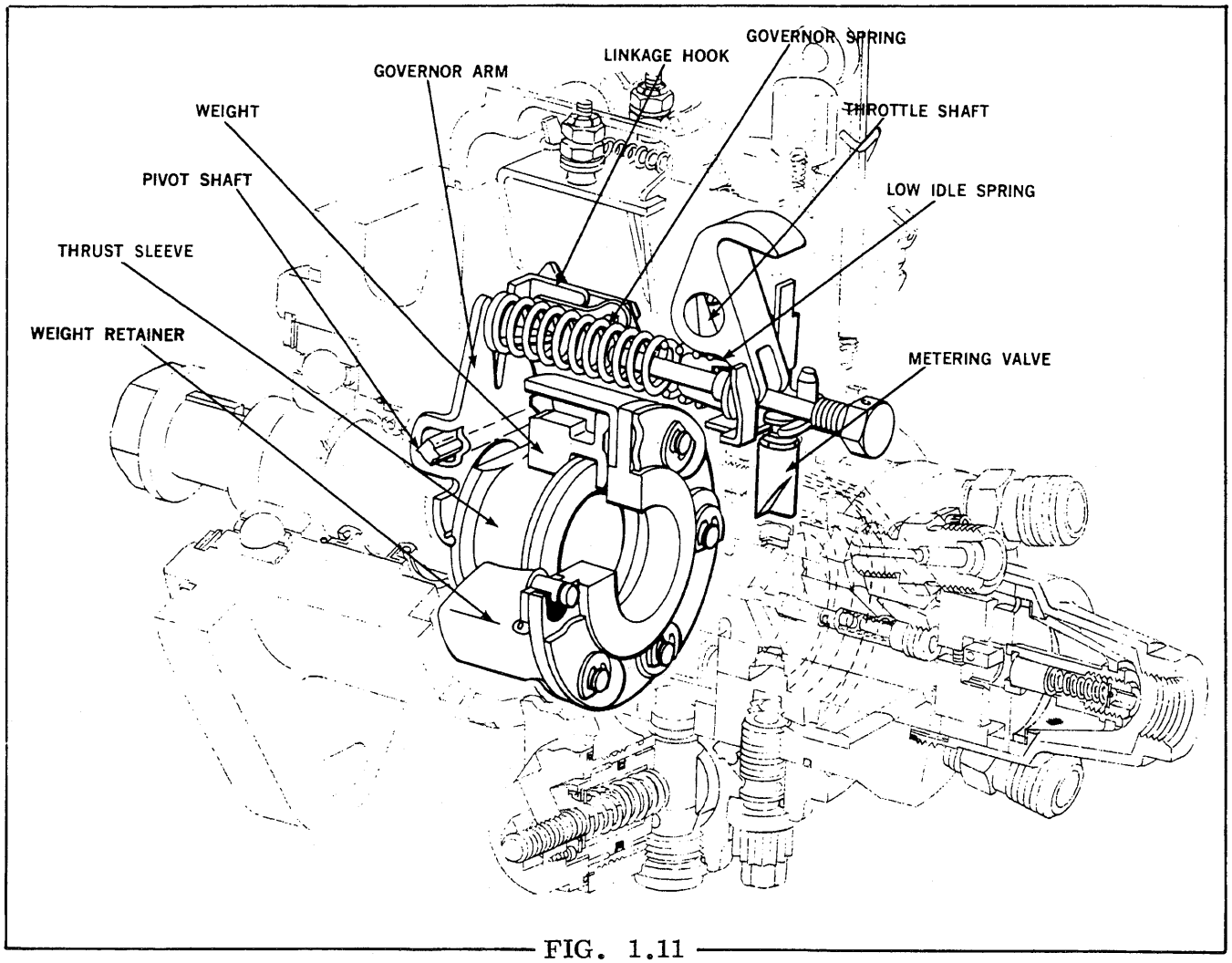

FIG. 1.11

When the load on the engine is increased, the speed tends to reduce. The lower speed reduces the force generated by the weights permitting the spring force to rotate the metering valve in a counter-clockwise direction to increase fuel. The speed of the engine at any point within the operating range is dependent upon the combination of load on the engine and the governor spring rate and setting as established by the throttle position.

A light idle spring is provided for more sensitive regulation when weight energy is low in the low end of the speed range. The limits of throttle travel are set by adjusting screws for proper low idle and high idle positions.

A light tension spring takes up any slack in the linkage joints and also allows the shut-off mechanism to close the metering valve without having to overcome the governor spring force. Only a very light force is required to rotate the metering valve to the closed position.

H. AUTOMATIC ADVANCE (Speed Advance)

The Roosa Master design permits the use of a simple, direct acting hydraulic mechanism powered by fuel pressure from the transfer pump, to rotate the cam and vary delivery timing. The advance mechanism advances or retards start of fuel delivery in response to engine speed changes. In most injection systems, the actual beginning of delivery of fuel at the nozzle will start later (in engine degrees of rotation) as the speed increases.

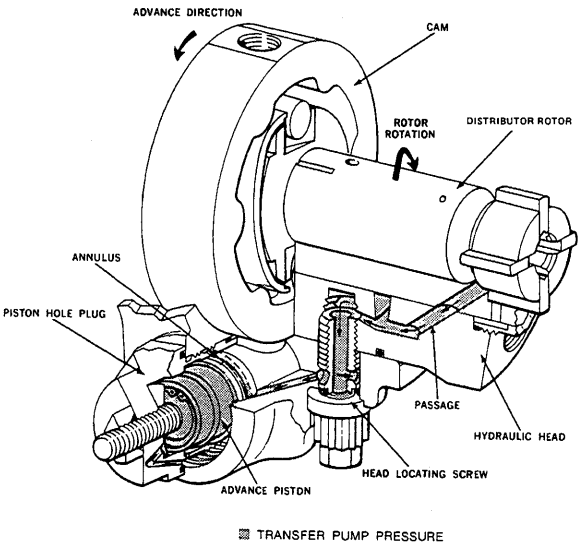

FIG. 1.12a

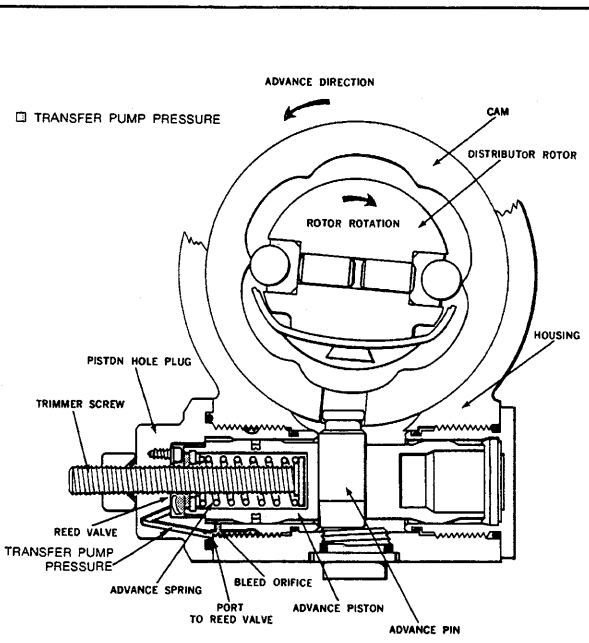

FIG. 1.12b

Compensating this inherent "increasing injection lag" will often improve the high speed performance of the engine. Starting delivery of fuel to the nozzle earlier when the engine is operating at higher speed insures that combustion takes place when the

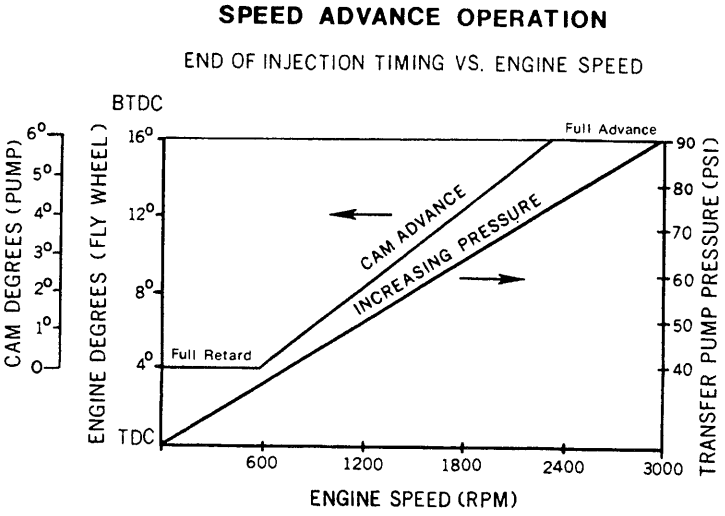

FIG. 1.13

piston is in its most effective position to produce optimum power with minimum specific fuel consumption and minimum smoke.

The advance piston, located in a bore in the housing, engages the cam through the advance pin and moves the cam (when fuel pressure moves the piston) opposite to the direction of rotor rotation (Fig. 1.12a, Fig. 1.12 b). Fuel under transfer pump pressure is fed through a drilled passage in the hydraulic head which registers with the bore of the head locating screw. Fuel is then directed through a groove in the head locating screw to an annulus in the piston hole plug. It enters a port in the piston hole plug leading to the reed check valve. Increasing transfer pump pressure forces fuel past the valve to the advance piston. Fuel pressure against the piston must overcome the opposing spring force plus the dynamic injection loading on the cam in order to change the cam position. The reed check valve prevents the normal tendency of the cam to return to the retard position during injection by trapping the fuel in the piston chamber. When engine speed decreases, the hydraulic pressure is reduced and the spring returns the cam to a retarded position in proportion to the reduction of speed.

The fuel in the piston chamber is allowed to bleed off through a control orifice in the piston hole plug.

At low speeds, because transfer pump pressure is comparatively low, the cam remains in the retarded position . When engine speed increases, transfer pump pressure rises, which moves the piston to an advanced position. Advance piston movement is related to speed. Total movement of the cam is limited by the piston length.

A "trimmer screw" is provided to adjust advance spring preload which controls start of cam movement. It can be incorporated at either side of the advance mechanism and may be adjusted on the engine while running.

TOPIC 2 REMOVAL FROM ENGINE

⚠ DANGER

Extinguish all smoking materials and open flames before working around diesel fuel.

⚠ WARNING

Never use gasoline, solvent or other flammable fluids to clean parts.

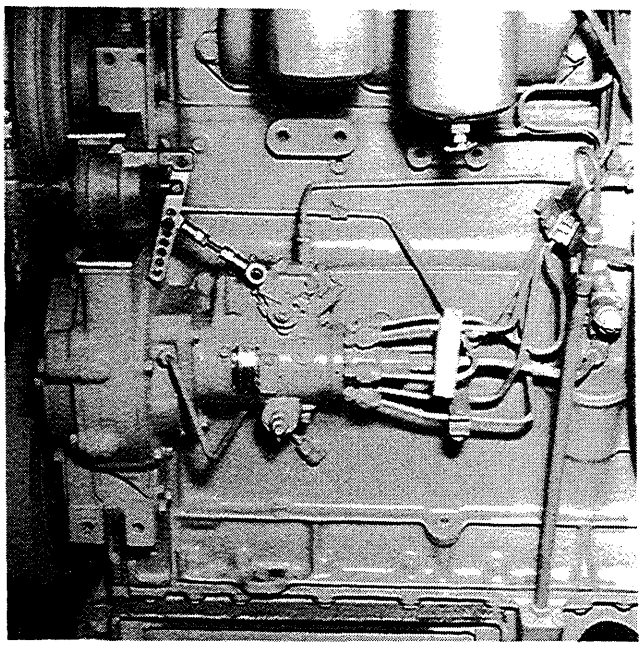

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FIG. 2.1

This procedure for removal of the pump from the engine should be followed in detail to assure ease of re-installation.

A. Clean and wash down the pump, fittings and all connections with non-flammable, non-toxic, commercial solvent to eliminate the possibility of contamination entering the system when lines are disconnected.

NOTE: Do not steam clean or wash down while the engine is operating. Severe damage to the pump may occur if its temperature is changed radically while running.

B. Shut off the fuel supply and disconnect inlet and return lines from their fittings. Loosen injection tubing nuts at the nozzles and pump.

NOTE: In removing the injection tubing nut from the pump, hold the discharge fitting with a wrench to prevent loosening from the hydraulic head. Immediately after the lines are removed, all pump, nozzles and line openings should be capped or plugged.

C. Check TEST STAND DATA (Topic 9) for proper timing position of crankshaft. Bar the engine in correct direction of rotation until the engine timing mark is indexed and the No. 1 cylinder is at the end of the compression stroke. Remove the timing line cover from the outboard side of the pump. Timing line on the governor weight retainer hub should be directly opposite the line on the cam.

D. Disconnect throttle and shut-off linkage and electrical connections if used.

E. In most cases it will be necessary to remove the pump drive gear from the hub or drive shaft. Refer to the engine manual.

F. Support the pump with one hand and remove the mounting stud nuts and washers on the pump flange. Remove the pump from the engine.

TOPIC 3 DISASSEMBLY

⚠ DANGER

Extinguish all smoking materials and open flames before working around diesel fuel.

⚠ WARNING

⚠ Never use gasoline, solvent or other flammable fluids to clean parts.

⚠ Wear safety glasses with side shields or goggles when using compressed air for cleaning to reduce the danger of personal injury from flying particals. Limit the pressure to 30 psi (2.1 kg/cm^2) according to OSHA requirements.

Study the Manual first. Before commencing the disassembly of the pump, cover inlet and outlet holes, remove all external grease and dirt by washing the unit with non-flammable, non-toxic commercial solvent and blowing it off with filtered, compressed air. It must be constantly kept in mind that dirt, dust, and foreign matter are the greatest enemies of the fuel injection pump. As an added precaution to prevent dirt from entering the fuel system while servicing the pump, it is essential that a clean work space, clean tools, and clean hands be used.

NOTE: All seals and gaskets should be discarded during disassembly.

A clean pan should be available in which the parts may be placed upon disassembly, and a pan of clean fuel oil must be available in which the parts may be flushed. It is recommended that these by deep drawn pans which rounded corners to lessen the chances of dirt pockets.

It is necessary for assembly to lubricate parts with clean diesel fuel. Make sure that all smoking materials are extinguished and no open flames and sparks are near. Place all parts prior to assembly in a closed container of clean diesel fuel for lubrication.

STEP 1 Remove the pump flange seal from the housing (Fig. 3.1).

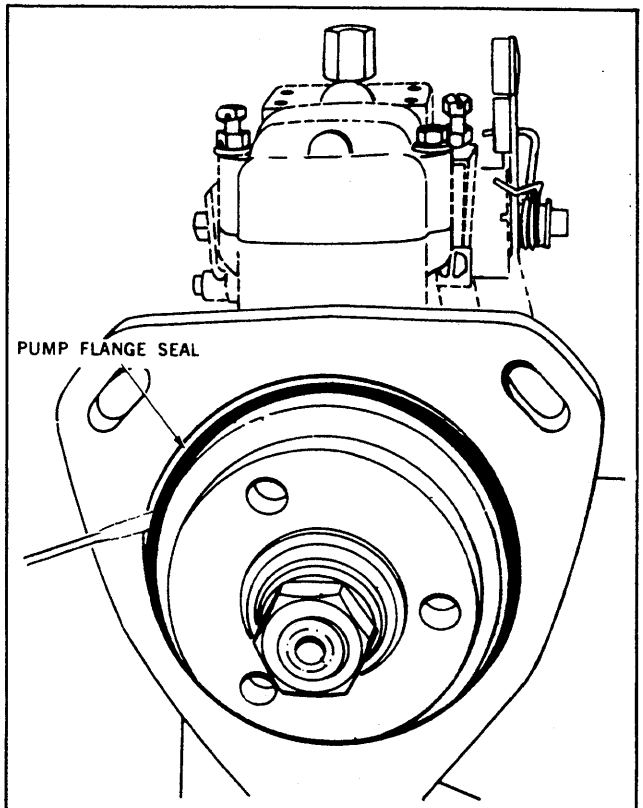


FIG. 3.1

STEP 2 Mount the pump in holding Fixture No. 19965. Never clamp the pump in a vise, always use a fixture. Remove all lead plumb seal wires. Unscrew the three cover hold-down screws (Fig. 3.2a). Remove the governor control cover and cover gasket (Fig. 3.2b).

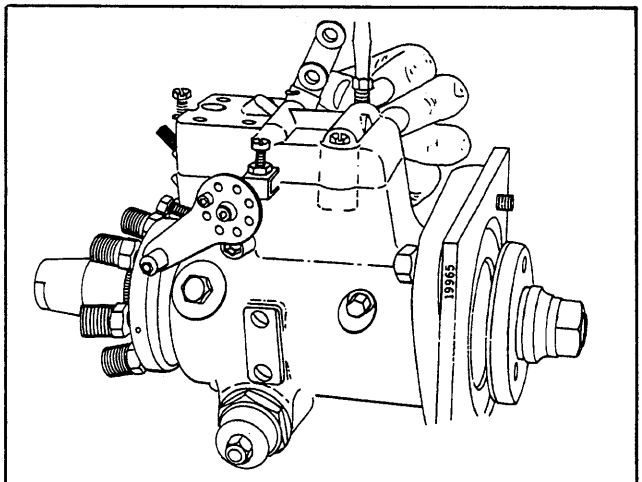


FIG. 3.2a

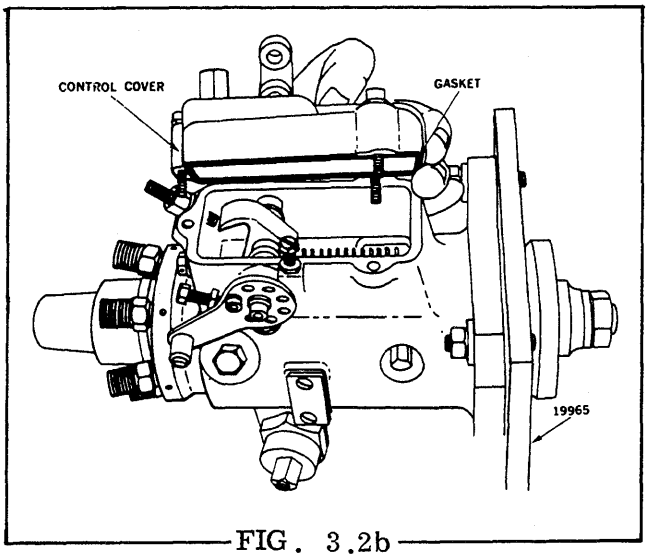


FIG. 3.2b

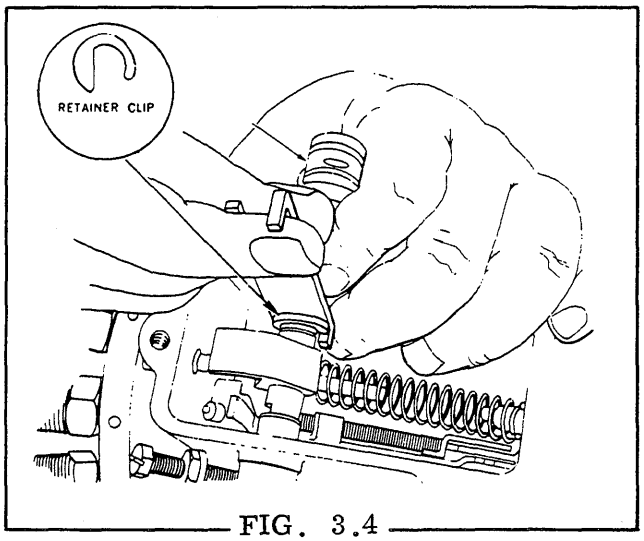


FIG. 3.4

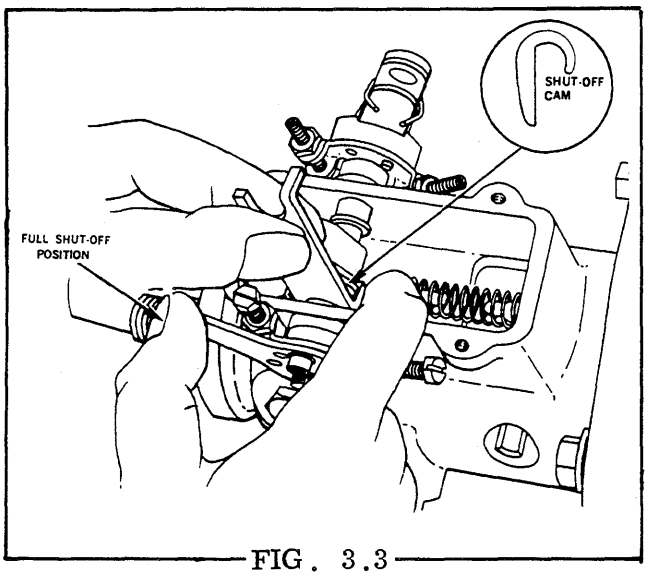


FIG. 3.3

STEP 3 Remove the shut-off cam by rotating the shut-off lever to the full run (W.O.T.) position. Place tool No. 20992, with tab beneath the shorter leg of the shut-off shaft and pry gently, sliding the cam off the shaft assembly (Fig. 3.3). Discard the shut-off cam.

STEP 4 Remove the throttle shaft retainer clip by rotating the throttle lever to the full run (W.O.T.) position. Place tool No. 20992, with tab beneath the shorter leg of the retainer clip, on the throttle shaft and pry gently, sliding the clip off the shaft assembly. (Fig. 3.4) discard the retainer clip.

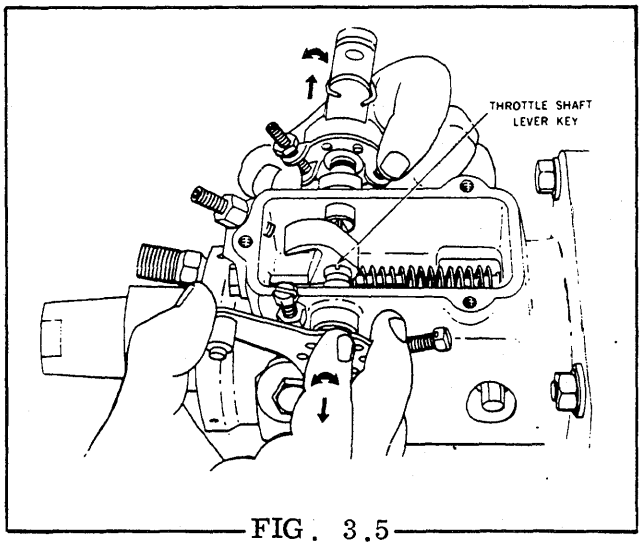


FIG. 3.5

STEP 5 Withdraw the throttle shaft assembly, and throttle shaft lever from the shut-off lever assembly (Fig. 3.5). To aid in correct reassembly, note the position of the throttle shaft lever key in relationship to the groove of the throttle shaft assembly.

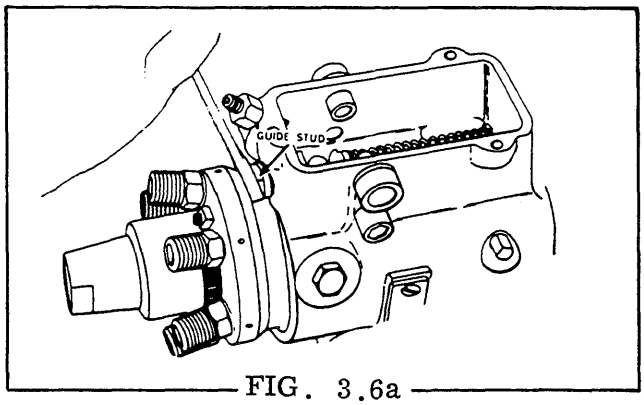


FIG. 3.6a

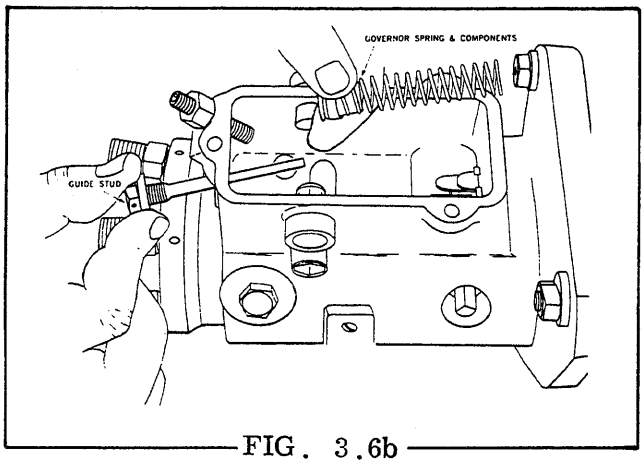


FIG. 3.6b

STEP 6 Loosen the guide stud (Fig. 3.6a). Hold the governor spring and spring retainer firmly between the thumb and forefinger. Lift out the governor spring components and guide stud (Fig. 3.6b).

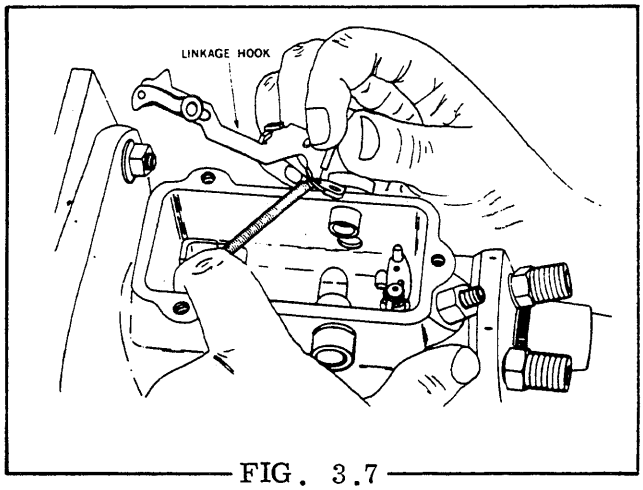


FIG. 3.7

STEP 7 While depressing the metering valve assembly raise the governor linkage hook assembly, at the metering valve end, to clear the metering valve arm pin. Pull the linkage hook back slightly to disengage it from the governor arm and place it over the side of the housing. Do not disengage the linkage spring (Fig. 3.7).

STEP 8 Remove the metering valve assembly (Fig. 3.8).

STEP 9 Loosen and remove the transfer pump end cap locking screw, plate and washer from the hydraulic head (Fig. 3.9).

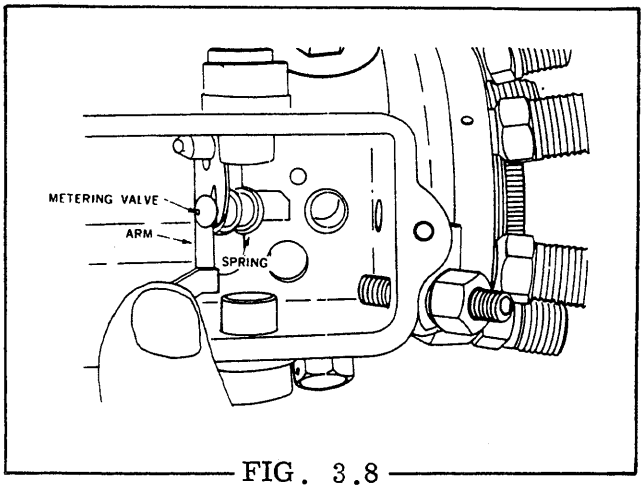


FIG. 3.8

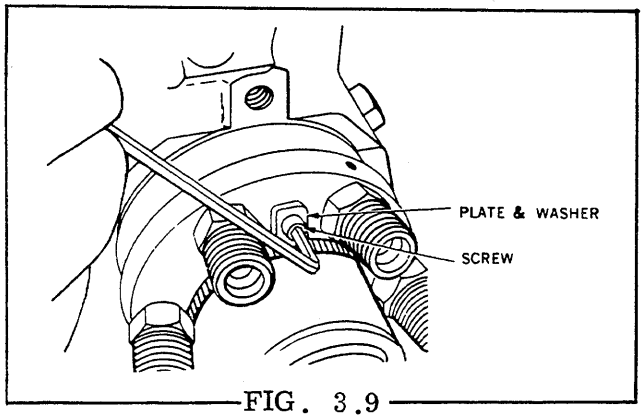


FIG. 3.9

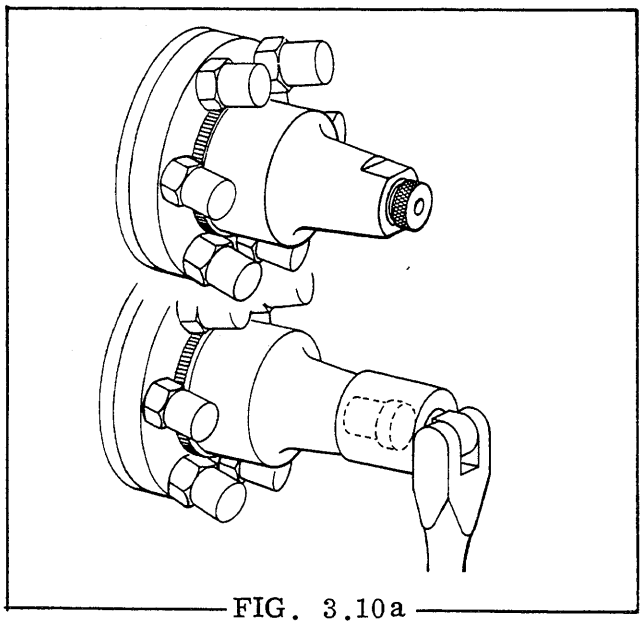


FIG. 3.10a

STEP 10 Install end cap plug No. 20549 into the end cap and loosen and remove the transfer pump end cap assembly, using the appropriate end cap wrench. (Fig. 3.10a and 3.10b).

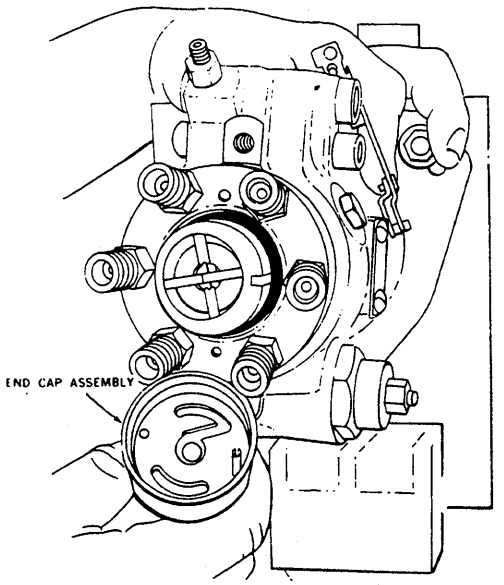


FIG. 3.10b

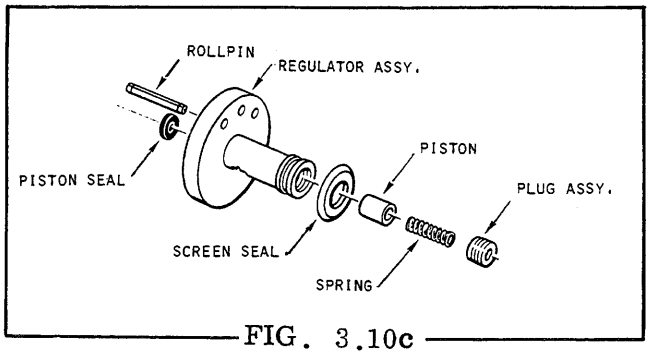


FIG. 3.10c

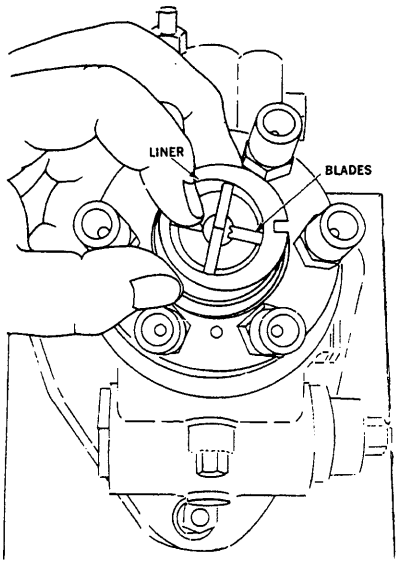


FIG. 3.10d

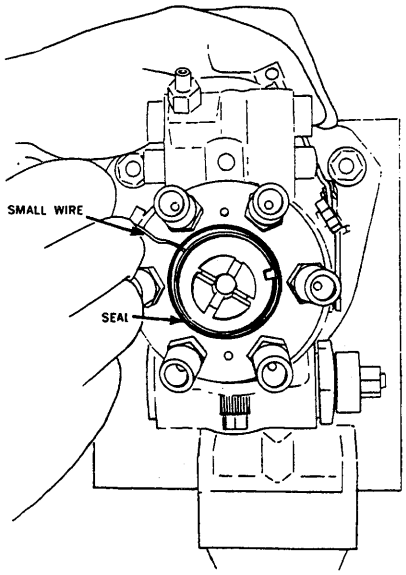


FIG. 3.10e

Disassemble the transfer pump regulator components (Fig. 3.10c). Remove the inlet filter screen seal. Remove the end plate adjusting plug assembly with a 5/32" hex key wrench. Shake the regulating spring and piston out of the regulator assembly. Using Tool No. 13301 remove the regulating piston seal from the regulator.

Remove the transfer pump blades and liner (Fig. 3.10d).

Remove the transfer pump end cap seal (Fig. 3.10e).

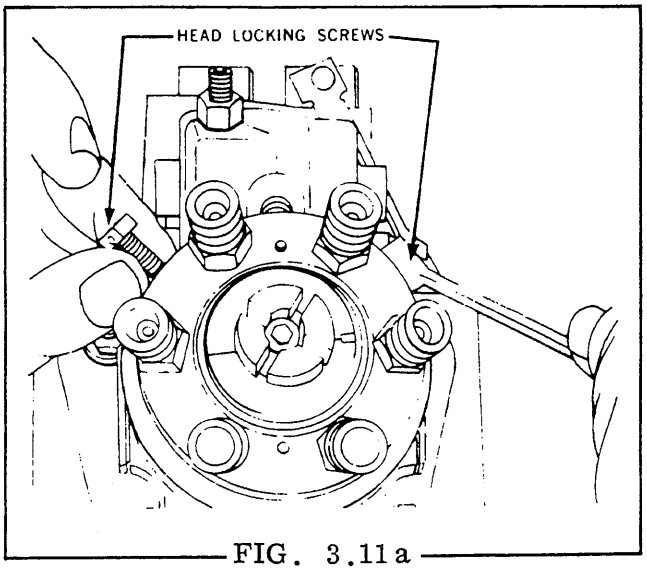


FIG. 3.11a

STEP 11 Loosen the head locking screws and remove one screw (Fig. 3.11a).

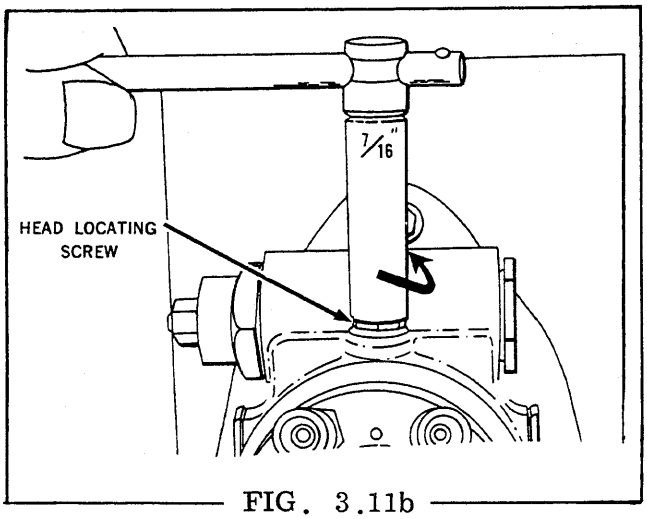


FIG. 3.11b

Invert the pump and holding fixture as a unit in the vise. Loosen and remove the head locating screw (Fig. 3.11b and 3.11c).

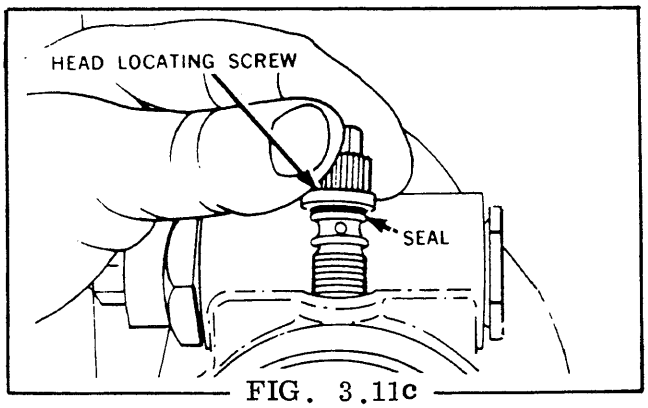


FIG. 3.11c

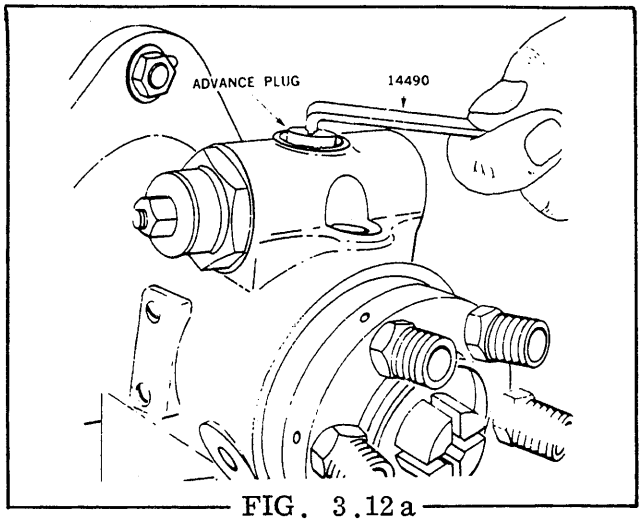


FIG. 3.12a

STEP 12 Loosen and remove the advance screw hole plug using Tool No. 14490 (Fig. 3.12a and 3.12b).

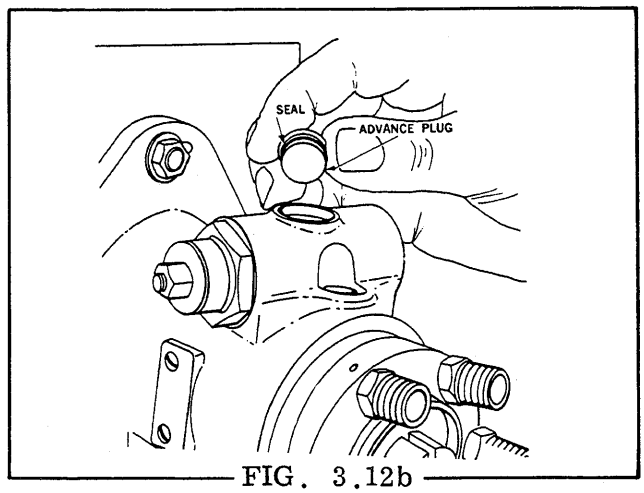


FIG. 3.12b

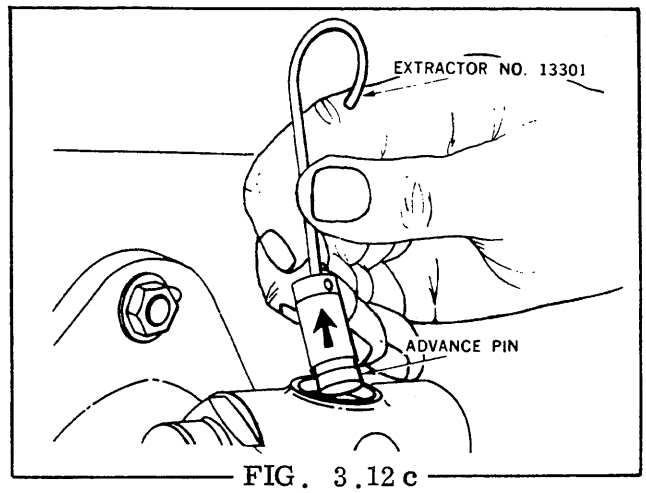


FIG. 3.12c

Insert Extractor No. 13301 into the hole in the advance pin and extract the pin (Fig. 3.12c).

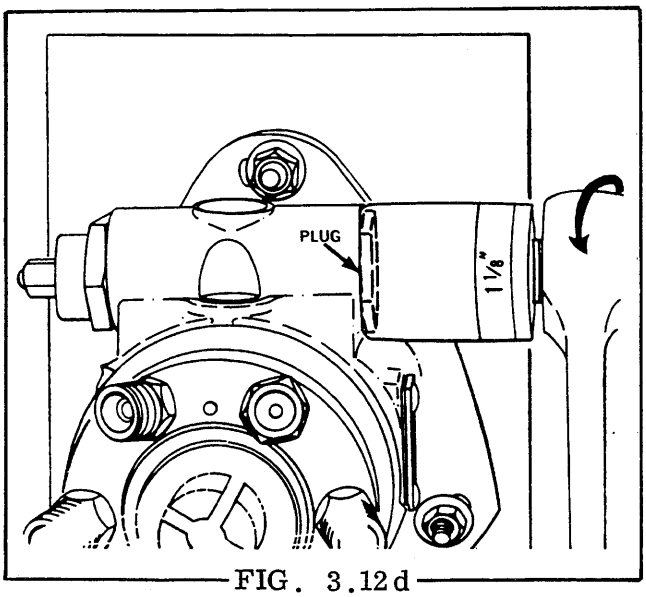


FIG. 3.12d

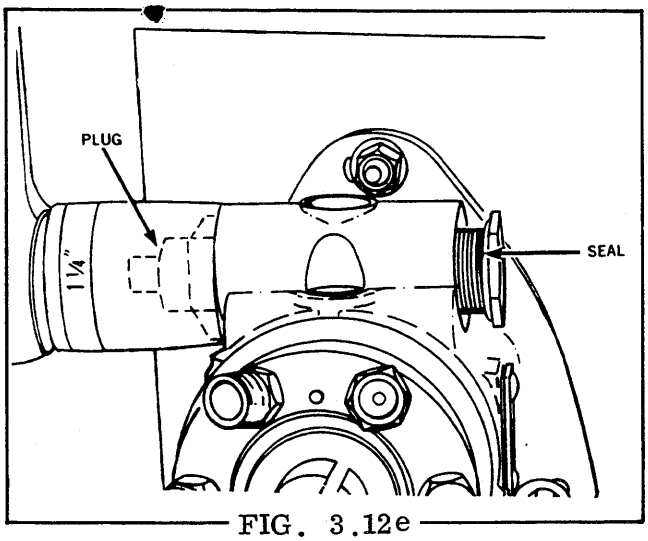


FIG. 3.12e

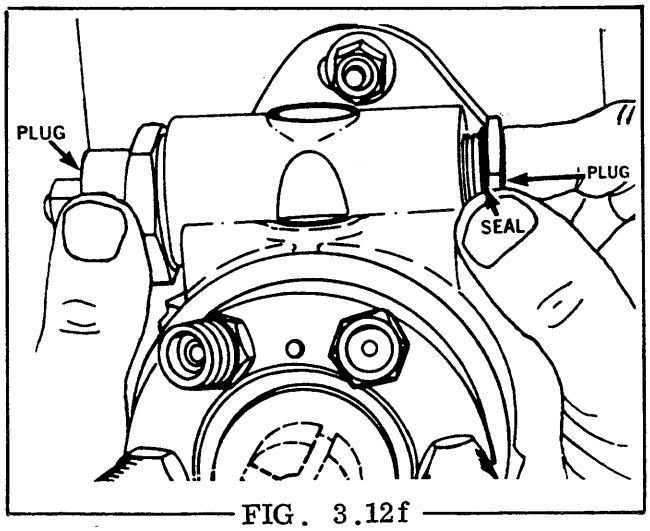


FIG. 3.12f

Loosen and remove the advance plug and power piston plug (Fig. 3.12d, 3.12e, 3.12f and 3.12g).

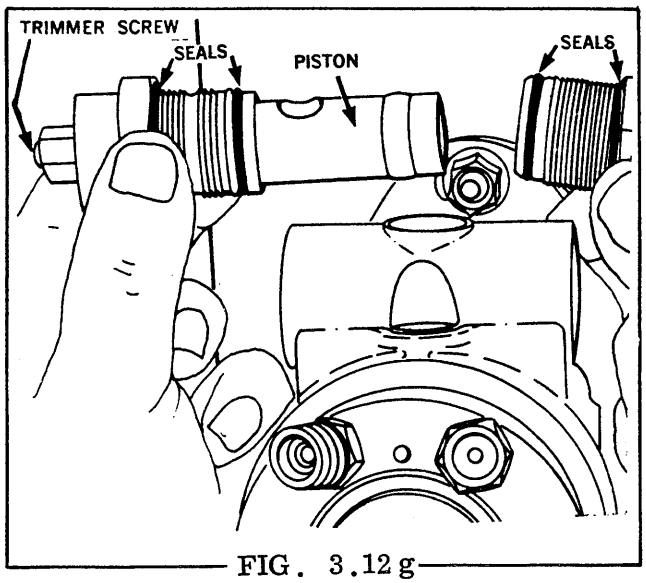


FIG. 3.12g

NOTE: The sides of the housing just above the advance bear a "C" or "CC" marking to denote pump rotation. The power side of the piston is located on the "C" side of a clockwise rotating pump and vice versa.

Disassemble the auto advance components (Fig. 3.12h).

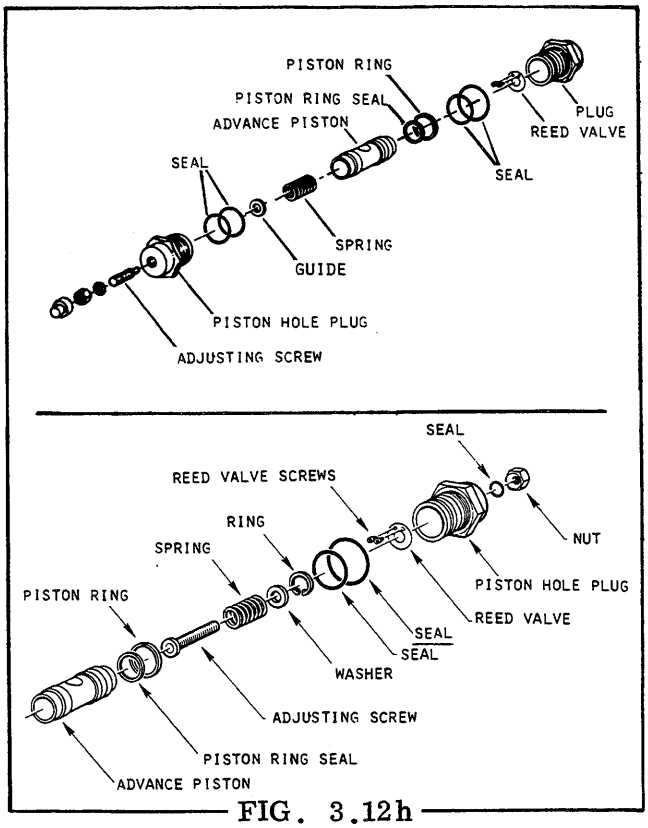


FIG. 3.12h

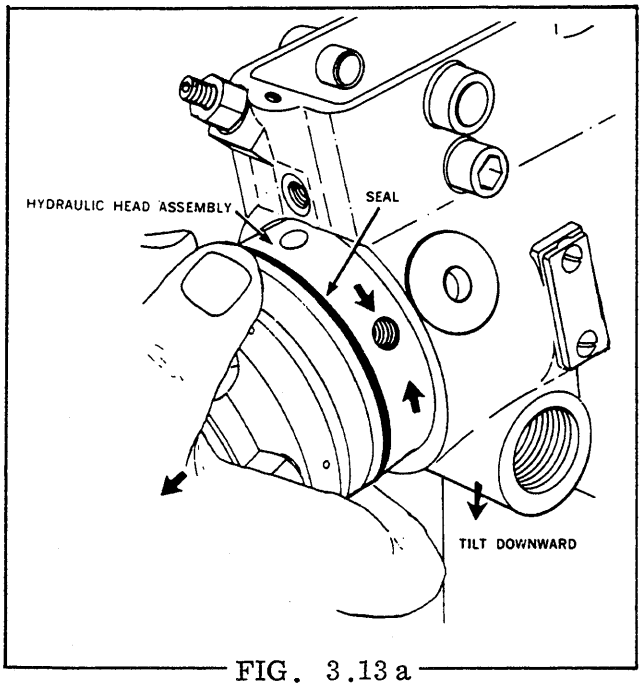


FIG. 3.13a

STEP 13 Return the pump and holding fixture as a unit to its initial position in the vise with the rear of the hydraulic head tilted slightly downward. Remove the remaining head locking screw. Grasp the hydraulic head assembly firmly in both hands and withdraw with a slight rotary motion (Fig. 3.13a and 3.13b).

NOTE: Use caution so as not to drop the governor weights.

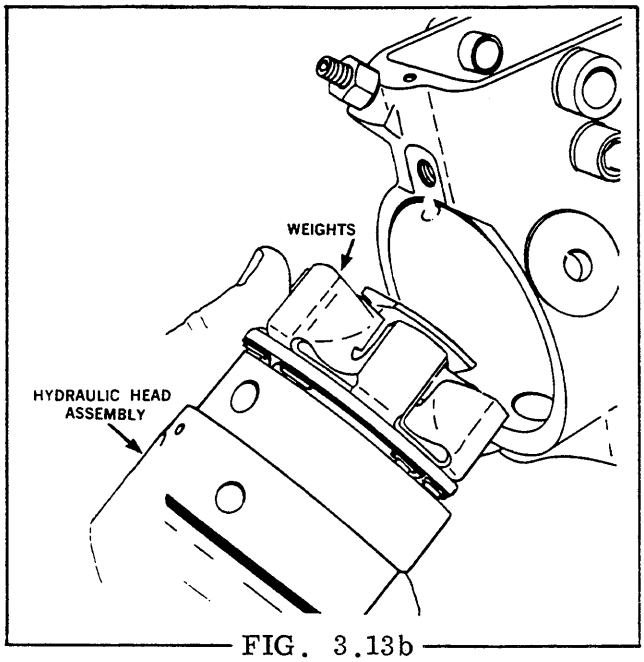


FIG. 3.13b

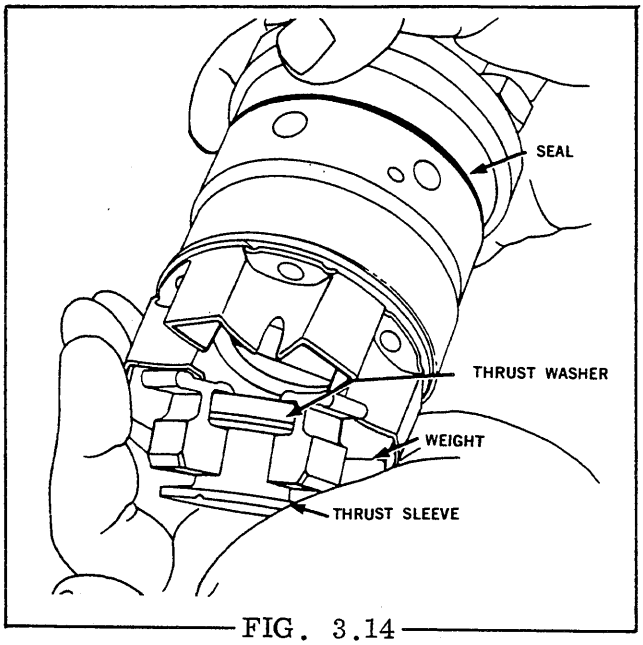


FIG. 3.14

STEP 14 To disassemble the governor, invert the hydraulic head and let the weights, governor thrust sleeve and washer fall into your hand (Fig. 3.14). Place head and rotor assembly on top of fixture No. 19965.

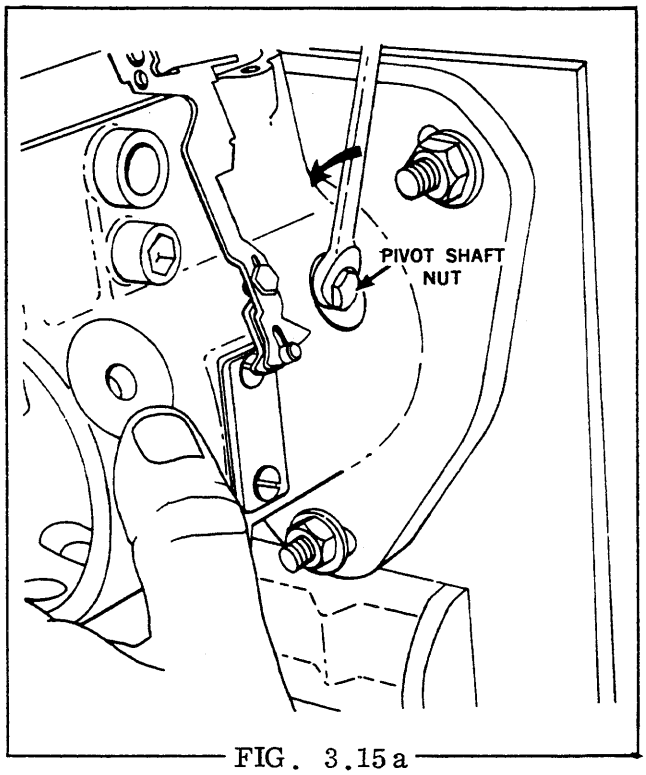


FIG. 3.15a

STEP 15 Loosen and remove one pivot shaft retainer nut and seal (Fig. 3.15a).

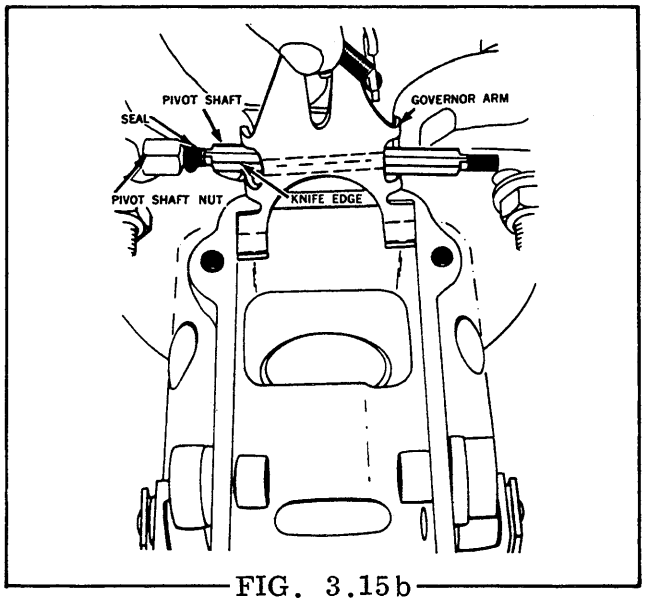


FIG. 3.15b

The governor arm pivot shaft, arm and linkage hook assembly may now be removed (Fig. 3.15b).

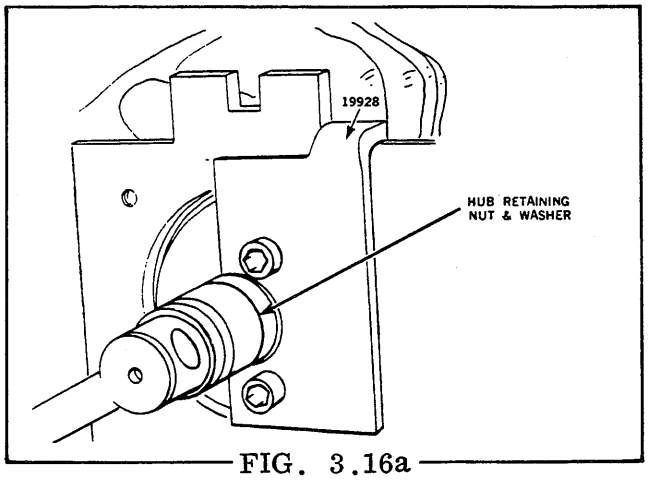


FIG. 3.16a

STEP 16 Install Tool No. 19928 on the gear hub, loosen and remove the hub regaining nut and washer (Fig. 3.16a).

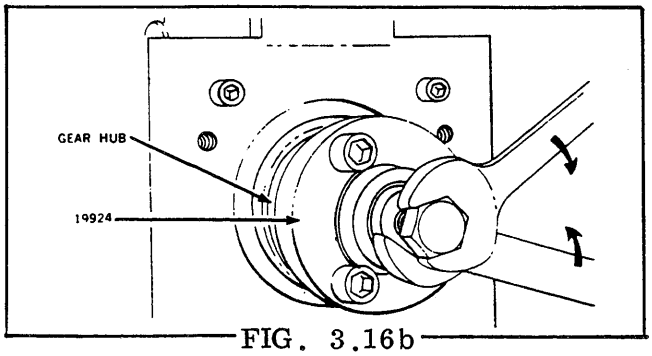


FIG. 3.16b

Install Gear Hub Puller Tool No. 19924 (Fig. 3.16b) and remove the gear hub.

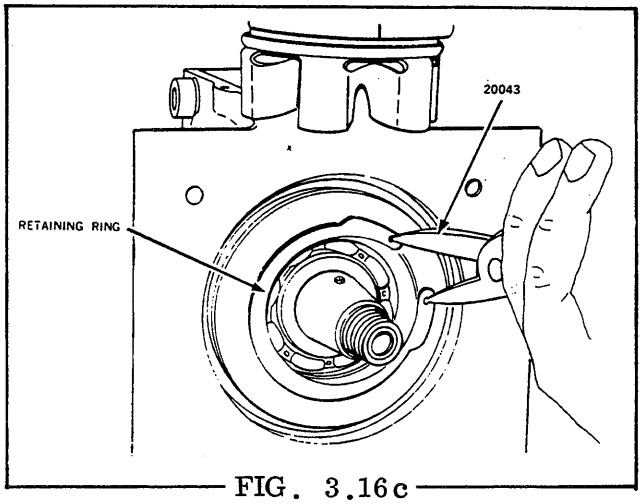


FIG. 3.16c

Remove the retaining ring using retaining ring pliers (No. 20043)(Fig. 3.16c).

NOTE: This retaining ring is under considerable compression force. Use only the recommended retaining ring pliers (No. 20043), and be extremely careful not to let the retaining ring slip off the pliers when removing.

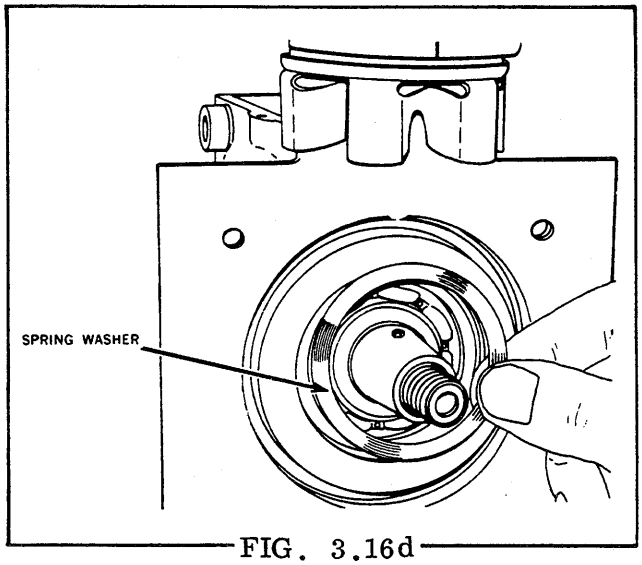


FIG. 3.16d

Remove the drive shaft spring washer (Fig. 3.16d).

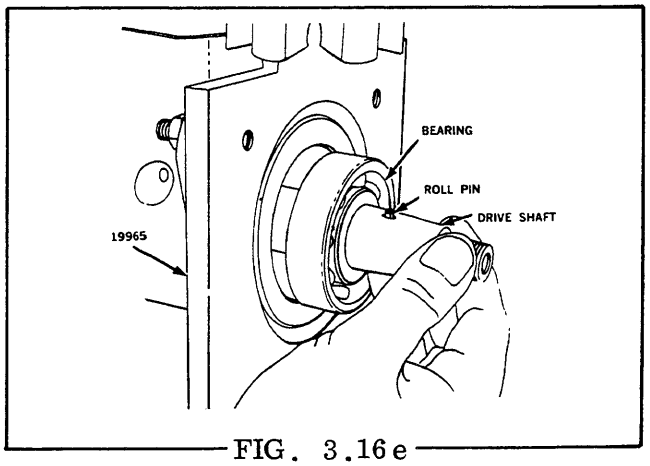


FIG. 3.16e

The drive shaft assembly may not be removed from the housing (Fig. 3.16e).

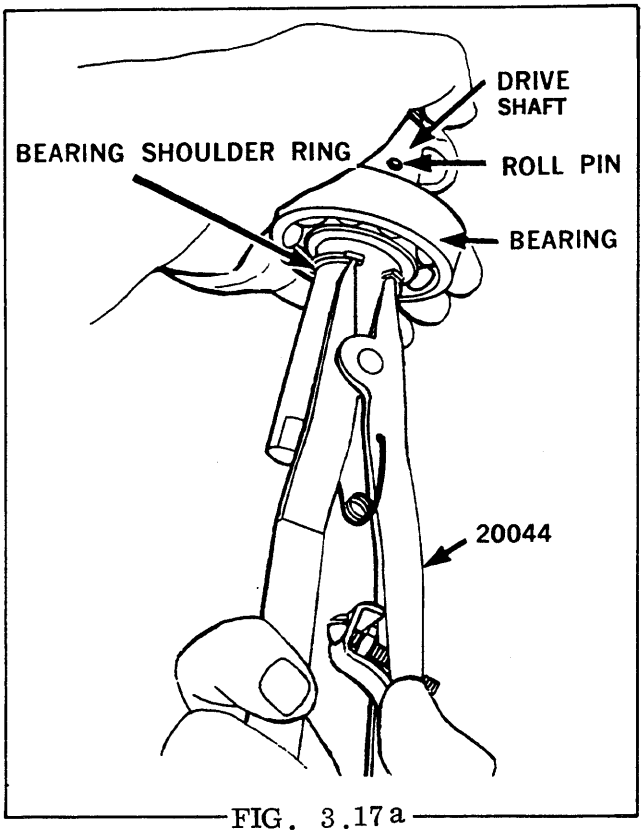


FIG. 3.17a

NOTE: Step 17 is only necessary if damage has occured to the drive shaft, roll pin or ball bearing.

STEP 17 Remove the bearing shoulder ring using retaining ring pliers (No. 20044) (Fig. 3.17a). It may be necessary to press off the ball bearing assembly slightly in order to do this.

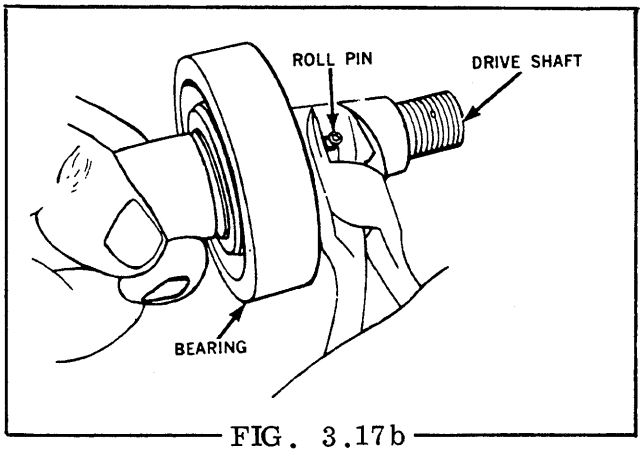


FIG. 3.17b

Remove the drive shaft roll pin using diagonal pliers (Fig. 3.17b). To remove the roll pin if it is broken use a 5/64" easy out extractor or a 3/32" carbide tipped drill.

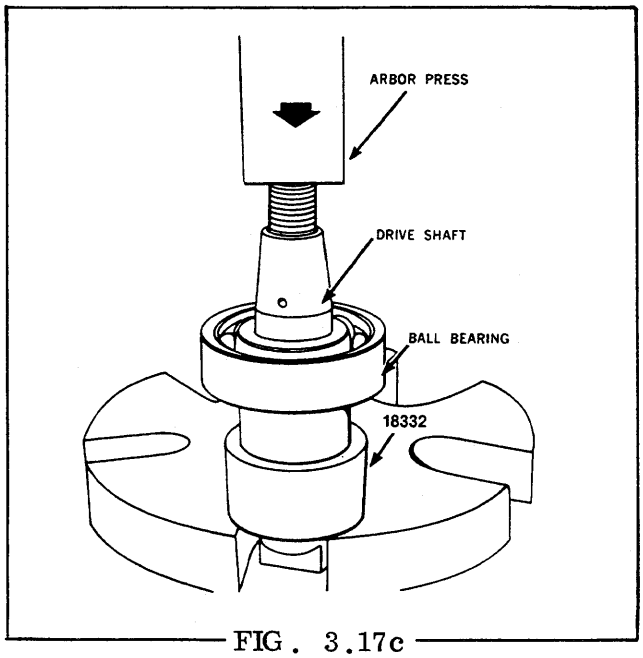


FIG. 3.17c

Place drive shaft on an arbor press and press on the threaded end of the drive shaft against the ball bearing. Support the bearing inner race with Tool No. 18332 to prevent bearing damage (Fig. 3.17c).

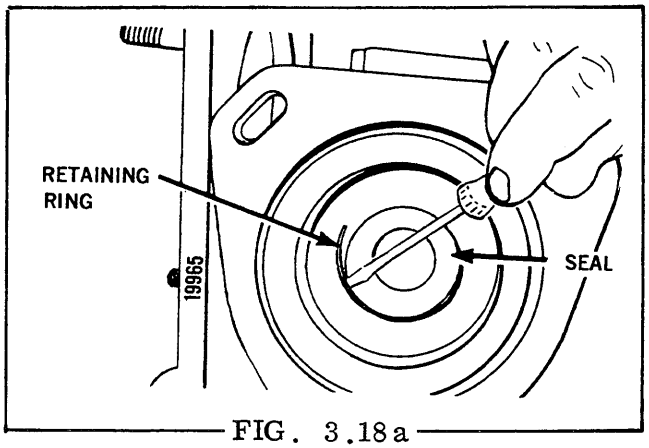


FIG. 3.18a

STEP 18 Remove the seal retaining ring from the housing (Fig. 3.18a).

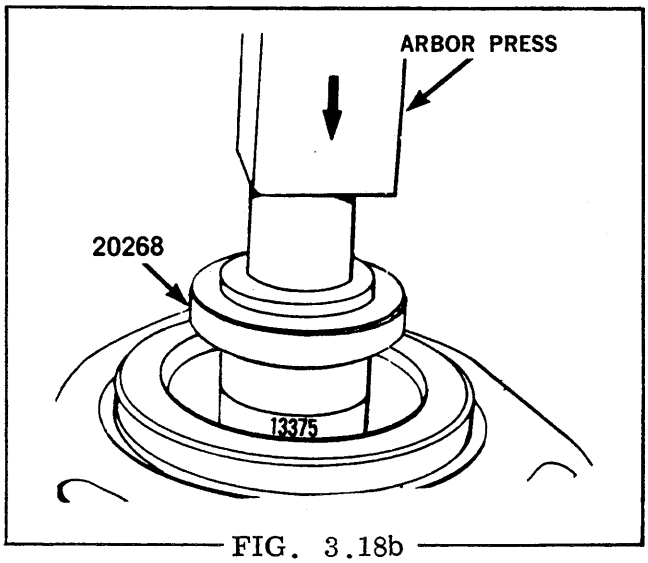


FIG. 3.18b

Place the inner portion of tool No. 13375 onto tool No. 20268 and press (From the front of the housing) the two drive shaft seals from the housing using an arbor press (Fig. 3.18b).

NOTE: Discard these seals, as they should not be reused.

STEP 19 Lift the liner locating ring from the rotor retainers (Fig. 3.19). (The early design transfer pump components used a locating ring without a split. Remove this solid ring by inserting two small rods or hex-key wrenches into the two holes in the ring and prying outward).

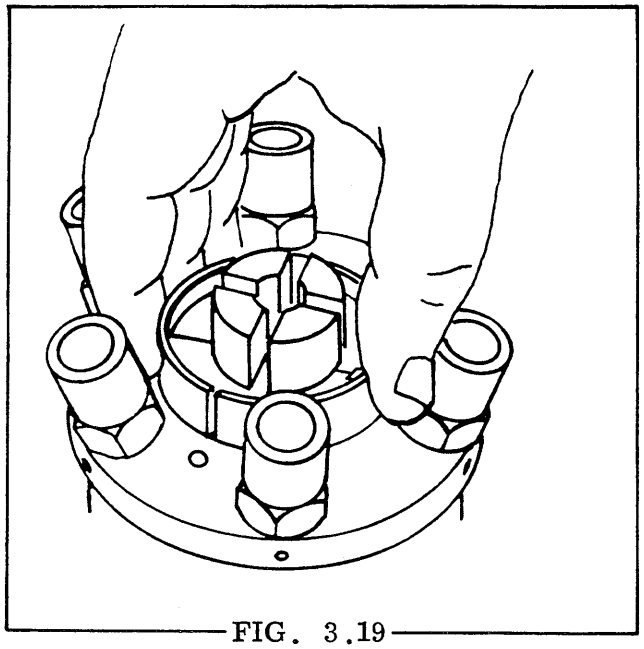


FIG. 3.19

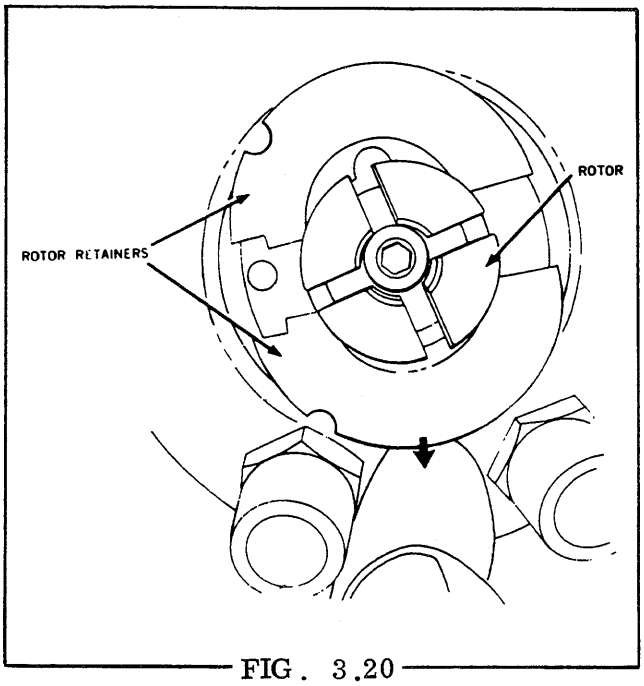


FIG. 3.20

STEP 20 Remove the rotor retainers (Fig. 3.20).

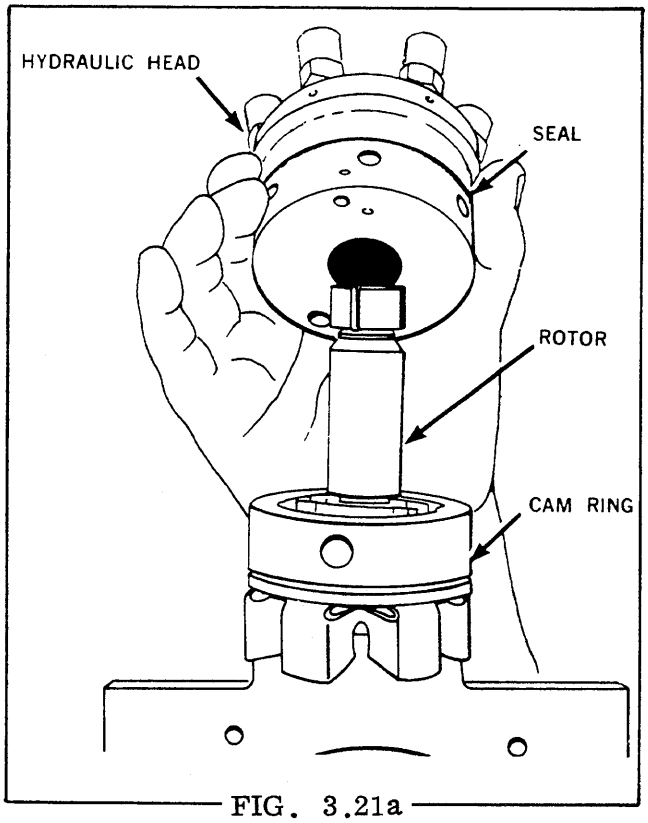


FIG. 3.21a

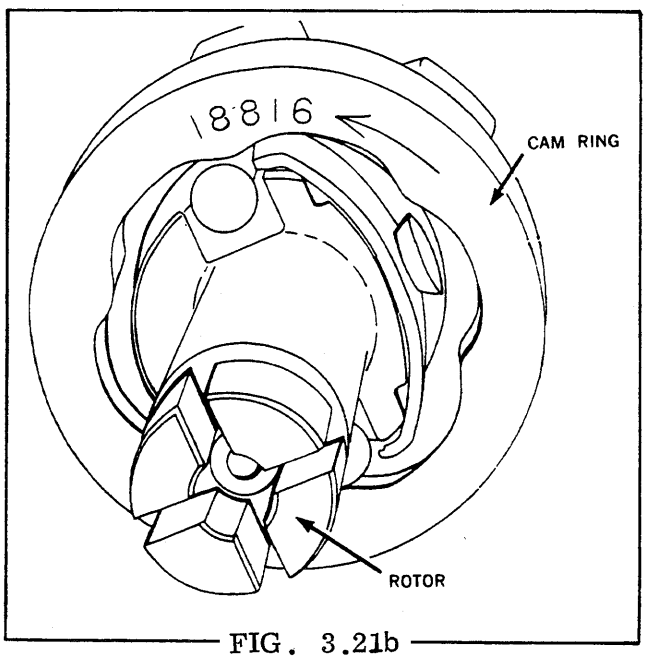


FIG. 3.21b

STEP 21 Lift the head from the rotor (Fig. 3.21a). Lift the cam ring from the rotor (Fig. 3.21b).

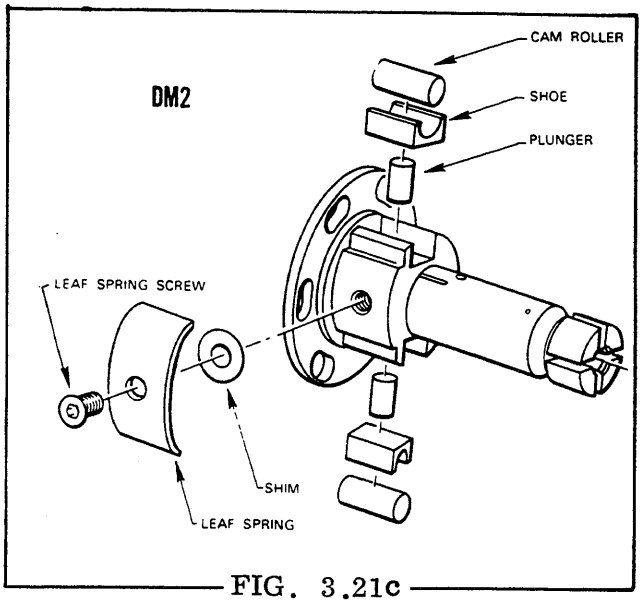


FIG. 3.21c

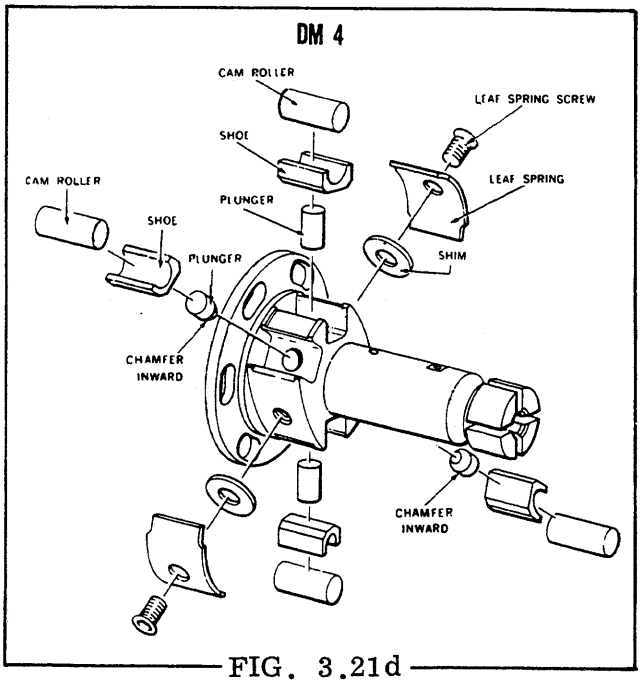


FIG. 3.21d

Check and record roller-to-roller dimension as instructed on page 5-6, Step 7, DM2 or DM4. Compare this dimension with that called for on the pump specification. Remove roller shoes and plungers (Fig. 3.21c and 3.21d). Use brass Tool No. 13301 to push pumping plungers from their bore. Handle all parts carefully with clean hands wet with fuel oil or calibrating oil. Avoid handling the precision ground surface of the rotor. Use a 5/32" hex key wrench to loosen and remove the leaf spring adjusting screw(s), leaf spring(s) and shims (if used) from the rotor.

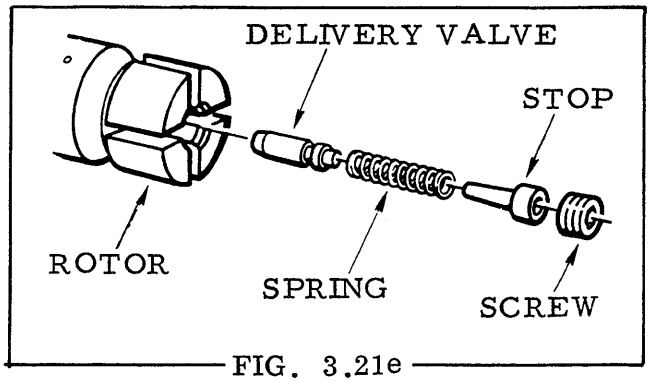


FIG. 3.21e

Loosen and remove delivery valve stop screw using a 5/32" hex key wrench or 3/16" hex key wrench (Fig. 3.21e). The delivery valve stop and spring may now be removed. If the delivery valve does not slide freely from its bore, use extractor No. 13383. Discard the delivery valve stop.

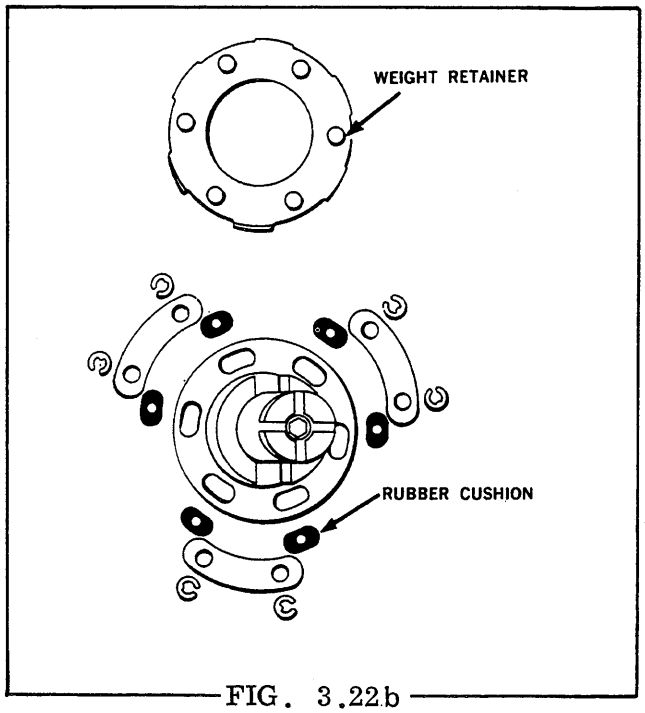


FIG. 3.22b

Remove weight retainer and rubber cushions from the hub (Fig. 3.22b).

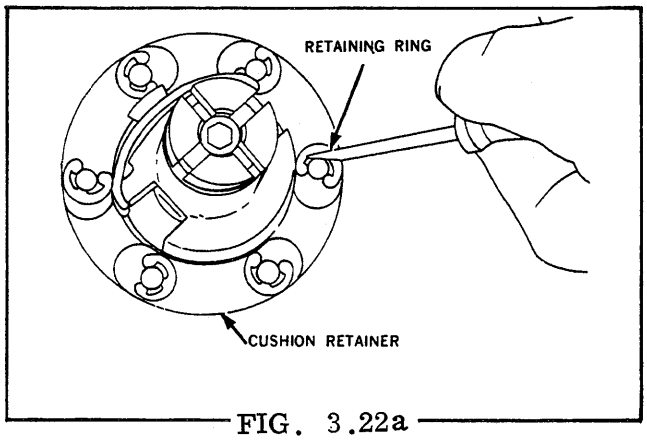


FIG. 3.22a

STEP 22 Remove the retaining rings and cushion retainers from the governor weight retainer assembly (Fig. 3.22a).

NOTE: Discard the retaining rings since they should not be reused.

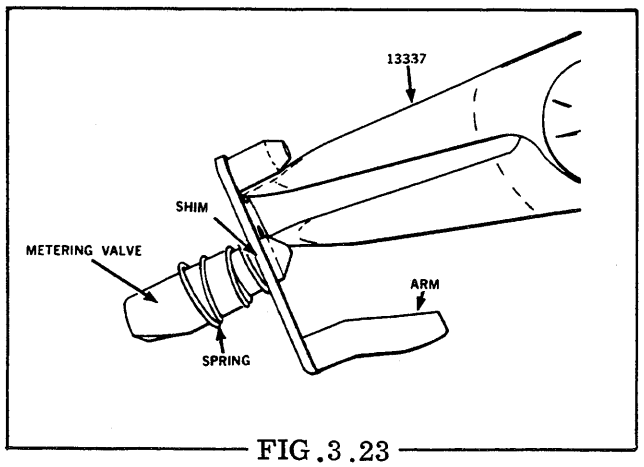


FIG.3.23

STEP 23 Remove the metering valve from the arm assembly with retaining ring pliers (No. 13337) (Fig. 3.23).

TOPIC 4 PARTS INSPECTION

⚠ DANGER

Extinguish all smoking materials and open flames before working around diesel fuel.

⚠ WARNING

⚠ Never use gasoline, solvent or other flammable fluids to clean parts.

⚠ Wear safety glasses with side shields or goggles when using compressed air for cleaning to reduce the danger of personal injury from flying particles. Limit the pressure to 30 psi (2.1 kg/cm^2) according to OSHA requirements.

A. GENERAL INSPECTION

Dirt is the greatest enemy of fuel injection pump. Keep the work area clean.

Parts must be washed in a non-flammable, non-toxic, commercial solvent and then placed in a clean pan containing fresh fuel or calibrating oil.

It is necessary for assembly to lubricate parts with clean diesel fuel. Make sure that all smoking materials are extinguished and no open flames and sparks are near. Place all parts prior to assembly in a closed container of clean diesel fuel for lubrication.

Examine all parts carefully in accordance with instructions which follow:

Discard all "O" rings, seals, gaskets, weight retainer cushions and weight retaining rings. Replace with appropriate gasket kits. Examine all springs for fretting, wear, distortion or breakage. Clean and carefully check all bores, grooves and seal seats for damage or wear of any kind.

Replace damaged or worn parts as necessary.

B. DETAILED INSPECTION

PART GROUP	PART	Excessive Wear	Foreign Material or Rust	Nicks or Chipping	Scratches or Scores	Thread Damage	Cracks	Distortion	Freedom of Movement	SPECIFICALLY INSPECT:
Housing & Drive	Housing	X	X	X	X	X	X	X		See Supplementary Inspection 1, Page 4.2
	Drive Shaft	X	X	X	X	X	X	X		
	Ball Bearing	X	X	X	X				X	
Hydraulic Head & Rotor	Hydraulic Head	X	X	X	X	X	X			
	Vent Wire		X						X	See Supplementary Inspection 2, Page 4.2
	Discharge Fittings	X	X	X	X	X	X			Inside diameter of discharge fittings, sealing area for wear, nicks & scores
	Distributor Rotor	X	X	X	X	X	X		X	See Supplementary Inspection 3, Page 4.2
	Delivery Valve	X	X	X	X		X		X	See Supplementary Inspection 4, Page 4.2
	Plungers	X	X	X	X				X	See Supplementary Inspection 5, Page 4.2
	Cam Rollers & Shoes	X	X	X	X		X		X	See Supplementary Inspection 6, Page 4.3
	Leaf Spring(s) & Screw(s)	X	X	X		X	X			See Supplementary Inspection 7, Page 4.3
	Cam	X	X	X	X		X	X		See Supplementary Inspection 8, Page 4.3
	Governor Weight Retainer	X	X	X			X	X		Where weights pivot in retainer socket, also "E" ring area for wear, loose pins
	Governor Weights	X	X	X			X		X	See Supplementary Inspection 9, Page 4.3
	Governor Thrust Washer	X	X	X	X		X	X		Contact areas for excessive wear
	Governor Thrust Sleeve	X	X	X			X	X		Points of contact with governor arm for excessive wear
Transfer Pump	End Cap		X			X	X			
	Inlet Screen		X				X	X		Screen and soldered area for breakage
	End Plate Adj. Plug		X			X				Tightness in regulator, plugged orifice, loose plate
	Regulating Piston	X	X	X	X				X	
	Regulator		X	X	X	X	X	X		Inside diameter of regulator
	Blades	X	X	X	X		X		X	See Supplementary Inspection 10, Page 4.3
	Liner	X	X	X	X					Inside diameter in high pressure area for wear
	Rotor Retainers	X	X	X	X					

(Continued)

Parts Inspection

PART GROUP	PART	Excessive Wear	Foreign Material or Rust	Nicks or Chipping	Scratches or Scores	Thread Damage	Cracks	Distortion	Freedom of Movement	SPECIFICALLY INSPECT:
Governor	Pivot Shaft	X	X	X		X		X		Chipped or worn knife edge
	Arm	X	X	X			X	X	X	Points of contact with thrust sleeve & pivot shaft for excessive wear
	Metering Valve	X	X	X	X		X		X	See Supplementary Inspection 11, Page 4.4
	Metering Valve Arm	X	X	X	X		X	X		See Supplementary Inspection 11, Page 4.4
Linkage	Linkage Hook	X	X	X	X	X	X	X	X	Metering valve pin hole
Advance	Piston	X	X	X	X				X	
	Pin	X	X	X	X				X	
	Reed Valve		X	X	X		X	X		
	Plugs	X	X	X	X	X	X	X	X	Bore for excessive wear

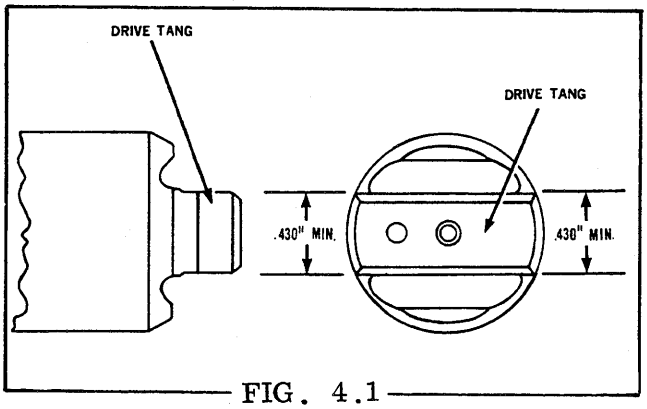


FIG. 4.1

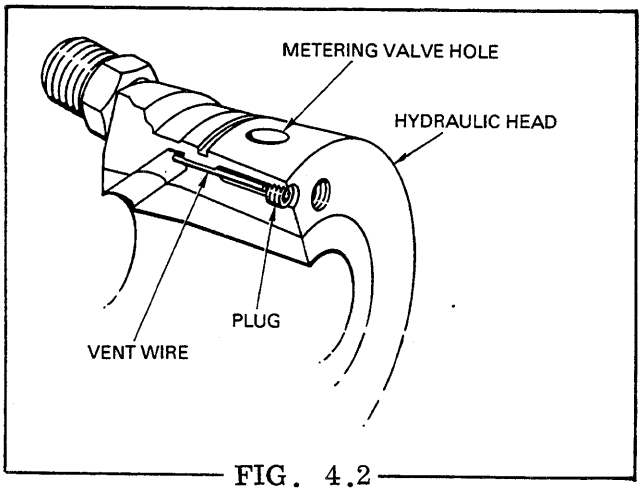


FIG. 4.2

C. SUPPLEMENTARY INSPECTION

1. Drive Shaft - Measure the distance across the flats of the drive tang which must not be less than .430". The shaft diameter in the drive shaft seal area must be free of nicks and scratches for the seals to function properly. Moderate shaft wear from the seal lips is normal (Fig. 4.1).

2. Hydraulic Head - Check the vent wire in the hydraulic head air bleed passage for freedom of movement. If the wire is free, flush the head and blow out all passages with clean, dry air. If vent wire is stuck, remove and replace it after a thorough cleaning of the passage. Refer to the proper specifications for the correct vent wire.

NOTE: Do not immerse this head in solvent for extended periods as sealant damage will result (Fig. 4.2).

3. Distributor Rotor - Examine the radii contacted by the leaf spring(s) and the tang slot for excessive wear. Check all slots, charging and discharge ports for chipping of edges or dirt, and the rotor shank for major scratches. Slight erosion on the edge of the discharge port is considered normal. If damage or excessive wear is apparent, the head and rotor must be replaced as a matched unit. Final check for excessive wear on the rotor should be performed on the test stand by checking for minimum cranking delivery.

4. Delivery Valve - Inspect delivery valve retraction cuff for chipping or erosion of edges (Fig. 4.3).

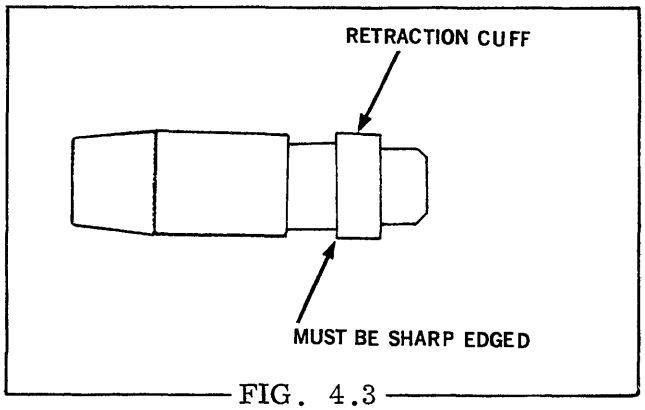


FIG. 4.3

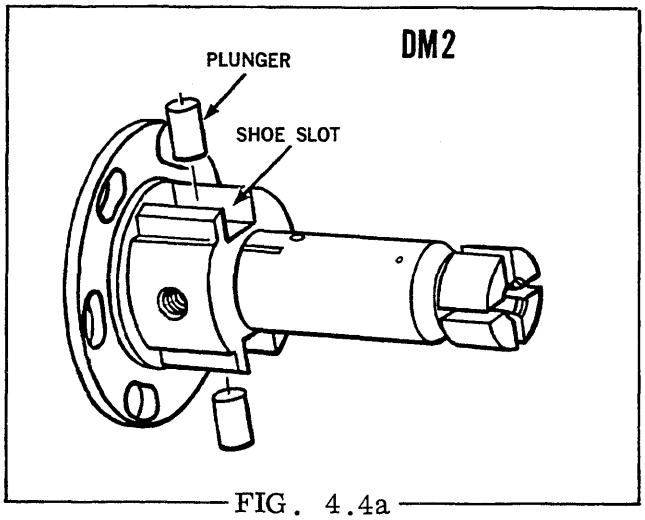


FIG. 4.4a

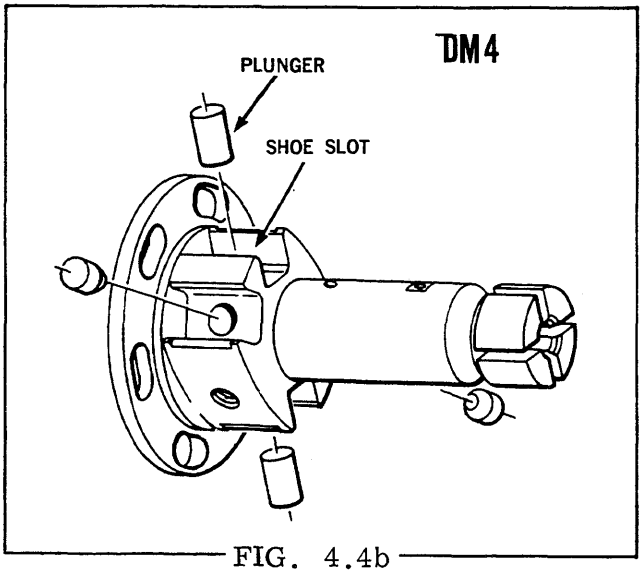


FIG. 4.4b

⚠ WARNING

Lacquer thinner and acetone are extremely flammable and may cause an allergic reaction in some individuals. Follow manufacturer's recommendations for proper use and handling.

5. Plungers - While holding the rotor under clean oil, insert the plungers into their bore. Insert only the longer plungers if the DM4 pump is being examined. With thumb and forefinger over the shoe slots, tilt from side to side several times to determine complete freedom of movement. Interchanging or reversing their initial positions may be necessary, as these are matched parts. Repeat with the short set without removing first set on the DM4 pump. If the plungers are sticking, but not visibly damaged, clean both plungers and bore with a soft brush and a solvent such as lacquer thinner or acetone. (See warning above) (Do not force plungers into their bore and do not handle rotor shank) (Figs. 4.4a and 4.4b).

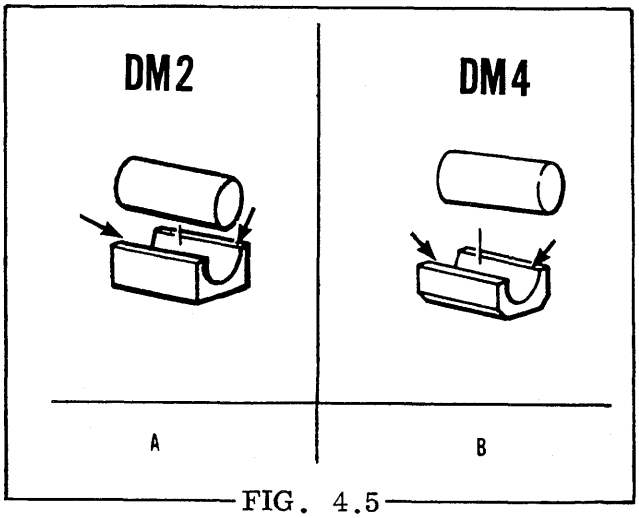


FIG. 4.5

6. Cam Rollers and Shoes - Check each roller in its shoe for freedom of rotation. Inspect the top edge of each shoe, where retained by the leaf spring, for chipping or excessive wear. Improved roller surfaces will result from long, normal operation in clean fuel oil (Figs 4.5a and 4.5b).

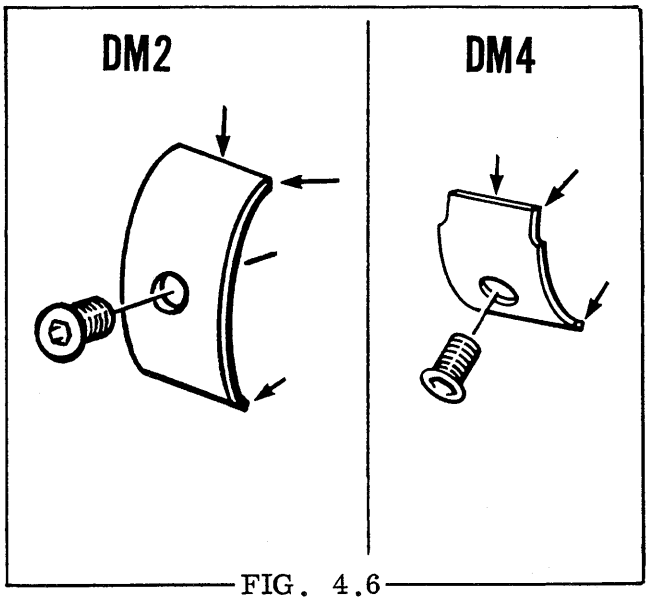


FIG. 4.6

7. Leaf Spring (s) and Screw(s) - Check for excessive wear at points where the spring(s) contacts the radii on the rotor and along the steps that retain the roller shoes. Check the adjusting screw(s) for tightness in the rotor (Figs. 4.6).

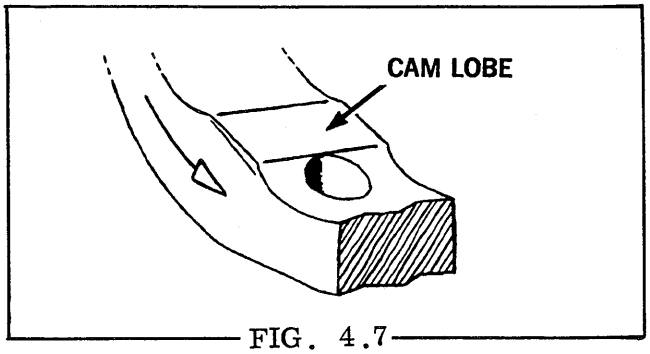


FIG. 4.7

8. Cam - Since only the working portions of the lobes on the inside diameter are ground, any tool marks between lobes should not be considered as damage. The mottled appearance of the cam is from heat treatment rather than from operation. Carefully inspect the cam lobes and edges of all flat surfaces. If there is evidence of spalling or flaking out, replace with a new cam. Improved cam lobe finish will result from long, normal operation in clean fuel oil (Fig. 4.7).

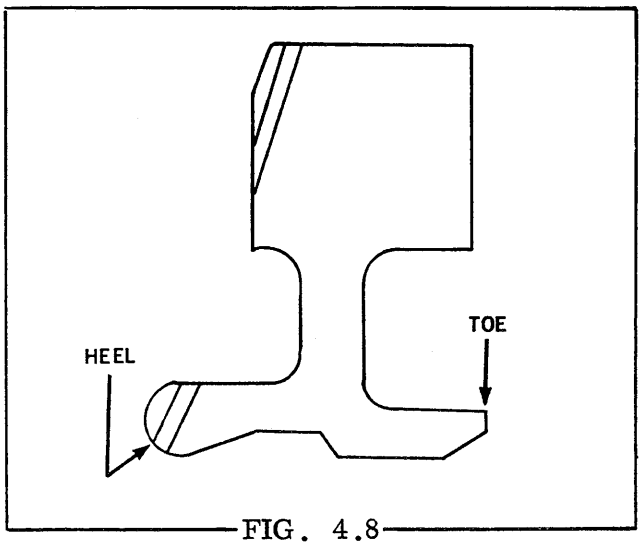


FIG. 4.8

9. Governor Weights - Check pivot points and toe) of all weights for excessive wear (Fig. 4.8).

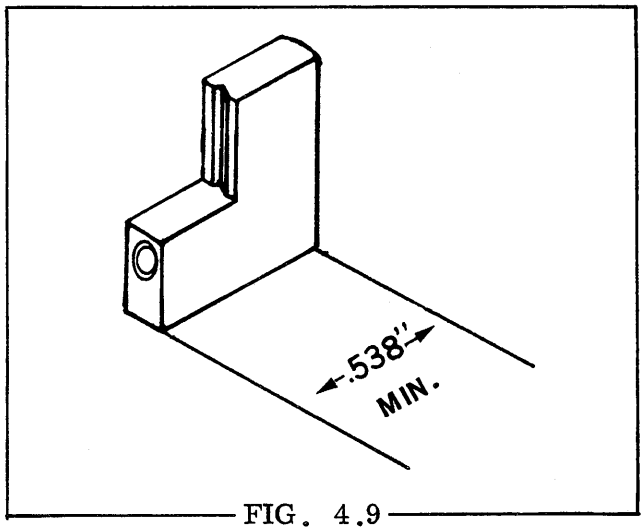


FIG. 4.9

10. Transfer Pump Blades - Inspect with the utmost care. Check for chipping on any of the edges, including spring bore edges, pitting, imbedded foreign particles or scoring on the rounded ends. Determine blade wear by measuring the length (0.538" minimum). Inspect flat surfaces visually for deep scores. If any discrepancies are noted, replace both blade sets and springs (Fig. 4.9).

11. Metering Valve and Arm - Check the metering valve body for excessive wear. Be sure the metering valve arm is well seated and that there is no radial movement of the arm on the valve. Check the metering valve spring for distortion and the metering valve arm pin for wear or looseness (Fig. 4.10).

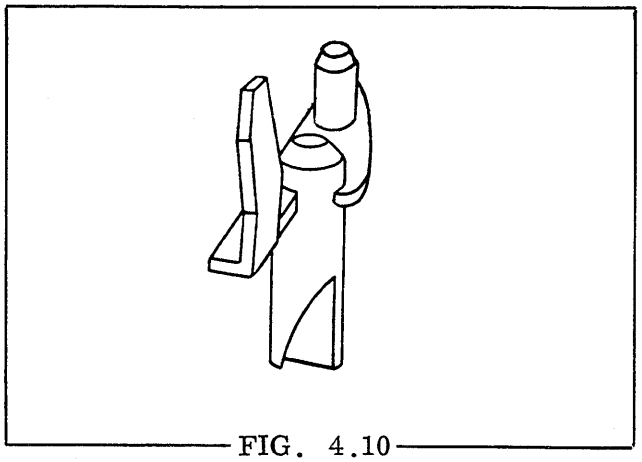


FIG. 4.10

TOPIC 5 REASSEMBLY

DANGER

Extinguish all smoking materials and open flames before working around diesel fuel.

WARNING

Never use gasoline, solvent or other flammable fluids to clean parts.

All parts must be thoroughly flushed in clean oil as they are being reassembled; do not wipe oil or wipe dry. Cleanliness will contribute to long life and trouble-free operation. All seals and gaskets must be replaced, whether visibly damaged or not. Gasket kits are provided for this purpose. Refer to PARTS CATALOG (Topic 12) for gasket kit part numbers. Apply clean grease sparingly to all seals to facilitate assembly and to prevent cutting.

It is necessary for assembly to lubricate parts with clean diesel fuel. Make sure that all smoking materials are extinguished and no open flames and sparks are near. Place all parts prior to assembly in a closed container of clean diesel fuel for lubrication.

IMPORTANT: Refer to the Torque Value Chart for proper tightening of all fasteners.

STEP 1 To install the drive shaft seals, place the pump housing (flange end down) on an arbor press. Apply a light coating of lithium base grease to the housing seal bore and the O.D. of the seals prior to assembly. If the housing seal bore is scored due to seal removal, apply a light coating of Gasoila sealing compound to the seal bore instead of grease. Place a new seal, with the seal lip facing the tool, on the short end of Tool No. 20268 (Fig. 5.1a). Press the seal into the housing until the tool bottoms against the housing (Fig. 5.1b). Note: This seal must not protrude into the housing cavity.

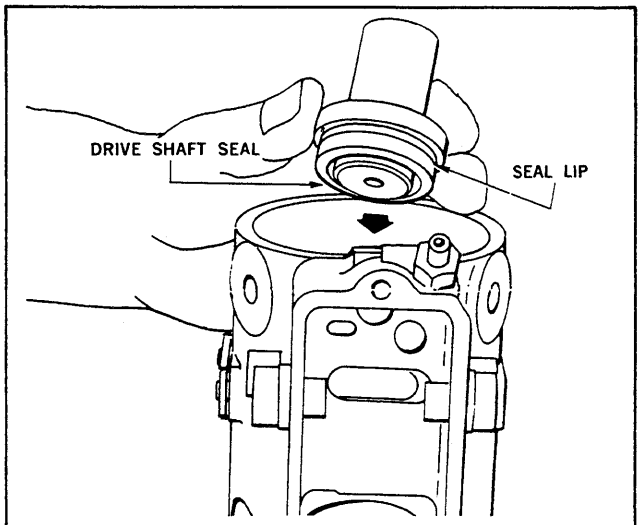


FIG. 5.1a

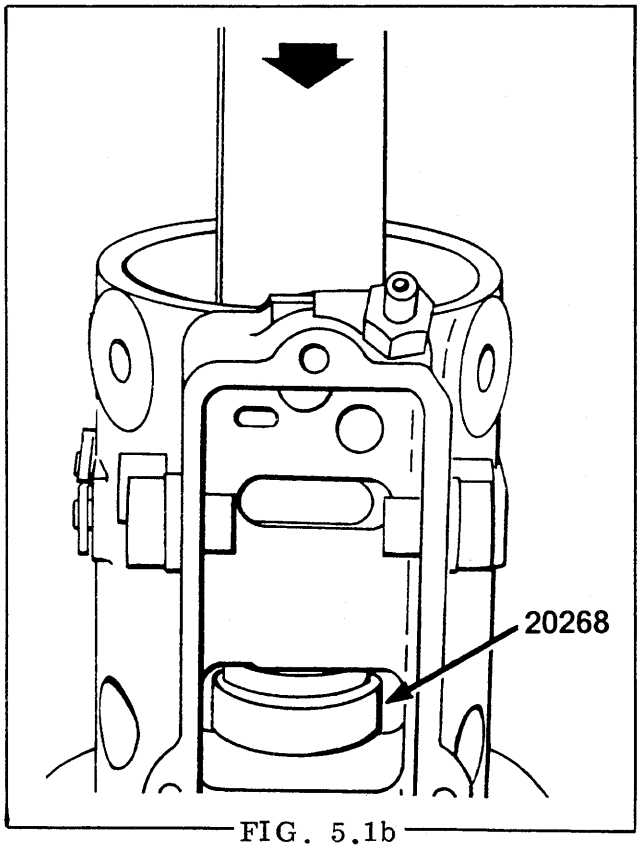


FIG. 5.1b

Invert the pump housing (flange end up) on the arbor press. Place a new seal, with seal lip facing the tool, on the short end of Tool No. 20268 (Fig. 5.1c) and press the seal into the flange end of the housing until the tool bottoms (Fig. 5.1d).

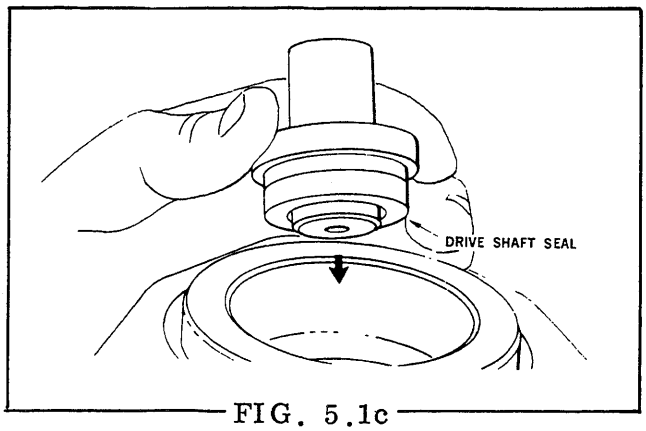


FIG. 5.1c

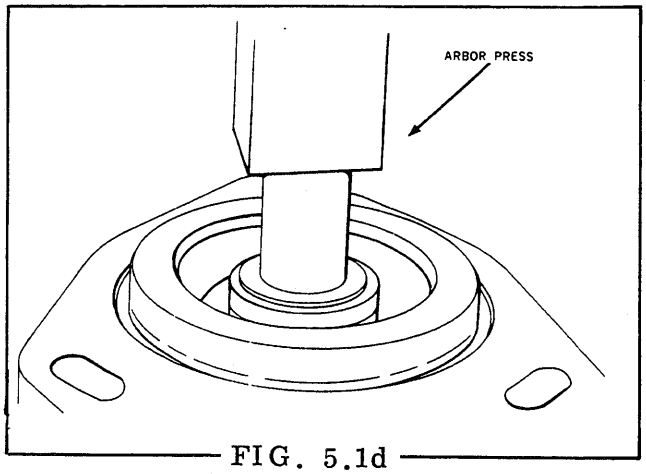


FIG. 5.1d

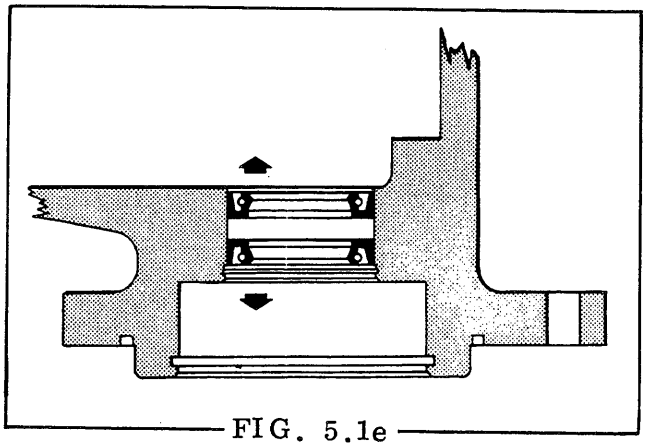


FIG. 5.1e

Note the correct position of the seals, as shown in Fig. 5.1e. Insert the seal retaining ring into the groove in the housing seal bore.

STEP 2 Install the bearing shoulder ring in the groove on the drive shaft using retaining ring pliers (No. 20044) (Fig. 5.2a).

Place the drive shaft into the bearing on an arbor press with threaded end down. Support the bearing inner race with Tool No. 18332. Press the shaft into the bearing until

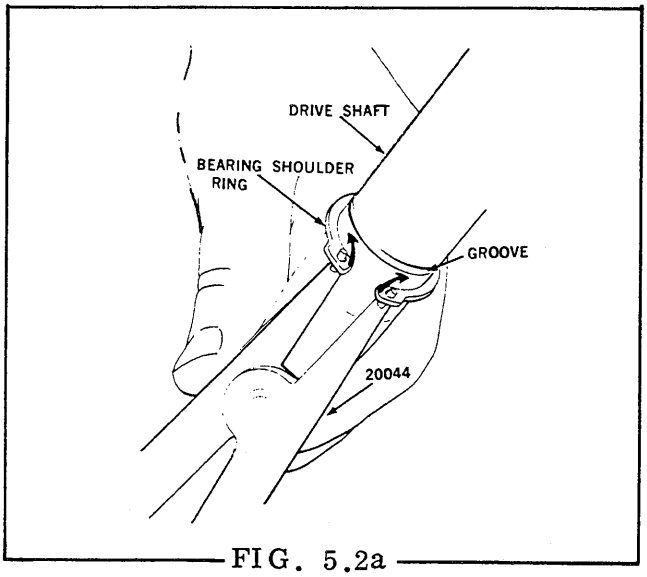


FIG. 5.2a

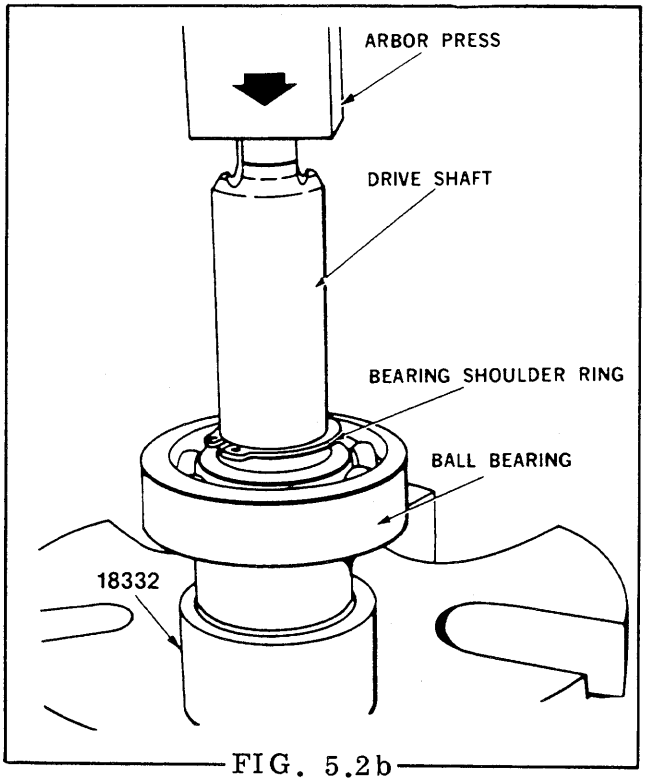


FIG. 5.2b

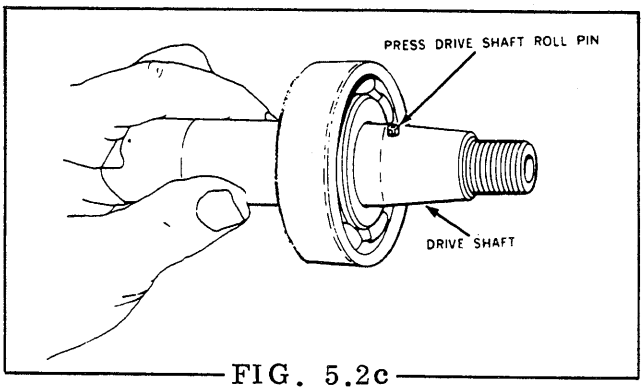


FIG. 5.2c

the bearing shoulder ring is flush with the bearing (Fig. 5.2b).

Press the drive shaft roll pin into the drive shaft pin hole until pin bottoms (Fig. 5.2c).

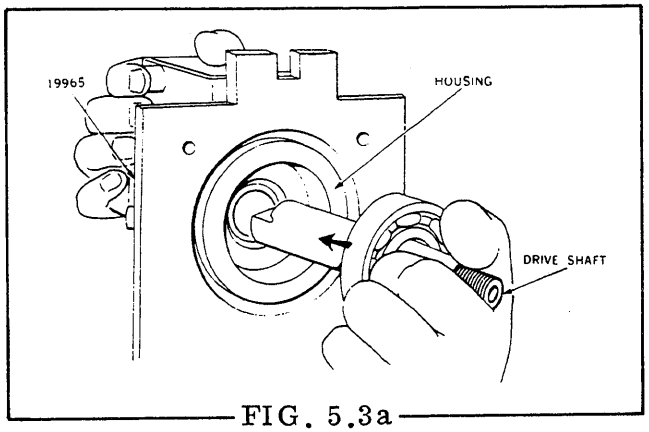


FIG. 5.3a

STEP 3 Mount the pump housing in holding Fixture No. 19965. Never clamp the pump into a vise, always use a fixture. Lubricate the O.D. of the drive shaft bearing with mineral oil and install the drive shaft assembly into the housing (Fig. 5.3a). Do not force bearing into the housing bore.

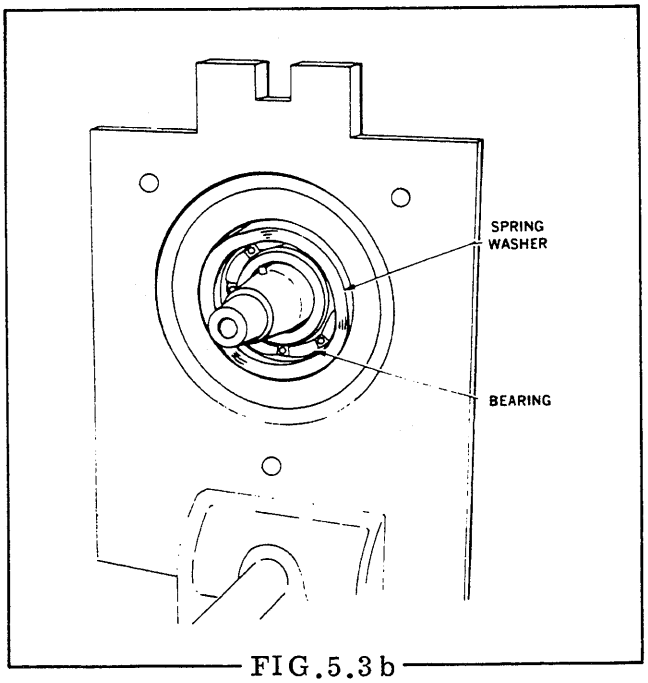


FIG.5.3b

Place the drive shaft spring washer against the bearing (Fig. 5.3b).

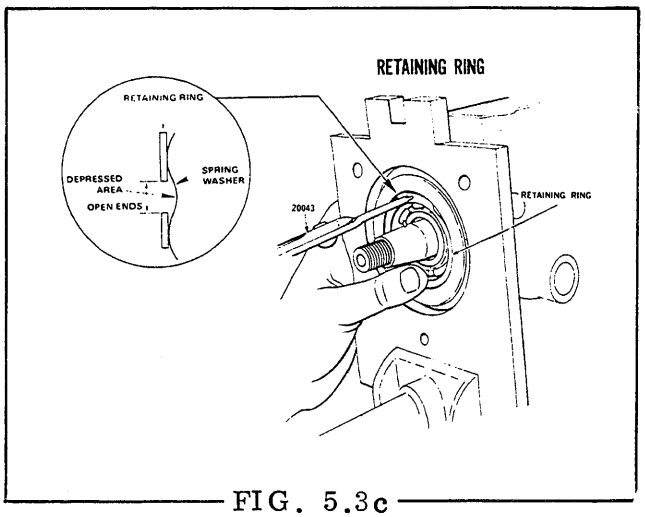


FIG. 5.3c

Assemble the retaining ring to the housing so that the open ends are against the depressed area of the spring washer, using retaining ring pliers (No. 20043)(Fig. 5.3c).

NOTE: This retaining ring will take considerable compression force to insert in the housing. Use the recommended retaining ring pliers (No. 20043) and be extremely careful not to let the retaining ring slip off the pliers when installing.

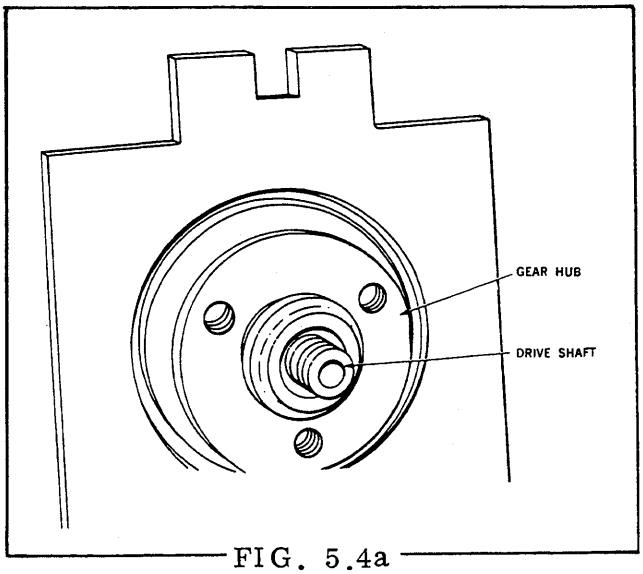


FIG. 5.4a

STEP 4 Assemble the gear hub to the drive shaft, with the notched portion of the gear hub in line with the drive shaft roll pin (Fig. 5.4a).

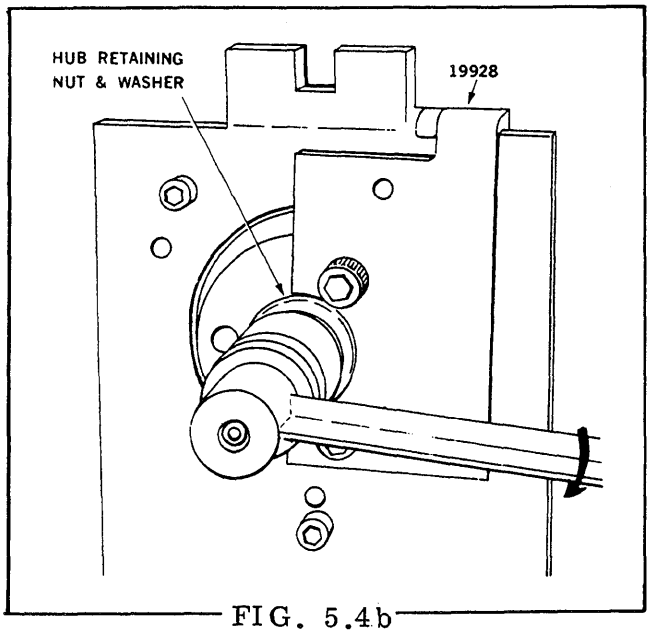


FIG. 5.4b

REFERENCE TORQUE VALUE CHART

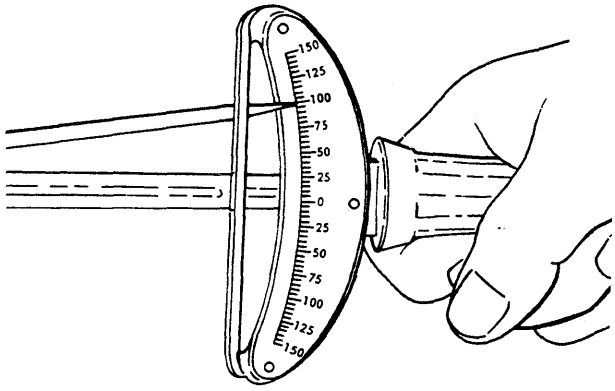


FIG. 5.4c

Install Tool No. 19928 on the gear hub. Place the hub retaining washer and nut on the drive shaft and torque (Fig. 5.4b and 5.4c). Refer to Torque Value Chart for proper torque.

NOTE: The correct torque on this nut is extremely important. Extensive damage to the pump and engine may result if the nut is not properly secured.

To mechanically time any pump, determine the position of the timing line from Test Stand Data (Topic 9) and use the Timing

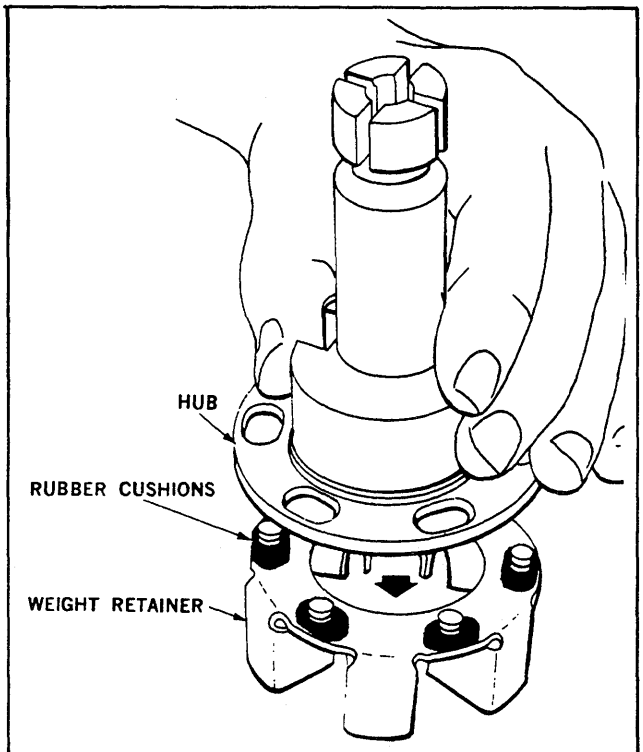


FIG. 5.5a

Line Location Indicator (Tool No. 20395) shown on page 11-2 .

STEP 5 Place the rubber cushions on the governor weight retainer pins and assemble the hub to the weight retainer (Fig. 5.5a).

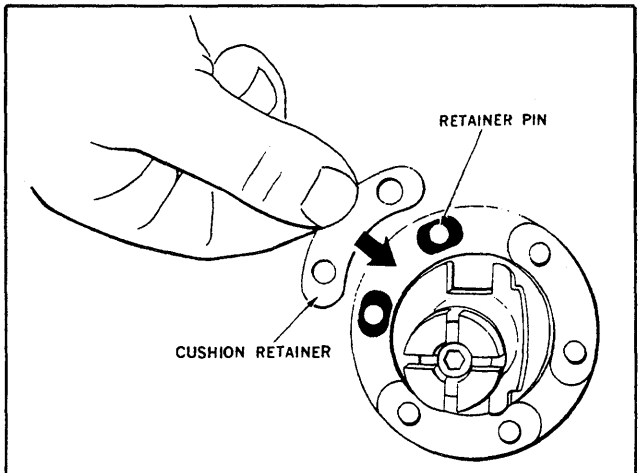


FIG. 5.5b

Place the cushion retainers on the weight retainer pins (Fig. 5.5b).

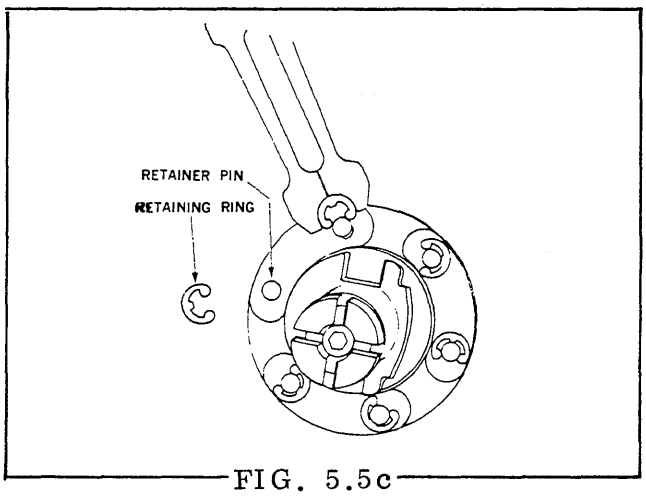


FIG. 5.5c

Assemble the retaining rings into the weight retainer pin slots with Applicator (No. 20045)(Fig. 5.5c).

NOTE: Do not distort the retaining rings. Check for proper assembly by trying to turn the retaining rings with a small bladed screw driver. They should not move under light pressure.

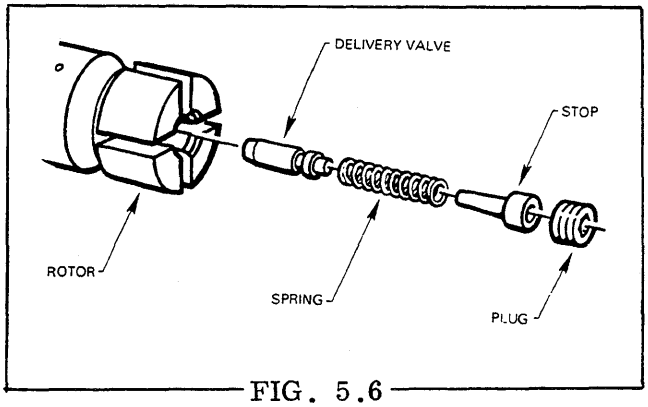


FIG. 5.6

STEP 6 Rinse the rotor thoroughly in clean fuel oil or calibrating oil. Place the rotor on top of holding Fixture No. 19965. Install the delivery valve to its bore using Extractor Tool No. 13383. Make sure that it operates freely in its bore.

NOTE: Do not mistake slight interference of the retractor collet in the bore for delivery valve sticking. If the valve is not secured straight and tight in the retractor collet, the collet diameter can drag in the rotor bore.

Install delivery valve spring and a new delivery valve stop to the rotor bore. Installation of a used stop can result in leakage and low output at cranking speeds. Start the delivery valve retaining screw into the bore using the hex end of the delivery Extractor Tool No. 13383 or use a 3/16" hex key wrench for a .250" delivery valve. Tighten the screw to the specified torque (Fig. 5.6).

NOTE: Excessive tightening of this screw may cause seizure of the hydraulic head and rotor assembly. Insufficient torque may cause leaking and hard starting.

Delivery Valve Replacement

Delivery valves of various retraction values are used for different applications. Correct part numbers are found on individual pump specifications. The letters "OV" etched on the head of the rotor indicate a .001" oversize delivery valve bore. A rotor so marked must use a .001" oversize delivery valve. The oversize valve is also identified by blackening on both ends and in the groove on the delivery valve shank. Oversized delivery valves are intended to compensate for manufacturing tolerances only and are not to be used in a standard delivery valve bore. Oversize valves are not standard stocked parts of Fiat-Allis; and are obtainable only by special order to your Fiat-Allis dealer.

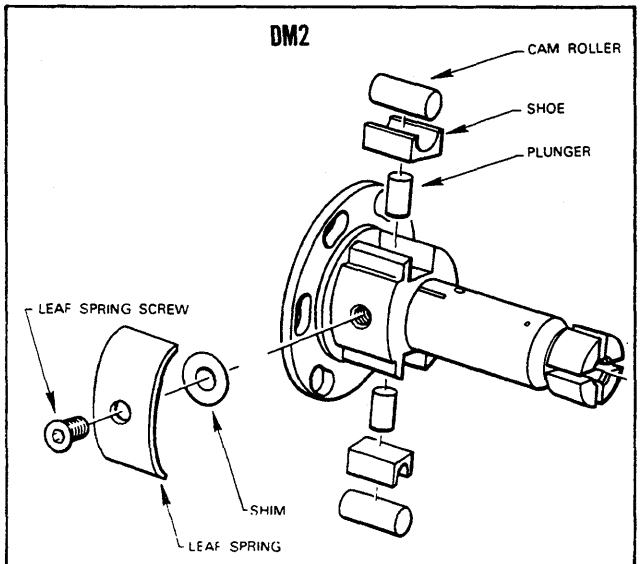


FIG. 5.7a

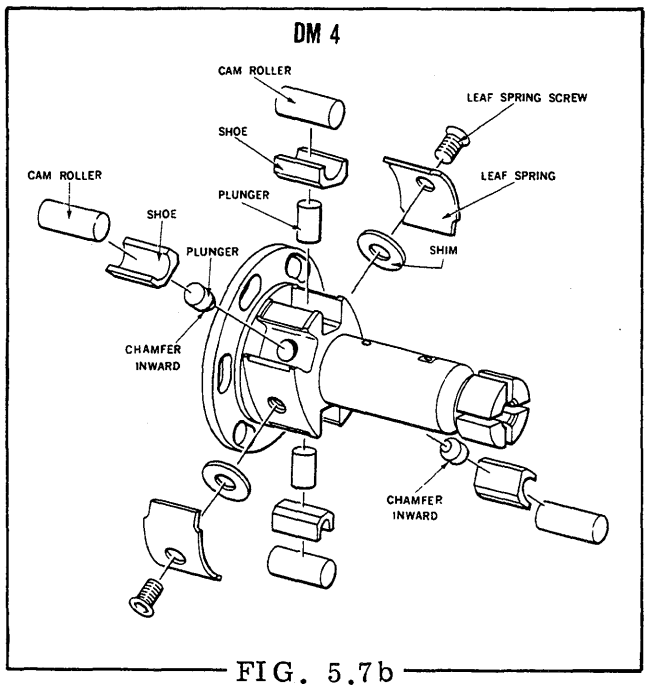


FIG. 5.7b

STEP 7 Remove the rotor from the holding fixture and submerge it in clean fuel oil or calibrating oil. Install the pumping plungers and check them for freedom of movement. Assemble the leaf spring(s), leaf spring adjusting screw(s) and shims (if used) to the rotor.

NOTE: DM4 roller shoes vary in size for different applications and are marked with a number on the end, e.g., from "-20 to - 10" in increments of "5". All four shoes must bear the same mark. The shoe size for a given application is determined by part number only. Assemble the cam rollers to the shoes by inserting from the end of the shoe. Never attempt to press a roller into its shoe from the outer edges, as the groove width at this point is less than the roller outside diameter and shoe breakage may result. Assemble the rollers and shoes to their slots in the rotor head (Fig. 5.7a and 5.7b).

Plunger Replacement:

Since the plungers are positioned centrally in the bore during operation and their travel is extremely short, wear of plungers is virtually nonexistent. Replacement however, may be made in instances where rust or damage is handling has occurred. Plungers of any given nominal diameter are graded in four select fit sizes: A, B, C and D. The rotor is etched with the letter indicating bore size. This mark is found on the head of the rotor.

If plunger replacement is required, check the size designation on the rotor and use the plunger of corresponding part number as indicated.

NOTE: A limited number of pumps will have a "-2" etched on the rotor following the letter grading code. This mark indicates a .002" oversize plunger bore. Replacement plungers should be ordered according to the oversize plunger group shown on individual specifications.

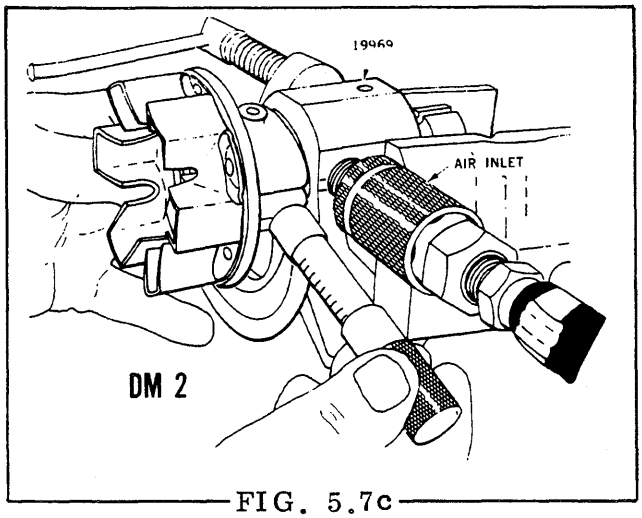


FIG. 5.7c

DM2
Install Fixture No. 19969 in a vise (clamping on the flat) so that the air inlet hole is not covered by the vise. Assemble a 1/4"-18 NPT fitting to the air inlet of the fixture. This fitting should be attached to a supply of clean, filtered, compressed air, regulated to a pressure between 40 and 100 psi. Handle the rotor carefully, holding the rollers and shoes in their slots. Install the rotor assembly to the fixture on the air inlet side. Rotate the rotor until the rollers are pushed to their extreme outward position

(shoes bottomed on the leaf spring) by the air pressure. Using a 1" to 2" micrometer, measure the roller-to-roller dimension (Fig. 5.7c) (distance between the outer surfaces of the opposed cam rollers) and compare this with the specification. To set the roller-to-roller dimension to the pump specification, turn the leaf spring adjusting screw inward (clockwise) to increase and outward (counter-clockwise) to reduce the roller-to-roller dimension.

NOTE: The roller-to-roller setting provides a completely accurate maximum fuel adjustment and it should not differ from that shown in the TEST STAND DATA (Topic 9).

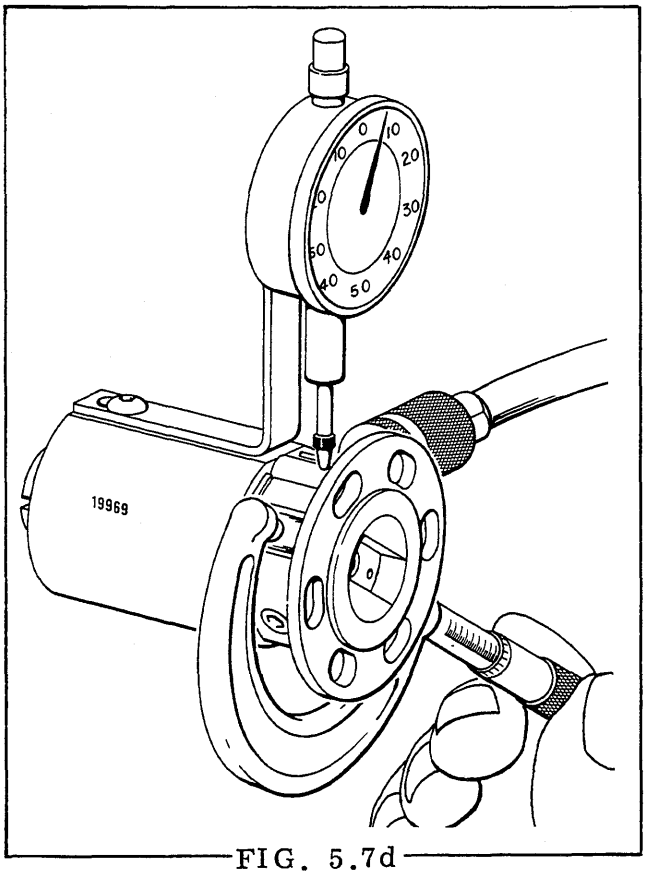


FIG. 5.7d

DM4

Install Fixture No. 19969 in a vise (clamping on the flat) so that the air inlet hole is not covered by the vise. Assemble a 1/4"-18 NPT fitting to the air inlet of the fixture. This fitting should be adapted to a supply of clean, filtered, compressed air, regulated to a pressure between 40 and 100 psi. Handle the rotor carefully, holding the rollers and shoes in their slots. Install the rotor assembly to the fixture on the air inlet side. Loosen the dial indicator retaining screw and slide the indicator to its outer limit. Rotate the rotor until the rollers are pushed to their extreme outward position (shoes bottomed on the leaf spring) by the air pressure. Using a 1" to 2" micrometer, measure the roller-to-roller dimensions (Fig. 5.7d) (distance between the outer surfaces of the opposed cam rollers) and compare this with the specification. To set the roller-to-roller dimension to the pump specification, set the rollers, adjusting each leaf spring alternately. Turn the leaf spring adjusting screws inward (clockwise) to increase and outward (counter-clockwise) to reduce the roller-to-roller dimensions. Since each roller shoe for a given cylinder is controlled by a separate leaf spring, it may be necessary to invert or interchange leaf springs to obtain correct dimensions on both sets of rollers. Roller settings of both cylinders must be within .003" of each other while maintaining the average roller-to-roller setting within the specification.

Check centrality of the rollers (to assure that each one starts its pumping stroke at the same time) as follows:

a. Rotate the rotor until one roller is aligned with the dial indicator plunger. Slide the indicator inward until plunger depresses it at least .010". Lock indicator retaining screw. "Zero" in indicator on high point of roller by rotating knurled dial.

b. Rotate rotor (either direction) until the next roller depresses dial indicator plunger. Allowable centrality is plus or minus .002" (total .004"). Before making any correction, check and record centrality of all four rollers.

c. If roller centrality is beyond specified tolerance, rollers and/or shoes can be interchanged. Recheck centrality after each change. Be sure to recheck roller-to-roller dimension.

NOTE: The roller-to-roller setting provides a completely accurate maximum fuel adjustment and it should not differ from that shown in the applicable specification.

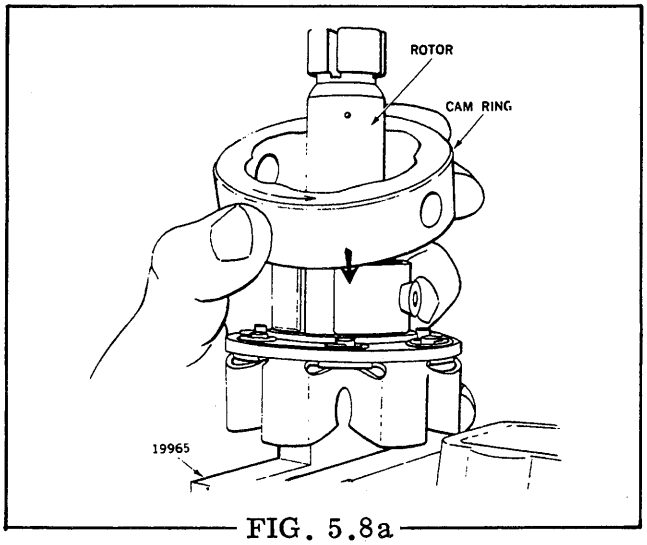


FIG. 5.8a

STEP 8 When the roller-to-roller adjustment is completed, remove the rotor assembly from the fixture, making sure that the cam rollers and shoes are not dislodged from their slots. Thoroughly rinse the rotor in clean fuel oil or calibrating oil and place the rotor shank end up on top of Fixture No. 19965. Place the cam ring on top of the rotor with the directional arrow indicating the opposite direction of pump rotation (Fig. 5.8a). This is necessary since pump rotation is always expressed as viewed from the drive end. The pump will not deliver proper fuel if the cam ring is incorrectly assembled.

⚠ WARNING

Wear safety glasses with side shields or goggles when using compressed air for cleaning to reduce the danger of personal injury from flying particles. Limit the pressure to 30 psi (2.1 kg/cm^2) according to OSHA requirements.

Thoroughly rinse the hydraulic head in clean fuel oil or calibrating oil. Blow out all head passages and ports with clean, filtered, compressed air. Assemble the head to the rotor assembly (Fig. 5.8b).

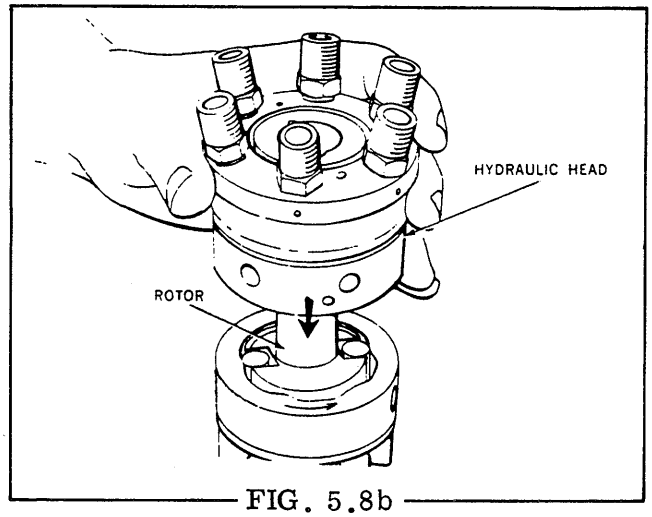


FIG. 5.8b

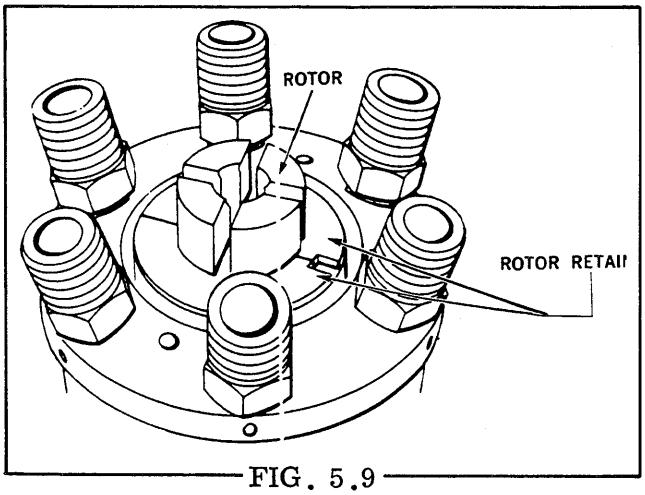


FIG. 5.9

REASSEMBLY OF TRANSFER PUMP SPRING WASHER DESIGN

STEP 9 Insert the two rotor retainers between the rotor and head. Position the retainers so the cutout portion is over the hole which the regulator assembly roll pin enters (Fig. 5.9).

REASSEMBLY OF TRANSFER PUMP PRESSURE PLATE DESIGN

A second style of transfer pump components is currently in use. Step 9-1, on page 5-9 and 10.1 on page 5-11, give instructions for reassembly of the new "pressure plate" design. Details for reassembly of the earlier type "spring washer" design are contained in Step 9, above, and Step 10 on page 5-9.

Many of the component parts for these two designs are not interchangeable, and care should be exercised to use only the correct parts with each design. Upgrading of an early model DM2 or DM4 to the new "pressure plate" design should be performed only in kit form.

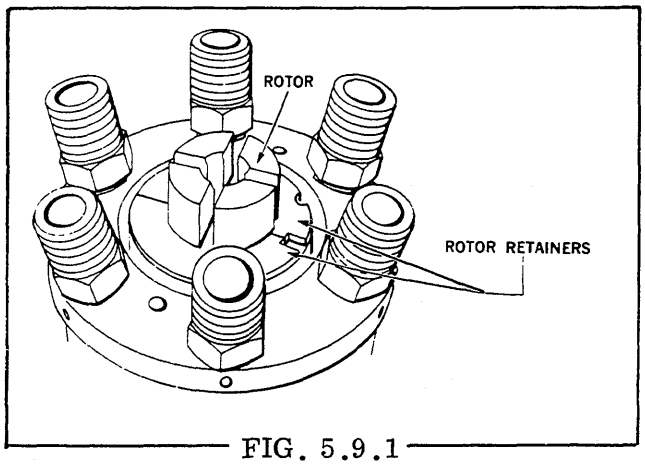


FIG. 5.9.1

STEP 9.1 Assemble the rotor retainers to the head and rotor with the cut-out portions meeting over the roll pin hole in the hydraulic head (Fig. 5.9.1). Rotor retainers for the pressure plate design are identified by a radial notch on the outside diameter.

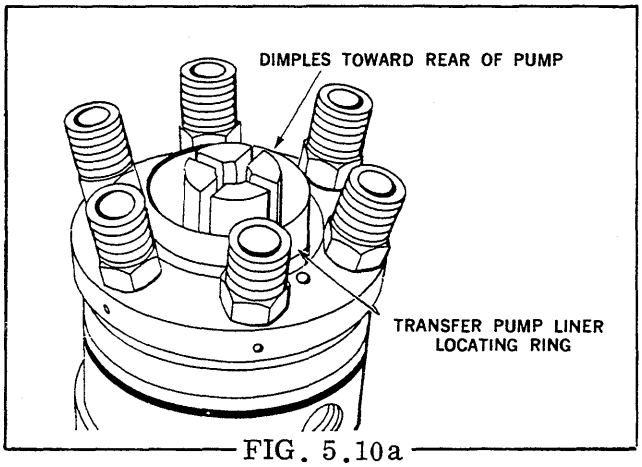


FIG. 5.10a

STEP 10 The inside diameter of the transfer pump liner locating ring has dimples to keep the rotor retainers tight. The dimples are not centered longitudinally. Place the liner locating ring over the retainers with the dimples towards the rear of the pump. No dimples should coincide with the points at which the two retainers join. Do not seat the liner locating ring at this time (Fig. 5.10a).

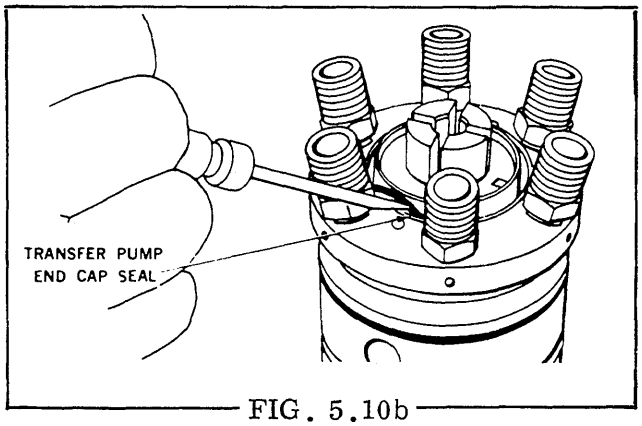


FIG. 5.10b

Install the transfer pump end cap seal to the hydraulic head (Fig. 5.10b). The seal must be pushed down to the bottom of its groove to avoid interference with the end cap threads as it is installed.

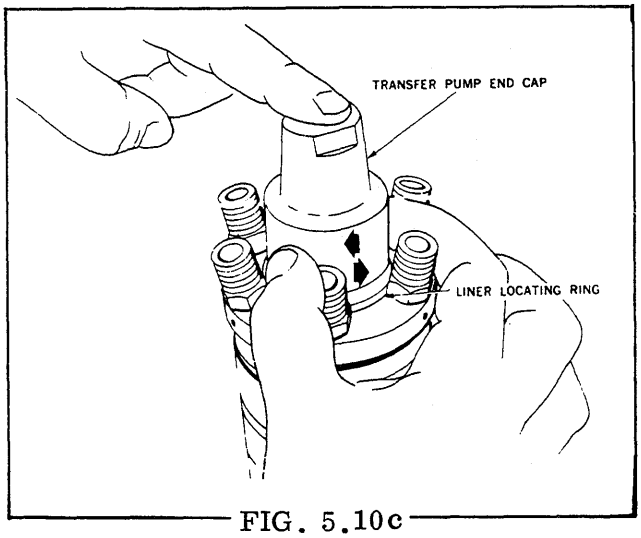


FIG. 5.10c

The liner locating ring should be seated in place with the transfer pump end cap used as an installation tool. Install the end cap and thread into the hydraulic head by applying a slight pressure on top of the end cap. Rotate the cap counterclockwise until a slight "click" is heard. The cap threads will align themselves with the threads in the head, thus minimizing the possibility of cross-threading. Turn the cap clockwise by hand until tight. Continue tightening with wrench until the end cap is bottomed in the head (Fig. 5.10c). Remove the end cap, the liner locating ring should now be in place.

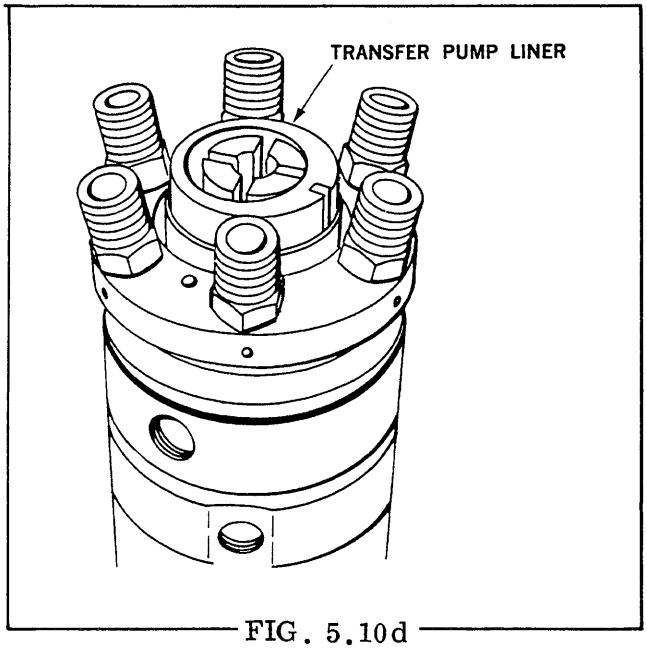


FIG. 5.10d

Insert the transfer pump liner so that the slot is in line with the hole which the regulator assembly roll pin will enter (Fig. 5.10d).

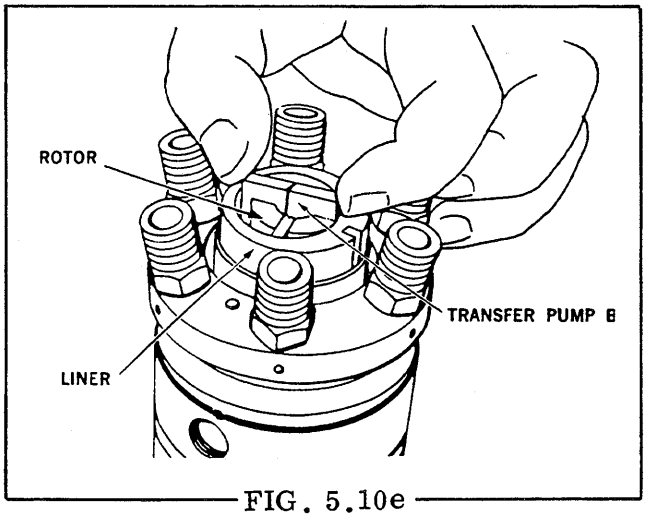


FIG. 5.10e

Assemble springs to transfer pump blade halves and install the blades in their slots in the rotor (Fig. 5.10e). The blade springs must be fully compressed as they are installed and care should be taken not to cock the blades during installation, as the sharp edge of the liner can score the blade ends.

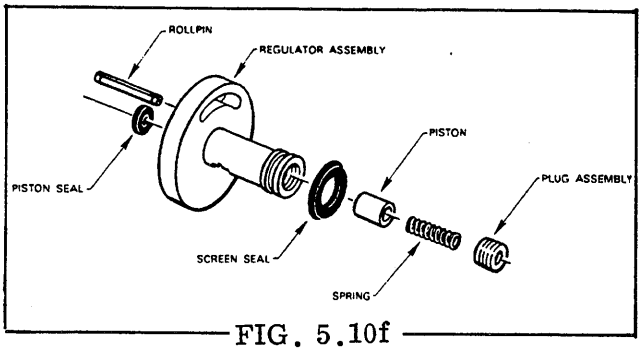


FIG. 5.10f

SPRING WASHER DESIGN

Assemble the transfer pump regulator components (Fig. 5.10f). Install the inlet filter screen seal on the regulator. Using Tool No. 13301, place the regulating piston seal in the groove of the regulator. Do not roll over the seal when assembling. Install the piston to the regulator with the piston bore facing the inlet end of the regulator. The piston should not bind or stick within the regulator bore. Install the regulating spring. Install the end plate adjusting plug with a 5/32" hex key wrench until it is flush with the inlet side of the regulator.

NOTE: Do not tighten the plug any further at this time, as this can result in severe damage when the pump is completely assembled and operated.

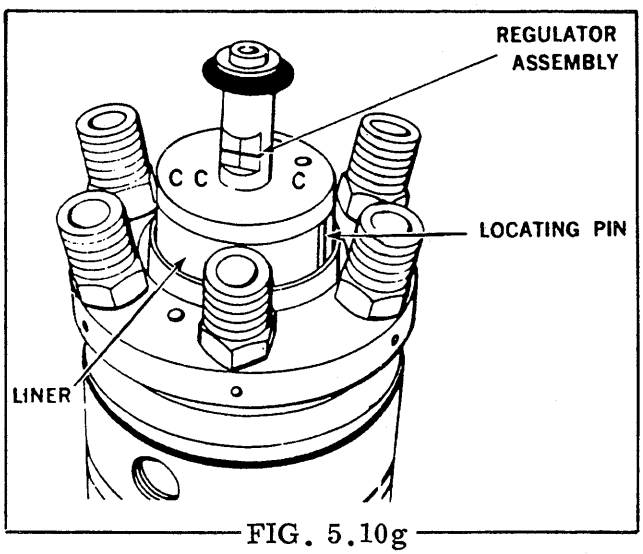


FIG. 5.10g

Assemble the regulator assembly to the liner (Fig. 5.10g). The locating pin must be in the correct hole of the regulator for the proper pump rotation. On the face of

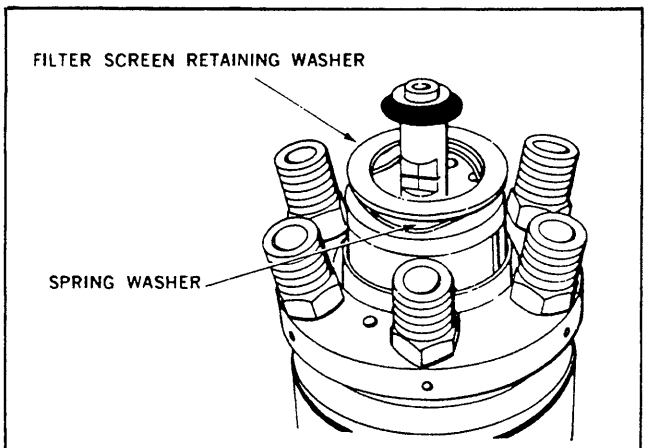


FIG. 5.10h

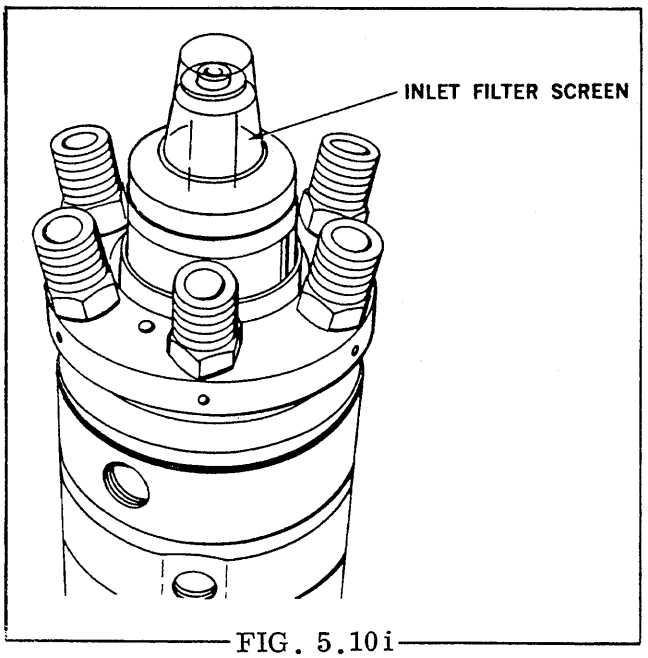


FIG. 5.10i

the regulator assembly "C" or "CC" is stamped for clockwise or counterclockwise pump rotation.

Assemble the transfer pump spring washer and filter screen retaining washer to the regulator assembly (Fig. 5.10h). Place the inlet filter screen on the regulator assembly (Fig. 5.10i).

Install the transfer pump end cap and thread into the hydraulic head by applying a slight pressure on top of the end cap. Rotate the cap counterclockwise until a slight "click" is heard, now turn the cap clockwise by hand until tight (Fig. 5.10j).

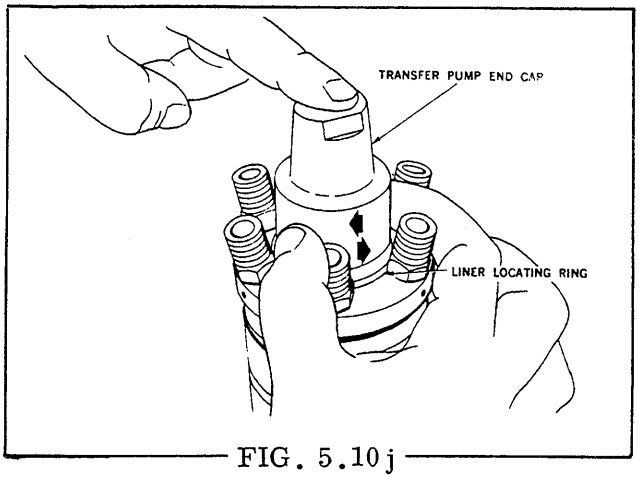


FIG. 5.10j

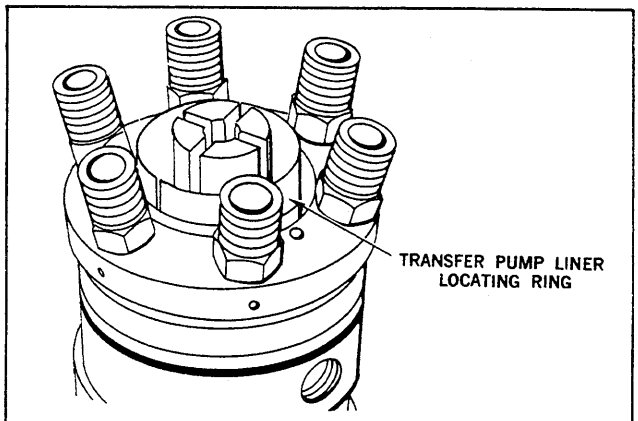


FIG. 5.10.1a

STEP 10.1 Place the liner locating ring over the rotor retainers and bottom it against the head. The liner locating ring for the pressure plate design is a split ring. Position the split in the ring 90° from the split in the retainers. (Fig. 5.10.1a).

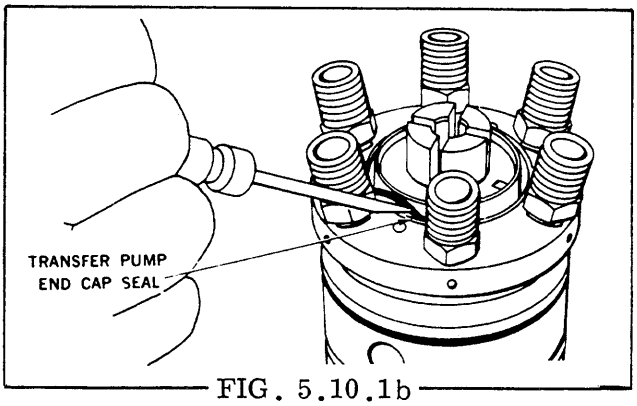


FIG. 5.10.1b

Install the oval cross section transfer pump seal into the hydraulic head. Rolling the transfer pump seal between the fingers will identify this seal from the round cross section seal used with the earlier design

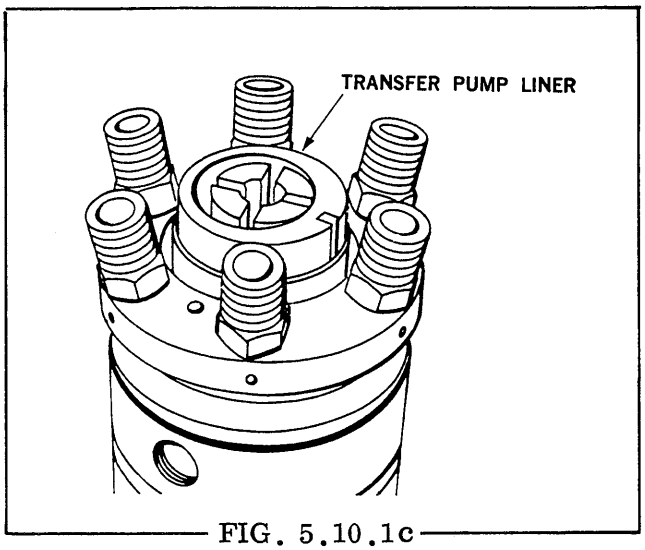


FIG. 5.10.1c

components. The correct seal must be used for each design in order to obtain the correct transfer pump pressure. The two types of transfer pump seals are not interchangeable (Fig. 5.10.1b).

Insert the transfer pump liner so that the slot is in line with the hole which the regulator assembly roll pin will enter (Fig. 5.10.1c).

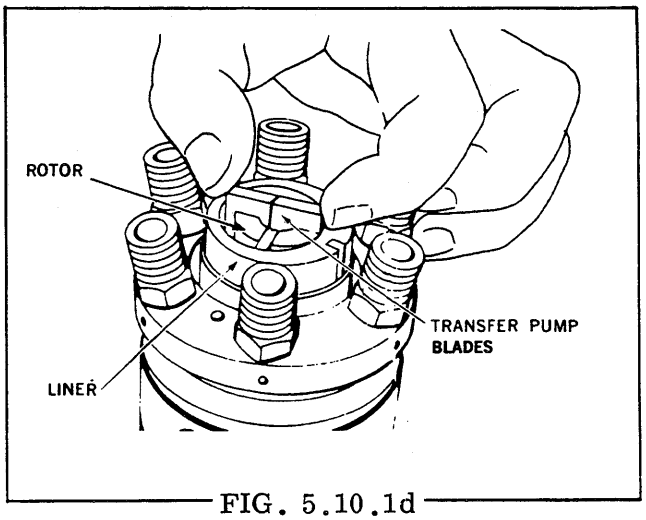


FIG. 5.10.1d

Assemble springs to transfer pump blade halves and install the blades in their slots in the rotor (Fig. 5.10.1d). The blade springs must be fully compressed as they are installed and care should be taken not to cock the blades during installation, as the sharp edge of the liner can score the blade ends.

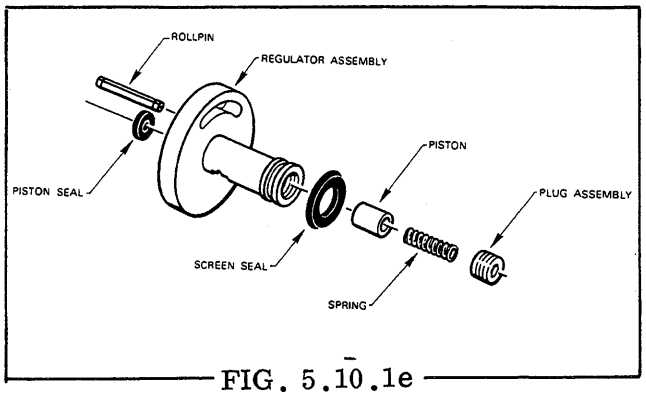


FIG. 5.10.1e

PRESSURE PLATE DESIGN

Assemble the transfer pump regulator components (Fig.5.10.1e). Install the inlet filter screen seal on the regulator. Using tool No. 13301, place the regulating piston seal in the groove of the regulator. Do not roll over the seal when assembling. Install the piston to the regulator with the piston bore facing the inlet end of the regulator. The piston should not bind or stick within the regulator bore. Install the regulating spring. Install the end plate adjusting plug with a 5/32" hex-key wrench until it is flush with the inlet side of the regulator.

NOTE: Do not tighten the plug any further at this time, as this can result in severe damage when the pump is completely assembled and operated.

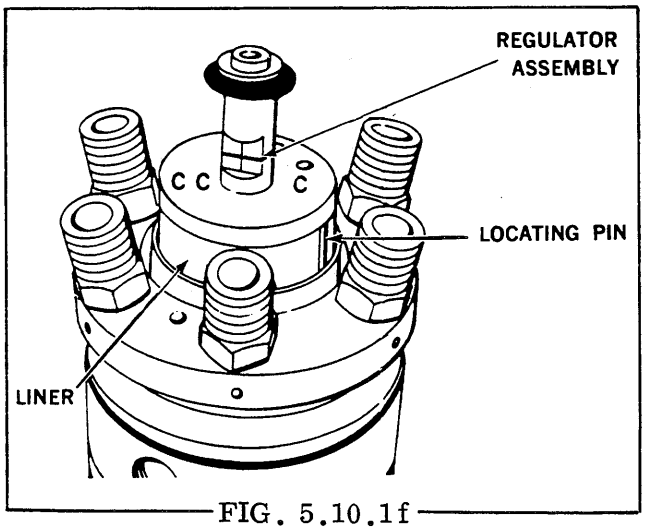


FIG. 5.10.1f

Assemble the regulator assembly to the liner (Fig.5.10.1f). The locating pin must be in the correct hole of the regulator for the proper pump rotation. On the face of

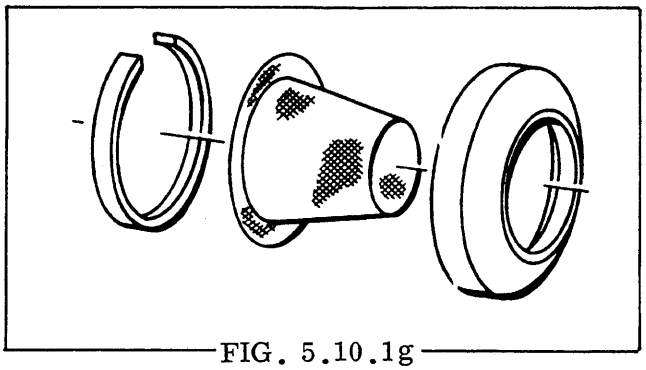


FIG. 5.10.1g

the regulator assembly "C" or "CC" is stamped for clockwise or counterclockwise pump rotation.

Assemble the filter screen to the pressure plate and install the screen retaining ring (Fig. 5.10.1g).

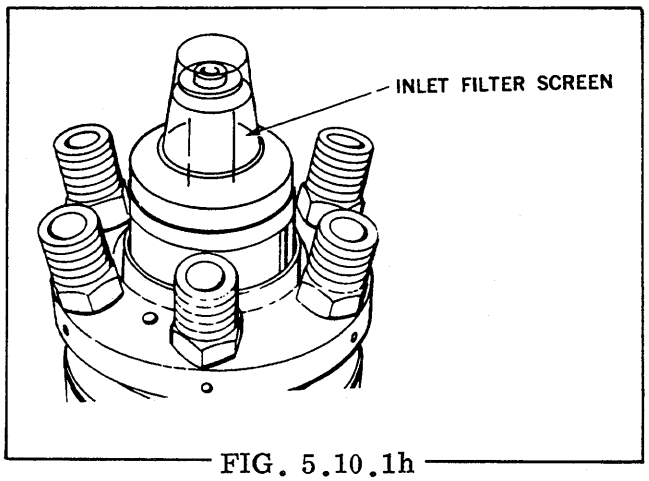


FIG. 5.10.1h

Coat the beveled surface of the pressure plate and the threads on the outside diameter of the end cap with Lubriplate #630AA or equivalent.

Install the assembled pressure plate and screen onto the transfer pump regulator assembly (Fig. 5.10.1h).

Install the transfer pump end cap and thread into the hydraulic head by applying a slight pressure on top of the end cap. Rotate the cap counterclockwise until a slight "click" is heard, now turn the cap clockwise by hand until tight (Fig. 5.10.1i).

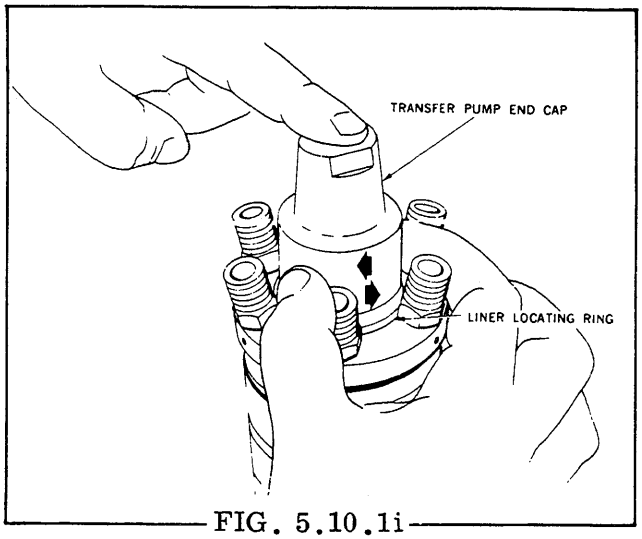


FIG. 5.10.1i

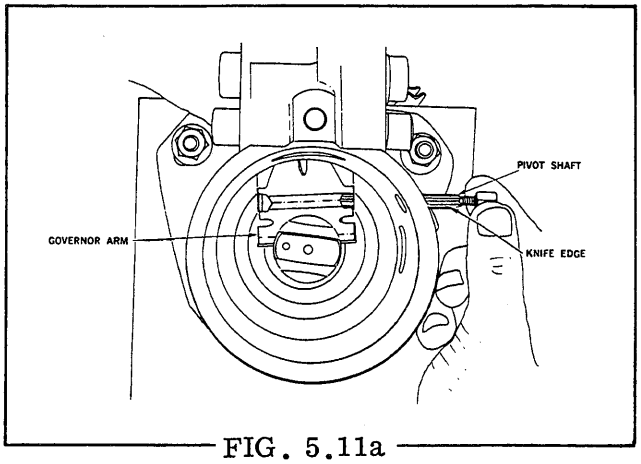


FIG. 5.11a

STEP 11 Place the governor arm in position in the housing with the fork for the governor linkage hook assembly facing the rear of the pump. Insert the pivot shaft (knife edge facing the rear of the pump), in the arm slot (Fig. 5.11a).

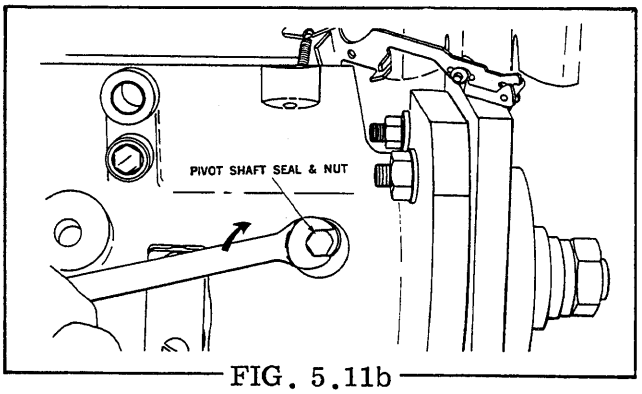


FIG. 5.11b

Assemble the pivot shaft seal and nut, and tighten both cap nuts successively to the specified torque (Fig. 5.11b).

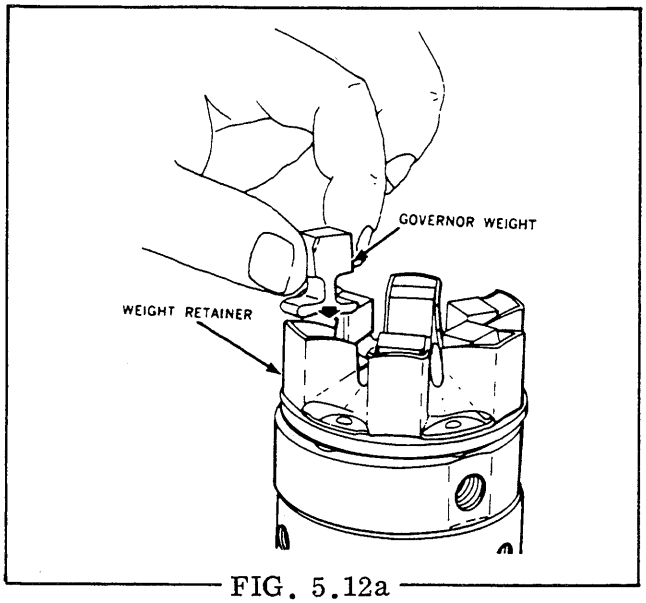


FIG. 5.12a

STEP 12 Remove the head and rotor assembly from the fixture. Position the governor weights into the retainer sockets (Fig. 5.12a).

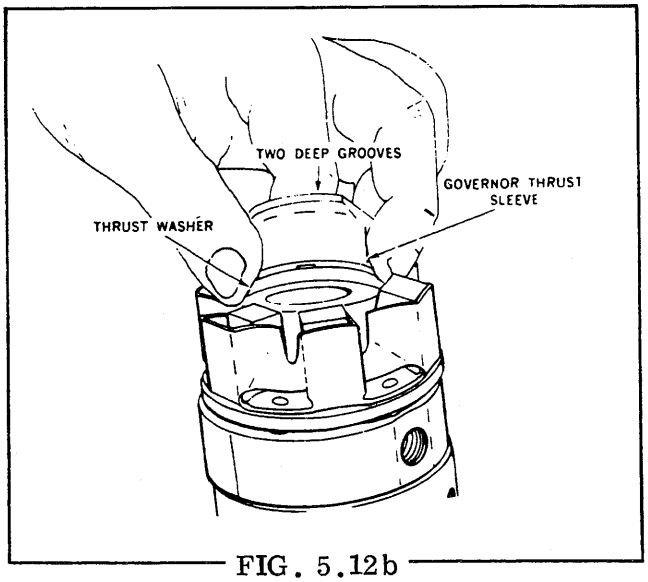


FIG. 5.12b

Insert the governor thrust washer and thrust sleeve into the lower slots of the governor weights by tilting the weights outward slightly. The two deep grooves of the thrust sleeve should face upward as installed (Fig. 5.12b). Sight across the tops of the assembled weights. They should all be level, and collapsed against the thrust sleeve.

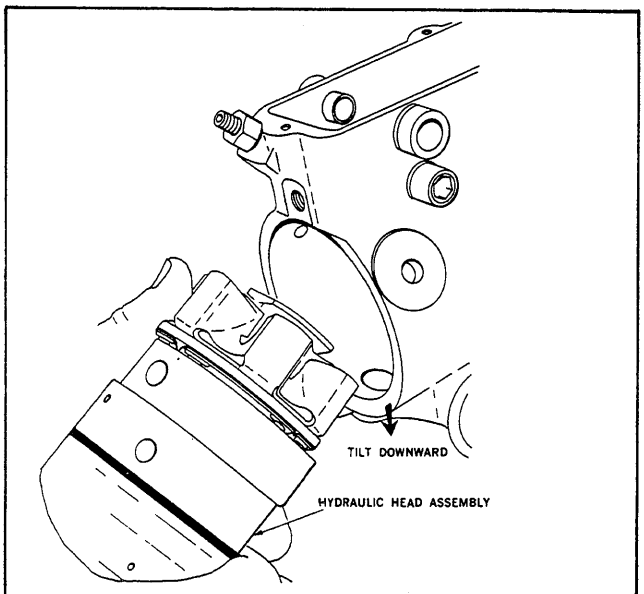


FIG.5.13a

STEP 13 The hydraulic head and rotor assembly, including the transfer pump assembly, cam ring and governor assembly, are now ready to be put into the housing. Install a new seal on the hydraulic head after first greasing it slightly. Apply a light film of clean grease around the inside edge of the housing and tilt the housing slightly downward at the rear to aid in assembly. Rotate the cam ring so that the unthreaded hole is in line with the head locating screw bore. This will insure proper position of the cam ring. Turn the weight retainer until the drill point on the end of the rotor registers with the drill point on the drive shaft tang. Grasp the hydraulic head firmly in both hands and insert it into the housing bore with a slight rotary motion (Fig. 5.13a and 5.13b). Do not force. If the assembly should jam during insertion, withdraw and start over. Make sure the assembly is wrung into position past the hydraulic head seal (Failure to do this will cause damage to the seal, resulting in leakage). Slight force may be required to overcome the drive shaft spring washer force.

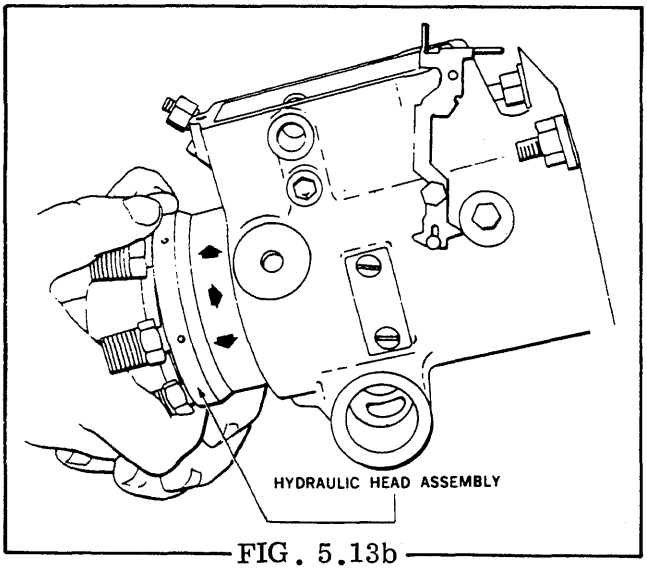


FIG. 5.13b

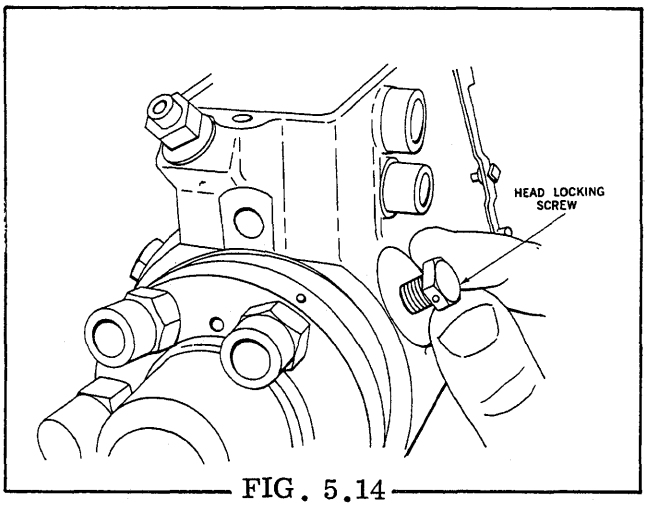


FIG. 5.14

STEP 14 Rotate the head assembly until the head locking screw holes line up with their corresponding holes in the housing. Insert the two head locking screws finger tight (Fig. 5.14). Do not tighten with a wrench until Step 26.

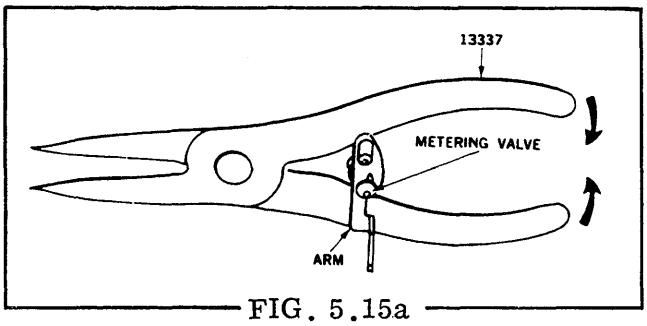


FIG. 5.15a

STEP 15 Assemble the metering valve, spring and shim to the arm assembly (Fig. 5.15a).

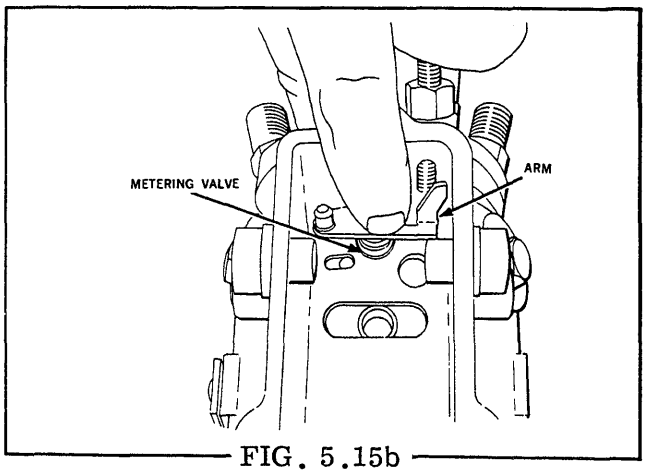


FIG. 5.15b

Place the metering valve assembly into its bore (Fig. 5.15b). Depress and rotate the valve several times to insure freedom of movement. If valve sticks, rinse off with clean fuel oil or calibrating oil. Never use any abrasive, or the special surface treatment provided will be removed.

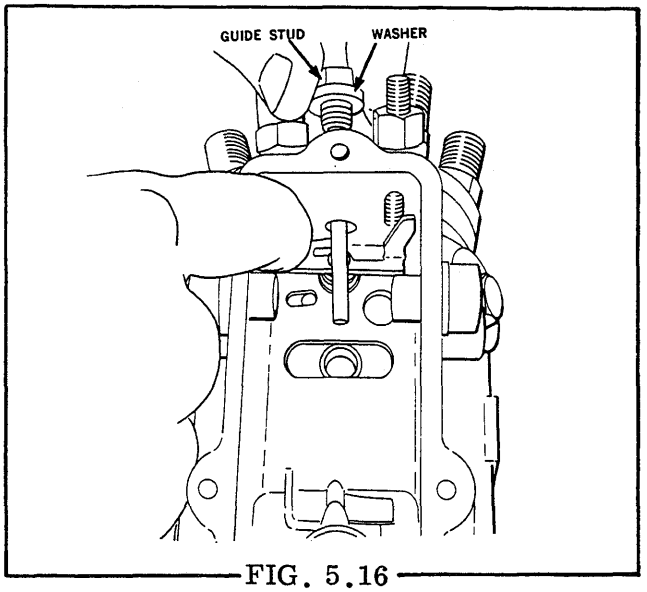


FIG. 5.16

STEP 16 Depress the metering valve assembly and install the guide stud and washer into the housing and tighten (Fig. 5.16).

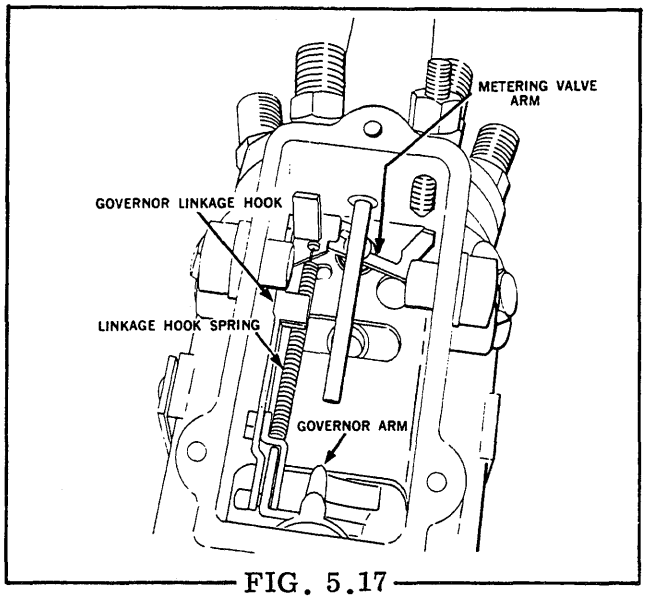


FIG. 5.17

STEP 17 Pull back the governor linkage hook, stretching the spring just enough to assemble the hook correctly to the fork on the governor arm. Position the opposite end of the hook over the pin on the metering valve arm (Fig. 5.17). Check all of the governor parts for freedom of movement.

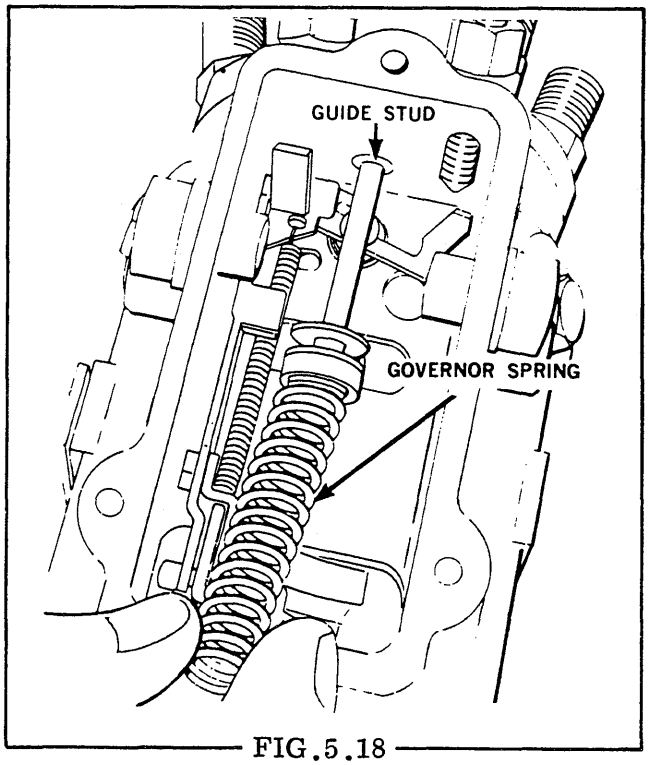


FIG.5.18

STEP 18 Assemble the governor spring, spring retainer, idle spring and idle spring guide on the bench. Apply a light film of grease to the parts in order to keep them in place while assembling. Install the spring components onto the guide stud as shown (Fig. 5.18).

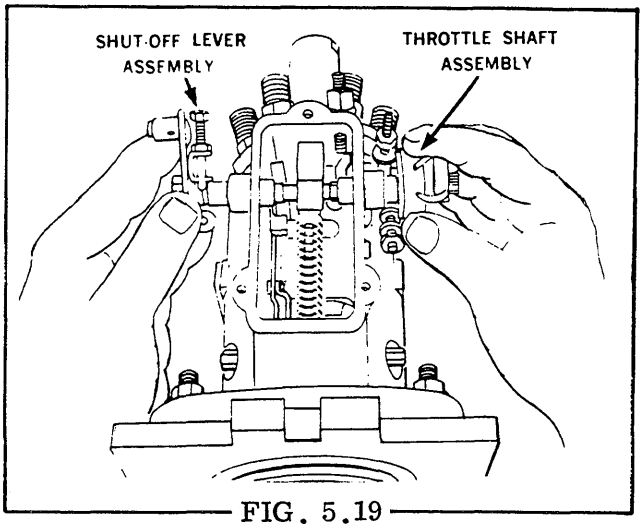


FIG. 5.19

NOTE: Be sure the governor spring is correct--compare the color of the spring with color indicated in parts catalog.

STEP 19 Apply a light film of grease to the throttle and shut-off shaft seals. Assemble the throttle shaft assembly partially through its bore in the housing. Slide the throttle shaft lever over the throttle shaft so that the projection in the throttle shaft lever bore engages the rear key way on the shaft. Position the forked end of the throttle lever so that it straddles the guide stud. Assemble the shut-off lever assembly with a slight rotary motion so as not to damage the seal. If the throttle shaft lever is correctly installed, rotating the throttle shaft assembly to the rear will cause compression of the governor spring (Fig. 5.19).

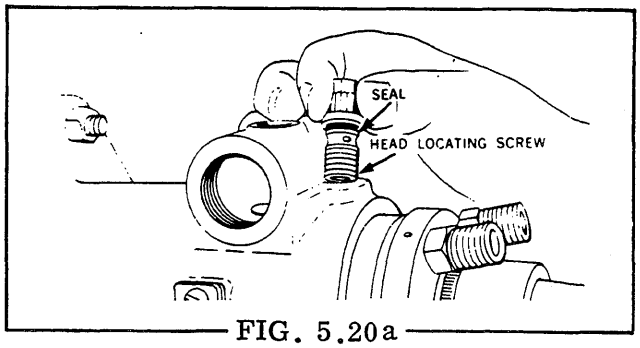


FIG. 5.20a

STEP 20 Invert the pump and holding fixture in the vise. Coat the seal of the head locating screw with clean grease. Insert and tighten the head locating screw to specified torque (Fig. 5.20a and 5.20b).

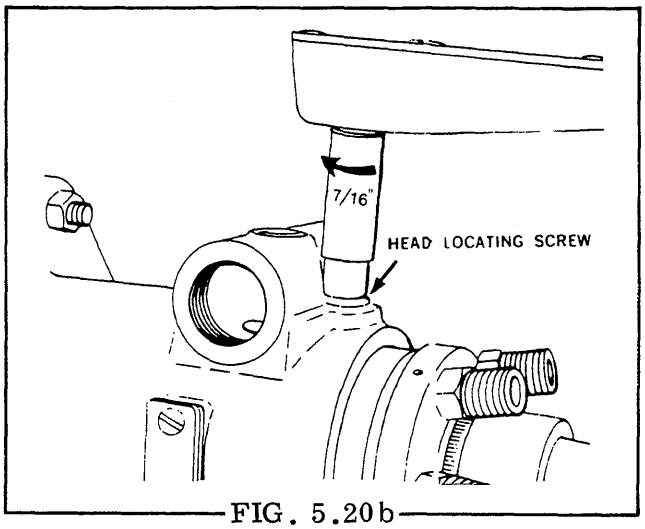


FIG. 5.20b

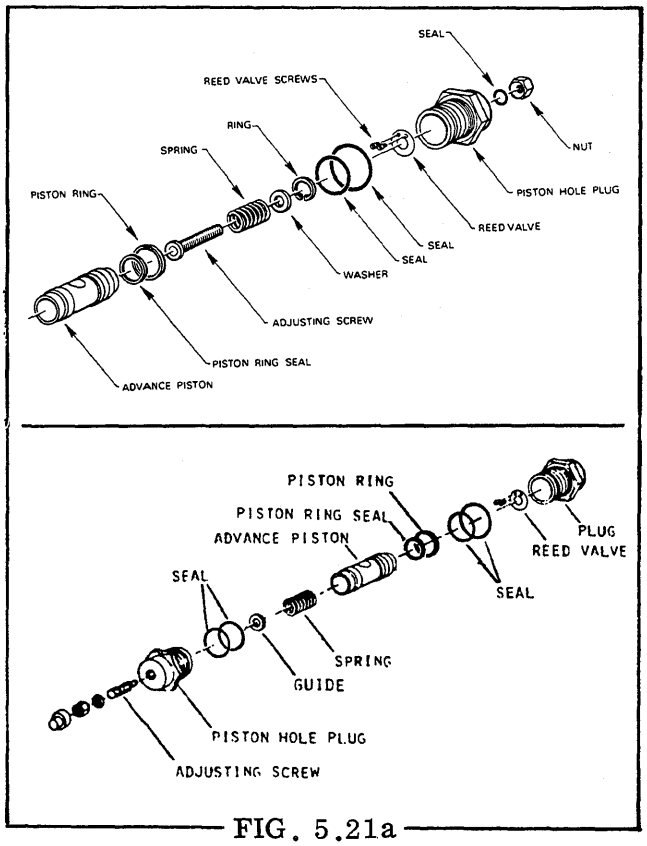


FIG. 5.21a

STEP 21 Assemble the auto advance components (Fig. 5.21a). Place the reed valve into the piston hole plug and insert and tighten two reed valve screws, using a 5/64" hex key wrench to the specified torque. Install the piston ring seal, and ring in the groove of the advance piston. Complete assembly as shown in Fig. 5.21a.

NOTE: Be sure the advance spring is correct--compare the color of the spring with color indicated in parts catalog.

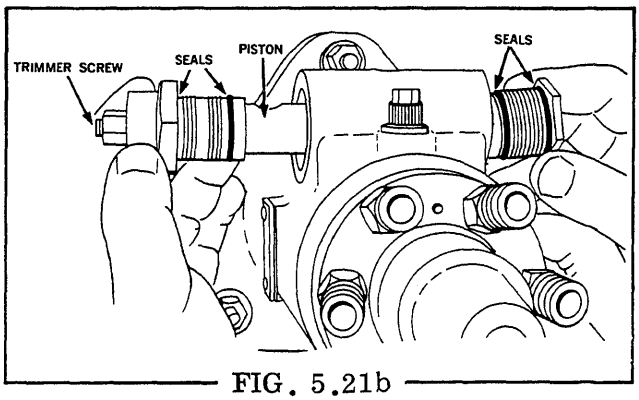


FIG. 5.21b

Install the advance plug and power piston plug assembly in the pump housing (Fig. 5.21b).

NOTE: The sides of the housing near the advance boss bear a "C" or "CC" marking to denote pump rotation. The power side of the piston is located on the side marked "C" for a clockwise rotating pump and vice versa.

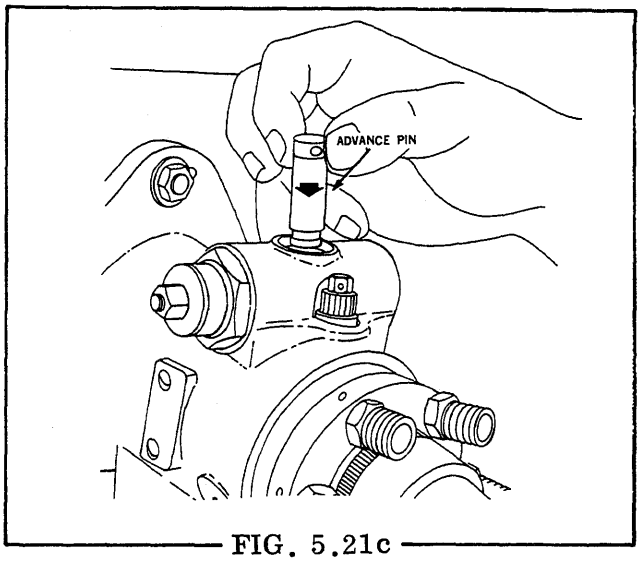


FIG. 5.21c

Align the advance pin hole in advance piston with the unthreaded hole in the cam ring. Insert advance pin into the cam ring, ball-end first (Fig. 5.21c). It may be necessary to move the pin back and forth slightly to facilitate installing.

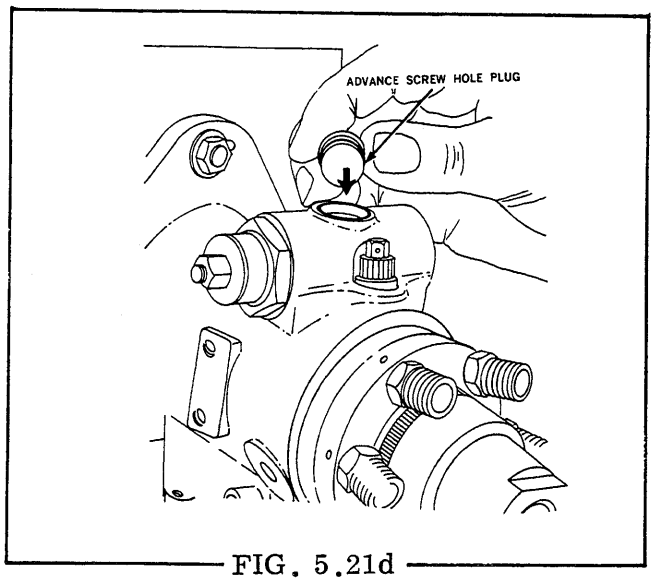


FIG. 5.21d

Install the advance screw hole plug and new seal into the housing and tighten using Tool No. 14490 (Fig. 5.21d).

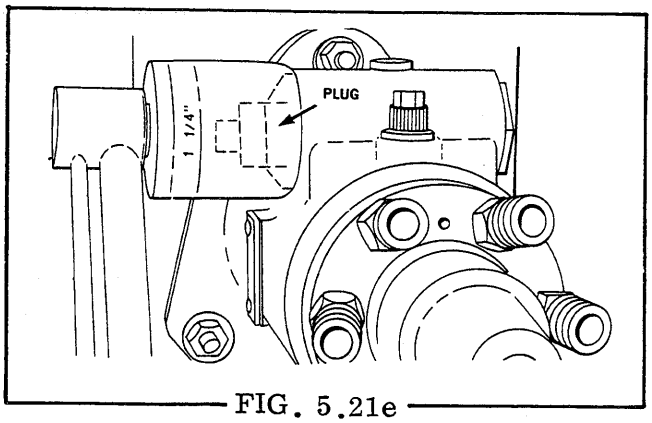


FIG. 5.21e

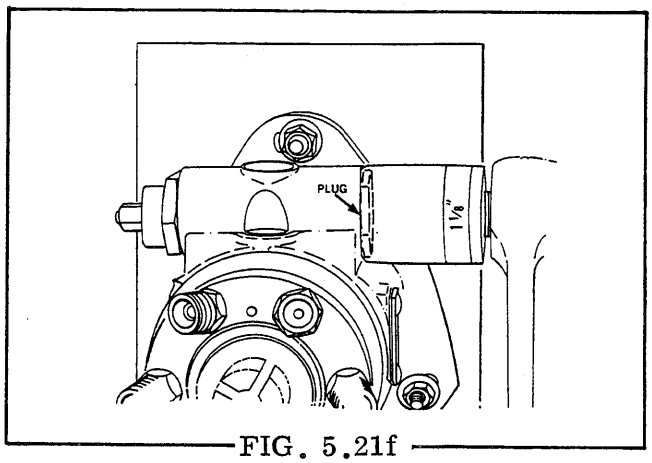


FIG. 5.21f

Tighten the advance plugs to the specified torque (Fig. 5.21a and 5.21f).

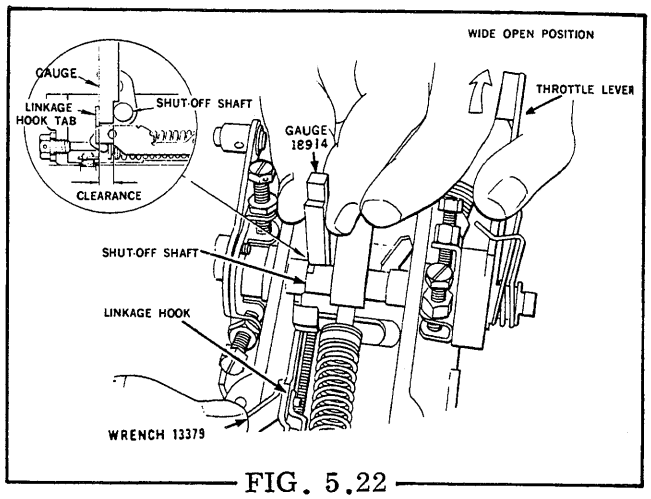


FIG. 5.22

STEP 22 Invert the pump and fixture in the vise. Prior to measuring and adjusting the linkage gap, hold throttle lever in wide open position and rotate the drive shaft in the proper direction of rotation until a slight "click" is heard, as the toes of the governor arm engage slots in the thrust sleeve. The torque screw (if used) should be backed out. With the throttle lever held in wide open position, use linkage gauge No. 18914 to check the clearance between the rear of the shut-off shaft and the vertical tab on the linkage hook. (Refer to TEST STAND DATA (Topic 9) for correct dimension). Adjustment of this clearance is made by using linkage Wrench No. 13379 to change the effective length of the linkage hook. Loosen the adjusting screw and slide linkage to maximum open length. Insert linkage Gauge No. 18914 between vertical tab and shut-off shaft, and slide linkage hook together from the rear until face of tab is flush against gauge. Tighten adjusting screw. Check adjustment and reset if required (Fig.5.22).

STEP 23 Install a new shut-off cam with the straight inner edge engaging the slot. The cam should snap into position. Install a new throttle shaft retainer clip with the straight inner edge engaging the slot. The clip should snap into position (Fig. 5.23).

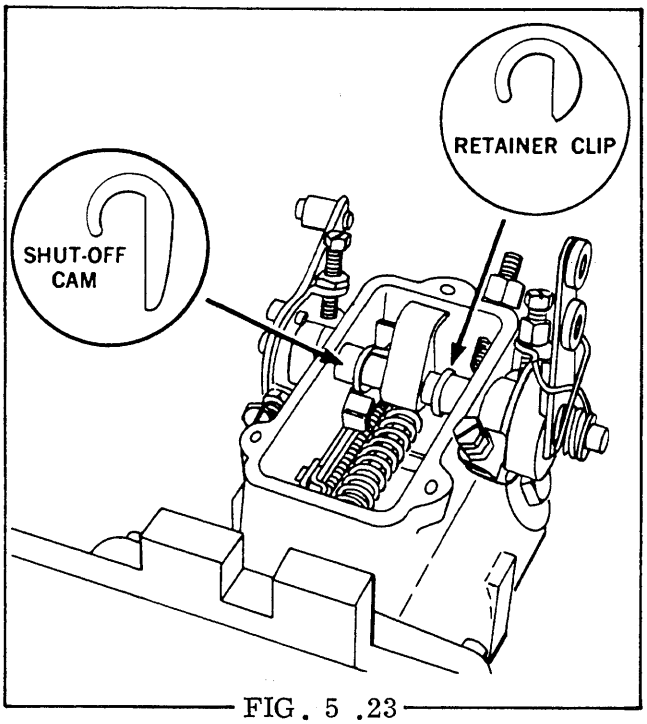


FIG. 5 .23

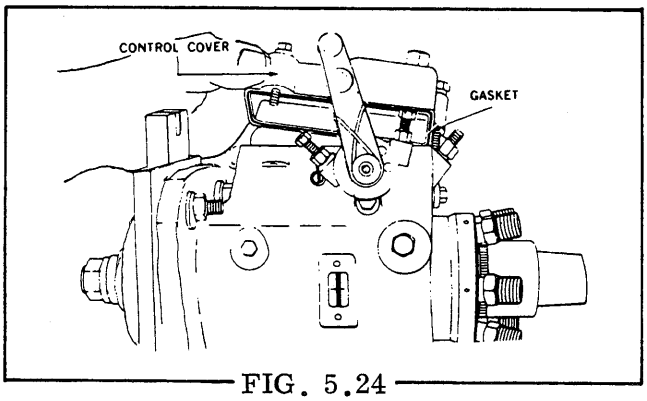


FIG. 5.24

STEP 24 Assemble a new gasket to governor control cover and install cover on pump. Slip the flat washers and lock washers onto cover screws and tighten securely (Fig. 5.24).

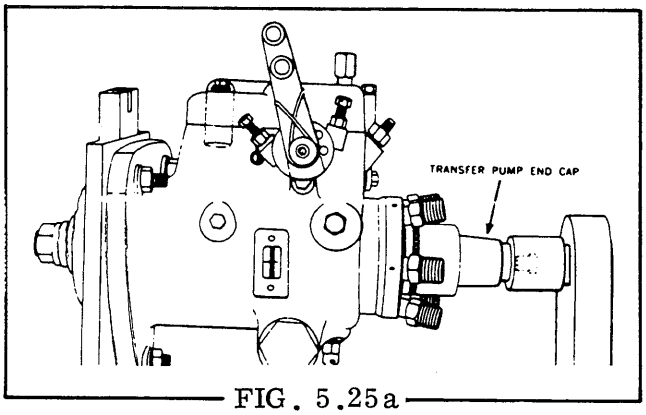


FIG. 5.25a

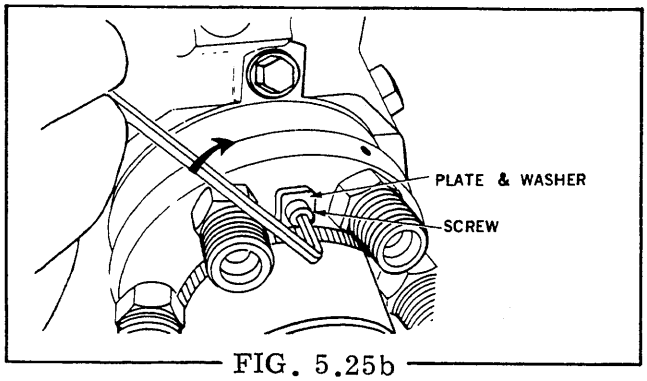


FIG. 5.25b

STEP 25 Insert end cap plug (No. 20549) in the end cap and tighten the end cap to the specified torque, using the appropriate end cap wrench.

NOTE: The transfer pump end cap inlet requires a special fitting with an "O" ring seal (1/2"-20 straight thread). Do not use a taper pipe thread type fitting as this could bottom and result in seizure of the head and rotor assembly and damage to the end cap threads. Assemble the end cap locking plate, washer and screw, to the head and tighten (Fig. 5.25b).

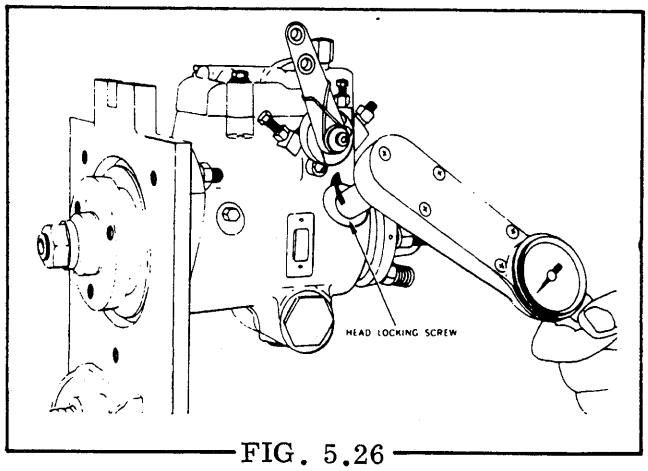


FIG. 5.26

STEP 26 Tighten the two head locking screws to the specified torque (Fig. 5.26).

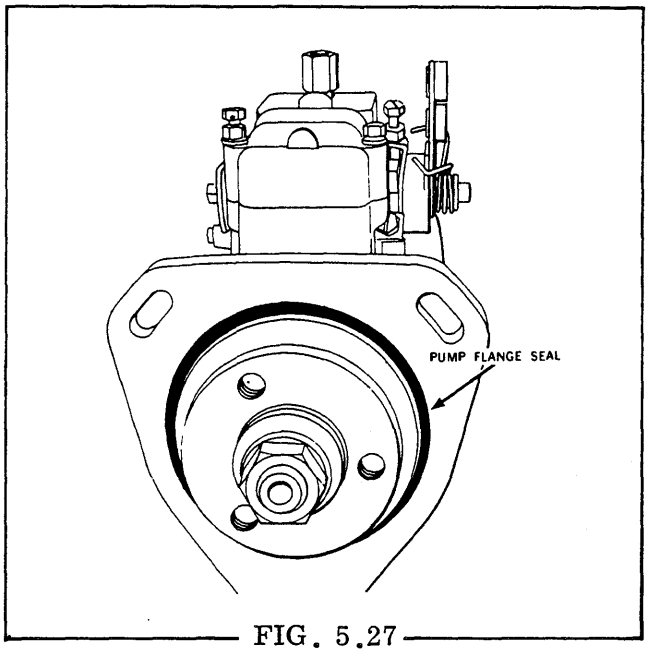


FIG. 5.27

STEP 27 Remove the pump from holding fixture and install the pump flange seal (Fig. 5.27).

TOPIC 6 ACCESSORIES

ELECTRICAL SHUT-OFF

The Electrical Shut-Off Device may be furnished for "energized to run" or "energized to shut-off" operation. It is available for 12, 24 and 32 volt systems. Since this device is housed within the governor control cover, the external dimensions of the pump do not change.

OPERATION

ENERGIZED TO SHUT-OFF (ETSO): Energizing the coil overcomes the force of the shut-down coil spring, pulling the arm in and causing the tab on its lower end to contact the governor linkage hook. This moves the linkage hook against the governor linkage spring tension, rotating the metering valve to its closed position and cutting off the fuel (Fig. 6.1).

NOTE: Most ETSO applications use a coil with a voltage rating lower than system voltage to provide positive shut-off action. This is allowable since the coil is used under intermittent duty conditions.

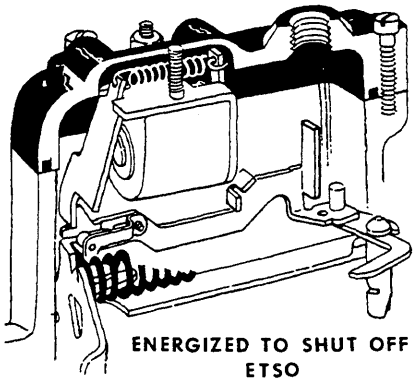


FIG. 6.1

ENERGIZED TO RUN (ETR): De-engergizing the coil allows the shut-down coil spring to release the shut-off arm. The lower end of the arm moves the governor linkage hook, rotating the metering valve to the closed position and cutting off the fuel (Fig. 6.2)

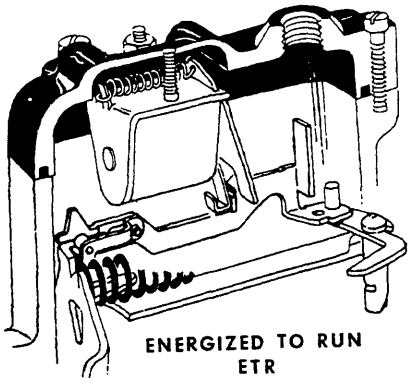


FIG. 6.2

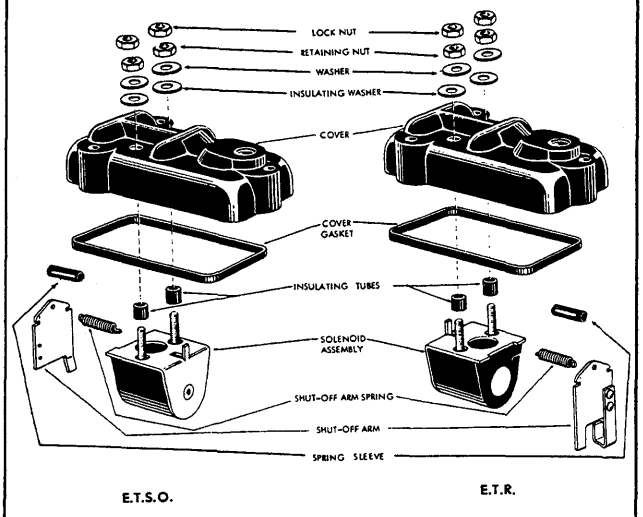


FIG. 6.3

NOTE: Some "Energized to Run" applications of Model "DM" pumps will incorporate a mechanical override device for emergency use if the coil becomes inoperative due to electrical system failure. The override consists of a rod and guide assembly attached to the control cover through a tapped hole at the rear of the cover in a location that aligns the rod with the solenoid arm assembly. When the rod is pushed into the cover to the limit of its travel it contacts the solenoid arm assembly and locks it up against the solenoid, allowing the linkage hook to operate. Shut-

off of the pump during an electrical failure is accomplished by pulling out the override rod.

DISASSEMBLY

Remove the cover screws, governor control cover and gasket from pump. Remove the cover contact nuts and washers and work the solenoid assembly out of the cover. Remove the shut off spring and arm.

Some applications will incorporate a grounding wire assembly secured at one end to a contact screw and at the other end to the rear control cover screw in order to provide a grounded connection. On these applications a "hot" lead only is required for the opposite terminal.

MECHANICAL OVERRIDE

1. Remove the governor control cover.

2. Push in the control rod so that the snap ring is away from the inside edge of the guide assembly.

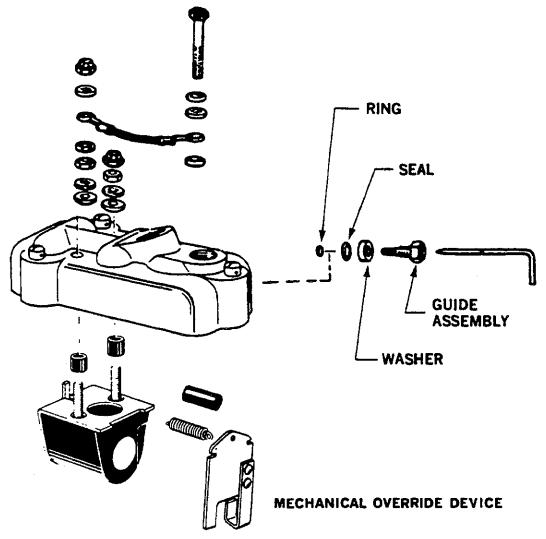
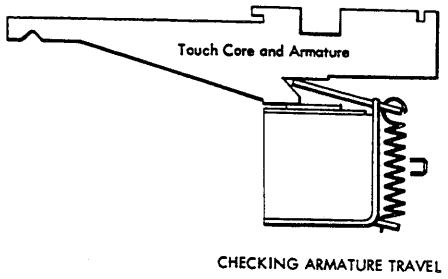


FIG. 6.4

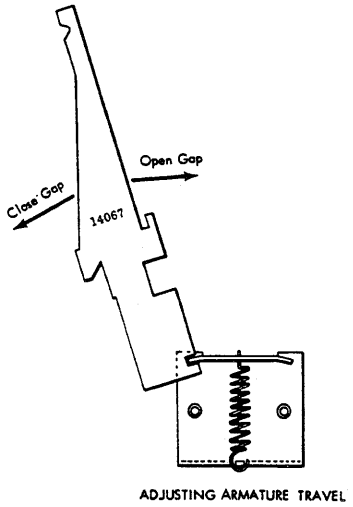
3. Remove the snap ring and pull the control rod out of the guide.

4. Loosen and remove the cover guide, the washer and the seal.



ENERGIZED TO RUN
ENERGIZED TO SHUT OFF

FIG. 6.5



ENERGIZED TO RUN
ENERGIZED TO SHUT OFF

FIG. 6.6

INSPECTION

Examine the solenoid visually for cracks and swelling in the encapsulating material and looseness of the contact screws. Check the solenoid for a complete circuit with an ohmmeter.

REASSEMBLY AND ADJUSTMENT

Assemble the shut-off arm and spring to the coil. Before installation of the solenoid assembly to the cover is made, adjustment of the arm travel and spring tension should be carried out as indicated (Figs. 6.5 through 6.8) using tools 14067 and 14725. Check the linkage hook adjustment, with reference to Section 5, Step 20. Install new insulating tubes to both contact screws. Insert the assembly into the governor control cover as a unit. Replace the insulating washer and assemble the contact nuts (10-15 inch pounds). Mount the cover assembly, with new cover seal, to the pump and tighten securely.

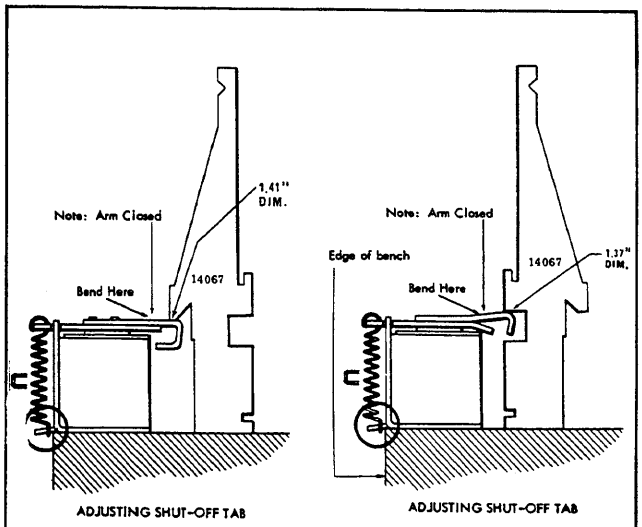


FIG. 6.7

REASSEMBLY-MECHANICAL OVERRIDE

1. Screw guide into the rear of the governor cover, securing the washer and seal.
2. Push in the control rod and secure it from the inside with the snap ring.
3. During normal run conditions when the electric shut-off is in operating position, keep the rod extended to its full outward movement.

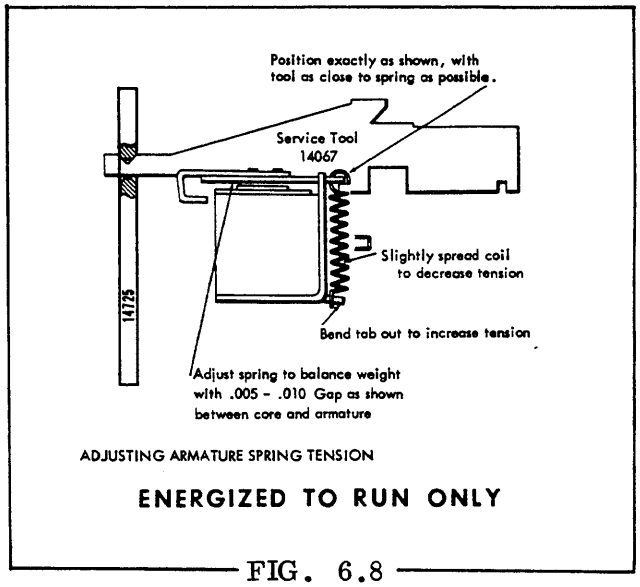


FIG. 6.8

TESTING

With the pump mounted on the test bench, the electrical shut-off device must be checked with designated voltage rating (stamped on cover) and wide open throttle at the following speeds:

A. 400 RPM
B. Full Load governor speed
C. High idle (shut-off only)

A good, heavy duty battery charger can be used as long as voltage can be selected and will hold with minimum drop (1/2 volt max.) during application to the solenoid coil.

Connect battery charger to the electrical shut-off device before applying power to charger. This will reduce the possibility of a spark at the pump.

Use of small, inexpensive trickle chargers is not recommended, since a voltage drop of 2-3 volts can be expected when current is applied to the coil. This can result in questionable operation and rejection of good coils under some conditions.

NOTE: Do not attempt to check solenoid operation with the cover removed from the pump. The governor linkage spring aids operation when the cover is assembled.

MEMO

MEMO

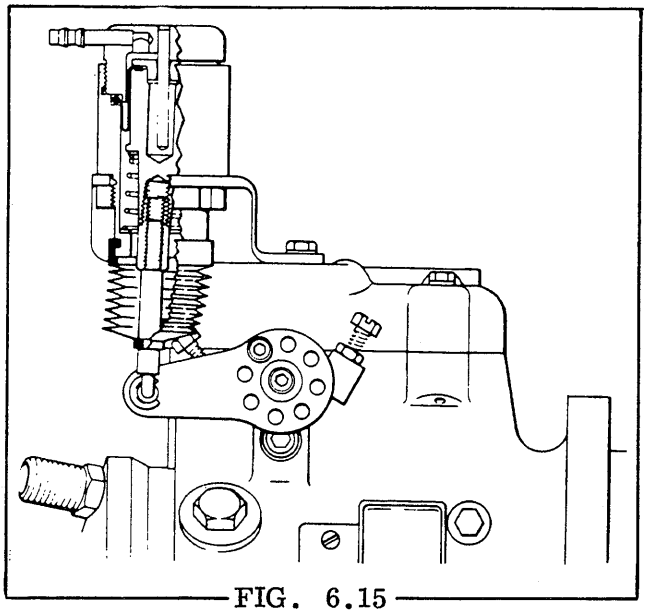


FIG. 6.15

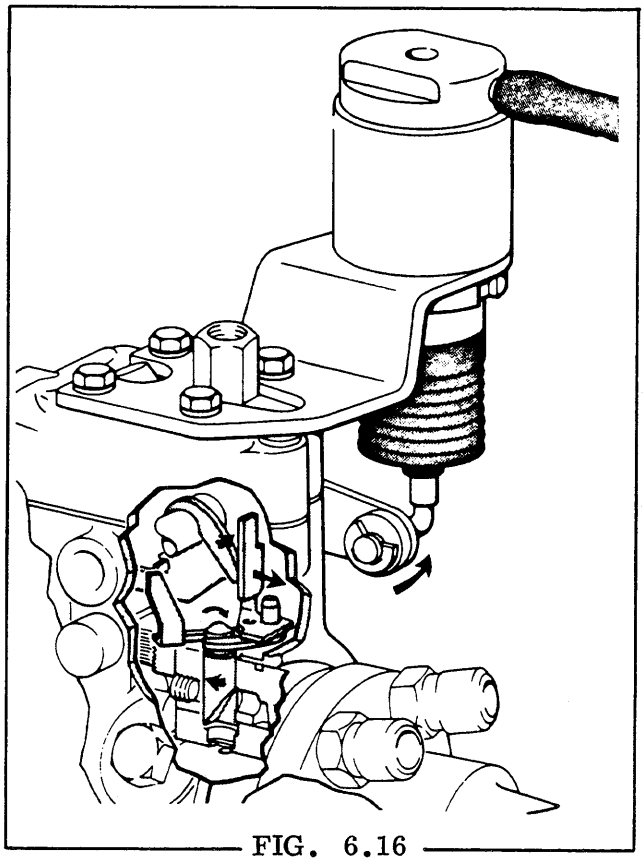


FIG. 6.16

ANEROID

A pressure sensitive fuel reduction control commonly called an "Aneroid" is in use on some turbocharged engine applications. The aneroid matches pump fuel delivery quantity to engine intake manifold pressure during periods of acceleration.

During acceleration, while the injection pump delivers full load fuel quantity, turbocharger speed lags engine speed. Until full turbo speed is attained, insufficient air is supplied to the engine for complete combustion of full load fuel quantity. A reduction in the full load fuel quantity delivered during acceleration is required to prevent overfueling and excessive smoke. The aneroid senses intake manifold pressure and reduced fuel quantity until the turbocharger comes up to speed and is able to provide enough air for efficient combustion. This device is developed for each specification and sold for original equipment engine applications.

OPERATION

At rated speed and load, when manifold pressure is at its peak, the aneroid piston is pushed outward positioning its operating rod and pump shut-off lever in the "Run" position. A decrease in intake manifold pressure allows the spring loaded piston to pull the lever toward the shut-off position. As the lever is moved forward, the shut-off cam pushes the linkage hook slightly to the rear, reducing fuel flow past the metering valve, as shown in Fig. 6.16. The amount of fuel reduction is determined by the setting of the forward screw on the adjustable shut-off lever.

As turbocharger speed increases, intake manifold pressure overcomes the force of the aneroid spring, and the piston pushes the shut-off lever to the full "Run" position allowing full load fuel delivery.

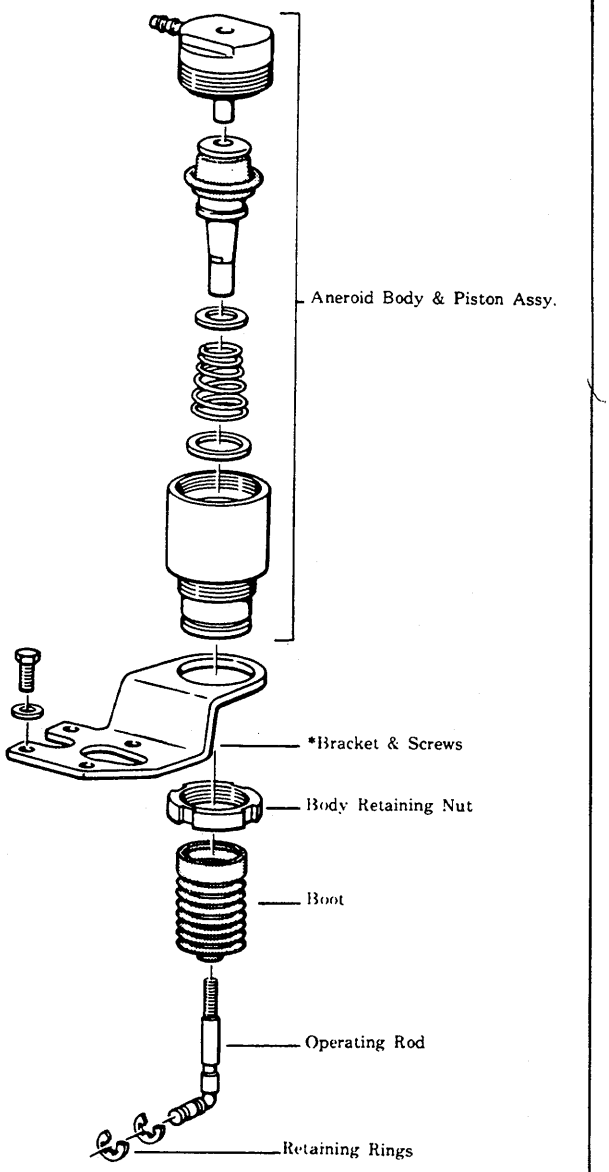


FIG. 6.17

Checking Aneroid Operation:

The operation of the aneroid may be checked before disturbing adjustments by connecting a regulated air pressure source to the boost pressure inlet fitting. A mercury manometer is preferable to a gauge for measuring air pressure, as operating pressures are very low. If a gauge is used, one with a range of zero to 30 psi, calibrated in half-pound increments should be obtained. Refer to TEST STAND DATA (Topic 9) for the

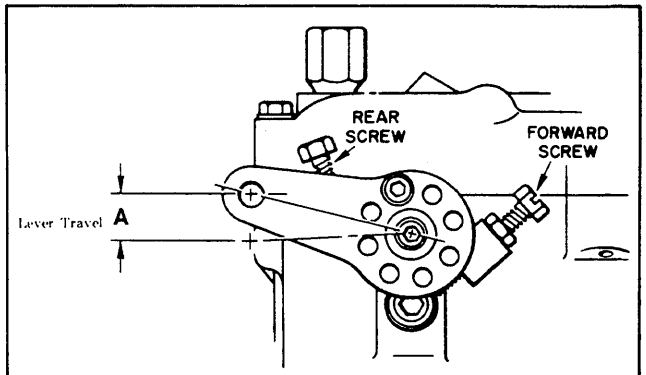


FIG. 6.18

correct aneroid settings for each application.

Removal and Disassembly:

1. Remove boost line connection from aneroid inlet.

2. Remove both operating rod retaining "E" rings using snap ring pliers 13337.

3. Remove aneroid bracket mounting s screws. The aneroid and bracket assembly may now be removed from the pump.

4. If binding of the piston or leakage was apparent during test, the aneroid body and piston assembly should be replaced. Do not attempt to disassemble the aneroid body and piston assembly. It is a sealed unit, and serviceable only by replacement.

5. Clamp the aneroid bracket in a vise.

6. Separate the boot from the aneroid body and unscrew the operating rod.

7. Remove the aneroid body retaining nut, using tool 18031.

NOTE: The shape of the aneroid bracket is designed for each application to allow convenient positioning of the Aneroid, and several different brackets are in use. Servicing procedures are the same for all configurations.

NOTE: Do not submerge the aneroid assembly in oil or solvents. A dry lubricant is used on the internal diaphragm. Washing of the assembly will remove the lubricant and possibly damage the diaphragm.

Reassembly:

1. With the mounting bracket secured in a vise, attach the aneroid body to the bracket, positioning the aneroid inlet according to TEST STAND DATA (Topic 9). Assemble the retaining nut to the body and tighten to 80 to 90 ft.-lbs., using tool 18031.

2. Attach a new boot to the opening rod and thread the rod into the piston. Avoid twisting the piston, as this may cause damage or binding of the internal diaphragm. When the operating rod bottoms in the piston, back it out approximately two turns to allow for repositioning of the rod. Do not attach the boot to the aneroid body at this time.

3. Fasten aneroid bracket to pump with bracket retaining screws.

4. Do not attach operating rod to pump shut-off lever until pump is calibrated and preliminary adjustments are made.

TEST STAND ADJUSTMENTS

NOTE: All adjustments are made with throttle lever in full fuel position (W.O.T.).

1. Calibrate pump with aneroid operating rod disconnected from shut-off lever, and shut-off lever in "Run" position.

2. After pump performance is checked, set forward shut-off adjusting screw for the required delivery according to TEST STAND DATA (Topic 9). The pump may now be removed from the test stand.

Aneroid Adjustments:

1. Set rear shut-off adjusting screw to obtain lever travel required on pump specification sheet. Lever travel is measured at lever hole as shown in Fig. 6.18.

2. Connect aneroid operating rod to the pump shut-off lever and connect a regulated air pressure source to the aneroid inlet. Note pressure at which shut-off lever lifts off forward adjusting screw and pressure required to obtain full travel of lever. Lift off pressure may be checked by inserting a piece of shim stock beneath the forward adjusting screw. The shim will slip free as lever movement begins.

3. If the lever travel requires more pressure than indicated on pump specification sheet, lengthen the operating rod. If lever travel requires less pressure than indicated shorten the operating rod.

4. Once aneroid is set, recheck reponse and repeatability.

5. Attach boot to aneroid body groove.

Replacement During Dynamometer Test:

The aneroid assembly, if found to be inoperative during dynamometer testing, may be replaced without removing the pump from the engine. The aneroid may be properly set by employing a mercury manometer to measure engine intake manifold pressure, and following instructions outlined in this Topic and TEST STAND DATA (Topic 9).

TOPIC 7 TORQUE CONTROL

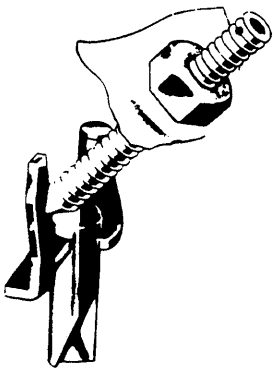


FIG. 7.1

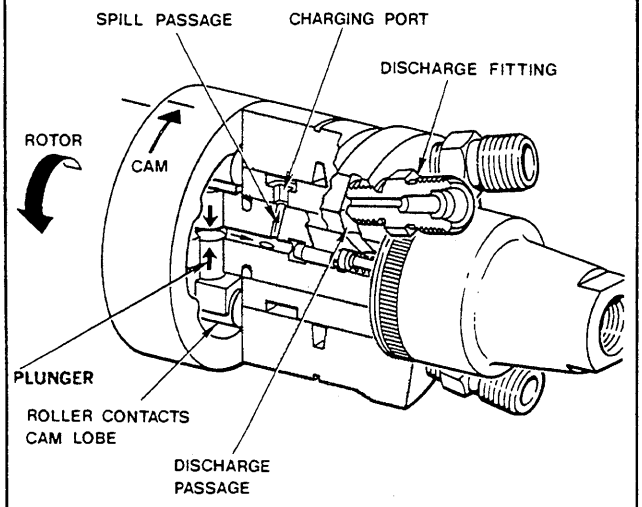


FIG. 7.2b

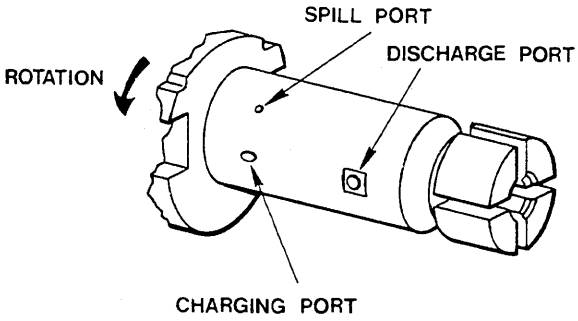


FIG. 7.2a

TORQUE SCREW

Torque is commonly defined as the turning moment or "lugging ability" of an engine. Maximum torque varies at each speed in the operating range for two reasons: (1) as engine speed increases, friction losses progressively increase and, (2) combustion chamber efficiency drops due to loss of volumetric efficiency (breathing ability of an engine), and due to reduction of time necessary to completely and cleanly burn the fuel in the cylinder. Since torque increases with increased load conditions a predetermined point at which maximum torque is desired may be selected for any engine. Thus, as engine RPM decreases, the torque generally increases toward this preselected point. This desirable feature is called "Torque Back-Up". Three basic factors affect Torque Back-Up. These are:

1. Metering valve opening area
2. Time allowed for charging
3. Transfer pump pressure curve

Of these, the only control between engines for purposes of establishing a desired torque curve is the transfer pump pressure curve and metering valve opening, since the other factors involved are common to all engines. Torque control in the fuel injection pump is accomplished in the following manner.

The manufacturer determines at what speed for a specific application he wants his engine to develop its maximum torque. The maximum fuel setting is then adjusted for required delivery during dynamometer test. This delivery must provide acceptable fuel economy. The engine is then brought to full

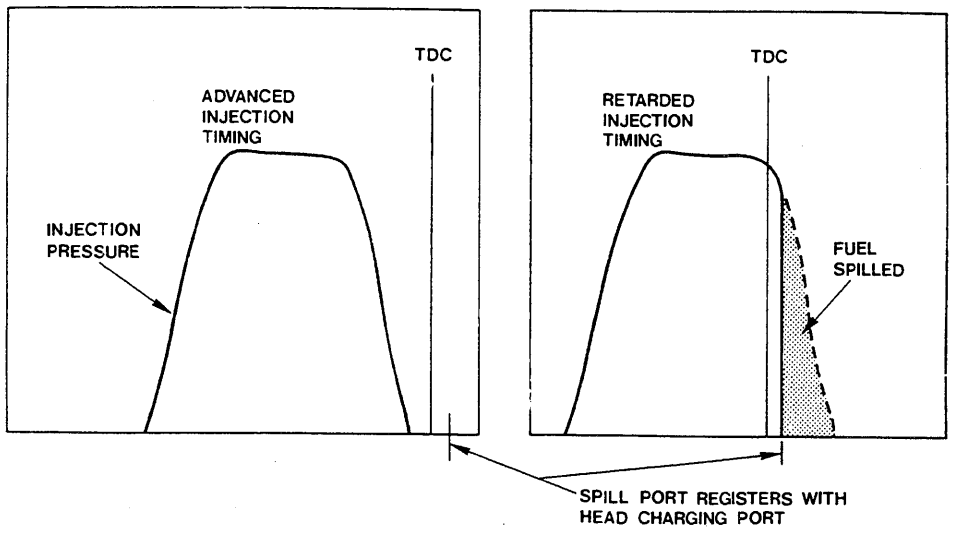


FIG. 7.2c

load governed speed. The fuel delivery is then reduced from that determined by the maximum fuel setting by turning in an adjustment or "torque screw" (Fig. 7.1), which moves the metering valve toward the closed position. The engine is now running at full load governed speed. When the engine is operating at high idle speed, no-load, the quantity of fuel delivered is controlled only by governor action through the metering valve.

NOTE: At this point, the torque screw and maximum fuel adjustment have no effect. As load is applied, the quantity of fuel delivered is controlled only by governor action and metering valve position until full-load governed speed is reached. At this point, further opening of the metering valve is prevented by its contact with the previously adjusted torque screw. Thus, the amount of fuel delivered at full-load governed speed is controlled by the torque screw and not by the roller-to-roller dimension. As additional load is applied and engine RPM decreases, a greater quantity of fuel is allowed to pass into the pumping chamber due to the increased time of registration of the charging ports. During this phase of operation the metering valve position remains unchanged, still being held from further rotation by the torque screw. As engine RPM continues to decrease, the rotor charging ports remain in registry for a longer time period allowing a larger quantity of fuel into the pumping chamber. Fuel delivery increases until the predetermined point of maximum torque is reached. At this point the quantity of fuel is controlled by the roller-to-roller dimension. It must be remembered that torque adjustment on the pump may be properly carried out only during dynamometer or bench test. It should not be attempted on a unit in the field without means of determining actual fuel delivery.

SPILL PORT/TORQUE CHOPPER

A fuel delivery control system which operates in conjunction with the speed advance mechanism has been developed for use in some Model DM injection pumps. The system is known as the Spill Port/Torque Chopper and uses a special hydraulic rotor with a spill passage drilled into the rotor bore between the pumping plungers and the

delivery valve. The spill passage is located radially following the rotor charging passage as shown in Fig. 7.2a.

During retarded injection timing, the location of the spill port allows high pressure to flow back through the spill passage and into the charging annulus via a head charging port prior to the normal end of injection. High pressure spilling, as shown in Fig. 7.2b, can only occur when the advance mechanism has positioned the cam in a retarded direction.

As the cam advances injection occurs earlier and spilling is reduced. At full advance, injection is completed before the spill port comes into registry with a head charging port.

Decreasing advance, as a result of reduced engine speed and transfer pump pressure, permits more spilling as the spill port comes into registry with a head charging port while injection is still occurring.

The combined effect of the Spill Port/ Torque Chopper and speed advance mechanism is to reduce fuel delivery as engine speed drops. The reduced fuel delivery and lower engine output torque result in reduced exhaust smoke as engine speed decreases.

The adjustment procedure for pumps equipped with the Spill Port/ Torque Chopper is important and must be followed exactly. While the roller-to-roller setting is responsible for determining full load fuel at full rated speed, the advance mechanism is adjusted to obtain the fuel delivery required at reduced engine speed and the desired engine peak torque speed. On pumps equipped with speed/light load advance, adjustment of both the speed advance trimmer screw and the load advance trimmer screw may be required. Once these adjustments are completed, fuel delivery at all checkpoints should coincide with the performance requirements listed in TEST STAND DATA (Topic 9).

TOPIC 8 TEST BENCH DATA

A. BENCH COMPONENT AND TEST FLUID RECOMMENDATIONS

TEST BENCH HORSEPOWER

Because engine horsepower ratings, and injection pump fuel flows have substantially increased in the last few years, Fiat-Allis, today, recommends TEST BENCH CAPACITY BE A MINIMUM OF 7.5 kw (10 horse power). Although test benches of 5.6 kw (7.5 horse power) are usually acceptable, even these benches can be stalled out when testing the larger fuel pumps; it is important to note that even though the bench does not completely stall, erratic flows, questionable data and a decrease in bench life may be experienced.

For those Fiat-Allis dealers who do not have enough fuel injection pump overhaul business to warrant the expense of an adequate heavy duty test bench, it is recommended that they use the facilities of their local Rossa-Master service station for their Ross-Master pump repairs and adjustments.

IMPORTANT: To be certain your pump is calibrated using the most current data, we advise supplying the Roosa-Master Service Station with a copy of the appropriate data from this manual as well as the calibration procedures.

TEST BENCH SUPPLY LINES

Flexible, transparent hose is recommended; this will allow pump metering action surge pressures to dissapate; it will also allow fuel flow observation to determine when fuel is free of air bubbles.

TEST BENCH FILTERS

Primary filter size--maximum, 30 micron.

Final stage filter size--maximum, 5 micron.

CALIBRATION FLUID

The meaningful difference in calibrating fluids (as utilized for testing outlined in this manual) is basically viscosity. Note also that viscosity changes as the temperature of the fluid changes. Therefore, even though the various bench manufacturers may state their particular fluid viscosity and temperature requirements differently, the calibration testing data obtained (when using fluid of the following SAE recommendation at the specified pump test temperature recommendation) will be acceptable in all cases.

NOTE: The fluid recommend by the SAE is, SAE J-967d. A fluid meeting this specification has been developed by the Viscosity Oil Co. under specification:

Viscor Calibration Fluid #1467

"Viscor" may be purchased from:
Viscosity Oil Co.
3200 Western Avenue
Chicago, Ill., 60608

Other acceptable fluids are:
Allis-Chalmers
Part #4040036
Roosa-Master "S.B. 201"
Fiat "CFB"
(Standardization Spec. #55787)
-Not available in North America-

FLUID SPECIFICATIONS

The calibrating fluid shall be formulated from straight-run, low odor fuel stocks containing the additives as required to meet the fluid specifications: (See chart on next page).

CALIBRATING FLUID CHANGE PERIOD

Change calibrating fluid every 6 months, or 200 pump tests (whichever comes first) or at any time the fluid viscosity falls out of a viscosity range of 34 -- 38 SUS (2.4 -- 3.18 cSt kinomatic viscosity) at 37°C (100°F).

TEST BENCH FLUID HEATER

The test bench calibration fluid heater must be capable of controlling the fluid temperature within 5° at a temperature range of 38° -- 49°C (100° -- 120°F); this accuracy will cover the range of test recommendations.

Roosa-Master and SAE recommend 43° -- 46°C (110° -- 115°F).

FLUID GRADUATES (ACCUMULATORS)

The graduation accuracy of the graduates (may be called accumulators or test measure tubes) should be within 1% of the full scale; the graduations should be 1% of full scale.

Test Bench Data

FLUID SPECIFICATION CHART

PROPERTY	SPECIFICATION LIMIT	TEST DESIGNATION
Viscosity at 100°F (37.8°C)	2.40-2.85 (2.40-2.85) cst (mm^2/s	ASTM D 445
Viscosity at 100°F (37.8°C)	34.0-35.5 SUS	ASTM D 2161
Specific Gravity (60/60°F) (15.5/15.5°C)	0.820-0.830	ASTM D 1298
Gravity, API 60°F (15.5°C)	39-41	ASTM D 287
Color, ASTM, maximum	3	ASTM D 1500
Color, ASTM, after storage of 6 months at 110±5°F (43.3±2.8°C), maximum	4	ASTM D 1500
Corrosion at 212°F (100°C), after 3 hours, copper	Pass-Classification 1	ASTM D 130
Galvanic corrosion	Pass-10 days	FSTM 5322.1
Sulfur, % weight, maximum	0.4	ASTM E 129
Distillation at 20% point, max.	470°F (243°C)	ASTM D 86
Flash point (P.M. closed cup), minutes	170°F (76.7°C)	ASTM D 93
Trace sediment, % volume, max.	0.01	ASTM D 2273
Foaming tendency at 75°F (23.9°C) after minutes blowing, ml. maximum	50	ASTM D 982
Foam stability at 75°F (23.9°C) after 2 minutes settling ml, maximum	0	ASTM D 892
Rust protection (humidity cabinet) sand blasted panel	Pass-100 hours Pass five out of six faces of panels tested according to ASTM 1748	ASTM D 1748

For maximum drainage efficiency, the graduate rack should be capable of tilting about 45° (unless of bottom draining type). The graduates should be allowed to drain about 30 -- 40 seconds, and equal drain times should be used to avoid variations in subsequent readings.

Note that the fluid level in the graduates is not straight across the tube, but curves (⌒); the curve is called a meniscus; always read the bottom of the meniscus to obtain maximum accuracy.

TEST BENCH COUNTER MECHANISM

The construction should be positive and fast acting. On and off motion should be approximately the same speed. Counter should be of the predetermining type and should allow collection of at least the following counts: 200 and 500 strokes. The larger number of strokes tends to reduce the effect of the small counting error occurring during starting and stopping of the counting mechanism.

CALIBRATING NOZZLES

The following chart identifies the test bench nozzles which may be used for calibration purposes.

IMPORTANT: Calibration (test bench) nozzles may not be interchanged with engine nozzles; engine nozzles may not be used for calibration purposes unless the given calibration data specifically states that engine nozzles and/or holders are to be used.

F.I.P. AND MANUFACTURER	ENGINE	NOZZLE AND HOLDER		
		TEST NOZZLES		HOLDERS
Roosa-Master	2900	12SD12	EFEP 182	BKB50SD
	3500	12SD12	EFEP 182	BKB50SD
	11000	8S2C		BKB50SD

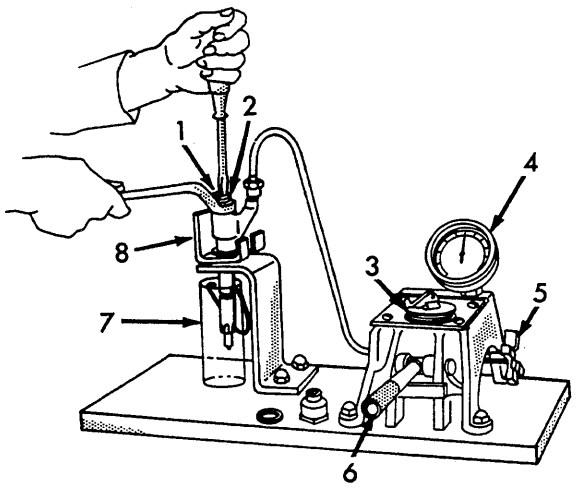


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FIG. 8-1 FUEL INJECTION NOZZLE TESTER

1. Pressure adjusting screws
2. Adjusting screw locknut
3. Filler cap
4. Pressure gauge
5. Valve handle
6. Tester handle (pump)
7. Spray collector
8. Nozzle-holder assembly

NOTE: Part numbers, ADN...(nozzles) and AKB...(holders) are American Bosch part numbers; EFEP...and EF...numbers are Robert Bosch part numbers.

CALIBRATING NOZZLE TESTING

NOTE: Nozzle assemblies should be tested at least monthly, or after each 20 pumps have been tested.

Calibrating nozzles must be handled as you would handle a delicate gauge. In this respect, the nozzles should not be disassembled for repair unless your shop is completely equipped; "equipped", will include a master calibrating fuel injection pump.

Unless "completely equipped", only two tests should be made; pressure test and nozzle seating test. To properly test a nozzle and holder assembly, a nozzle tester (with a recently calibrated gauge) similar to the one shown in Fig. 8-1 is required.

Also, test bench calibration fluid must be used.

⚠ WARNING

Keep hands away from nozzle tip when popping a nozzle. The finely atomized fuel is ejected with sufficient force to penetrate the skin and cause blood poisoning. Also, wear safety glasses with side shields or goggles when popping a nozzle.

PRESSURE TEST

Install nozzle holder assembly on nozzle tester as shown in Fig. 8-1. Install spray collector.

Open nozzle tester valve and operate the handle several strokes to force the air out of the nozzle assembly.

Operate tester handle a few quick strokes then observe the opening pressure (should be 2500 psi -- 175.8 kg/cm^2)

Adjust the fuel injection nozzle to obtain specified opening pressure (if necessary) as follows:

Remove the cap nut from the upper end of the fuel injection nozzle holder and loosen the adjusting screw locknut.

While operating the tester pump handle, turn the pressure adjusting screw IN to increase or OUT to decrease the opening pressure until the specified pressure is obtained. At this time, hold the adjusting screw from turning and tighten the adjusting screw locknut to the specified torque as follows:

NOZZLE NO.	TORQUE
ADN8S2C	44--58 (6--8 m-kg)
ADNI2SD12	44--58ft. lbs. (6-8 m-kg)
EFEP 182	44--58ft. lbs. (6-8 m-kg)

On all tests, check for leakage between nozzle and holder bodies--a slight seepage is permissable.

NOZZLE VALVE SEATING TEST

Slowly operate tester until nozzle opens.

Wipe the tip of nozzle until thoroughly dry.

⚠ WARNING

Keep hands and face away from the loosened line nuts while performing fuel line and nozzle tests. Also, wear safety glasses with side shields or goggles.

Again operate tester until pressure is approximately 155.14 bar (2250 psi) somewhat less than specified. Maintain this pressure and watch the nozzle tip for leakage. The nozzle is considered leak free if the droplet which has formed at the orifice has not fallen from nozzle within 10 seconds. If nozzle leaks, return nozzle and holder assembly to place of purchase for reconditioning and "Master Pump Testing".

HIGH PRESSURE CALIBRATION TUBING

All tubing sets must be of the same length, inside diameter, and outside diameter. Tubing should be capped during storage and flushed clean before usage. Tubing end bores should be checked for crimping using suitable drill gauges; always flush-clean tubing after drilling or reaming.

Tubing can be checked for flow accuracy by switching one tube for another (within set) and comparing draw results on the test bench.

Tubing size for use with 12SD12 or 8S2C nozzles must be:

I.D.	2.4mm (.094")
O.D.	6.35mm (.250")
Length	508mm (20")

NOTE: SAE orifice plate nozzles may not be used in place of 12SD12 or 8S2C nozzles unless specific SAE calibration data is used. Too, the nozzle opening pressure, and tubing size is different.

TEST STAND ADAPTORS

Adaptors for all Roosa-Master pumps are available from the test stand manufacturers for the following:

American Bosch TSE 4500
Bacharach - GP-500C
Unitest U7000: U4500
Hartridge Majestic - Powermaster

TEST STAND MAINTENANCE

Daily:
Check hole size at the ends of injection lines with the chuck end of a drill bit of the same size as the I.D. of the lines. If the hole is restricted, use the drill to bore it out to the original size.

Weekly:
Check the collector system thoroughly for evidence of leakage. Correct as necessary.

Monthly:
1. Check nozzle holder opening pressure with a hand pump.
2. Check temperature and pressure gauges against other gauges known to be accurate. If gauges are out of adjustment, have them repaired locally.
3. Check tachometer with stroboscope or hand tachometer. Repair locally if necessary.
4. Change calibrating oil. Be sure to use only approved calibrating oil.

Quarterly:
1. Change calibrating and lube oil filters. Use original manufacturer's replacement parts; do not use substitute - "will-fit" parts.
2. Verify calibration of the test stand with the master pump as outlined in instructions included with the master pump.

Bi-Annually:
1. Change lube oil.

Annually:
1. Return the complete set of calibrating nozzles and holders to the manufacturer for inspection and reconditioning.

Time intervals recommended here are based on constant daily use of the test stand. The intervals may be adjusted according to the amount each stand is used.

B. CHECKING BENCH DRIVE SHAFT ALIGNMENT

IMPORTANT: To avoid serious pump damage, always check bench drive shaft parallel and angular alignment. A guide for checking is as follows:

Parallel Alignment (Fig. 8-2) - The pump mounting bracket pilot diameter must be held within .127 mm (.005"). Total Indicator Reading with the outboard end of the test stand drive shaft. The mounting bracket should be in the immediate area of the test bench bed where the pump is normally mounted and connected for this measurement. Remove the test stand drive coupling and mount a dial indicator extending directly from the test stand drive shaft to the mounting bracket pilot. Depress indicator approximately .254 mm (.010") and set to "zero". Rotate the test stand drive shaft 360° by hand

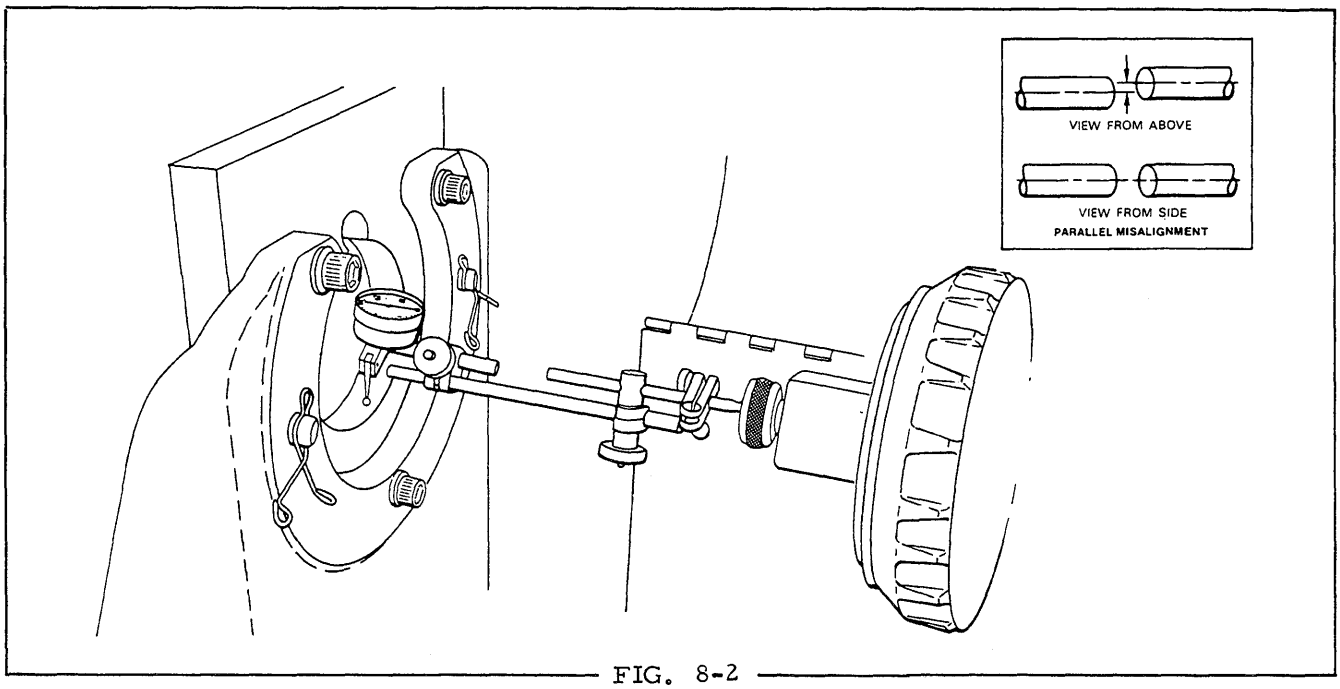


FIG. 8-2

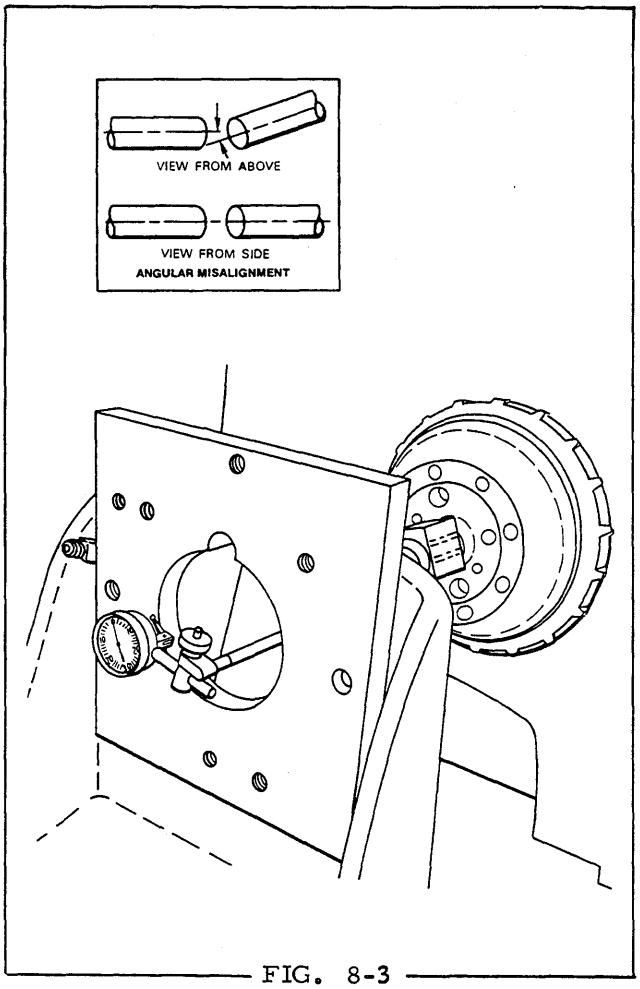


FIG. 8-3

while watching the indicator. Should the measurement exceed .127 mm (.005") shim the bracket mounting supports as required to correct the alignment. If unable to correct the bracket mounting supports, consult the test stand manufacturer.

Angular Alignment (Fig. 8-3) - The pump mounting bracket front face must be held within .254 mm (.010") Total Indicator Reading with the outboard end of the test stand drive shaft. With the same set up as parallel alignment, extend the dial indicator to the front face of the mounting bracket. Depress indicator approximately .254 mm (010") and set to "zero". Rotate the test stand drive shaft 360° by hand while watching the indicator. Should the measurement exceed .254 mm (.010") shim the bracket mounting supports as required to correct the alignment. If unable to correct the bracket mounting supports, consult the test stand manufacturer.

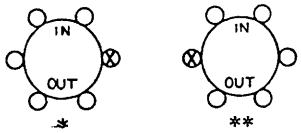
The pump drive shaft must not be deflected by the test stand drive shaft. There should be .025 -- .127 mm (.001 to .005") gap between the shaft coupling surfaces.

The test stand coupling should be of the self-aligning, no backlash type; similar to the Thomas Coupling (SAE J969a).

TOPIC 9 FUEL INJECTION PUMP REFERENCES, CALIBRATION PROCEDURES AND DATA

A. REFERENCES

Timed to this cylinder (viewed from end plate) ⊗



* **

F/A PUMP NO.	MFG. PUMP NO.	MODEL	ENGINE	PAGE NO.
74008318 *	DM4629RH3260	605-B	2900	9-4
74008322 *	DM4629RH3259	545-B	2900	9-4
74008551 *	DM4629RP3278	545-B	649T	9-4
74008552 *	DM4629RP3279	605-B	649T	9-4
74035827 *	DM4631RH3230	645-B	3500	9-7
74036268 *	DM4629RH3277	645-B	3500	9-6
74321756 *	DM4631AJ3069	100-C 150-C	11000	9-6
74321756 *	DM4631AJ3069	100-C 150-C	685T	9-6
74321882 **	DM4631AJ3117	200-C	11000	9-7
74321924 **	DM4631FB3129	745-C	11000	9-5
74321973 **	DM4631AL3062 (Superseded by) DM4631AL3153	262-B 263-B	11000	9-5
74322021 **	DM4631PF3256	745-C	11000	9-5, 9-6

B. CALIBRATION PROCEDURES

1. Mount the pump securely with appropriate adapters. The drive shaft bearing must be lubricated during test. An effective means of lubrication can be arranged by allowing all of the pump return oil to flow over the front face of the drive shaft bearing and then drain back to the tank thru the test bench bed (Fig. 9-1).

NOTE: Firing order is 1-5-3-6-2-4 for 6 cylinder engines; 1-3-4-2 for 4 cylinder engines.

Leave injection line nuts at the nozzles loose. Install transfer pump inlet connector (No. 19971) and fuel inlet line.

NOTE: Inlet connector No. 19971 is the only one to be used; use of other connectors could cause rotor seizure. Install transfer pump pressure gauge connector (No. 20012) and fuel line to the pressure gauge connector (No. 20012) and fuel line to the pressure gauge with a shut-off valve close to the pump. Install the advance test window(No. 19918) in place of the timing line cover on the housing.

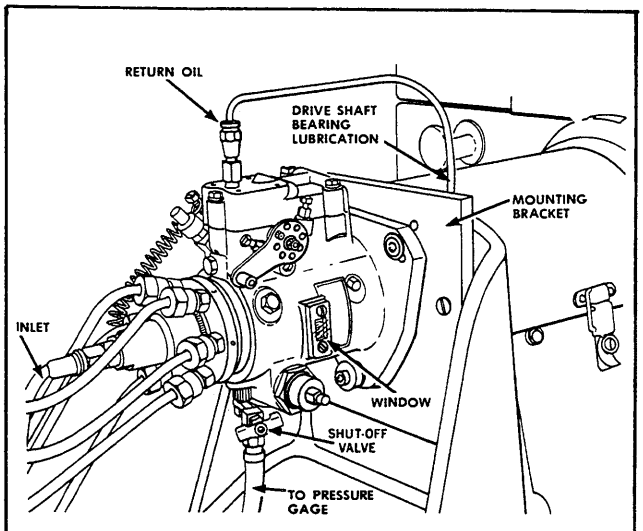


FIG. 9-1

2. Pump rotation is clockwise. Rotation is determined as viewed from drive end of pump.

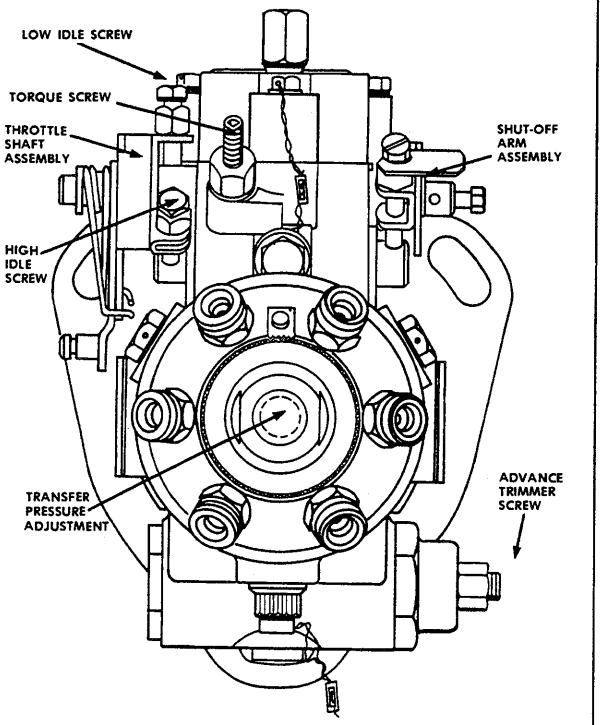


FIG. 9-2

3. If the pump is equipped with an Electric Shut-off device, energize the solenoid before starting the test stand. Start stand at lowest speed. Move pump throttle lever to "full-load" position. When transfer pump is primed, allow fuel to bleed for several seconds from the loosened injection line nuts at the nozzles. Tighten line nuts securely.

⚠ WARNING

Wear safety glasses with side shields or goggles when using compressed air for cleaning to reduce the danger of personal injury from flying particles. Limit the pressure to 2.068 bar (30 psi) according to local or national requirements.

4. Operate pump at 500 rpm (wide open throttle) for 10 minutes. Dry pump off completely with compressed air. Observe for leaks and correct as necessary. Back out the high idle adjusting screw and torque screw (if equipped).

NOTE: The inlet to the transfer pump must never be pressurized in excess of .689 bar (10 psi) during bench testing.

5. Vacuum Check: Close valve in fuel supply line - At 200 rpm transfer pump must be capable of creating vacuum of at least 457 mm (18")hg. If it does not, check for air leaks on suction side or malfunction of transfer pump components.

6. Fill graduates to bleed air from test stand and to wet graduates.

7. The return oil is measured by directing the return oil line into an appropriate calibrated graduate for the proper time and pump speed and comparing the results with the specification.

IMPORTANT: Since this oil flow is used to lubricate the drive shaft bearing, it must be returned to its original location immediately upon completion of the above check.

NOTE: Refer to CALIBRATION DATA for correct sequence of test stand adjustments.

8. Operate at the specified speeds with wide open throttle and observe transfer pump pressure. Adjust pressure regulating spring plug to raise or lower transfer pump pressure.

NOTE: Under no circumstances should 8.963 bar (130 psi) be exceeded. To adjust pressure, remove the line to the transfer pump inlet connector and use a hex key wrench to adjust the plug. Clockwise adjustment increases pressure. Do not over-adjust. Re-install fuel inlet line after adjustment.

NOTE: Transfer pump pressure gauge must be isolated by the shut-off valve at the injection pump when checking fuel delivery and advance movement.

9. Check for minimum delivery at cranking speed.

10. Operate at high idle speed and adjust high idle screw to obtain the specified delivery. Recheck transfer pump pressure upon completion of this adjustment.

11. Adjust the low idle screw to the correct low idle delivery.

12. Automatic Advance: Check the cam position at specified points in the speed range. Adjust trimmer screw, as required, to obtain proper advance operation. Each line on the advance gauge (No. 19918) equals two pump degrees. After setting the advance, check to see that the cam returns to its inital position at 0 rpm. Recheck transfer pump pressure after setting advance and correct if necessary.

13. Record fuel delivery at check points shown in CALIBRATION DATA. ROLLER SETTINGS SHOULD NOT BE READJUSTED ON TEST BENCH. Experience has proven that micrometer and dial indicator settings provide more consistent, accurate results in performance. Variations in test bench drives, instrumentation, nozzles, lines and fuels in different areas sometimes result in nonconforming flow readings.

14. While operating at full-load governed speed, set torque screw (if employed) to specified delivery. Recheck the transfer pump pressure upon completion of this adjustment.

15. Recheck delivery at lowest speed checkpoint.

16. Check governor cut-off specified speed.

17. Check Electric Shut-off (if equipped) at speeds indicated.

18. Remove the pump from the test stand and assemble all sealing wires. Pump is now ready for installation to engine.

C. PROCEDURE EXAMPLE

To illustrate the use of CALIBRATION DATA, pump number 74321973 will be used as an example. The pump carries the manufacturer's part number DM4631AL3153. It is used on 262-B, 263-B, 11000 Mark II engine. When the pump is rebuilt, it is to be set at the specifications given. The engine, with the pump properly calibrated, should have a high idle speed of 2280 -- 2340 rpm, a low idle speed of 600 -- 700 rpm, and should develop a full load horse power at 2100 rpm. A roller-to-roller setting of 49.911 ± .038 mm (1.965 ± .0015") should make the pump deliver 71 -- 74 cc/500 strokes at 600 rpm on the test stand. At the same time, the transfer pump should be producing a pressure of 5.86 -- 6.205 bar (85 -- 90 psi) at 1050 rpm. Check the pump for minimum rate of flow at 75 rpm on the test stand. If it does not deliver a minimum of 44 cc in 500 strokes and if transfer pump pressure is not at least .551 bar (8 psi) parts are worn excessively and do not have the proper tolerances. Next, set the torque screw to deliver the specified amount of fuel at the specified speed; in this case the pump should deliver 60 -- 62 cc/500 strokes at 1050 rpm. Again, check the transfer pump pressure.

If the pump incorporates an automatic advance mechanism, either load or speed, adjust the trimmer screw or shims to achieve the correct cam positions at the specified speeds or loads.

Pump and governor specifications show that this pump has 7 -- 10% regulation, and that it is to be timed to start injection when the #1 engine piston is at 14° before top dead center. When mechanically timing the pump, etch the timing mark on the rotor according to the procedure outlined. (See page 11-2).

For proper testing and adjusting of pumps, it is mandatory that the test stand and its accessories be in good condition. The following check list will provide a guide for proper maintenance of the test stand.

D. ANEROID ADJUSTMENTS

1. Operate pump at ---------- 1000 rpm (745-C)
   900 rpm (645-B)

2. Pressurize the aneroid, and check shut-off lever response.
   Lever should lift off screw at ---------- 102-152 mm (4"-6")Hg (745-C)
   254-305 mm (10"-12")Hg (645-B)

   If lever lift-off requires less than minumum Hg, shorten operating rod; if more than maximum Hg, lengthen rod.

3. While viewing end plate, **position aneroid so that inlet** fitting is at ---------- 12 o'clock (745-C)
   10 o'clock (645-B)

E. CALIBRATION DATA (Roosa-Master-DM)

F/A PUMP NO. Mfr. Pump No.	74008318 DM4629RH3260	74008322 DM4629RH3259	74008551 DM4629RP3278	74008552 DM4629RP3279
TEST NOZZLE Nozzle Holder Pressure-bar (psi)	12SD12 BKB50SD 172.4 (2500)	← ← ← ←	← ← ← ←	← ← ← ←
ANEROID	(Refer to page 9-3 for Aneroid Adjustment)			
APPLICATION	Wh. Loader 605-B	Wh. Loader 545-B	Wh. Loader 545-B	Wh. Loader 605-B
ENGINE High Idle rpm Low Idle rpm Full Load rpm Timing B.T.D.C.	2900 MK II 2500-2640 750-800 2400 20°Static	← ← ← ← ←	649T ← ← ← ←	← ← ← ← ←
ADJUSTMENTS Roller-Roller Dim. Timing Mark Angle Gov. Linkage Gap Gov. Regulation	49.58 ± .038mm (1.952 ±.0015") 351.5° 3.175 - 3.683mm (.125 - .145") 7-10%	49.53 ± .038mm (1.950 ± .0015") ← ← ← ←	← ← ← ← ← ←	49.58 ± .038mm (1.952 ± .0015") ← ← ← ←
TRANSFER PUMP Pressure-bar (psi) @ rpm(full throttle)	5.86-6.55 (85-95) 1200	← ← ←	← ← ←	← ← ←
FLOW CHECK (R-R) cc @ 500 Strokes @ rpm(full throttle) Max. Variation Between Cylinders	38-41 800 -	36-39 ← -	← ← -	38-41 ← -
FLOW CHECK (Min.) cc @ 500 Strokes @ rpm(full throttle) @ Trans.Pump Press-bar (psi)	22 75 .69 min. (10)	21 ← ← ←	23 ← ← ←	← ← ← ←
HIGH IDLE (Set) cc @ 500 Strokes @ rpm(full throttle) Max. Variation Between Cylinders	8-10 1320 -	← ← -	← ← -	← ← -
TORQUE SCREW (Set) cc @ 500 Strokes @ rpm(full throttle) Max. Variation Between Cylinders	30-32 1200 -	28-30 ← -	← ← -	30-32 ←
LOW IDLE (Set) cc @ 500 Strokes @ rpm	8-10 350	← ←	← ←	← ←
AUTO. SPEED ADV. Pump Engine @ rpm	1° 6° 8° 2° 12° 16° 200 600-700 by 1000	← ← ←	← ← ←	← ← ←
GOV. CUT-OFF(Check) cc @ 500 Strokes @ rpm(full throttle)	10 max 1345	← ←	← ←	← ←

E. CALIBRATION DATA (Roosa-Master-DM)

F/A PUMP NO. Mfr. Pump No.	74321924 DM4631FB3129	74321973 DM4631AL3153	← ←	74322021 DM4631PF3256
TEST NOZZLE Nozzle Holder Pressure-bar (psi)	8S2C BKB50SD 172.4 (2500)	8S2C BKB50SD 172.4 (2500)	12SD12 ← ← ←	8S2C BKB50SD 172.4 (2500)
ANEROID	(Refer to page 9-3 for Aneroid Adjustments)			
APPLICATION	Wh. Loader 745-C	Scrapers 262-B, 263-B	← ←	Wh. Loader 745-C
ENGINE High Idle rpm Low Idle rpm Full Load rpm Timing B.T.D.C.	11000 MK II 2350-2450 750-800 2200 14°Static	11000 MK II 2280-2340 600-700 2100 14°Static	685T ← ← ← ←	11000 MK II 2350-2450 750-800 2200 14°Static
ADJUSTMENTS Roller-Roller Dim. Timing Mark Angle Gov. Linkage Gap Gov. Regulation	50.241 ± .038mm (1.978 ± .0015") 348.50° 3.175 - 3.683mm (.125 - .145") 7-10%	49.911 ± .038mm (1.965 ± .0015") 350° 3.175 - 3.683mm (.125 - .145") 7-10%	49.96 ± .038 mm (1.967 ± .0015") ← ← ← ←	50.241 ± .038mm (1.978 ± .0015") 348.50° 3.175-3683mm (.125-.145") 7-10%
TRANSFER PUMP Pressure-bar (psi) @ rpm(full throttle)	6.55 -6.895 (95-100) 915	5.86-6.205 (85-90) 1050	← ← ←	5.86-6.205 (85-90) 915
FLOW CHECK (R-R) cc @ 500 Strokes @ rpm(full throttle) Max. Variation Between Cylinders	84-87 915 -	71-74 600 5	60-64 750	84-87 915 -
FLOW CHECK (Min.) cc @ 500 Strokes @ rpm(full throttle) @ Trans.Pump Press-bar (psi)	52.5 75 .6895 min. (10)	44 75 .5516 min. (8)	40 ← ← ←	52.5 75 .6895 min. (10)
HIGH IDLE (Set) cc @ 500 Strokes @ rpm(full throttle) Max. Variation Between Cylinders	12-14 1212 -	22-28 1150 -	← ← -	12-14 1212 -
TORQUE SCREW (Set) cc @ 500 Strokes @ rpm(full throttle) Max. Variation Between Cylinders	73-77 915 -	60-62 1050 2.5	54-56 ← 5	73-77 915 -
LOW IDLE (Set) cc @ 500 Strokes @ rpm	14-16 412	25-30 360	12-14 ←	14-16 412
AUTO. SPEED ADV. Pump Engine @ rpm	1° 10° 11° 2° 20° 22° 200-400 750-700 by 875	1° 9°Set 11° 2° 18° 22° 200-300 500-550 by 650	← ← 250 550 by 800	1° 10° 11° 2° 20° 22° 200-400 750-800 by 875
GOV. CUT-OFF(Check) cc @ 500 Strokes @ rpm(full throttle)	5 1237	5 max. 1225	10 max. ←	5 1237

E. CALIBRATION DATA (Roosa-Master-DM)

F/A PUMP NO. Mfr. Pump No.	74036268 DM4629RH3277	74321756 DM4631AJ3069	← ←	74322021 DM4631PF3256
TEST NOZZLE Nozzle Holder Pressure-bar (psi)	12SD12 BKB50SD 172.4 (2500)	12SD12 BKB50SD 172.4 (2500)	12SD12 ← ← ←	12SD12 BKB50SD 172.4 (2500)
ANEROID	(Refer to page 9-3 for Aneroid Adjustment)			
APPLICATION	Wh. Loader 645-B	Graders 100-C, 150-C	← ←	Wh. Loader 745C
ENGINE High Idle rpm Low Idle rpm Full Load rpm Timing B.T.D.C.	3500 MK II 2360-2480 750-800 2200 16°Static	11000 MKII, 685T 1950-2020 600-700 1800 14°Static	685T ← ← ← ←	685T 2350-2450 750-800 2200 14° Static
ADJUSTMENTS Roller-Roller Dim. Timing Mark Angle Gov. Linkage Gap Gov. Regulation	50.11 ±.038mm (1.973 ±.0015") 351° 3.175 - 3.683mm (.125 - .145") 7-10%	49.7±.038mm (1.957±.0015") 351° 3.175-3.683mm (.125-.145") 12%	49.7 ± .038mm (1.957 ± .0015") ← ← ← 12%	50.24 ±.038mm (1.978±.0015") 348.5° 3.175-3.683mm (.125-.145") 7-10%
TRANSFER PUMP Pressure-bar (psi) @ rpm(full throttle)	5.86-6.55 (85-95) 1100	5.516-6.205 (80-90) 900	← ← ←	5.86-6.205 (85-90) 915
FLOW CHECK (R-R) cc @ 500 Strokes @ rpm(full throttle) Max. Variation Between Cylinders	61-64 800 4	50-53 800 -	50-53 800 -	84-87 915
FLOW CHECK (Min.) cc @ 500 Strokes @ rpm(full throttle) @ Trans.Pump Press-bar (psi)	31 75 .5516 min. (8)	50 75 .69 min. (10)	50 ← .69 min. (10)	50 75 .6895 min. (10)
HIGH IDLE (Set) cc @ 500 Strokes @ rpm(full throttle) Max. Variation Between Cylinders	10-12 1210 6	10-12 1010 -	← 1010 -	12-14 1212
TORQUE SCREW (Set) cc @ 500 Strokes @ rpm(full throttle) Max. Variation Between Cylinders	50-52 1100 -	47-49 900 -	47-49 ← -	73-77 915 11
LOW IDLE (Set) cc @ 500 Strokes @ rpm	10-12 350	10-14 200	10-14 ←	14-16 412
AUTO. SPEED ADV. Pump Engine @ rpm	1° 2° 250-450	8° 16° 725-775	10° 20° by 1000	1° 2° 200-300	9° 18° 500-550	Full Full by 800	← ← ←	Full Full by 800	1° 2° 250	10° 20° 825	Full Full by 900
GOV. CUT-OFF(Check) cc @ 500 Strokes @ rpm(full throttle)	10 max 1235	10 max. 1035	← 1035	10 max. 1237

E. CALIBRATION DATA (Roosa-Master-DM)

F/A PUMP NO. Mfr. Pump No.	74035827 DM4629RH3230	74321882 DM4631AJ3117	← ←	
TEST NOZZLE Nozzle Holder Pressure-bar (psi)	12SD12 BKB50SD 172.4 (2500)	12SD12 BKB50SD 172.4 (2500)	12SD12 ← ← ←	
ANEROID	(Refer to page 9-3 for Aneroid Adjustments)			
APPLICATION	Wh. Loader 645-B	Grader 200-C	← ←	
ENGINE High Idle rpm Low Idle rpm Full Load rpm Timing B.T.D.C.	3500 MK II 2360-2480 750-800 2200 16° Static	11000 MK II 1950-2020 600-700 1800 14° Static	← ← ← ← ←	
ADJUSTMENTS Roller-Roller Dim. Timing Mark Angle Gov. Linkage Gap Gov. Reguation	50.11 ± .038mm (1.973 ± .0015") 349.5° 3.175-3683mm (.125-.145") 7-10%	49.87±.038mm 1.965±.0015") 350° 3.175-3.683mm (.125-.165") 7-12%	← ← ← ← ← ←	
TRANSFER PUMP Pressure-bar (psi) @ rpm(full throttle)	5.86-6.55 (85-95) 1100	5.516-6.205 (80-90) 900	← ← ←	
FLOW CHECK (R-R) cc @ 500 Strokes @ rpm(full throttle) Max. Variation Between Cylinders	61-64 800 8	58-62 700 -	58-62 700 -	
FLOW CHECK (Min.) cc @ 500 Strokes @ rpm(full throttle) @ Trans.Pump Press-bar (psi)	31 75 .5516 min. (10)	37.5 75 .6895 min. (10)	37.5 ← ← ←	
HIGH IDLE (Set) cc @ 500 Strokes @ rpm(full throttle) Max. Variation Between Cylinders	10-12 1210 3	10-12 1010 -	10-12 ← -	
TORQUE SCREW (Set) cc @ 500 Strokes @ rpm(full throttle) Max. Variation Between Cylinders	50-52 1100 -	55-57 900 -	55-57 ← -	
LOW IDLE (Set) cc @ 500 Strokes @ rpm	10-12 350	12-14 200	← ←	
AUTO. SPEED ADV. Pump Engine @ rpm	1° 2° 250-450	8° 16° 725-775	10° 20° by 1000	1° 2° 250min	9° 18° 550	11° 22° by800	← ← ←	
GOV. CUT-OFF(Check) cc @ 500 Strokes @ rpm(full throttle)	10 max. 1235			10 max. 1035			← ←	

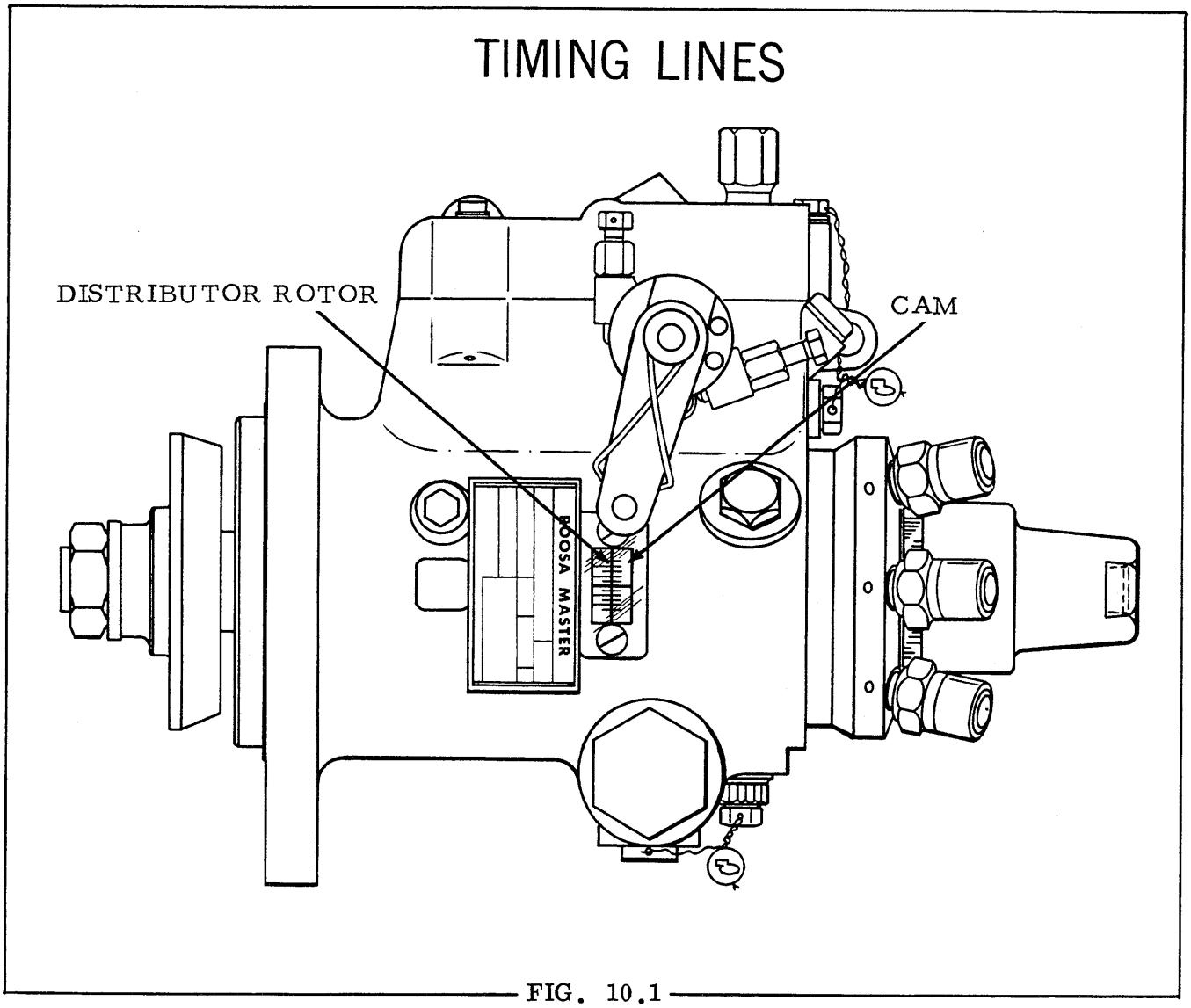


FIG. 10.1

DANGER

Extinguish all smoking materials and open flames before working around diesel fuel.

INSTALLING THE PUMP

A. Remove timing line cover.

B. Turn pump drive shaft in the direction of pump rotation until the timing line on the Distributor rotor registers with the line on the cam O.D. (Fig. 10.1)

C. Check TEST STAND DATA (Topic 9) for proper timing position of crankshaft.

D. Slide the pump into position over the mounting studs. Assemble washers and the mounting stud nuts and tighten.

E. Install the pump drive gear to the hub or drive shaft. Refer to the engine manual. Back off the engine at least 1/2 revolution and bar it in the direction of rotation to the proper timing mark. Recheck line marks in the pump and correct if necessary. Repeat procedure to insure proper timing. Install timing line cover.

F. Remove caps on high pressure lines. Connect the lines to their respective discharge fittings and tighten to specified torque.(Refer to engine manual.) Connect throttle and shut-off linkage and electrical connections if used. Assemble and tighten fuel return line. Open bleed screw on secondary filter, and operate hand primer (if equipped and filter is after hand primer) or allow fuel to flow from tank until all air is dispelled from filter.

NOTE: Do not open filter bleed if hand primer is after filter. Close bleed screw. Continue hand priming until a quantity of fuel flows "air-free" at pump inlet line. Fasten the inlet to the pump. This procedure should also be followed without fail after every filter change. Refer to Operation and Maintenance Instruction Manual for starting instructions before starting engine.

TOPIC 11 GENERAL DATA

GENERAL DATA

The Model DM Fuel injection Pump operates with all types of combustion chambers on 2 or 4 stroke cycle engines.

TRANSFER PUMP OPERATIONAL DATA

Maximum permissible transfer pump pressure - 130 psi.

Transfer pump lift for fully primed injection pump at 400 engine RPM (minimum) - 18 in. of mercury.

DIMENSIONAL DATA

Weight of basic pump, regardless of number of cylinders served - approximately 14 lbs.

SERVICE TOOLS

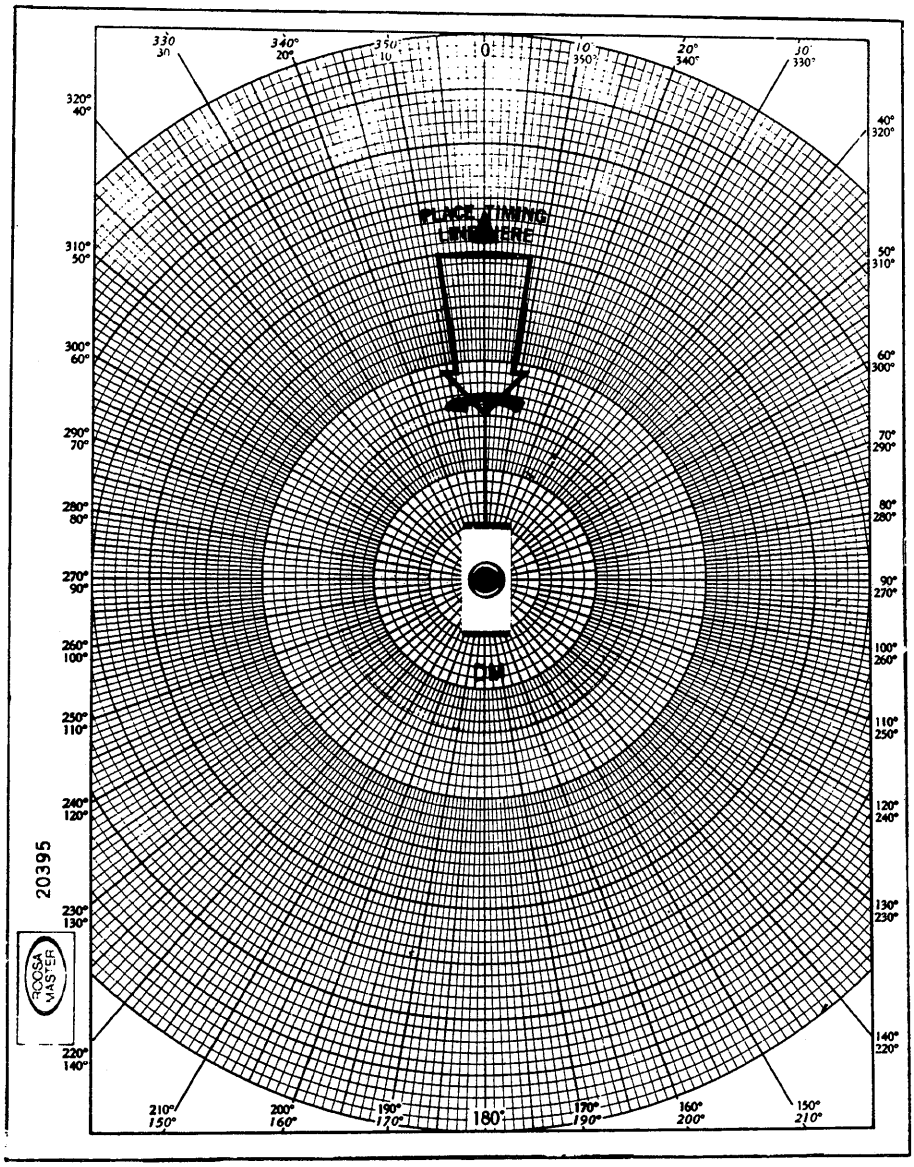
Service tools required to perform the various repairs explained in this manual are listed below.

Order service tools from your local Fiat-Allis dealer.

IMPORTANT: Refer to Fiat-Allis Tool Catalogs, as follows, for complete tool illustrations, descriptions and usage:

English- - - - - - 73128466
French - - - - - - 73128467
Spanish- - - - - - 73128468
Italian - - - - - - 73128469

VENDOR PART NO.	Fiat-Allis Part No.	DESCRIPTION
13301	75294932	Pressure regulating sleeve puller
13337	75300888	Snap ring pliers
13375	75300894	Rotor retaining ring installer
13379	75294818	Linkage hook wrench
13383	75294815	Delivery valve extractor
14067	75294819	Fuel shut-off adjusting tool
14490	75294822	Advance screw and piston plug wrench
14725	75294820	Fuel shut-off adjusting weight
16349	75300910	Snap ring pliers
18031	75294880	Aneroid bracket tool
18332	75300912	End cap gauge
18914	75294884	Linkage hook adjustment gauge
19918	75300887	Advance test window
19924	Part of 75300891	Puller
19927	75300891	Gear hub puller
19928	Part of 75300893	Bracket
19930	75300893	Holding fixture bracket kit
19965	75300895	Holding fixture plate assembly
19969	75294821	Centrality gauge kit
16094	Part of 75294821	Indicator
16099	Part of 75294821	Bracket screws
19966	Part of 75294821	Sleeve
19967	Part of 75294821	Bracket - indicator
19971	75300896	Inlet connector
20012	75300897	Transfer pump pressure check adapter
20029	75300898	Holding fixture plate assembly
20043	75300899	Snap ring pliers
20044	75300901	Snap ring pliers
20045	75300903	Governor weight retaining clip installer
20268	75300904	Drive shaft seal installer
20395	75300906	Timing line location indicator
20545	75300909	Holding fixture plate assembly
20546	75300911	End cap wrench
20548	75300914	End cap wrench
20549	75300915	End cap plug
20550	75300916	Drive hub for testing pump
20920	75300917	Drive shaft bearing installer
20992	75300918	Throttle shaft retaining clip remover



T-80628

TIMING LINE LOCATION INDICATOR (Tool No. 20395)

DIRECTIONS

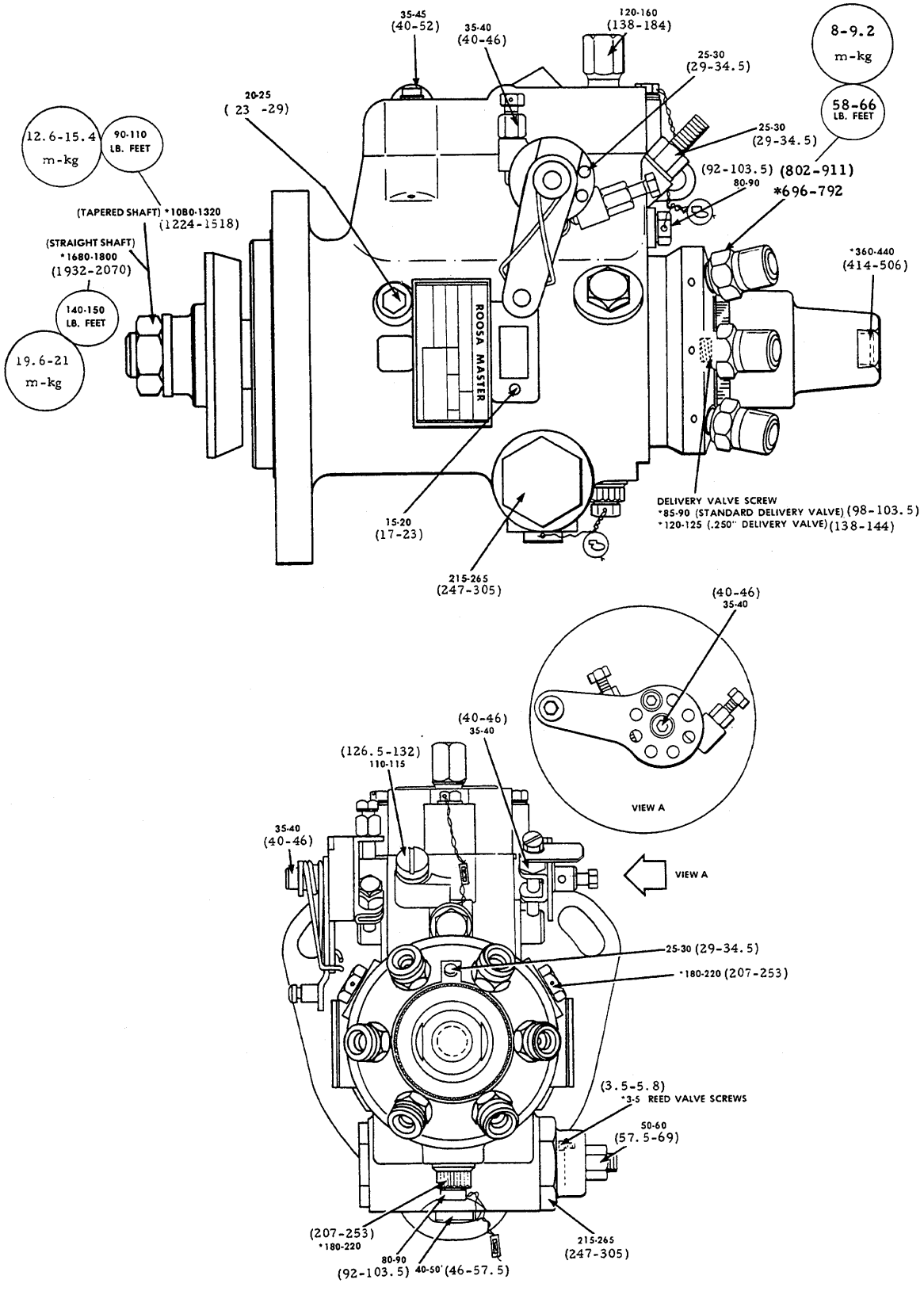
1. Place dry distributor rotor on indicator dial with drill point reference mark on rotor adjacent to reference mark on dial.

2. Turn dial counter-clockwise to timing mark degree location indicated in TEST STAND DATA (Topic 9). Read number of degrees on inner or bottom set of numbers.

3. Pencil mark weight retainer hub in line with point of arrow labeled "Place Timing Line Here". Remove the rotor and overscore pencil mark with an electric pencil or similar tool.

TORQUE VALUES

All values are given in lb. inches (kg-cm) unless circled.



***CRITICAL TORQUE VALUES**

Study SAFETY RULES, pages I thru III, thoroughly for the protection of personal and machine safety.

PROBLEM

PROBLEM MAY OCCUR	CAUSE (Numbers in "Problem" Check Chart indicate order in which to check possible "Causes" of Problem.)	A. Fuel not reaching pump	B. Fuel delivered from transfer pump but not to nozzles.	C. Fuel reaching nozzles but engine won't start.	D. Engine starts hard.	E. Engine starts and stops.	F. Erratic engine operation — surge, misfiring, poor governor regulation.	G. Engine idles imperfectly.	H. Engine does not develop full power or speed.	I. Engine smokes black.	J. Engine smokes blue or white.	CORRECTION
ON TEST STAND FOLLOWING OVERHAUL	Transfer Pump liner locating pin in wrong hole for correct rotation.	7										Re-install properly.
	Plunger missing.		9									Assemble new plunger.
	Cam backwards in housing.		8									Reassemble correctly.
	Metering Valve incorrectly assembled to metering valve arm.		6									Reassemble correctly.
	Delivery Valve Sticking, missing or assembled backwards.				19		21	17	15			Remove, clean or replace as needed.
	Hydraulic head vent wires missing.		13						24			Install as indicated in reassembly instructions.
	Idling spring missing, or incorrect.						15	8				Assemble as indicated in reassembly instructions.
FOLLOWING INSTALLATION ON ENGINE	Hand primer installed backwards.	3										Re-install properly.
	Seizure of Distributor Rotor.	2										Check for cause of seizure. Replace hydraulic head and distributor rotor assembly.
	Failure of electrical shut-off.		-2			8						Remove, inspect and adjust parts. Replace parts as necessary.
DURING OPERATION	Fuel supply lines clogged, restricted, wrong size or poorly located.	9	7	7	5	1	2	13	4			Blow out all fuel lines with filtered air. Replace if damaged. Remove and inspect all flexible lines.
	Air leaks on suction side of system.	11			6	7	8	3	5			Trouble-shooting the system for air leaks. See Supplementary Inspections in manual.
	Transfer Pump Blades worn or broken.	8			12		18	5	13			Replace.
	Delivery Valve Retainer Screw loose and leaking or incorrectly installed.				25		20		21			Inspect Delivery Valve Stop seat for erosion, tighten Retainer Screw, or replace head and rotor assembly as needed.
	Transfer Pump Regulating Piston sticking.	10			13		19	12				Remove piston and regulator assembly and inspect for burrs, corrosion or varnishes. Replace if necessary.
	Shut-off device at "stop" position.		1									Move to "run" position.
	Plungers sticking.		10		21	10		18	17			Disassemble and inspect for burrs, corrosion or varnishes.
	Metering Valve sticking or closed.		3		14	9	12	7	10			Check for governor linkage binding, foreign matter, burrs, missing metering valve shim, etc.
	Passage from Transfer Pump to Metering Valve clogged with foreign matter.		11									Disassemble and flush out Hydraulic Head.
	Tank valve closed.	1										Open valve.
	Fuel too heavy at low temperature.	6			8							Add kerosene as recommended for O°F, -15° F and -30°F temperatures.
	Cranking speed too low.			1	2						7	Charge or replace batteries.
	Lube oil too heavy at low temperature.			18	9							See engine manual.
	Engine engaged with load.			2	1							Disengage load.
	Nozzles faulty or sticking.			10	17		9	10		5		Replace or correct nozzles.
	Intake air temperature low.			5	3							Provide starting aids. See engine manual.
	Engine compression poor.			17	10				25	9	8	Correct compression. See engine manual.
	Pump timed incorrectly to engine.			3	4		4	4	7	4	3	Correct timing. See engine manual.
	Excessive fuel leakage past plungers (worn or badly scored).			15	22			16	18			Replace rotor and hydraulic head assembly.
	Filters or Inlet Strainer clogged.	5			7	6	3		6			Remove and replace clogged elements. Clean strainer.
	Cam, Shoes or Rollers worn.			14	20				16			Remove and replace.
	Automatic advance faulty or not operating.			11	24		11	11	12	7	4	Remove, inspect, correct and reassemble.
	Governor linkage out of adjustment or broken.				16		14	9	11			Adjust governor linkage hook.
	Governor not operating: parts or linkage worn, sticking or binding, or incorrectly assembled.		4		26		13	6	9			Disassemble, inspect parts, replace if necessary and reassemble.
	Maximum fuel setting too low.			12	18				14			Reset to pump specifications.
	Engine valves faulty or out of adjustment.				28		10	15		6	9	Correct valves or valve adjustment as in engine manual.

PROBLEM

PROBLEM MAY OCCUR	CAUSE *Numbers in "Problem" Check Chart indicate order in which to check possible "Causes" of Problem.*	A. Fuel not reaching pump.	B. Fuel delivered from transfer pump but not to nozzles.	C. Fuel reaching nozzles but engine won't start.	D. Engine starts hard.	E. Engine starts and stops.	F. Erratic engine operation — surge, misfiring, poor governor regulation.	G. Engine idles imperfectly.	H. Engine does not develop full power or speed.	I. Engine smokes black.	J. Engine smokes blue or white.	CORRECTION
DURING OPERATION	Water in fuel.					2	5	1	23			Drain fuel system and pump housing, provide new fuel, prime system.
	Return oil line or fittings restricted.				29	4	23	19	8			Remove line, blow clean with filtered air and reassemble. Replace if damaged.
	Engine rotation wrong.	4										Check engine rotation. See engine manual.
	Air intake restricted.					3			26	2		Check. See engine manual.
	Wrong Governor spring.						17		27			Remove and replace with proper spring as in pump specifications.
	Pump housing not full of fuel.						7	2				Operate engine for approximately 5 minutes until pump fills with fuel.
	Low cetane fuel.			13	11		6	14	20	8		Provide fuel per engine specifications.
	Fuel lines incorrect, leaking or connected to wrong cylinders.			6			1		28			Relocate fuel lines for correct engine firing sequence.
	Tang Drive excessively worn.						22		19		5	Remove and install new head and rotor assembly and drive shaft as necessary.
	Governor sleeve binding on drive shaft.						16					Remove, inspect for burrs, dirt, etc. Correct and reassemble.
	Shut-off device interfering with Governor linkage.			8	15				2			Check and adjust governor linkage dimension.
	Governor high-idle adjustment incorrect.								3			Adjust to pump specifications.
	Torque Screw incorrectly adjusted.		5	9	23				22	11		Adjust to specification.
	Throttle Arm travel not sufficient.			4					1			Check installation and adjust throttle linkage.
	Rotor excessively worn.		12	16	27							Replace hydraulic head and rotor assembly.
	Maximum fuel setting too high.									10		Reset to pump specifications.
	Engine overheating.					5				3		Correct as in engine manual.
	Exceeding rated load.									1		Reduce load on engine.
	Engine cold.				30						1	Check thermostats or shutter controls, warm to operating temperature. See engine manual.
	Lube oil pumping past valve guides or piston rings in engine.										6	Correct as in engine manual.
	Excess lube oil in engine air cleaner.										2	Correct as in engine manual.

TOPIC 12

PARTS CATALOG

INSTRUCTIONS FOR ORDERING PARTS

At the time this parts catalog was published the listed part numbers were current. It is our policy to constantly improve our machines and therefore, part numbers and design may change. When ordering parts, verify part numbers through your dealer's parts catalog which is up to date with all latest part numbers.

Order parts from the dealer covering the local territory.

ALWAYS GIVE THE MODEL AND SERIAL NUMBER OF INJECTION PUMP.

To obtain parts promptly, give part name and part number.

Give post office address, town, county and state where parts are to be shipped. Also specify whether material is to be shipped by freight, express or parcel post.

Confirm all telephone or telegraph order in writing.

No credit will be allowed on parts unless that are returned to the dealer from whom they were purchased; from there they will be returned, at the customer's expense, to the factory for inspection.

Unless claims for shortages or errors are made immediately upon receipt of goods, they will not be considered.

When broken goods are received, a full description of the damage should be made by the carrier agent on the freight bill. If this description is insisted upon, full damage can always be collected from the transportation company.

No responsibility is assumed for delay or damage to merchandise while in transit. Our responsibility ceases upon delivery of shipment to the transportation company from whom a receipt is received showing that shipment was in good condition when delivered to them; therefore, claims (if any) should be filed with the transportation company.

The right is reserved to change the construction or material of any parts where it seems desirable to do so without incurring the obligation of installing such changes on units already delivered.

(Specifications and design subject to change without notice)

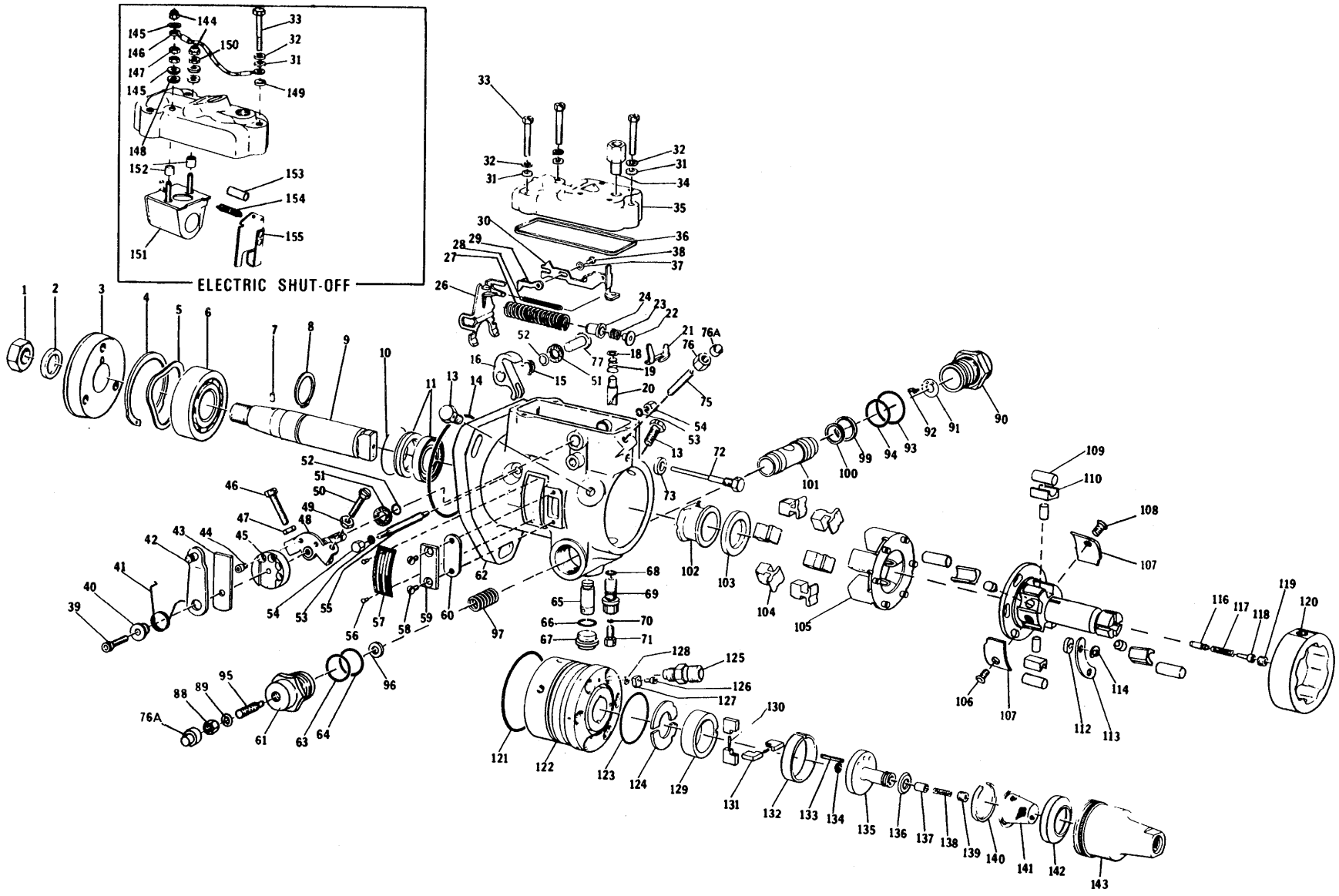


Fig. 11.3

INJECTION PUMP PARTS

INJECTION PUMP PARTS

USAGE: 262B, 263B Motor Scraper (Model 11000 MKII Engines)

ITEM	PART NO.	QTY.	DESCRIPTION
-	74321973	1	PUMP ASSY., injection (Includes items 1 thru 155)
1	70910345	1	NUT, hub retaining
2	74061132	1	WASHER, hub retaining
3	74062193	1	HUB, gear
4	70925995	1	RING, retaining
5	74061141	1	WASHER, drive shaft spring
6	74061142	1	BEARING, ball
7	74061135	1	PIN, spring, drive shaft
8	74061134	1	RING, bearing shoulder
9	74062187	1	SHAFT, drive
10	--------	1	RING, seal retaining (Not required)
11	74061570	2	□ SEAL, drive shaft
13	74062050	2	SCREW, head locking
14	74062183	1	SEAL, pump flange
15	74051559	1	CLIP, shaft retainer
16	74049532	1	LEVER, throttle shaft
18	74052915	1	SHIM, metering valve
19	74061670	1	SPRING, metering valve
20	74061709	1	VALVE, metering
21	74061703	1	ARM ASSY., metering valve
22	74048627	1	GUIDE, idling spring
23	74049533	1	SPRING, idling
24	74048635	1	RETAINER, spring
26	74061168	1	ARM, governor
27	74061781	1	SPRING, governor control (Black-Brown)
28	74048624	1	SPRING, governor linkage
--		1	HOOK ASSY., governor linkage (Includes items 29, 30, 37, 38)
29	74059171	1	LINK ASSY., adjusting
30	74061704	1	HOOK, governor linkage
31	74053267	3	WASHER, plain
32	70906957	3	LOCKWASHER, cover screw
33	74053266	3	SCREW, cover
34	74055293	1	CONNECTOR ASSY., return line
35	74051807	1	COVER, governor control
36	74048630	1	□ GASKET, governor cover
37	74061206	1	WASHER, adjusting link
38	74059170	1	SCREW, adjusting link
39	74061744	1	SCREW, throttle lever spring
40	74051412	1	RETAINER, throttle lever spring
41	74051413	1	SPRING, throttle lever
42	74054594	1	LEVER ASSY., throttle
43	74056486	1	ARM, adjusting spacer
44	74369478	1	SCREW, spacer
45	74056484	1	SPACER, throttle lever
46	74048645	1	SCREW, low idle adjusting
47	74369507	1	NUT, low idle adjusting screw
48	74061716	1	SHAFT ASSY., throttle
49	74369507	1	NUT, high idle adjusting screw
50	74048645	1	SCREW, high idle adjusting
51	74053375	2	□ WASHER, throttle shaft seal
52	74369878	2	□ SEAL, throttle shaft

(Continued)

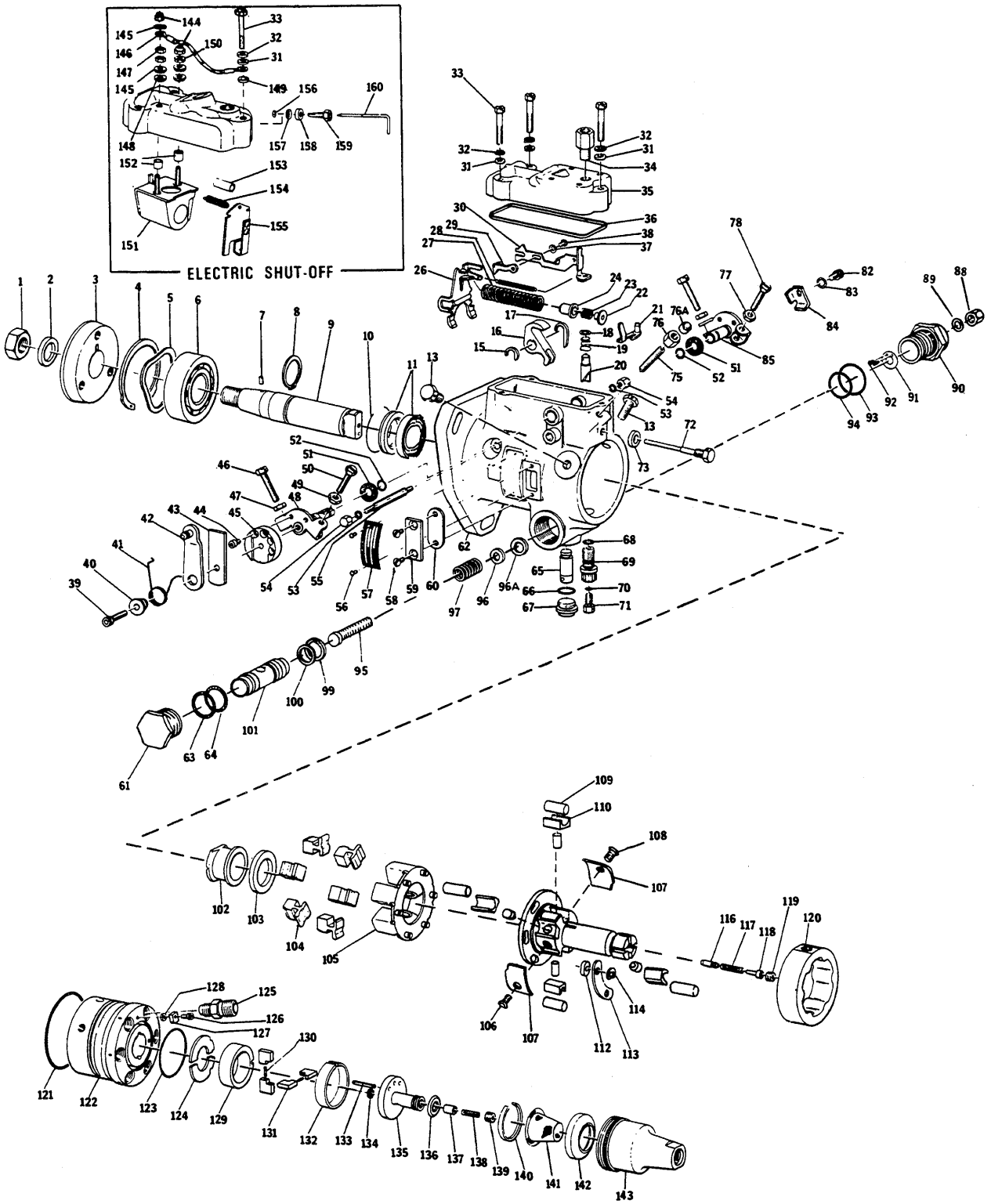
ITEM	PART NO.	QTY.	DESCRIPTION	
53	74050910	2	□SEAL, pivot shaft	
54	74048642	2	NUT, pivot shaft	
55	74048636	1	SHAFT, governor arm pivot	
56	74369429	2	SCREW, name plate	
57	74369428	1	PLATE, name	
58	74061192	2	SCREW, timing line cover	
59	74048603	1	COVER, timing line	
60	74048604	1	□GASKET, timing line cover	
61	74059271	1	PLUG, piston (spring)	
62	74062184	1	HOUSING ASSY., pump	
63	74061170	1	□SEAL, advance piston hole plug	
64	74054589	1	□SEAL, advance piston hole plug	
65	74059066	1	PIN, advance	
66	74054585	1	□SEAL, advance screw hole plug	
67	74059067	1	PLUG, advance screw hole	
68	74369595	1	□SEAL, head locating screw	
69	74061130	1	SCREW, head locating	
70	74051365	1	□SEAL, head locating screw	
71	74061131	1	PLUG, head locating screw	
72	74051378	1	STUD, guide	
73	74048650	1	□WASHER, guide stud	
74	74369878	1	□SEAL, torque screw	
75	74054582	1	SCREW, torque	
76	74054583	1	NUT, torque screw	
76A	74052917	2	CAP, cover, adjusting screw	
77	74061715	1	SHAFT, shut-off	
88	74054583	1	NUT, advance adjusting screw	
89	74369878	1	□SEAL, advance adjusting screw	
90	74062194	1	PLUG, piston hole (power)	
91	74061127	1	VALVE, reed	
92	74061169	2	SCREW, reed valve	
93	74061873	1	SEAL, advance piston hole	
94	74054589	1	□SEAL, advance piston hole	
95	74054593	1	SCREW, advance adjusting	
96	74054591	1	GUIDE, advance adjusting screw	
97	74062182	1	SPRING, outer advance	
99	74061128	1	RING, advance piston	
100	74059064	1	□SEAL, piston ring	
101	74062192	1	PISTON, advance	
102	74061852	1	SLEEVE, governor thrust	
103	74061148	1	WASHER, governor thrust sleeve	
104	74061149	6	WEIGHT, governor	
105	74061150	1	RETAINER ASSY., governor	
106	74055970	1	SCREW, leaf spring	
107	74055890	2	SPRING, leaf	
108	74055969	1	SCREW, leaf spring	
109	74369436	4	ROLLER, cam	
110	74061590	4	SHOE, cam roller (-.381mm)(-.015")	Use as required
	74061509	4	SHOE, cam roller (-.254mm)(-.010")	
	74061157	4	SHOE, cam roller (-.508mm)(-.020")	
112	74061156	6	□CUSHION	
113	74061155	3	RETAINER, cushion	
114	74061154	6	□RING, retaining "E" clip	

(Continued)

INJECTION PUMP PARTS (Continued)

ITEM	PART NO.	QTY.	DESCRIPTION
116	74062185	1	VALVE, delivery
117	74061188	1	SPRING, delivery valves
118	74061161	1	STOP, delivery valve
119	74061160	1	SCREW, delivery valve
120	74062051	1	RING, cam
121	74369444	1	□SEAL, hydraulic head
122	74062195	1	HEAD ASSY. (Includes rotor, plunger, 3 screws, 1 vent wire and item 125)
123	74061661	1	□SEAL, transfer pump
124	74061663	2	RETAINER, rotor
125	74061195	6	CONNECTOR, fuel line
126	74061187	1	SCREW, locking plate
127	74061159	1	PLATE, locking
128	--------	1	WASHER, locking plate (Not required)
129	74061172	1	LINER, transfer pump
130	74059733	4	BLADE, transfer pump
131	74055958	2	SPRING, transfer pump blade
132	74061665	1	RING, inner locating
133	74061162	1	ROLLPIN
134	74061163	1	□SEAL, regulating piston
135	74061174	1	REGULATOR ASSY., transfer pump
136	74061164	1	□SEAL, inlet filter screen
137	74061165	1	PISTON, regulating
138	74061175	1	SPRING, regulating
139	74055960	1	PLUG ASSY., end plate adjustment
140	74061666	1	RING, screen retainer
141	74061662	1	SCREEN, inlet filter
142	74061664	1	PLATE, transfer pump pressure
143	74061660	1	CAP, transfer pump end
144	74053829	2	NUT, lock terminal contact
145	74060067	3	WASHER, terminal contact
146	74062188	1	STRAP, terminal ground
147	70912739	1	LOCKWASHER, terminal contact
148	74051383	2	WASHER, terminal insulating
149	74061205	1	LOCKWASHER, cover screw
150	74049437	2	NUT, terminal contact
151	74060670	1	COIL ASSY., shut-off (24V. E.T.S.O.)(Includes solenoid which is not serviced separately and items 144, 145, 148, 150 and 152 thru 155)
152	74369502	2	TUBE
153	74060214	1	SLEEVE, coil arm spring
154	74053332	1	SPRING
155	74053378	1	ARM ASSY., solenoid
-	74061643	1	GASKET KIT, pump
156	74061643	1	GASKET KIT, pump (Includes items 11, 36, 51, 52, 53, 60, 60, 63, 64, 66, 68, 70, 73, 74, 89, 100, 112, 114, 121, 123, 134 and 136)(Sufficient quantity for complete overhaul)

□Components of item 156



INJECTION PUMP PARTS

T-80630

INJECTION PUMP PARTS

USAGE: 545-B, 605-B Wheel Loaders (Model 2900 MKII Engine, 649T Engine)

ITEM	PART NO.	QTY.	DESCRIPTION
-	74008322	1	PUMP ASSY., 545-B (Includes items 1 thru 160)
-	74008318	1	PUMP ASSY., 605-B (Includes items 1 thru 160)
1	70910345	1	NUT, hub retaining
2	74061140	1	WASHER, hub retaining
3	74062193	1	HUB, gear
4	70925995	1	RING, retaining
5	74061141	1	WASHER, drive shaft spring
6	74061142	1	BEARING, ball
7	74061135	1	PIN, spring, drive shaft
8	74061134	1	RING, bearing shoulder
9	74062187	1	SHAFT, drive
10	74061133	1	RING, seal retaining
11	74061570	2	□SEAL, drive shaft
13	74062050	2	SCREW, head locking
15	74051559	1	CLIP, shaft retainer
16	74049532	1	LEVER, throttle shaft
17	74048639	1	CAM, shut-off
18	74052915	1	SHIM, metering valve
19	74061670	1	SPRING, metering valve
20	74061178	1	VALVE, metering
21	74054579	1	ARM ASSY., metering valve
22	74048627	1	GUIDE, idling spring
23	74049533	1	SPRING, idling
24	74048635	1	RETAINER, spring
26	74061168	1	ARM, governor
27	74062288	1	SPRING, governor control (Green-Blue)
28	74048624	1	SPRING, governor linkage
--		1	HOOK ASSY., governor linkage (Includes items 29,30, 37, 38)
29	74059171	1	LINK ASSY., adjusting
30	74062261	1	HOOK, governor linkage
31	74053267	3	WASHER, plain
32	70906957	3	LOCKWASHER, cover screw
33	74053266	3	SCREW, cover
34	74055293	1	CONNECTOR ASSY., return line
35	74062198	1	COVER, governor control
36	74048630	1	□GASKET, governor cover
37	74061206	1	WASHER, adjusting link
38	74059170	1	SCREW, adjusting link
39	74061744	1	SCREW, throttle lever spring
40	74051412	1	RETAINER, throttle lever spring
41	74051413	1	SPRING, throttle lever
42	74054594	1	LEVER ASSY., throttle
43	74056486	1	ARM, adjusting spacer
44	74369478	1	SCREW, spacer
45	74056484	1	SPACER, throttle lever
46	74056799	1	SCREW, low idle adjusting
47	74051409	1	NUT, low idle adjusting screw

(Continued)

INJECTION PUMP PARTS (Continued)

ITEM	PART NO.	QTY.	DESCRIPTION
48	74061716	1	SHAFT ASSY., throttle
49	74058951	1	NUT, high idle adjusting screw
50	74058950	1	SCREW, high idle adjusting
51	74053375	2	□ WASHER, throttle shaft seal
52	74369878	2	□ SEAL, throttle shaft
53	74050910	2	□ SEAL, pivot shaft
54	74048642	2	NUT, pivot shaft
55	74048636	1	SHAFT, governor arm pivot
56	74369429	2	SCREW, name plate
57	74369428	1	PLATE, name
58	74061192	2	SCREW, timing line cover
59	74048603	1	COVER, timing line
60	74048604	1	□ GASKET, timing line cover
61	74059271	1	PLUG, piston (spring)
62	74061589	1	HOUSING ASSY., pump
63	74061170	1	□ SEAL, advance piston hole plug
64	74054589	1	□ SEAL, advance piston hole plug
65	74059066	1	PIN, advance
66	74054585	1	□ SEAL, advance screw hole plug
67	74059067	1	PLUG, advance screw hole
68	74369595	1	□ SEAL, head locating screw
69	74061130	1	SCREW, head locating
70	74051365	1	□ SEAL, head locating screw
71	74061131	1	PLUG, head locating screw
72	74051378	1	STUD, guide
73	74048650	1	□ WASHER, guide stud
74	74369878	1	□ SEAL, torque screw
75	74054582	1	SCREW, torque
76	74054583	1	NUT, torque screw
76A	74052917	2	CAP, cover adjusting screw
77	74051409	2	NUT, shut-off arm adjusting screw
78	74048632	2	SCREW, shut-off arm adjustment
82	74048647	1	SCREW, adjusting shut-off return
83	70906957	1	WASHER, adjusting shut-off return
84	74061602	1	ARM ASSY., adjusting shut-off
85	74061593	1	SHAFT ASSY., shut-off
88	74054583	1	NUT, advance adjusting screw
89	74369878	1	□ SEAL, advance adjusting screw
90	74061179	1	PLUG, piston hole (power)
91	74061127	1	VALVE, reed
92	74061169	2	SCREW, reed valve
93	74061873	1	SEAL, advance piston hole
94	74054589	1	SEAL, advance piston hole
95	74062204	1	SCREW, advance adjusting
96	74059395	1	GUIDE, advance adjusting screw
96A	74059397	1	RING, spring retaining
97	74059667	1	SPRING, outer advance (Yellow-Yellow)
99	74061128	1	RING, advance piston

(Continued)

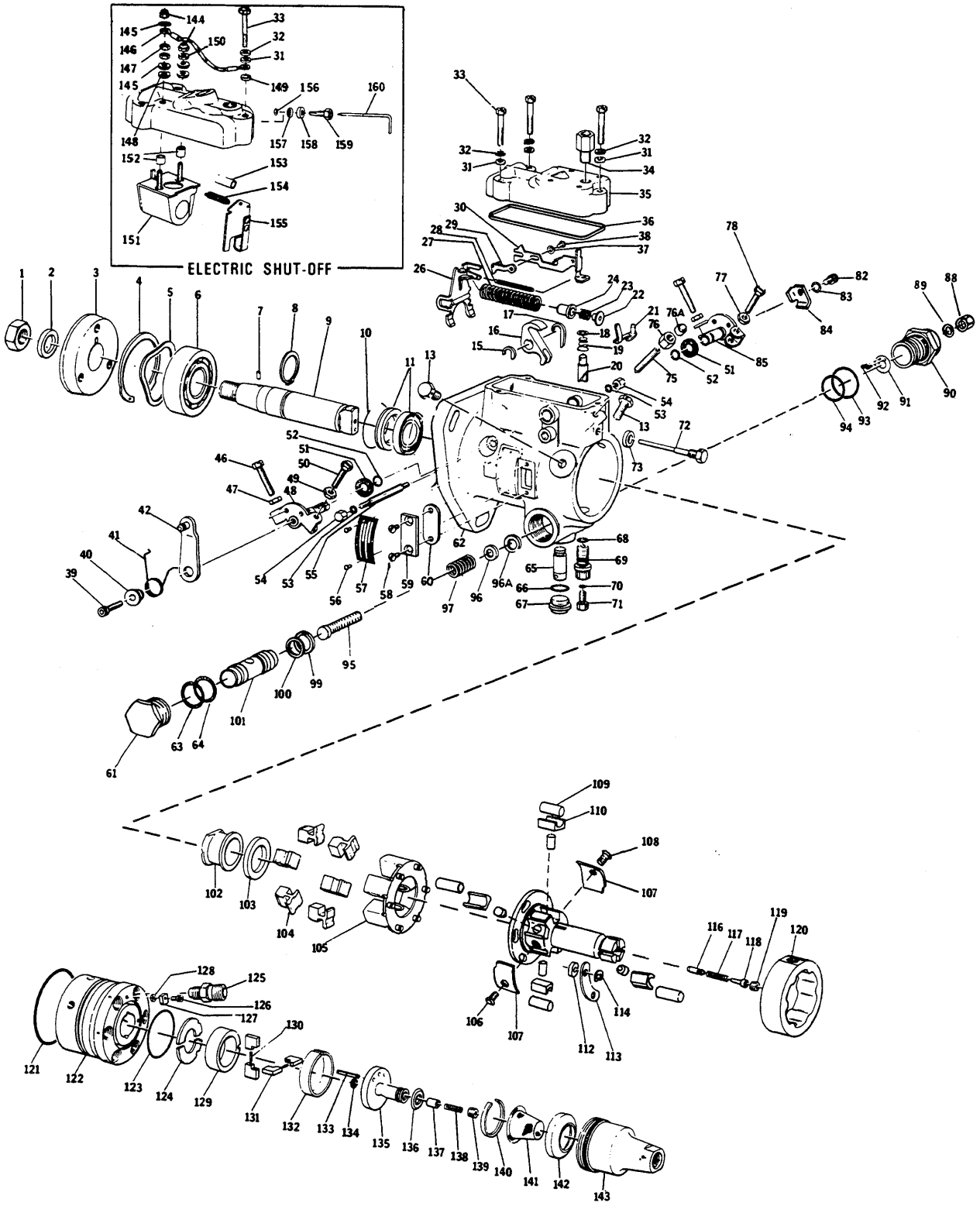
ITEM	PART NO.	QTY.	DESCRIPTION
100	74059064	1	□ SEAL, piston ring
101	74061677	1	PISTON, advance
102	74061852	1	SLEEVE, governor thrust
103	74061148	1	WASHER, governor thrust sleeve
104	74061149	6	WEIGHT, governor
105	74061150	1	RETAINER ASSY., governor
106	74055970	1	SCREW, leaf spring
107	74055890	2	SPRING, leaf
108	74055969	1	SCREW, leaf spring
109	74369436	4	ROLLER, cam
110	74061157	4	SHOE, cam roller (-.508mm)(-.020") } Use as
	74061590	4	SHOE, cam roller (-.381mm)(-.015") } required
112	74061156	6	□ CUSHION
113	74061155	3	RETAINER, cushion
114	74061154	6	□ RING, retaining "E" clip
116	74062211	1	VALVE, delivery
117	74061188	1	SPRING, delivery valve
118	74061161	1	STOP, delivery valve
119	74061160	1	SCREW, delivery valve
120	74062051	1	RING, cam
121	74369444	1	□ SEAL, hydraulic head
122	74061152	1	HEAD ASSY. (Includes rotor, plungers, 3 screws, 1 vent wire and item 125)
123	74061661	1	□ SEAL, transfer pump
124	74061663	2	RETAINER, rotor
125	74061195	6	CONNECTOR, fuel line
126	74061187	1	SCREW, locking plate
127	74061159	1	PLATE, locking
128	74061158	1	WASHER, locking plate
129	74061172	1	LINER, transfer pump
130	74059733	4	BLADE, transfer pump
131	74055958	2	SPRING, transfer pump blade
132	74061665	1	RING, inner locating
133	74061162	1	ROLL PIN
134	74061163	1	□ SEAL, regulating piston
135	74061174	1	REGULATOR ASSY., transfer pump
136	74061164	1	□ SEAL, inlet filter screen
137	74061165	1	PISTON, regulating
138	74061175	1	SPRING, regulating
139	74055960	1	PLUG ASSY., end plate adjustment
140	74061666	1	RING, screen retainer
141	74061662	1	SCREEN, inlet filter
142	74061664	1	PLATE, transfer pump pressure
143	74061660	1	CAP, transfer pump end
144	74053829	2	NUT, lock terminal contact
145	74060067	3	WASHER, terminal contact
146	74060058	1	WIRE ASSY., terminal ground
147	70912739	1	LOCKWASHER, terminal contact
148	74051383	2	WASHER, terminal insulating
149	74061205	1	LOCKWASHER, cover screw
150	74049437	2	NUT, terminal contact

(Continued)

ITEM	PART NO.	QTY.	DESCRIPTION
151	74062104	1	COIL ASSY., shut-off (12V E.T.R.)(Includes solenoid which is not serviced separately and items 144, 145, 148, 150 and 152 thru 155)
152	74369502	2	TUBE
152A	74062190	1	PLUNGER, solenoid (Not illustrated)
153	74060214	1	SLEEVE, coil arm spring
154	74369496	1	SPRING
155	74062191	1	ARM ASSY., solenoid
156	74060210	1	RING, over-ride retaining
157	74369878	1	□SEAL, over-ride rod
158	74060212	1	WASHER, over-ride guide
159	74060211	1	GUIDE ASSY., over-ride
160	74060213	1	ROD, over-ride
161	74061643	1	GASKET KIT, pump (Includes items 11,36,51,52,53,60, 63,64,66,68,70,73,74,89,100,112,114,121,123,134, 136 and 157)(Sufficient quantity for complete overhaul)

□Components of item 160

MEMO



T-80630

INJECTION PUMP PARTS

INJECTION PUMP PARTS

USAGE: 645-B Wheel Loader (Model 3500 MKII Engine)

ITEM	PART NO.	QTY.	DESCRIPTION
-	74035827	1	PUMP ASSY., injection (Includes items 1 thru 160)
1	70910345	1	NUT, hub retaining
2	74061132	1	WASHER, hub retaining
3	74061140	1	HUB, gear
4	70925995	1	RING, retaining
5	74061141	1	WASHER, drive shaft spring
6	74061142	1	BEARING, ball
7	74061135	1	PIN, spring, drive shaft
8	74061134	1	RING, bearing shoulder
9	74061574	1	SHAFT, drive
10	74061133	1	RING, seal retaining
11	74061570	2	□SEAL, drive shaft
13	74062050	2	SCREW, head locking
15	74051559	1	CLIP, shaft retainer
16	74049532	1	LEVER, throttle shaft
17	74048639	1	CAM, shut-off
18	74052915	1	SHIM, metering valve
19	74061670	1	SPRING, metering valve
20	74061178	1	VALVE, metering
21	74054579	1	ARM ASSY., metering valve
22	74048627	1	GUIDE, idling spring
23	74049533	1	SPRING, idling
24	74048635	1	RETAINER, spring
26	74061168	1	ARM, governor
27	74061836	1	SPRING, governor control (Blue-Blue)
28	74048624	1	SPRING, governor linkage
--		1	HOOK ASSY., governor linkage (Includes items 29, 30, 37, 38)
29	74059171	1	LINK ASSY., adjusting
30	74062261	1	HOOK, governor linkage
31	74053267	3	WASHER, plain
32	70906957	3	LOCKWASHER, cover screw
33	74053266	3	SCREW, cover
34	74055293	1	CONNECTOR ASSY., return line
35	74062198	1	COVER, governor control
36	74048630	1	□GASKET, governor cover
37	74061206	1	WASHER, adjusting link
38	74059170	1	SCREW, adjusting link
39	74055625	1	SCREW, throttle lever spring
40	74051412	1	RETAINER, throttle lever spring
41	74051413	1	SPRING, throttle lever
42	74054594	1	LEVER ASSY., throttle
46	74056799	1	SCREW, low idle adjusting
47	74051409	1	NUT, low idle adjusting screw
48	74061599	1	SHAFT ASSY., throttle
49	74061186	1	NUT, high idle adjusting screw
50	74056799	1	SCREW, high idle adjusting
51	74053375	2	□WASHER, throttle shaft seal
52	74369878	2	□SEAL, throttle shaft
53	74050910	2	□SEAL, pivot shaft

(Continued)

INJECTION PUMP PARTS (Continued)

ITEM	PART NO.	QTY.	DESCRIPTION
54	74048642	2	NUT, pivot shaft
55	74048636	1	SHAFT, governor arm pivot
56	74369429	2	SCREW, name plate
57	74369428	1	PLATE, name
58	74061192	2	SCREW, timing line cover
59	74048603	1	COVER, timing line
60	74048604	1	□ GASKET, timing line cover
61	74059061	1	PLUG, piston (spring)
62	74061599	1	HOUSING ASSY., pump
63	74061170	1	□ SEAL, advance piston hole plug
64	74054589	1	□ SEAL, advance piston hole plug
65	74059066	1	PIN, advance
66	74054585	1	□ SEAL, advance screw hole plug
67	74059067	1	PLUG, advance screw hole
68	74369595	1	□ SEAL, head locating screw
69	74061130	1	SCREW, head locating
70	74051365	1	□ SEAL, head locating screw
71	74061131	1	PLUG, head locating screw
72	74051378	1	STUD, guide
73	74048650	1	□ WASHER, guide stud
74	74369878	1	□ SEAL, torque screw
75	74054582	1	SCREW, torque
76	74054583	1	NUT, torque screw
76A	74052917	2	CAP, cover adjusting screw
77	74051409	2	NUT, shut-off arm adjusting screw
78	74048632	2	SCREW, shut-off arm adjustment
80	70912739	1	WASHER, adjusting shut-off position screw
81	74369478	1	SCREW, adjusting shut-off position
82	74048647	1	SCREW, adjusting shut-off return
83	70906957	1	WASHER, adjusting shut-off return
84	74062371	1	ARM ASSY., adjusting shut-off
85	74060735	1	SHAFT ASSY., shut-off
88	74054583	1	NUT, advance adjusting screw
89	74369878	1	□ SEAL, advance adjusting screw
90	74061179	1	PLUG, piston hole (power)
91	74062909	1	VALVE, reed
92	74061169	2	SCREW, reed valve
93	74061873	1	SEAL, advance piston hole
94	74054589	1	SEAL, advance piston hole
95	74062204	1	SCREW, advance adjusting
96	74059395	1	GUIDE, advance adjusting screw
96A	74059397	1	RING, spring retaining
97	74059662	1	SPRING, outer advance (Black-Green)
99	74061128	1	RING, advance piston
100	74059064	1	□ SEAL, piston ring
101	74061667	1	PISTON, advance
102	74061852	1	SLEEVE, governor thrust
103	74061148	1	WASHER, governor sleeve
104	74061149	6	WEIGHT, governor
105	74061150	1	RETAINER ASSY., governor
106	74055970	1	SCREW, leaf spring
107	74055890	2	SPRING, leaf

(Continued)

INJECTION PUMP PARTS (Continued)

ITEM	PART NO.	QTY.	DESCRIPTION	
108	74055969	1	SCREW, leaf spring	
109	74369436	4	ROLLER, cam	
110	74061590	4	SHOE, cam roller (-.381mm)(-.015")	Use as required
	74061509	4	SHOE, cam roller (-.254mm)(-.010")	
	74061157	4	SHOE, cam roller (-.508mm)(-.020")	
112	74061156	6	CUSHION	
113	74061155	3	RETAINER, cushion	
114	74061154	6	□RING, retaining "E" clip	
116	74062211	1	VALVE, delivery	
117	74061188	1	SPRING, delivery valve	
118	74061161	1	STOP, delivery valve	
119	74061160	1	SCREW, delivery valve	
120	74062051	1	RING, cam	
121	74369444	1	□SEAL, hydraulic head	
122	74062195	1	HEAD ASSY. (Includes rotor, plungers, 3 screws, 1 vent wire and item 125)	
123	74061661	1	□SEAL, transfer pump	
124	74061663	2	RETAINER, rotor	
125	74061195	6	CONNECTOR, fuel line	
126	74061187	1	SCREW, locking plate	
127	74061159	1	PLATE, locking	
128	74061158	1	WASHER, locking plate	
129	74061172	1	LINER, transfer pump	
130	74059733	4	BLADE, transfer pump	
131	74055958	2	SPRING, transfer pump blade	
132	74061665	1	RING, inner locating	
133	74061162	1	ROLL PIN	
134	74061163	1	□SEAL, regulating piston	
135	74061174	1	REGULATOR ASSY., transfer pump	
136	74061164	1	□SEAL, inlet filter screen	
137	74061165	1	PISTON, regulating	
138	74061175	1	SPRING, regulating	
139	74055960	1	PLUG ASSY., end plate adjustment	
140	74061666	1	RING, screen retainer	
141	74061662	1	SCREEN, inlet filter	
142	74061664	1	PLATE, transfer pump pressure	
143	74061660	1	CAP, transfer pump end	
144	74053829	2	NUT, lock terminal contact	
145	74060067	3	WASHER, terminal contact	
146	74060058	1	WIRE ASSY., terminal ground	
147	70912739	1	LOCKWASHER, terminal contact	
148	74051383	2	WASHER, terminal insulating	
149	74061205	1	LOCKWASHER, cover screw	
150	74049437	2	NUT, terminal contact	
151	74062197	1	COIL ASSY., shut-off (24V. E.T.R.)(Includes solenoid which is not serviced spearately and items 144, 145, 148, 150, 151A and 152 thru 155)	
151A	74062190	1	PLUNGER, solenoid (Not illustrated)	
152	74369502	2	TUBE	
153	74060214	1	SLEEVE, coil arm spring	
154	74369496	1	SPRING	
155	74062191	1	ARM ASSY., solenoid	
156	74060210	1	RING, over-ride retaining	
157	74369878	1	□SEAL, over-ride rod	

INJECTION PUMP PARTS (Continued)

ITEM	PART NO.	QTY.	DESCRIPTION
158	74060212	1	WASHER, over-ride guide
159	74060211	1	GUIDE ASSY., over-ride
160	74060213	1	ROD, over-ride
161	74061643	1	GASKET KIT, pump (Includes items 11,36,51,52,53, 60,63,64,66,68,70,73,74,89,100,112,114,121,123, 134,136 and 157)(Sufficient quantity for complete overhaul)

□ Components of item 161

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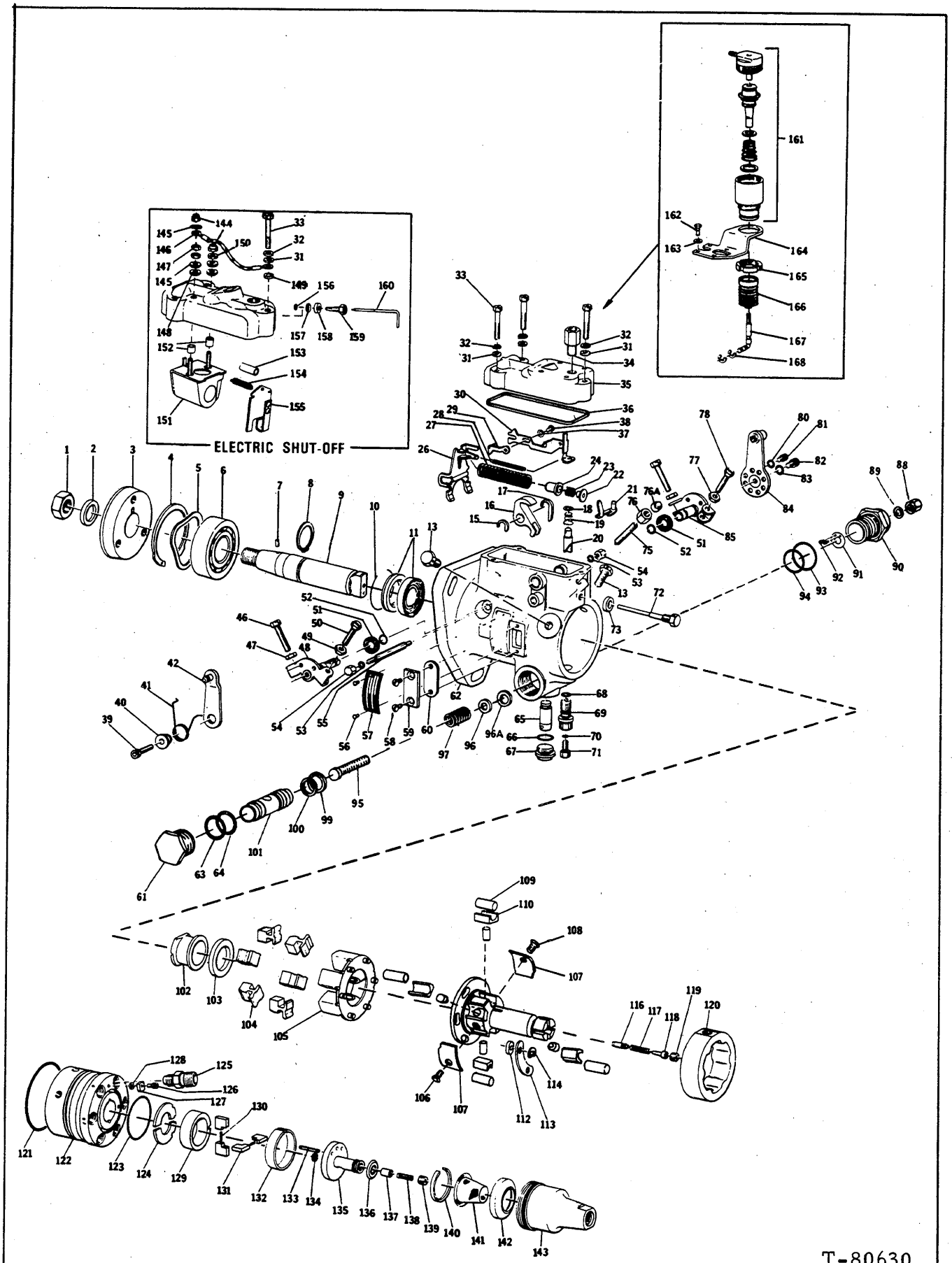

INJECTION PUMP PARTS

INJECTION PUMP PARTS

USAGE: 645-B Wheel Loader (Model 3500 MK II Engine)

ITEM	PART NO.	QTY.	DESCRIPTION
-	74036268	1	PUMP ASSY., injection (Includes items 1 thru 168)
1	70910345	1	NUT, hub retaining
2	74061132	1	WASHER, hub retaining
3	74061140	1	HUB, gear
4	70925995	1	RING, retaining
5	74061141	1	WASHER, drive shaft spring
6	74061142	1	BEARING, ball
7	74061135	1	PIN, spring, drive shaft
8	74061134	1	RING, bearing shoulder
9	74061574	1	SHAFT, drive
10	74061133	1	RING, seal retaining
11	74061570	2	□SEAL, drive shaft
13	74062050	2	SCREW, head locking
15	74051559	1	CLIP, shaft retainer
16	74049532	1	LEVER, throttle shaft
17	74048639	1	CAM, shut-off
18	74052915	1	SHIM, metering valve
19	74061670	1	SPRING, metering valve
20	74061178	1	VALVE, metering
21	74054579	1	ARM ASSY., metering valve
22	74048627	1	GUIDE, idling spring
23	74049533	1	SPRING, idling
24	74048635	1	RETAINER, spring
26	74061168	1	ARM, governor
27	74061836	1	SPRING, governor control (Blue-Blue)
28	74048624	1	SPRING, governor linkage
--		1	HOOK ASSY., governor linkage (Includes items 29, 30, 37, 38)
29	74059171	1	LINK ASSY., adjusting
30	74062261	1	HOOK, governor linkage
31	74053267	3	WASHER, plain
32	70906957	3	LOCKWASHER, cover screw
33	74053266	3	SCREW, cover
34	74055293	1	CONNECTOR ASSY., return line
35	74062198	1	COVER, governor control
36	74048630	1	□GASKET, governor cover
37	74061206	1	WASHER, adjusting link
38	74059170	1	SCREW, adjusting link
39	74055625	1	SCREW, throttle lever spring
40	74051412	1	RETAINER, throttle lever spring
41	74051413	1	SPRING, throttle lever
42	74054594	1	LEVER ASSY., throttle
46	74056799	1	SCREW, low idle adjusting
47	74051409	1	NUT, low idle adjusting screw
48	74061599	1	SHAFT ASSY., throttle
49	74061186	1	NUT, high idle adjusting screw
50	74056799	1	SCREW, high idle adjusting
51	74053375	2	□WASHER, throttle shaft seal
52	74369878	2	□SEAL, throttle shaft
53	74050910	2	□SEAL, pivot shaft
54	74048642	2	NUT, pivot shaft

(Continued)

INJECTION PUMP PARTS (Continued)

ITEM	PART NO.	QTY.	DESCRIPTION
55	74048636	1	SHAFT, governor arm pivot
56	74369429	2	SCREW, name plate
57	74369428	1	PLATE, name
58	74061192	2	SCREW, timing line cover
59	74048603	1	COVER, timing line
60	74048604	1	□ GASKET, timing line cover
61	74059061	1	PLUG, piston (spring)
62	74061589	1	HOUSING ASSY., pump
63	74061170	1	□ SEAL, advance piston hole plug
64	74054589	1	□ SEAL, advance piston hole plug
65	74059066	1	PIN, advance
66	74054585	1	□ SEAL, advance screw hole plug
67	74059067	1	PLUG, advance screw hole
68	74369595	1	□ SEAL, head locating screw
69	74061130	1	SCREW, head locating
70	74051365	1	□ SEAL, head locating screw
71	74061131	1	PLUG, head locating screw
72	74051378	1	STUD, guide
73	74048650	1	□ WASHER, guide stud
74	74369878	1	□ SEAL, torque screw
75	74054582	1	SCREW, torque
76	74054583	1	NUT, torque screw
76A	74052917	2	CAP, cover adjusting screw
77	74051409	2	NUT, shut-off arm adjusting screw
78	74048632	2	SCREW, shut-off arm adjustment
80	70912739	1	WASHER, adjusting shut-off position screw
81	74369478	1	SCREW, adjusting shut-off position
82	74048647	1	SCREW, adjusting shut-off return
83	70906957	1	WASHER, adjusting shut-off return
84	74061602	1	ARM ASSY., adjusting shut-off
85	74061593	1	SHAFT ASSY., shut-off
88	74054583	1	NUT, advance adjusting screw
89	74369878	1	□ SEAL, advance adjusting screw
90	74061179	1	PLUG, piston hole (power)
91	74061127	1	VALVE, reed
92	74061169	2	SCREW, reed valve
93	74061873	1	SEAL, advance piston hole
94	74054589	1	SEAL, advance piston hole
95	74062204	1	SCREW, advance adjusting
96	74059395	1	GUIDE, advance adjusting screw
96A	74059397	1	RING, spring retaining
97	74059662	1	SPRING, outer advance (Black-Green)
99	74061128	1	RING, advance piston
100	74059064	1	□ SEAL, piston ring
101	74061667	1	PISTON, advance
102	74061852	1	SLEEVE, governor thrust
103	74061148	1	WASHER, governor thrust sleeve
104	74061149	6	WEIGHT, governor
105	74061150	1	RETAINER ASSY., governor
106	74055970	1	SCREW, leaf spring
107	74055890	2	SPRING, leaf
108	74055969	1	SCREW, leaf spring

(Continued)

INJECTION PUMP PARTS (Continued)

ITEM	PART NO.	QTY.	DESCRIPTION	
109	74369436	4	ROLLER, cam	
110	74061590	4	SHOE, cam roller (-.381mm)(-.015")	Use as required
	74061509	4	SHOE, cam roller (-.254mm)(-.010")	
	74061157	4	SHOE, cam roller (-.508mm)(-.020")	
112	74061156	6	□CUSHION	
113	74061155	3	RETAINER, cushion	
114	74061154	6	□RING, retaining "E" clip	
116	74062211	1	VALVE, delivery	
117	74061188	1	SPRING, delivery valve	
118	74061161	1	STOP, delivery valve	
119	74061160	1	SCREW, delivery valve	
120	74062051	1	RING, cam	
121	74369444	1	□SEAL, hydraulic head	
122	74061152	1	HEAD ASSY. (Includes rotor, plungers, 3 screws, 1 vent wire and item 125)	
123	74061661	1	□SEAL, transfer pump	
124	74061663	2	RETAINER, rotor	
125	74061195	6	CONNECTOR, fuel line	
126	74061187	1	SCREW, locking plate	
127	74061159	1	PLATE, locking	
128	74061158	1	WASHER, locking plate	
129	74061172	1	LINER, transfer pump	
130	74059733	4	BLADE, transfer pump	
131	74055958	2	SPRING, transfer pump blade	
132	74061665	1	RING, inner locating	
133	74061162	1	ROLL PIN	
134	74061163	1	□SEAL, regulating piston	
135	74061174	1	REGULATOR ASSY., transfer pump	
136	74061164	1	□SEAL, inlet filter screen	
137	74061165	1	PISTON, regulating	
138	74061175	1	SPRING, regulating	
139	74055960	1	PLUG ASSY., end plate adjustment	
140	74061666	1	RING, screen retainer	
141	74061662	1	SCREEN, inlet filter	
142	74061664	1	PLATE, transfer pump pressure	
143	74061660	1	CAP, transfer pump end	
144	74053829	2	NUT, lock terminal contact	
145	74060067	3	WASHER, terminal contact	
146	74060058	1	WIRE ASSY., terminal ground	
147	70912739	1	LOCKWASHER, terminal contact	
148	74051383	2	WASHER, terminal insulating	
149	74061205	1	LOCKWASHER, cover screw	
150	74049437	2	NUT, terminal contact	
151	74062197	1	COIL ASSY., shut-off (24V. E.T.R.)(Includes solenoid which is not serviced separately and items 144, 145, 148, 150, 151A and 152 thru 155)	
151A	74062190	1	PLUNGER, solenoid (Not illustrated)	
152	74369502	2	TUBE	
153	74060214	1	SLEEVE, coil arm spring	
154	74369496	1	SPRING	
155	74062191	1	ARM ASSY., solenoid	
156	74060210	1	RING, over-ride retaining	
157	74369878	1	□SEAL, over-ride rod	
158	74060212	1	WASHER, over-ride guide	

INJECTION PUMP PARTS (Continued)

ITEM	PART NO.	QTY.	DESCRIPTION
159	74060211	1	GUIDE ASSY., over-ride
160	74060213	1	ROD, over-ride
161	74061591	1	ANEROID ASSY. (Serviced only as a unit. (Includes Cap Assy., Piston Assy., Shims, Spring and Body which are not serviced separately)
162	74061592	4	SCREW, bracket mounting
163	70906957	4	WASHER, bracket mounting
164	74061780	1	BRACKET, aneroid mounting
165	74061594	1	NUT, body assembly retaining
166	74061595	1	BOOT, aneroid
167	74061596	1	ROD, operating
168	74061597	2	RING, retaining
169	74061643	1	GASKET KIT, pump (Includes items 11,36,51,52,53, 60,63,64,66,68,70,73,74,89,100,112,114,121,123, 134,136 and 157)(Sufficient quantity for complete overhaul)

□ Components of item 169

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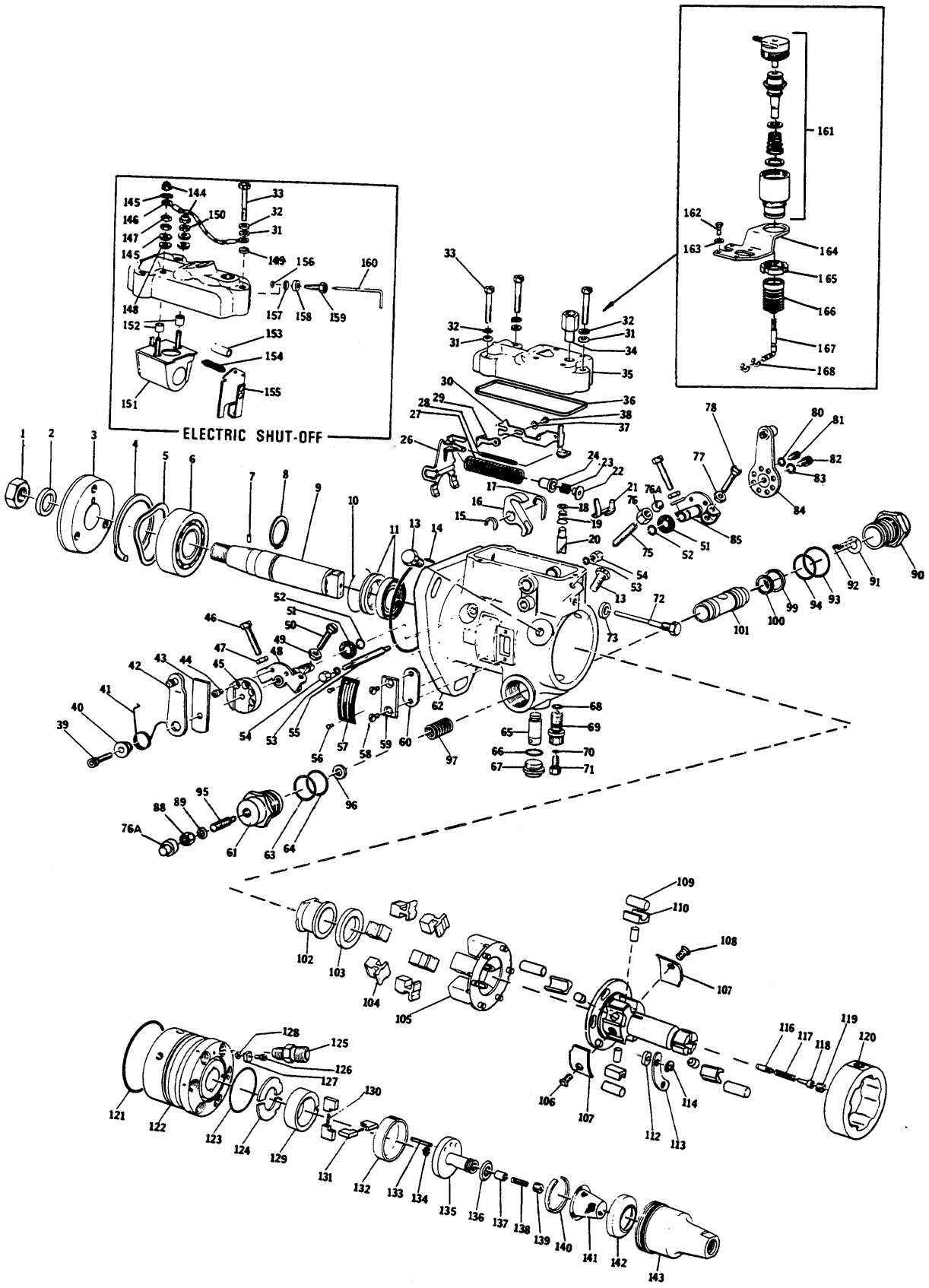

T-80630

INJECTION PUMP PARTS

USAGE: 745-C Wheel Loader (Model 11000 MK II Engine)

ITEM	PART NO.	QTY.	DESCRIPTION
-	74321924	1	PUMP ASSY., injection } Includes items
-	74322021	1	PUMP ASSY., injection } 1 thru 168
1	70910345	1	NUT, hub retaining
2	74061132	1	WASHER, hub retaining
3	74062193	1	HUB, gear
4	70925995	1	RING, retaining
5	74061141	1	WASHER, drive shaft spring
6	74061142	1	BEARING, ball
7	74061135	1	PIN, spring, drive shaft
8	74061134	1	RING, bearing shoulder
9	74062187	1	SHAFT, drive
10	--------	1	RING, seal retaining (Not required)
11	74061570	2	□SEAL, drive shaft
13	74062050	2	SCREW, head locking
14	74062183	1	SEAL, pump flange
15	74051559	1	CLIP, shaft retainer
16	74049532	1	LEVER, throttle shaft
17	74048639	1	CAM, shut-off
18	74052915	1	SHIM, metering valve
19	74061670	1	SPRING, metering valve
20	74061709	1	VALVE, metering
21	74062848	1	ARM ASSY., metering valve
22	74048627	1	GUIDE, idling spring
23	74049533	1	SPRING, idling
24	74048635	1	RETAINER, spring
26	74061168	1	ARM, governor
27	74061836	1	SPRING, governor control (Blue-Blue)
28	74048624	1	SPRING, governor linkage
--		1	HOOK ASSY., governor linkage (Includes items 29, 30, 37, 38)
29	74059171	1	LINK ASSY., adjusting
30	74061704	1	HOOK, governor linkage
31	74053267	3	WASHER, plain
32	70906957	3	LOCKWASHER, cover screw
33	74053266	3	SCREW, cover
34	74055293	1	CONNECTOR ASSY., return line
35	74062198	1	COVER, governor control
36	74048630	1	□GASKET, governor cover
37	74061206	1	WASHER, adjusting link
38	74059170	1	SCREW, adjusting link
39	74061744	1	SCREW, throttle lever spring
40	74051412	1	RETAINER, throttle lever spring
41	74051413	1	SPRING, throttle lever
42	74054594	1	LEVER ASSY., throttle
43	74056486	1	ARM, adjusting spacer
44	74369478	1	SCREW, spacer
45	74056484	1	SPACER, throttle lever
46	74051799	1	SCREW, low idle adjusting
47	74051409	1	NUT, low idle adjusting screw
48	74061716	1	SHAFT ASSY., throttle
49	74051409	1	NUT, high idle adjusting screw

(Continued)

INJECTION PUMP PARTS (Continued)

ITEM	PART NO.	QTY.	DESCRIPTION
50	74056799	1	SCREW, high idle adjusting
51	74053375	2	□WASHER, throttle shaft seal
52	74369878	2	□SEAL, throttle shaft
53	74050910	2	□SEAL, pivot shaft
54	74048642	2	NUT, pivot shaft
55	74048636	1	SHAFT, governor arm pivot
56	74369429	2	SCREW, name plate
57	74369428	1	PLATE, name
58	74061192	2	SCREW, timing line cover
59	74048603	1	COVER, timing line
60	74048604	1	□GASKET, timing line cover
61	74059271	1	PLUG, piston (spring)
62	74062184	1	HOUSING ASSY., pump
63	74061170	1	□SEAL, advance piston hole plug
64	74054589	1	□SEAL, advance piston hole plug
65	74059066	1	PIN, advance
66	74054585	1	□SEAL, advance screw hole plug
67	74059067	1	PLUG, advance screw hole
68	74369595	1	□SEAL, head locating screw
69	74061130	1	SCREW, head locating
70	74051365	1	□SEAL, head locating screw
71	74061131	1	PLUG, head locating screw
72	74051378	1	STUD, guide
73	74048650	1	□WASHER, guide stud
74	74369878	1	□SEAL, torque screw
75	74054582	1	SCREW, torque
76	74054583	1	NUT, torque screw
76A	74052917	2	CAP, cover adjusting screw
77	74051409	2	NUT, shut-off arm adjusting screw
78	74048632	2	SCREW, shut-off arm adjustment
80	70912739	1	WASHER, adjusting shut-off position screw
81	74369478	1	SCREW, adjusting shut-off position
82	74048647	1	SCREW, adjusting shut-off return
83	70906957	1	WASHER, adjusting shut-off return
84	74061602	1	ARM ASSY., adjusting shut-off
85	74061593	1	SHAFT ASSY., shut-off
88	74054583	1	NUT, advance adjusting screw
89	74369878	1	□SEAL, advance adjusting screw
90	74062194	1	PLUG, piston hole (power)
91	74061127	1	VALVE, reed
92	74061169	2	SCREW, reed valve
93	74061873	1	SEAL, advance piston hole
94	74054589	1	SEAL, advance piston hole
95	74054593	1	SCREW, advance adjusting
96	74054591	1	GUIDE, advance adjusting screw
97	74062182	1	SPRING, outer advance (Brown) (For 74321924 Pump Assy.)
	74062266	1	SPRING, outer advance (Blue) (For 74322021 Pump Assy.)
99	74061128	1	RING, advance piston
100	74059064	1	□SEAL, piston ring
101	74062192	1	PISTON, advance
102	74061852	1	SLEEVE, governor thrust
103	74061148	1	WASHER, governor thrust sleeve
104	74061149	6	WEIGHT, governor

(Continued)

ITEM	PART NO.	QTY.	DESCRIPTION	
105	74061150	1	RETAINER ASSY., governor	
106	74055970	1	SCREW, leaf spring	
107	74055890	2	SPRING, leaf	
108	74055969	1	SCREW, leaf spring	
109	74369436	4	ROLLER, cam	
110	74061509	4	SHOE, cam roller (-.254mm)(-.010")	Use as required
	74061156	4	SHOE, cam roller (-.127mm)(-.005")	
	74061590	4	SHOE, cam roller (-.381mm)(-.015")	
112	74061156	6	□CUSHION	
113	74061155	3	RETAINER, cushion	
114	74061154	6	□RING, retaining "E" clip	
116	74062189	1	VALVE, delivery	
117	74061188	1	SPRING, delivery valve	
118	74061161	1	STOP, delivery valve	
119	74061160	1	SCREW, delivery valve	
119A	74059390	2	*PISTON, accumulator	Not used on pump No. 74322021
119B	74059392	2	*SPRING, accumulator	
119C	74059391	2	*SCREW, accumulator, piston return	
			*(Not illustrated)	
120	74062051	1	RING, cam	
121	74369444	1	□SEAL, hydraulic head	
122	74062195	1	HEAD ASSY. (For 74321924 Pump Assy.)	Each includes rotor, plungers, 3 screws 1 vent wire and item 125
	74061702	1	HEAD ASSY. (For 74322021 Pump Assy.)	
123	74061661	1	□SEAL, transfer pump	
124	74061663	2	RETAINER, rotor	
125	74061195	6	CONNECTOR, fuel line	
126	74061187	1	SCREW, locking plate	
127	74061159	1	PLATE, locking	
129	74061172	1	LINER, transfer pump	
130	74059733	4	BLADE, transfer pump	
131	74055958	2	SPRING, transfer pump blade	
132	74061665	1	RING, inner locating	
133	74061162	1	ROLL PIN	
134	74061163	1	□SEAL, regulating piston	
135	74061174	1	REGULATOR ASSY., transfer pump	
136	74061164	1	□SEAL, inlet filter screen	
137	74061165	1	PISTON, regulating	
138	74061175	1	SPRING, regulating	
139	74055960	1	PLUG ASSY., end plate adjustment	
140	74061666	1	RING, screen retainer	
141	74061662	1	SCREEN, inlet filter	
142	74061664	1	PLATE, transfer pump pressure	
143	74061660	1	CAP, transfer pump end	
144	74053829	2	NUT, lock terminal contact	
145	74060067	3	WASHER, terminal contact	
146	74060058	1	WIRE ASSY., terminal ground	
147	70912739	1	LOCKWASHER, terminal contact	
148	74051383	2	WASHER, terminal insulating	
149	74061205	1	LOCKWASHER, cover screw	
150	74049437	2	NUT, terminal contact	
151	74062197	1	COIL ASSY., shut-off (24V. E.T.R.)(Includes solenoid which is not serviced separately and items 144, 145, 148, 150, 151A and 152 thru 155)	
151A	74062190	1	PLUNGER, solenoid (Not illustrated)	

INJECTION PUMP PARTS (Continued)

ITEM	PART NO.	QTY.	DESCRIPTION
152	74369502	2	TUBE
153	74060214	1	SLEEVE, coil arm spring
154	74369496	1	SPRING
155	74062191	1	ARM ASSY., solenoid
156	74060210	1	RING, over-ride retaining
157	74369878	1	□SEAL, over-ride rod
158	74060212	1	WASHER, over-ride guide
159	74060211	1	GUIDE ASSY., over-ride
160	74060213	1	ROD, over-ride
161	74061591	1	ANEROID ASSY. (Serviced only as a unit. Includes Cap Assy., Piston Assy., Shims, Spring and Body which are not serviced separately)
162	74061592	4	SCREW, bracket mounting
163	70906957	4	WASHER, bracket mounting
164	74061593	1	BRACKET, aneroid mounting
165	74061594	1	NUT, body assembly retaining
166	74061595	1	BOOT, aneroid
167	74061596	1	ROD, operating
168	74061597	2	RING, retaining
169	74061643	1	GASKET KIT, pump (Includes items 11,36,51,52,53, 60,63,64,66,68,70,73,74,89,100,112,114,121,123, 134,136 and 157)(Sufficient quantity for complete overhaul)

□ Components of item 169

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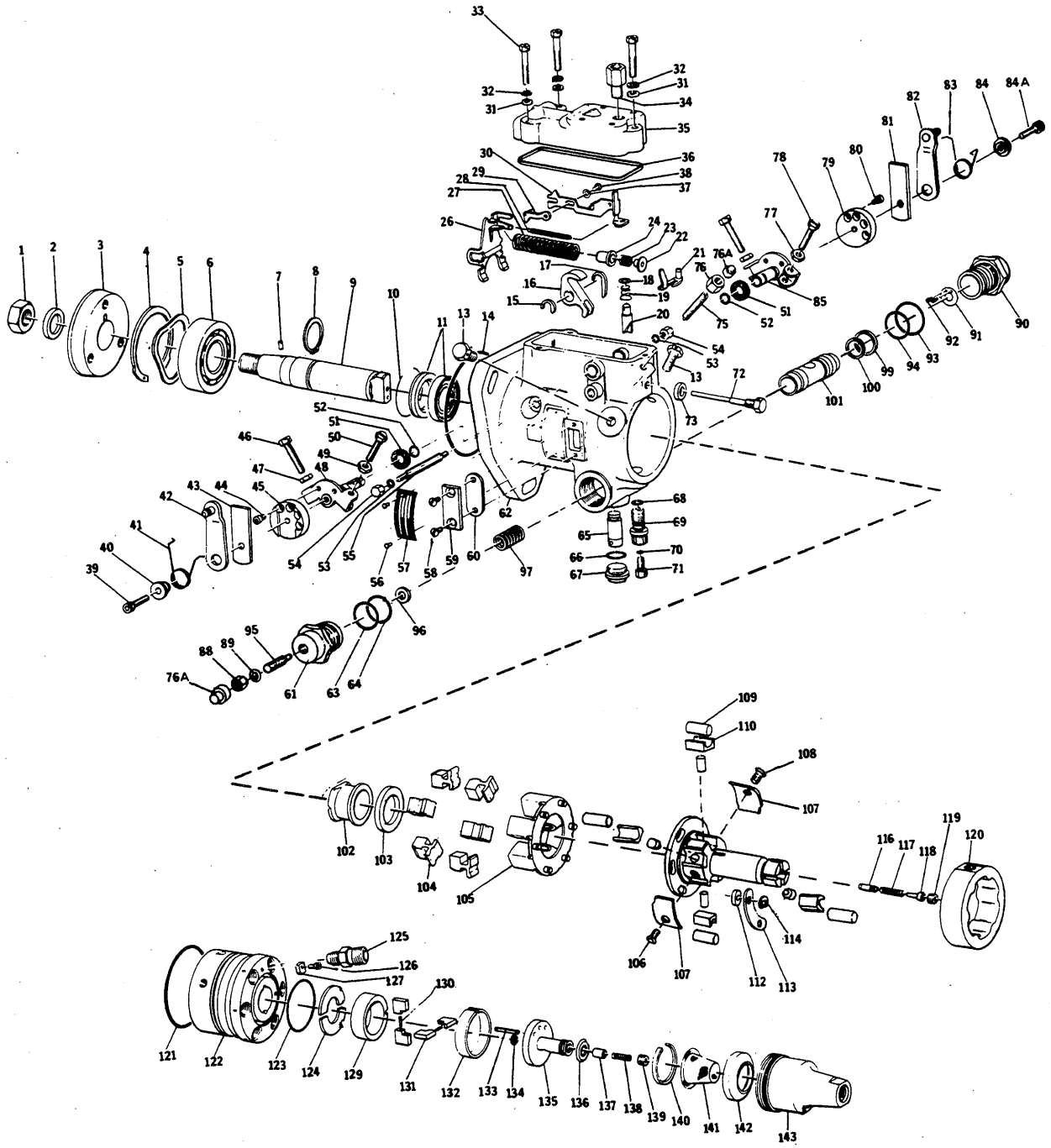


T-80630

INJECTION PUMP PARTS

INJECTION PUMP PARTS

USAGE: 100-C, 150-C, 200-C Graders (Model 11000 MK II and 685T)

ITEM	PART NO.	QTY.	DESCRIPTION
-	74321756	1	PUMP ASSY., injection (100-C, 150-C)(Includes items 1 thru 143)
-	74321882	1	PUMP ASSY., injection (200-C)(Includes items 1 thru 143)
1	70910345	1	NUT, hub retaining
2	74061132	1	WASHER, hub retaining
3	74062193	1	HUB, gear
4	70925995	1	RING, retaining
5	74061141	1	WASHER, drive shaft spring
6	74061142	1	BEARING, ball
7	74061135	1	PIN, spring, drive shaft
8	74061134	1	RING, bearing shoulder
9	74062187	1	SHAFT, drive
10	74061133	1	RING, seal retaining
11	74061570	2	□SEAL, drive shaft
13	74062050	2	SCREW, head locking
14	74062183	1	SEAL, pump flange
15	74051559	1	CLIP, shaft retainer
16	74049532	1	LEVER, throttle shaft
17	74048639	1	CAM, shut-off
18	74052915	1	SHIM, metering valve
19	74061670	1	SPRING, metering valve
20	74061709	1	VALVE, metering
21	74061703	1	ARM ASSY., metering valve (100-C, 150-C)
	74062848	1	ARM ASSY., metering valve (200-C)
22	74048627	1	GUIDE, idling spring
23	74049533	1	SPRING, idling
24	74048635	1	RETAINER, spring
26	74061168	1	ARM, governor
27	74061835	1	SPRING, governor control (Black-Black) (200-C)
	74061781	1	SPRING, governor control (Black-Brown) (100-C, 150-C)
28	74048624	1	SPRING, governor linkage
--		1	HOOK ASSY., governor linkage (Includes items 29, 30, 37, 38)
29	74059171	1	LINK ASSY., adjusting
30	74061704	1	HOOK, governor linkage
31	74053267	2	WASHER, plain
32	70906957	2	LOCKWASHER, cover screw
33	74053266	2	SCREW, cover
34	74055293	1	CONNECTOR ASSY., return line
35	74051002	1	COVER, governor control
36	74048630	1	□GASKET, governor cover
37	74061206	1	WASHER, adjusting link
38	74059170	1	SCREW, adjusting link
39	74061744	1	SCREW, throttle lever spring
40	74051412	1	RETAINER, throttle lever spring
41	74051413	1	SPRING, throttle lever
42	74054594	1	LEVER ASSY., throttle
43	74056486	1	ARM, adjusting spacer
44	74369478	1	SCREW, spacer
45	74056484	1	SPACER, throttle lever
46	74048645	1	SCREW, low idle adjusting
47	74051409	1	NUT, low idle adjusting screw

(Continued)

INJECTION PUMP PARTS (Continued)

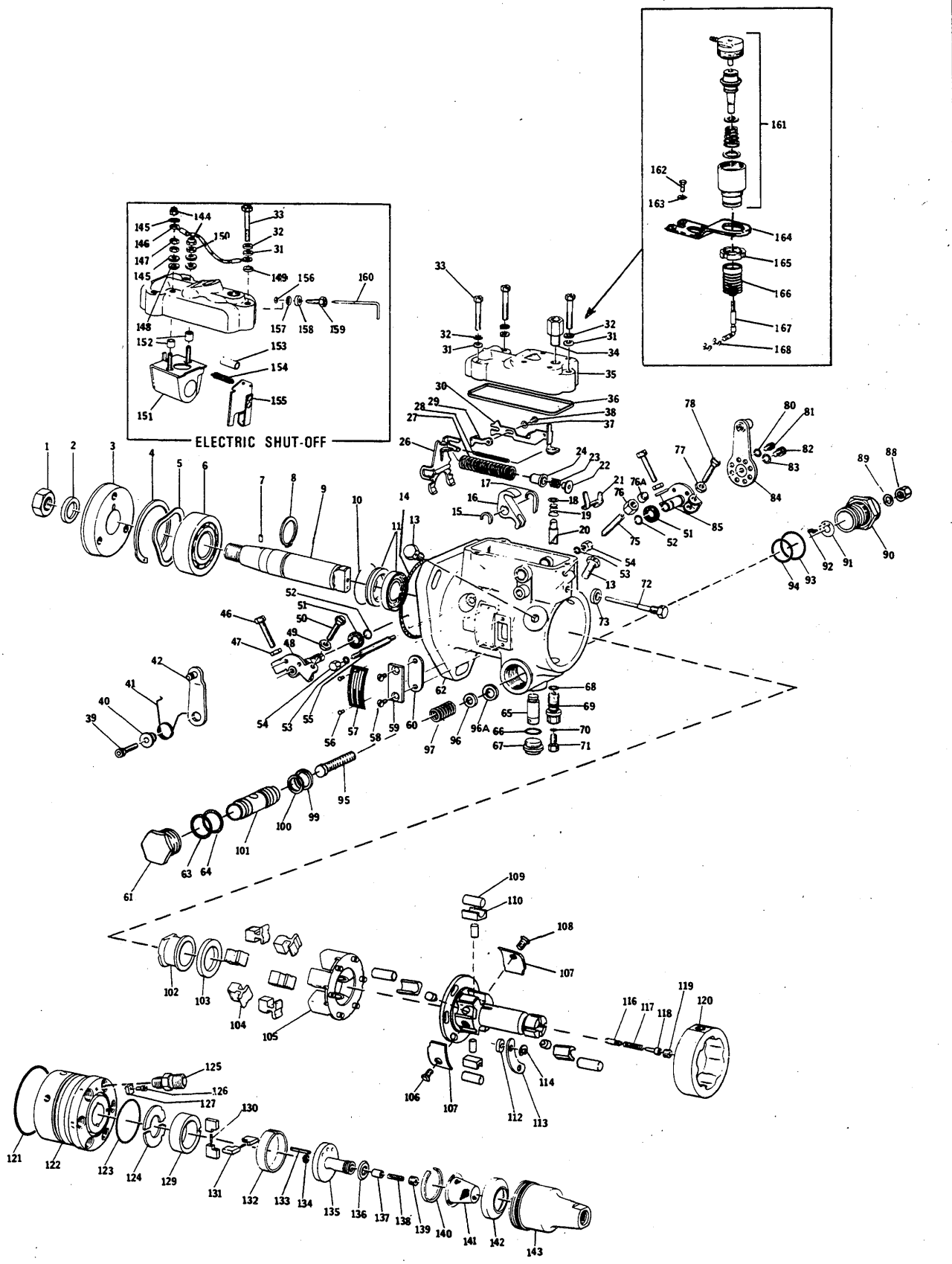
ITEM	PART NO.	QTY.	DESCRIPTION
48	74056488	1	SHAFT ASSY., throttle
49	74051409	1	NUT, high idle adjusting screw
50	74056799	1	SCREW, high idle adjusting
51	74053375	2	□WASHER, throttle shaft seal
52	74369878	2	□SEAL, throttle shaft
53	74050910	2	□SEAL, pivot shaft
54	74048642	2	NUT, pivot shaft
55	74048636	1	SHAFT, governor arm pivot
56	74369429	2	SCREW, name plate
57	74369428	1	PLATE, name
58	74061192	2	SCREW, timing line cover
59	74048603	1	COVER, timing line
60	74048604	1	□GASKET, timing line cover
61	74059271	1	PLUG, piston (spring)
62	74062184	1	HOUSING ASSY., pump
63	74061170	1	□SEAL, advance piston hole plug
64	74054589	1	□SEAL, advance piston hole plug
65	74059066	1	PIN, advance
66	74054585	1	□SEAL, advance screw hole plug
67	74059067	1	PLUG, advance screw hole
68	74369595	1	□SEAL, head locating screw
69	74061130	1	SCREW, head locating
70	74051365	1	□SEAL, head locating screw
71	74061131	1	PLUG, head locating screw
72	74051378	1	STUD, guide
73	74048650	1	□WASHER, guide stud
74	74369878	1	□SEAL, torque screw
75	74054582	1	SCREW, torque
76	74054583	1	NUT, torque screw
76A	74052917	2	CAP, cover adjusting screw
77	74051409	2	NUT, shut-off arm adjusting screw
78	74048632	2	SCREW, shut-off arm adjusting
79	74056484	1	SPACER, shut-off lever
80	74369478	1	SCREW, shut-off position screw
81	74056486	1	ARM, adjusting spacer
82	74054594	1	LEVER ASSY., shut-off
83	74051413	1	SPRING, shut-off lever
84	74051412	1	RETAINER, throttle lever spring
84A	74056487	1	SCREW, shut-off lever spring
85	74056490	1	SHAFT ASSY., shut-off
88	74054583	1	NUT, advance adjusting screw
89	74369878	1	□SEAL, advance adjusting screw
90	74062194	1	PLUG, piston hole (power)
91	74061716	1	VALVE, reed
92	74061169	2	SCREW, reed valve
93	74061873	1	SEAL, advance piston hole
94	74054589	1	SEAL, advance piston hole
95	74054593	1	SCREW, advance adjusting
96	74054591	1	GUIDE, advance adjusting screw
97	74062182	1	SPRING, outer advance (Brown)
99	74061128	1	RING, advance piston
100	74059064	1	□SEAL, piston ring

(Continued)

INJECTION PUMP PARTS (Continued)

ITEM	PART NO.	QTY.	DESCRIPTION
101	74062192	1	PISTON, advance
102	74061852	1	SLEEVE, governor thrust
103	74061148	1	WASHER, governor thrust sleeve
104	74061149	6	WEIGHT, governor
105	74061150	1	RETAINER ASSY., governor
106	74055970	1	SCREW, leaf spring
107	74055890	2	SPRING, leaf
108	74055969	1	SCREW, leaf spring
109	74369436	4	ROLLER, cam
110	74061157	4	SHOE, cam roller(-.508mm)(-.020") } Use as
	74061590	4	SHOE, cam roller(-.381mm)(-.015") } Use as
	74061512	4	SHOE, cam roller(-.127mm)(-.010") } required
			(Used on Pump No. 74321882 only)
112	74061156	6	□CUSHION
113	74061155	3	RETAINER, cushion
114	74061154	6	□RING, retaining "E" clip
116	74062189	1	VALVE, delivery
117	74061188	1	SPRING, delivery valve
118	74061161	1	STOP, delivery valve
119	74061160	1	SCREW, delivery valve
120	74062051	1	RING, cam
121	74369444	1	□SEAL, hydraulic head
122	74062195	1	HEAD ASSY. (Includes rotor, plungers, 3 screws, 1 vent wire and item 125)
123	74061661	1	□SEAL, transfer pump
124	74061663	2	RETAINER, rotor
125	74061195	6	CONNECTOR, fuel line
126	74061187	1	SCREW, locking plate
127	74062282	1	PLATE, locking
129	74061172	1	LINER, transfer pump
130	74059733	4	BLADE, transfer pump
131	74055958	2	SPRING, transfer pump blade
132	74061665	1	RING, inner locating
133	74061162	1	ROLL PIN
134	74061163	1	□SEAL, regulating piston
135	74061174	1	REGULATOR ASSY., transfer pump
136	74061164	1	□SEAL, inlet filter screen
137	74061165	1	PISTON, regulating
138	74061175	1	SPRING, regulating
139	74055960	1	PLUG ASSY., end plate adjustment
140	74061666	1	RING, screen retainer
141	74061662	1	SCREEN, inlet filter
142	74061664	1	PLATE, transfer pump pressure
143	74061660	1	CAP, transfer pump end
144	74061643	1	GASKET KIT, pump (Includes items 11, 36, 51, 52, 53, 60, 63, 64, 66, 68, 70, 73, 74, 89, 100, 112, 114, 121, 123, 134 and 136)(Sufficient quantity for complete overhaul)

□ Components of item 144



INJECTION PUMP PARTS

T-80630

INJECTION PUMP PARTS

USAGE: 545-B, 605-B Wheel Loader (Model 649T Engine with aneroid)

ITEM	PART NO.	QTY.	DESCRIPTION
-	74008551	1	PUMP ASSY., 545-B (Includes items 1 thru 160)
-	74008552	1	PUMP ASSY., 605-B (Includes items 1 thru 160)
1	70910345	1	NUT, hub retaining
2	74061140	1	WASHER, hub retaining
3	74062193	1	HUB, gear
4	70925995	1	RING, retaining
5	74061141	1	WASHER, drive shaft spring
6	74061142	1	BEARING, ball
7	74061135	1	PIN, spring, drive shaft
8	74061134	1	RING, bearing shoulder
9	74062187	1	SHAFT, drive
10	74061133	1	RING, seal retaining
11	74061470	2	SEAL, drive shaft
13	74062050	2	SCREW, head locking
14	74062183	1	SEAL, pump flange
15	74051559	1	CLIP, shaft retainer
16	74049532	1	LEVER, throttle shaft
17	74048639	1	CAM, shut-off
18	74052915	1	SHIM, metering valve
19	74061670	1	SPRING, metering valve
20	74061178	1	VALVE, metering valve
21	74054579	1	ARM ASSY., metering valve
22	74048627	1	GUIDE, idling spring
23	74049533	1	SPRING, idling
24	74048635	1	RETAINER, spring
26	74061168	1	ARM, governor
27	74061836	1	SPRING, governor control (Blue-Blue)
28	74048624	1	SPRING, governor linkage
--		1	HOOK ASSY., governor linkage (Includes items 29, 30, 37, 38)
29	74059171	1	LINK ASSY., adjusting
30	74062261	1	HOOK, governor linkage
31	74053267	3	WASHER, plain
32	70906957	3	LOCKWASHER, cover screw
33	74053266	3	SCREW, cover
34	74055293	1	CONNECTOR ASSY., return line
35	74062198	1	COVER, governor control
36	74048630	1	GASKET, governor cover
37	74061206	1	WASHER, adjusting link
38	74059170	1	SCREW, adjusting link
39	74061744	1	SCREW, throttle lever spring
40	74051412	1	RETAINER, throttle lever spring
41	74051413	1	SPRING, throttle lever
42	74054594	1	LEVER ASSY., throttle
43	74056486	1	ARM, adjusting spacer
44	74369478	1	SCREW, spacer
45	74056484	1	SPACER, throttle lever
46	74056799	1	SCREW, low idle adjusting
47	74051409	1	NUT, low idle adjusting screw

(Continued)

INJECTION PUMP PARTS (Continued)

ITEM	PART NO.	QTY.	DESCRIPTION
48	74061716	1	SHAFT ASSY., throttle
49	74058951	1	NUT, high idle adjusting screw
50	74058950	1	SCREW, high idle adjusting
51	74053375	2	WASHER, throttle shaft seal
52	74369878	2	SEAL, throttle shaft
53	74050910	2	SEAL, pivot shaft
54	74048642	2	NUT, pivot shaft
55	74048636	1	SHAFT, governor arm pivot
56	74369429	2	SCREW, name plate
57	74369428	1	PLATE, name
58	74061192	2	SCREW, timing line cover
59	74048603	1	COVER, timing line
60	74048604	1	GASKET, timing line cover
61	74059271	1	PLUG, piston (spring)
62	74061589	1	HOUSING ASSY., pump
63	74061170	1	SEAL, advance piston hole plug
64	74054589	1	SEAL, advance piston hole plug
65	74059066	1	PIN, advance
66	74054585	1	SEAL, advance screw hole plug
67	74059067	1	PLUG, advance screw hole
68	74369595	1	SEAL, head locating screw
69	74061130	1	SCREW, head locating
70	74051365	1	SEAL, head locating screw
71	74061131	1	PLUG, head locating screw
72	74051378	1	STUD, guide
73	74048650	1	WASHER, guide stud
74	74369878	1	SEAL, torque screw
75	74054582	1	SCREW, torque
76	74054583	1	NUT, torque screw
76A	74052917	2	CAP, cover adjusting screw
77	74061409	2	NUT, shut-off arm adjusting screw
78	74048632	2	SCREW, shut-off arm adjustment
80	70912739	1	WASHER, adjusting shut-off position screw
81	74369478	1	SCREW, adjusting shut-off position
82	74048647	1	SCREW, adjusting shut-off return
83	70906957	1	WASHER, adjusting shut-off return
84	74061602	1	ARM ASSY., adjusting shut-off
85	74061593	1	SHAFT ASSY., shut-off
88	74054583	1	NUT, advance adjusting screw
89	74369878	1	SEAL, advance adjusting screw
90	74061179	1	PLUG, piston hole (power)
91	74061127	1	VALVE, reed
92	74061169	2	SCREW, reed valve
93	74061873	1	SEAL, advance piston hole
94	74054589	1	SEAL, advance piston hole
95	74062149	1	SCREW, advance adjusting
96	74059395	1	GUIDE, advance adjusting screw
96A	74059397	1	RING, spring retaining
97	74059667	1	SPRING, outer advance (Yellow-Yellow)
99	74061128	1	RING, advance piston

(Continued)

ITEM	PART NO.	QTY.	DESCRIPTION	
100	74059064	1	SEAL, piston ring	
101	74061677	1	PISTON, advance	
102	74061852	1	SLEEVE, governor thrust	
103	74061148	1	WASHER, governor thrust sleeve	
104	74061149	6	WEIGHT, governor	
105	74061150	1	RETAINER ASSY., governor	
106	74055970	1	SCREW, leaf spring	
107	74055890	2	SPRING, leaf	
108	74055969	1	SCREW, leaf spring	
109	74369436	4	ROLLER, cam	
110	74061157	4	SHOE, cam roller (-.508mm)(-.020")	Use as
	74061590	4	SHOE, cam roller (-.381mm)(-.051")	Required
112	74061156	6	CUSHION	
113	74061155	3	RETAINER, cushion	
114	74061154	6	RING, retaining "E" clip	
116	74062211	1	VALVE, delivery	
117	74061188	1	SPRING, delivery valve	
118	74061161	1	STOP, delivery valve	
119	74061160	1	SCREW, delivery valve	
120	74062051	1	RING, cam	
121	74369444	1	SEAL, hydraulic head	
122	74061152	1	HEAD ASSY. (Includes rotor, plungers, 3 screws, 1 vent wire and item 125)	
123	74061661	1	SEAL, transfer pump	
124	74061663	2	RETAINER, rotor	
125	74061195	6	CONNECTOR, fuel line	
126	74061187	1	SCREW, locking plate	
127	74062282	1	PLATE, locking	
129	74061172	1	LINER, transfer pump	
130	74059733	4	BLADE, transfer pump	
131	74055958	2	SPRING, transfer pump blade	
132	74061665	1	RING, inner locating	
133	74061162	1	ROLL PIN	
134	74061163	1	SEAL, regulating piston	
135	74061174	1	REGULATOR ASSY., transfer pump	
136	74061164	1	SEAL, inlet filter screen	
137	74061165	1	PISTON, regulating	
138	74061175	1	SPRING, regulating	
139	74055960	1	PLUG ASSY., end plate adjustment	
140	74061666	1	RING, screen retainer	
141	74061662	1	SCREEN, inlet filter	
142	74061664	1	PLATE, transfer pump pressure	
143	74061660	1	CAP, transfer pump end	
144	74053829	2	NUT, lock terminal contact	
145	74060067	3	WASHER, terminal contact	
146	74060058	1	WIRE ASSY., terminal ground	
147	70912739	1	LOCKWASHER, terminal contact	
148	74051383	2	WASHER, terminal insulating	
149	74061205	1	LOCKWASHER, cover screw	
150	74049437	2	NUT, terminal contact	

(Continued)

ITEM	PART NO.	QTY.	DESCRIPTION
151	74062326	1	COIL ASSY., shut-off (24V E. T. R.)(Includes solenoid which is not serviced separately and items 144, 145, 148, 150 and 152 thru 155)
152	74369502	2	TUBE
152A	74062190	1	PLUNGER, solenoid (Not illustrated)
153	74060214	1	SLEEVE, coil arm spring
154	74369496	1	SPRING
155	74062191	1	ARM ASSY., solenoid
156	74060210	1	RING, over-ride retaining
157	74369878	1	SEAL, over-ride rod
158	74060212	1	WASHER, over-ride guide
159	74060211	1	GUIDE ASSY., over-ride
160	74060213	1	ROD, over-ride
161	74062322	1	ANEROID ASSY. (Serviced only as a unit. (Includes Cap Assy., Piston Assy., Shims, Spring and Body which are not serviced separately)(Also includes 162, 163 and 164)
162	74061592	4	SCREW, bracket mounting
163	70906957	4	WASHER, bracket mounting
164	74061593	1	BRACKET, aneroid mounting
165	74061594	1	NUT, body assembly retaining
166	74061595	1	BOOT, aneroid
167	74061596	1	ROD, operating
168	74061597	2	RING, retaining
169	74061643	1	GASKET KIT, pump (Includes items 11, 36, 51, 52, 53, 60, 63, 64, 66, 68, 70, 73, 74, 89, 100, 112, 114, 121, 123, 134, 136 and 157)(Sufficient quantity for complete overhaul)

Components of item 169

CONVERSION TABLES

DECIMAL AND METRIC EQUIVALENTS OF FRACTIONS OF AN INCH

Inches				Inches			
Fractions	Decimals	*Nom. Dec.	Millimeters	Fractions	Decimals	*Nom. Dec.	Millimeters
1/64	.015625	.02	.397	33/64	.515625	.52	13.097
1/32	.03125	.03	.794	17/32	.53125	.53	13.494
3/64	.046875	.05	1.191	35/64	.546875	.55	13.891
1/16	.0625	.06	1.588	9/16	.5625	.56	14.288
5/64	.078125	.08	1.984	37/64	.578125	.58	14.684
3/32	.09375	.09	2.381	19/32	.59375	.59	15.081
7/64	.109375	.11	2.778	39/64	.609375	.61	15.478
1/8	.125	.12	3.175	5/8	.625	.62	15.875
9/64	.140625	.14	3.572	41/64	.640625	.64	16.272
5/32	.15625	.16	3.969	21/32	.65625	.66	16.669
11/64	.171875	.17	4.366	43/64	.671875	.67	17.066
3/16	.1875	.19	4.763	11/16	.6875	.69	17.463
13/64	.203125	.20	5.159	45/64	.703125	.70	17.859
7/32	.21875	.22	5.556	23/32	.71875	.72	18.256
15/64	.234375	.23	5.953	47/64	.734375	.73	18.653
1/4	.250	.25	6.350	3/4	.750	.75	19.050
17/64	.265625	.27	6.747	49/64	.765625	.77	19.447
9/32	.28125	.28	7.144	25/32	.78125	.78	19.844
19/64	.296875	.30	7.541	51/64	.796875	.80	20.241
5/16	.3125	.31	7.938	13/16	.8125	.81	20.638
21/64	.328125	.33	8.334	53/64	.828125	.83	21.034
11/32	.34375	.34	8.731	27/32	.84375	.84	21.431
23/64	.359375	.36	9.128	55/64	.859375	.86	21.828
3/8	.375	.38	9.525	7/8	.875	.88	22.225
25/64	.390625	.39	9.922	57/64	.890625	.89	22.622
13/32	.40625	.41	10.319	29/32	.90625	.91	23.019
27/64	.421875	.42	10.716	59/64	.921875	.92	23.416
7/16	.4375	.44	11.113	15/16	.9375	.94	23.813
29/64	.453125	.45	11.509	61/64	.953125	.95	24.209
15/32	.46875	.47	11.906	31/32	.96875	.97	24.606
31/64	.484375	.48	12.303	63/64	.984375	.98	25.003
1/2	.500	.50	12.700	1	1.000	1.00	25.400

VOLUME AND WEIGHT CONVERSION CONSTANTS — U.S. TO METRIC

Pints x .4732 = Liters
Quarts x .9463 = Liters
Gallons x 3.7853 = Liters
Pounds x .4536 = Kilograms
Cubic Yards x .7645 = Cubic Meters

TORQUE & PRESSURE CONVERSION CONSTANTS –

lb. ft. x 0.1383 = m-kg
lb. in. x 1.1521 = cm-kg
psi x 0.0703 = kg/cm^2

LENGTH CONVERSION CONSTANTS — U.S. TO METRIC

Inches x 25.400 = Millimeters
Inches x .0254 = Meters
Feet x .3048 = Meters
Statute Miles x 1.60935 = Kilometers

*Nominal decimals are used in place of fractions of an inch, with exception of such items as bolts, screws, washers, tubing, wire, etc.