

FUEL INJECTION PUMP

(AMERICAN BOSCH APE Series)

service manual

Form 70657399 English
4/90

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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(AMERICAN BOSCH APE Series)

service manual

Form 70657399 English
(Same as 0657399-2)



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.

NOTICE
THESE CHANGES ARE
INCLUDED IN THIS COPY

REPLACEMENT PAGES FOR
657399 (9-66)
SERVICE MANUAL
For
FUEL INJECTION SYSTEM
American Bosch APE Type Pumps

Mailing No. 2

The following replace like pages:

Sect. 3	9 (No change)	23 (Revised)	35 (No change)
	10 (Revised)	23A (Revised)	36 (Revised)
Sect. 5	11 (No change)	23B (Added)	39 (Revised)
	12 (Revised)	24 (No change)	40 (No change)
	13 (Revised)	24A (Revised)	43 (Revised)
	14 (No change)		44 (Revised)
	19 (Revised)	33 (Revised)	Sect. 8 3 (Added)
	20 (Revised)	34 (No change)	
	21 (No change)		
	22 (Revised)		

INSERT THIS SHEET INTO THE FRONT OF MANUAL 657399 (9-66) TO INDICATE RECEIPT OF THIS MAILING. Additional copies of this mailing are available. Please direct your order to the Technical Publications Department, Springfield Plant.

This mailing expands this manual to include late model pump information.

NOTICE
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REPLACEMENT PAGES FOR
657399 (9-66)
SERVICE MANUAL
For
Fuel Injection Pump American Bosch
(APE Type)

MAILING NO. 1

The following replace like pages:

- | | |
|-------------------------------|--------------------------------|
| Sect. 2, Page 7 - (No change) | Sect. 5, Page 15 - (No change) |
| 2, 8 - (Revised) | 5, 16 - (Revised) |
| Sect. 3, Page 7 - (No change) | Sect. 5, Page 17 - (Revised) |
| 3, 8 - (Revised) | 5, 17A - (New) |
| Sect. 3, Page 9 - (No change) | Sect. 5, (Blank) |
| 3, 10 - (Revised) | 5, 18 - (No change) |
| Sect. 4, Page 3 - (Revised) | Sect. 5, Page 23 - (Revised) |
| 4, 4 - (No change) | 5, 23A - (Revised) |
| Sect. 5, Page 5 - (Revised) | Sect. 5, Page 24 - (Revised) |
| 5, 6 - (No change) | 5, 24A - (Revised) |
| Sect. 5, Page 7 - (No change) | Sect. 5, Page 35 - (Revised) |
| 5, 8 - (Revised) | 5, 36 - (No change) |
| Sect. 5, Page 9 - (Revised) | Sect. 7, Page 1 - (Revised) |
| 5, 10 - (Revised) | Sect. 8, Page 1 - (Revised) |
| Sect. 5, Page 11 - (Revised) | 8, 2 - (New) |
| 5, 12 - (Revised) | |
| Sect. 5, Page 13 - (Revised) | |
| 5, 14 - (Revised) | |

INSERT THIS SHEET INTO THE FRONT OF MANUAL 657399 (9-66) TO INDICATE RECEIPT OF THIS MAILING. Additional copies of this mailing are available. Please direct your order to the Parts Order Department.

This mailing expands this manual to include late model pump information.

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 safely 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 manufacturer's approved cap. Use of a non-approved cap may result in over-pressurization 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.

This manual may not be reprinted or reproduced, either in whole or in part, without written permission of Fiatallis ®.

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.

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SECTION 1 - DESCRIPTION AND OPERATION

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TOPIC 1 - GENERAL DESCRIPTION AND FUEL INJECTION PUMP IDENTIFICATION

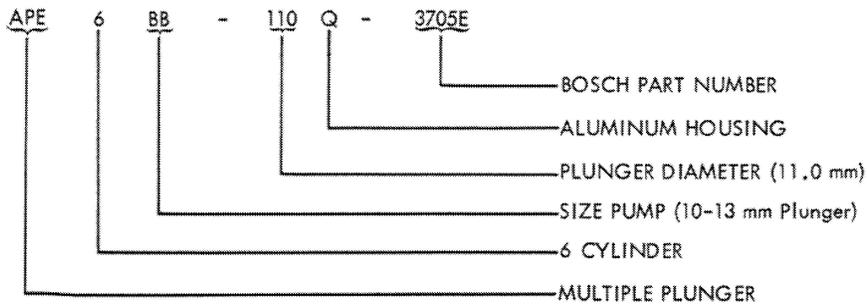
The American Bosch APE fuel injection pump used on Allis-Chalmers diesel engines is a multiple plunger, constant stroke, cam actuated heavy duty fuel injection pump. This pump is equipped with various size plungers and may be timed for either port opening or port closing. The number of degrees before top dead center (BTDC) at which the fuel injection pump effects the injection of fuel into the cylinders is dependent upon the engine application.

The purpose of the fuel injection pump is to meter the fuel accurately, deliver it precisely at a definite moment in the engine cycle and deliver it at a definite

rate depending on the cam profile under high pressure to the fuel injection nozzles.

Governing is accomplished with a mechanical - centrifugal system attached to the rear of the fuel injection pump. The purpose of this governor is to serve as a means of pre-setting and maintaining within close regulation any desired engine speed within the nominal idling and maximum speed range, irrespective of engine load. The governor also controls the engine idling speed to prevent stalling and the maximum speed to prevent overspeed.

MODEL NUMBER DESIGNATION



TOPIC 2 - FUEL INJECTION PUMP OPERATION

A. PUMPING

The fuel injection pump and governor are mounted on the left side (front is fan end and rear is flywheel end) of the engine. The camshaft of the pump is driven at one-half engine speed by the accessory drive, through an adjustable pump coupling. The pump plungers, (11) are lifted by the pump camshaft (25) through tappet assemblies (13) located below the plungers and in contact with the pump camshaft. The plungers are returned by plunger springs (1).

Fuel is supplied by the fuel transfer pump (24) through the final stage fuel filter and into the fuel sump (9) of the fuel injection pump surrounding the injection pump plungers (11) and barrels (3). When a plunger is at the bottom of its stroke, the fuel flows through the plunger barrel (3) above the plunger. The plunger moving upward closes the barrel ports (4) and as it

continues its upward movement, the fuel now under pressure, opens the corresponding delivery valve (8) and flows through the fuel injection line to the corresponding fuel injection nozzle, where it is injected into the combustion chamber for that particular cylinder. Delivery of fuel ceases when the upper edge of the lower helix of the plunger (11)* opens the by-pass port in the plunger barrel (3). The by-passing of fuel back to the fuel sump of the injection pump relieves the pressure and permits the delivery valve to close.

*NOTE: In port opening pumps, the upper edge of the helix closes the port. The port is opened by the lower, straight edge of the plunger.

Excess fuel, delivered to the fuel sump of the injection pump, opens the overflow valve, and returns to the fuel tank.

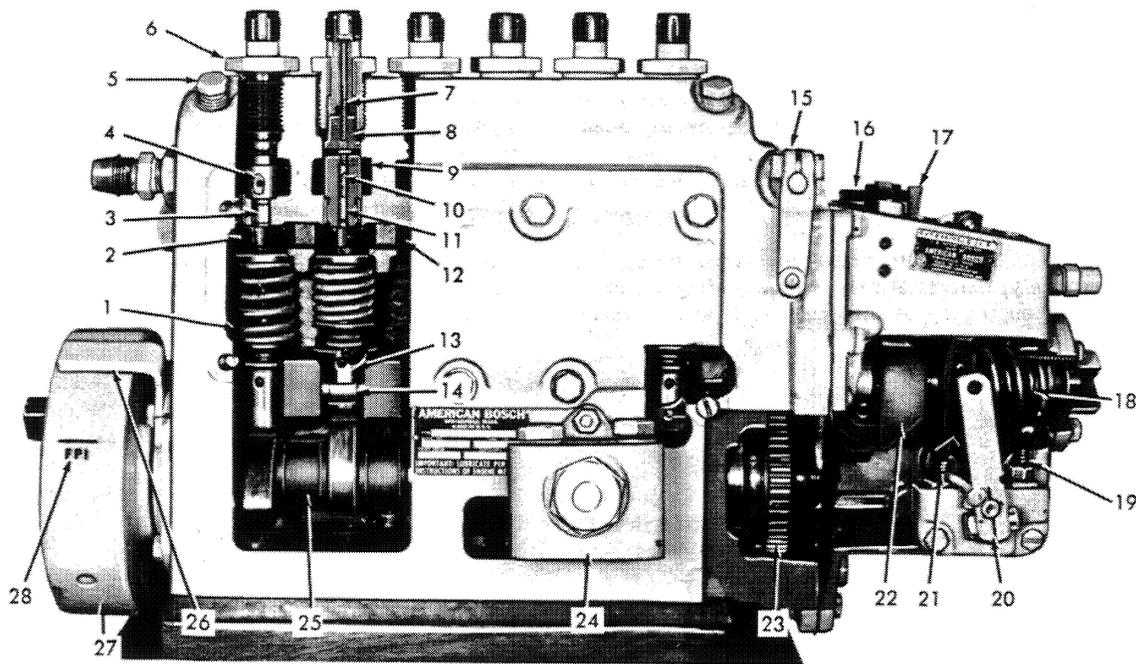


Fig. 1 Fuel Injection Pump-Cut-Away View
(T-41411)

- | | | |
|--|---------------------------------|-------------------------------|
| 1. Plunger Spring | 10. Plunger Helix | 20. Operating Lever |
| 2. Control Sleeve | 11. Plunger | 21. High Idle Adjusting Screw |
| 3. Plunger Barrel | 12. Control Rack Gear Segment | 22. Governor Weights |
| 4. Fuel Inlet Port | 13. Tappet Assembly | 23. Governor Drive Gear |
| 5. Transfer Pump Fuel Pressure Check Point | 14. Roller Assembly | 24. Fuel Transfer Pump |
| 6. Delivery Valve Holder | 15. Fuel Shut-Off Lever | 25. Camshaft |
| 7. Delivery Valve Spring | 16. Stop Plate Adjustment Screw | 26. Timing Pointer |
| 8. Delivery Valve | 17. Stop Plate | 27. Pump Flywheel |
| 9. Fuel Sump | 18. Governor Springs | 28. F. P. I. Mark |
| | 19. Low Idle Adjusting Screw | |

B. METERING

Control of the amount of fuel delivered by each plunger is accomplished by rotating the plunger, (11), in the plunger barrel (3); this in turn changes the position of the helix of the plunger in relation to the ports in the plunger barrel. A control sleeve (2) having a toothed segment, is installed over the plunger barrel and the teeth of this sleeve are engaged with teeth in a control rack (12) connected to the governor. Movement of the control rack by the governor rotates the plunger in its barrel which in turn controls the amount of fuel delivered by the plunger. The less the control rack is moved away from its stop position, the less the plunger is turned in its barrel, and the shorter the effective fuel delivery stroke of the plunger. The more the control rack is moved away from its stop, the more the plunger is turned in its barrel and the longer the effective fuel delivery stroke. When the control rack is moved to the stop position, the plunger is turned in its barrel so that the vertical groove in the plunger registers with the by-pass port and no fuel is delivered by the plunger.

C. GOVERNOR OPERATION

The governor drive gear, (23), located on the rear end of the fuel injection pump camshaft, is engaged

with the driven gear mounted on the front end of the governor weight shaft. A friction clutch, built into the governor drive gear, is so designed that it causes the drive gear to slip on the hub momentarily whenever sudden speed changes of the pump camshaft occur. This clutch assures smooth operation of the governor weights (22) and helps to minimize governor wear.

The governor weights are attached to and rotate with the governor weight shaft, thus providing governor control at all engine speeds. As the weights revolve, centrifugal force tends to throw them outward, moving the weight fingers and governor sleeve along the shaft. This movement is opposed by the governor springs (18). The higher the speed, the greater the centrifugal force and force of the sleeve against the governor springs. If the speed is decreased, the centrifugal force of the weights lessens, and the governor springs force the sleeve forward toward the fuel injection pump. A control rod, connected to the fulcrum lever on the governor sleeve and engaged with the tooth segment of the control sleeve on each plunger barrel of the injection pump, transmits the movement of the governor sleeve to the control sleeve on each plunger barrel. Movement of the control sleeve by the control rack rotates the corresponding pump plunger in its barrel, which in turn controls the amount of fuel delivered by the plunger.

SECTION 2 - PUMP AND GOVERNOR DISASSEMBLY

TOPIC NO.	TITLE	PAGE
1	PUMP DISASSEMBLY	2-1
2	GOVERNOR DISASSEMBLY	2-6
3	INSPECTION OF PUMP PARTS	2-8
4	INSPECTION OF GOVERNOR PARTS	2-9
5	INSPECTION OF FULCRUM LEVER	2-10

TOPIC 1 - PUMP DISASSEMBLY

STUDY THE MANUAL FIRST

Prior to disassembly of this, or any, fuel injection equipment, the work area should be thoroughly cleaned. No filing, sawing or scraping should be done on the bench while repairs are in progress.

Remove all external grease and dirt by washing the pump with fuel oil and blowing it off with filtered compressed air. Since dirt, dust and foreign matter are the greatest enemies of the fuel injection pump, it is absolutely necessary that hands and tools, as well as the work area, be as clean as possible.

Six clean pans with 1" - 2" of clean fuel oil should be available in which the parts may be placed. These pans should preferably be seamless to lessen the chance of dirt pockets.

NOTE

KEEP ALL PARTS IN ORDER AND REPLACE IN ORIGINAL POSITIONS. ALWAYS COMPLETE ONE OPERATION FOR ALL SIX CYLINDERS BEFORE PROCEEDING TO THE NEXT STEP.

1. Mount the pump in a vise, as shown, and remove the inspection cover, the governor top cover, the operating lever, operating shaft cover and the fuel supply pump.
2. Remove the governor housing fastening screws.
3. Carefully disengage the governor from the pump and at the same time disengage the governor linkage from the control rack.
4. Place the lower prongs of service tool TSE 76159B between the lower plunger spring seat and the tappet knob and the top prongs around the delivery valve holder. Depress the lever to compress the plunger spring. While the spring

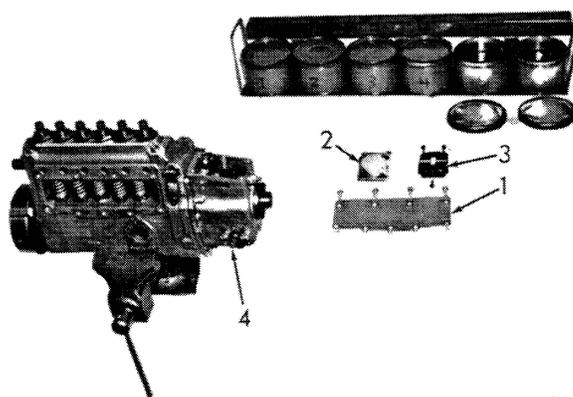


Fig. 1 Preparation for Disassembly
(T-53000)

1. Inspection Cover
2. Governor Top Cover
3. Operating Shaft Cover
4. Operating Shaft

is compressed, rotate the camshaft until each tappet assembly is positioned to allow access to the tappet knobs. With two narrow bladed screwdrivers, pry up the tappet knob. Use a needle nose pliers to remove the tappet spacer. (See Fig. 2).

While the spring is still compressed raise the tappet in the housing by rotating the camshaft and insert pin TSE 76156B in the tappet shell hole to hold the tappet assembly in raised position. For "B" or "Z" pumps, use tappet holder TSE 7693 ("B" pump) or TSE 7694 ("Z" pumps) curved side down beneath the lower spring seat instead of using pin.

5. Invert the pump in the vise.

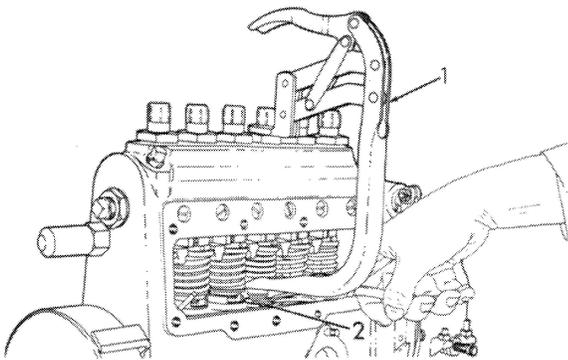


Fig. 2 Removal of Tappet Spacers
(T-53001)

1. Service Tool TSE 76159B
2. Tappet Spacer

6. Remove the base plugs from the pump housing with tool TSE 76157 and a 1/2" drive socket. Use plug wrench TSE 7675 for "B" and "Z" pump plugs.

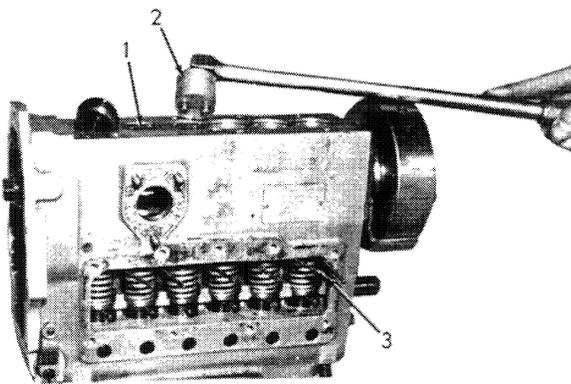


Fig. 3 Removal of Base Plugs
(T-53002)

1. Base Plug
2. Service Tool TSE 76157
3. Tappet Retaining Pin TSE 76156B

7. If lockwasher is used, loosen tabs with a sharp punch and, using spanner wrench TSE 7919 or box end wrench as needed, remove the large retaining nut from the friction clutch spring.

The camshaft is prevented from turning by use of coupling disc wrench TSE 7913 on the drive coupling tangs.

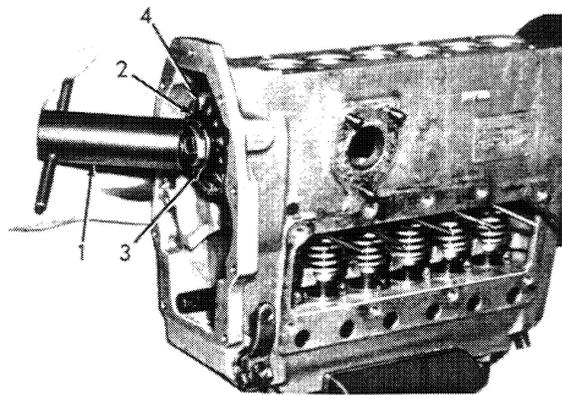


Fig. 4 Removal of Friction Clutch Nut
(T-53004)

1. Spanner Wrench TSE 7919
2. Lock Washer
3. Retaining Nut
4. Spring Disc

8. Remove the lockwasher, if used, spring discs, spacers and gear, noting the order of their removal.

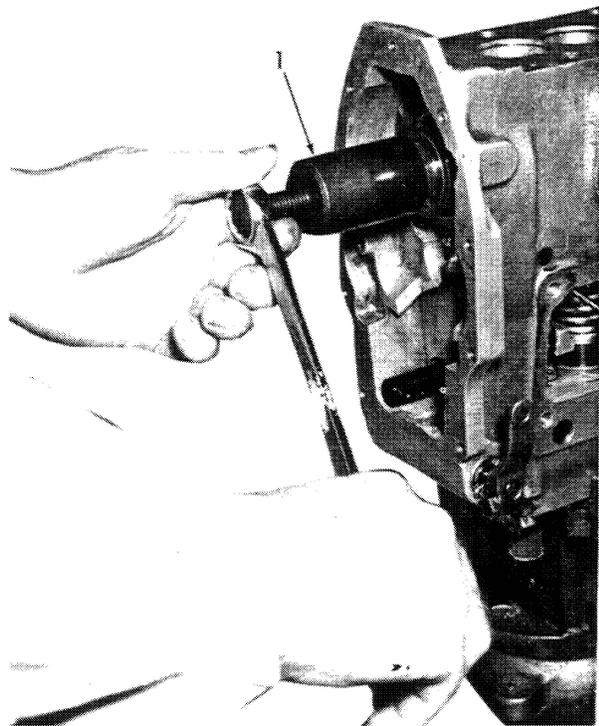


Fig. 5 Removal of Friction Clutch Hub
(T-53005)

1. Hub Puller TSE 7920

9. With hub remover TSE 7920 and a box end wrench, remove the friction clutch hub from the camshaft.
10. Using service tool TSE 7913 to hold the drive coupling, remove the retaining nut and lockwasher from the pump drive coupling.
11. Remove the coupling from the camshaft, using service tool TSE 7933. Remove the woodruff key.
12. Remove the timing pointer and front bearing retaining plate.

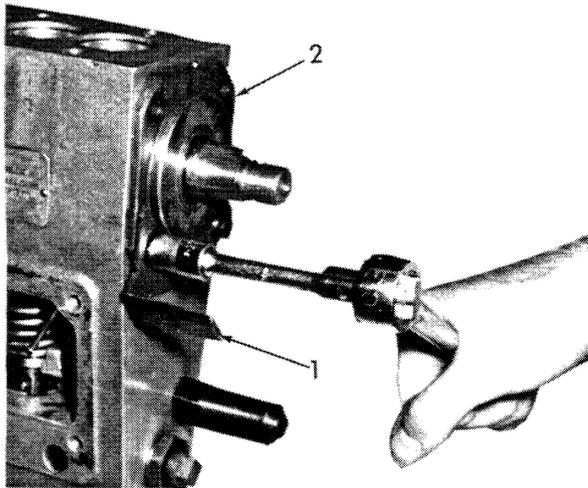


Fig. 6 Removal of Front Plate
(T-53007)

1. Timing Pointer
2. Bearing Retaining Plate

13. Loosen the four retaining screws on the rear camshaft bearing retaining plate.

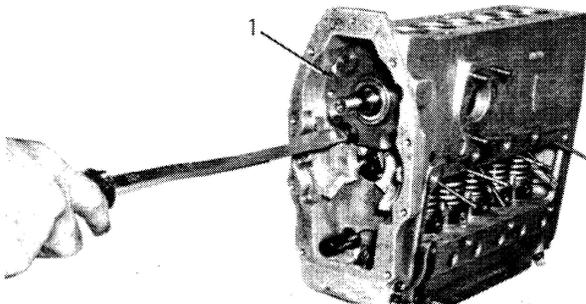


Fig. 7 Removal of Rear Plate
(T-53008)

1. Rear Camshaft Bearing Retaining Plate

14. Remove the two center bearing retaining screws.

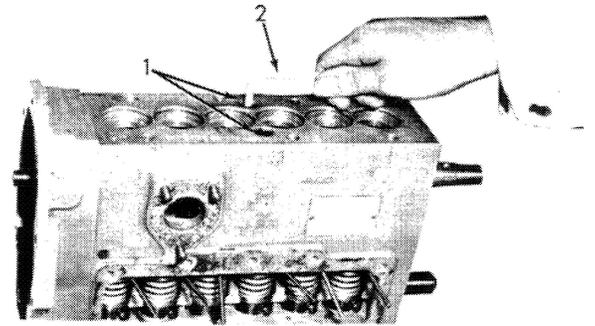


Fig. 8 Removal of Retaining Screws
(T-53009)

1. Camshaft Center Bearing Retaining Screws
2. Allen Wrench

15. Pry on the two center tappet shell retaining pins so that the tappets and rollers move away from the camshaft. This allows the camshaft assembly and center bearing to be withdrawn through the rear of the housing.

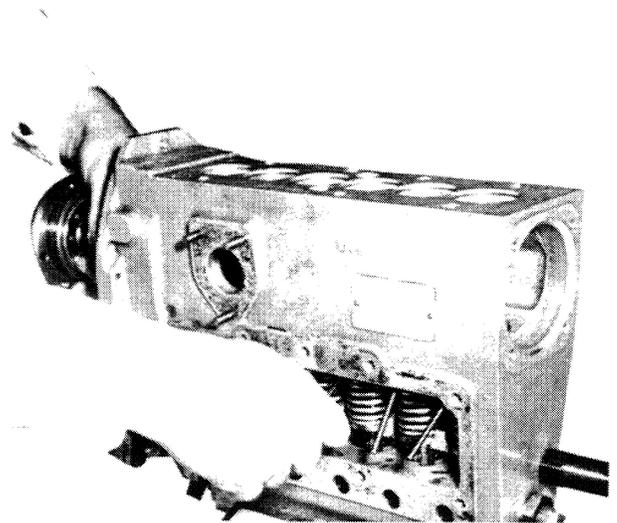


Fig. 9 Removal of Camshaft
(T-53010)

16. Compress the plunger springs and remove the retaining pins by screwing service tool TSE 76160 into the base plug holes and pressing on the tappet rollers with the curved end of the swinging bar.
17. Insert plunger puller TSE 7661 through the base plug holes. Grasp the tappet assembly by the roller with the mechanical fingers and lift through the base plug hole. Tappet lifter TSE 7697 may be used instead of plunger puller for this job.

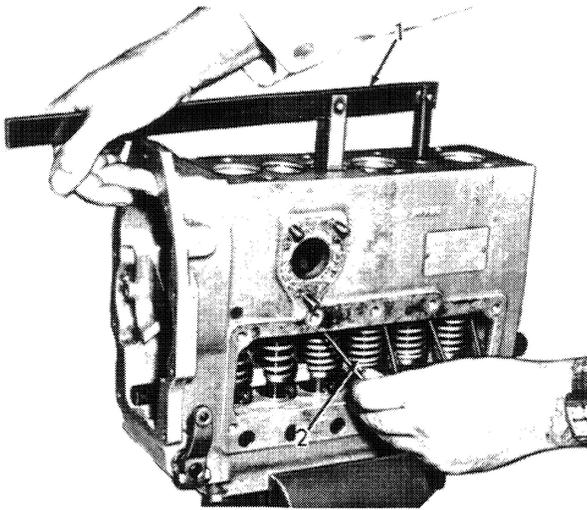


Fig. 10 Removal of Retaining Pins
(T-53012)

1. Tappet Compressing Tool TSE 76160
2. Tappet Retaining Pin

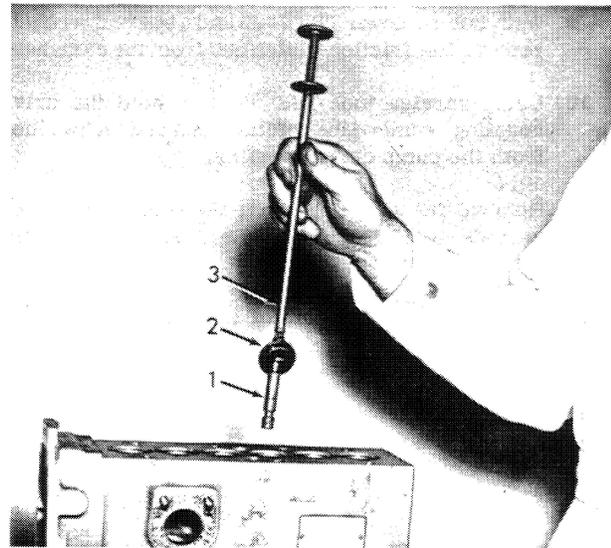


Fig. 12 Removal of Plungers
(T-53016)

1. Plunger
2. Lower Plunger Spring Seal
3. Plunger Puller TSE 7661

NOTE

Since the plunger and barrel are mated parts, it is mandatory that each be returned to its respective part. DO NOT touch the lapped portion of the plunger with the fingers, as this may initiate a corrosive action on the lapped surface.

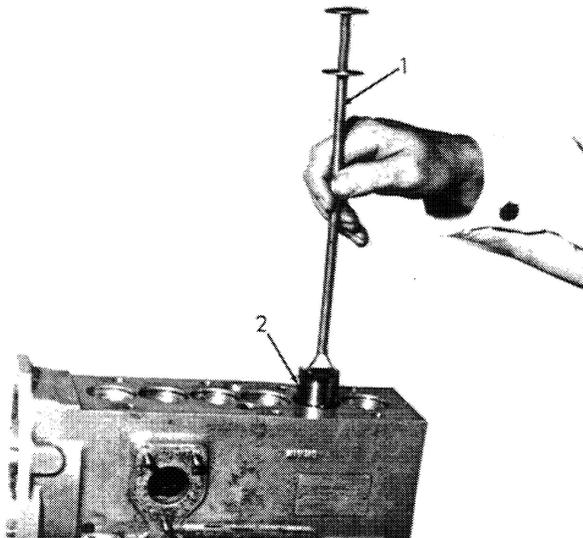


Fig. 11 Removal of Tappets
(T-53013)

1. Plunger Puller TSE 7661
2. Tappet Assembly

18. Use a screwdriver under the plunger control flange to lift the plunger enough to expose the end for the plunger puller to grasp. Again insert plunger puller TSE 7661 through the base plug holes and grasp the end of the plungers. Carefully withdraw the plunger and lower spring seat and place in the numbered pans.

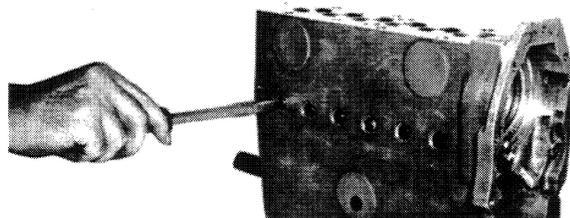


Fig. 13 Removal of Guide Screws
(T-53014)

19. Remove the tappet guide screws and washers.
20. Remove tappet guide screws. Withdraw the plunger springs through the base plug holes.
21. Remove the control sleeves and upper spring seats as units by raising them over the barrel and withdrawing them through the inspection window.

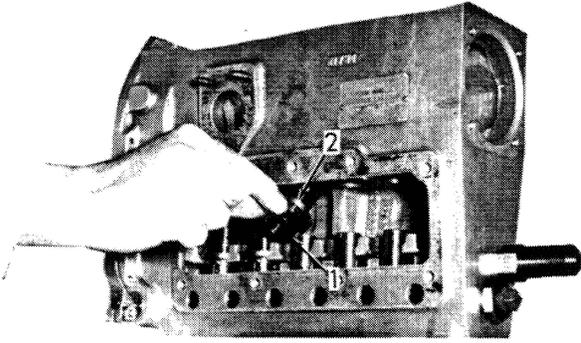


Fig. 14 Removal of Control Sleeves
(T-53017)

1. Control Sleeve
2. Upper Spring Seat

22. Return the pump housing to an upright position in the vise.
23. Remove the control rack protection cap and stop screw and carefully withdraw the control rack through the rear of the pump housing.
24. With a deep socket remove the delivery valve holder nut. Lift out the delivery valve holder and delivery valve spring.

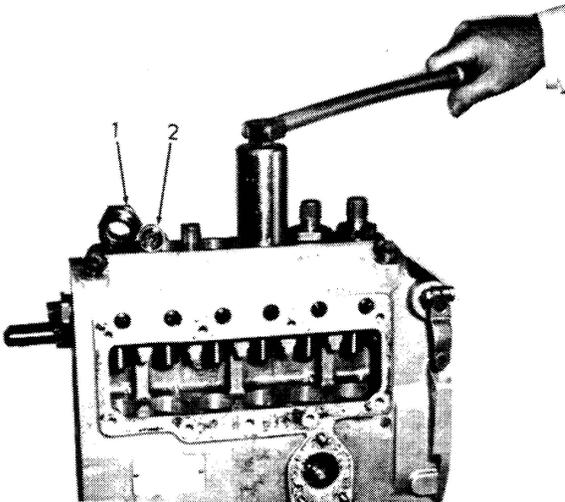


Fig. 15 Removal of Delivery Valve Nuts
(T-53018)

1. Delivery Valve Holder Nut
2. Delivery Valve Holder

25. Remove the delivery valve and delivery valve seat with service tool TSE 76196. These are mated parts and **MUST** be kept together.

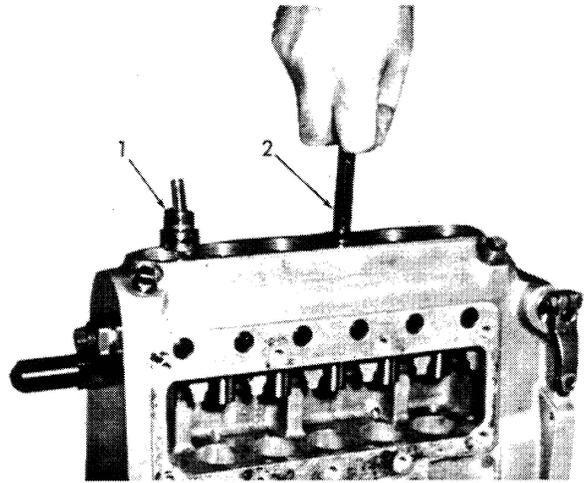


Fig. 16 Removal of Delivery Valve and Seat
(T-53019)

1. Delivery Valve Assembly
2. Delivery Valve Puller TSE 7699

26. Remove the barrel positioning screws and washers.

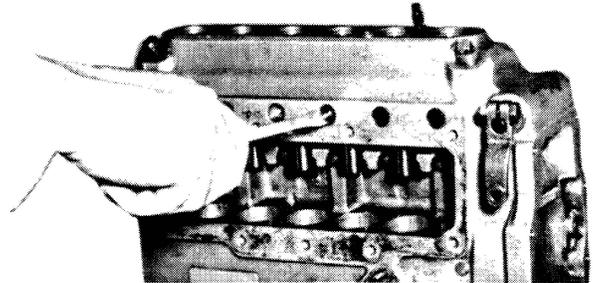


Fig. 17 Removal of Positioning Screws
(T-53020)

27. Lift out the barrels through the top of the pump. **MAKE SURE THE BARRELS ARE PUT WITH THEIR MATED PLUNGERS.**

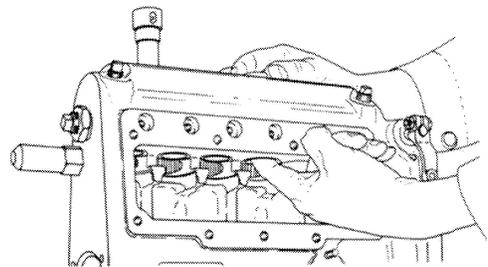


Fig. 18 Removal of Barrels
(T-53021)

28. Remove the oil baffle from the pumphousing.

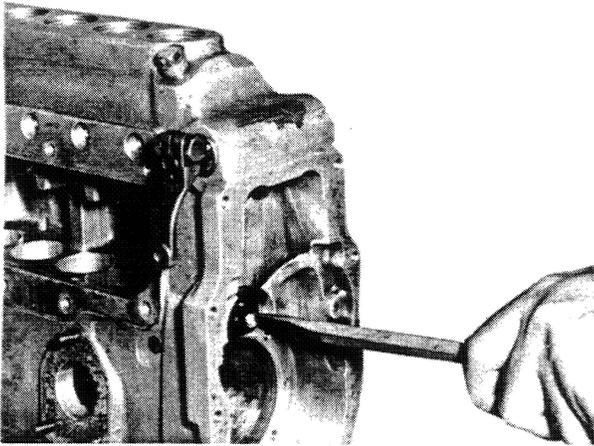


Fig. 19 Removal of Baffle
(T-53023)

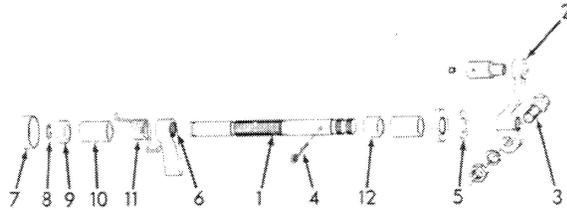


Fig. 20 Shut-off Shaft and Lever Assembly
(T-37230)

1. Shut-off Lever Shaft
2. Shut-off Lever
3. Clamping Screw
4. Cotter Pin
5. Lever Shaft Seal Washer
6. Stop Lever
7. Cap Plug
8. Snap Ring
9. Retaining Washer
10. Bushing
11. Stop Lever Spring
12. Spacer

29. If it is found necessary to remove the ball bearings from the camshaft, press them off the camshaft in the conventional manner on a suitable arbor press.
30. If it is found necessary to remove the shut-off shaft, Fig. 20 (1) scribe a line across the end of the shaft and the shut-off lever (2) and mark the position of the shaft when the shut-off plate is against the pump housing. Loosen the lever clamping screw and remove the lever from the shaft.
 - a. Remove cotter pin (4) from shut-off shaft (1).
 - b. Remove washer (5) from shaft.
 - c. Tap shaft to force out cap plug (7). Remove

snap ring (8) and washer (9) from plug side of shaft.

- d. Pull shaft (1) out lever side, and remove stop lever spring (11), stop lever (6) and spacer (12) from pump housing.
- e. If necessary, push bushing (10) on plug side toward center of housing until free.
31. If it is found necessary to remove control rack bushings, disassemble tool TSE 76150 and insert end into pump housing. Reassemble the pressing tool and press out either bushing. Push out other bushing from opposite end.

TOPIC 2 - GOVERNOR DISASSEMBLY

1. Scribe a line across the end of the operating lever shaft to coincide with the mark on the operating lever for correct positioning at reassembly. Remove the operating lever clamping screw and remove the lever from the shaft.
2. Remove the operating shaft dust covers and governor inspection cover.
3. Remove the four hex head governor end cap screws and carefully pry off the end cap.

For governors incorporating a ball bearing at rear of weight shaft, it is necessary to remove the

hex nut, ball bearing, spring seal and governor springs so that weight shaft assembly can be withdrawn from front of governor housing.

4. Remove all gaskets and clean the sealing surfaces.
5. Unscrew the four fastening screws from the bearing bridge plate and carefully pull the governor weight shaft assembly from the governor housing. Disengage the sliding sleeve from the fulcrum lever pins.
6. If, upon inspection, it is found necessary to dis-

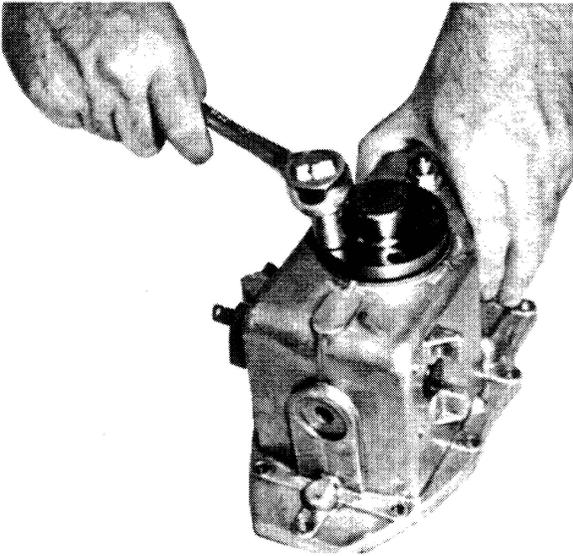


Fig. 21 Removal of End Cap
(T-53026)

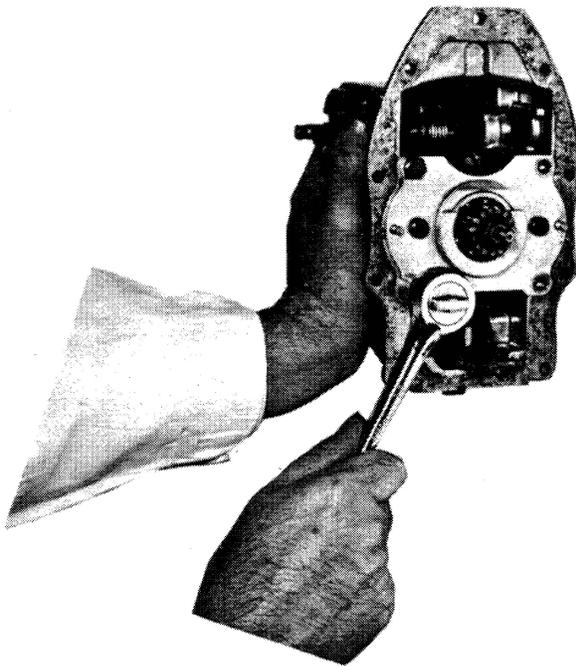


Fig. 22 Removal of Bridge Plate
(T-53028)

assemble the weight shaft assembly, proceed as follows. Refer to Fig. 23.

- a. Remove the weight lubricating plunger (1) and spring (2) from the gear end of the weight shaft.
- b. Straighten safety tab and remove nut (3), tab washer (4) and drive gear (5) from the shaft.

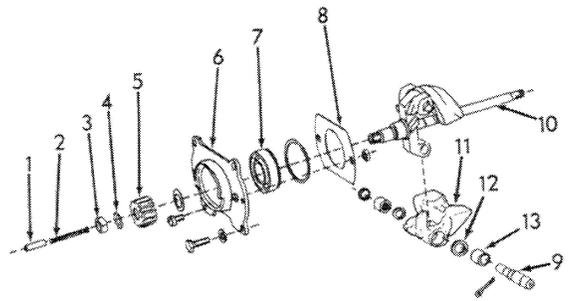


Fig. 23 Weight and Shaft Assembly
(T-37231)

1. Weight Lubricating Plunger
2. Weight Lubricating Plunger Spring
3. Gear Retaining Nut
4. Gear Retaining Nut Lockwasher
5. Drive Gear
6. Weight Shaft Bearing Bridge
7. Weight Shaft Ball Bearing
8. Bearing Retaining Plate
9. Weight Pin
10. Governor Weight Shaft
11. Weight Assembly
12. Bushing Spacer
13. Weight Bushing

- c. Use an arbor press to remove the shaft from the ball bearing and bridge plate assembly. The shaft should press out quite easily.
- d. Remove the ball bearing plate (8) and ball bearing (7) from the bridge plate (6).
- e. Use an arbor press to remove the pins from the weights and spider. If step pin and cotter pin are used, it is necessary to remove cotter pin and press the weight pin from the small diameter end.

CAUTION

Some pins have a larger diameter on one end than the other, so these pins must be pushed out ONE DIRECTION ONLY.

- f. With an arbor press and tool TSE-7937, press out the large inside diameter weight bushings from the weights. Use an old pin in the press to press out the bushing or needle bearing of smaller inside diameter from the weight.
7. Loosen the operating shaft setscrew.
8. Withdraw the operating shaft from the pump housing. This leaves the fulcrum lever assembly free to be removed from the governor housing.

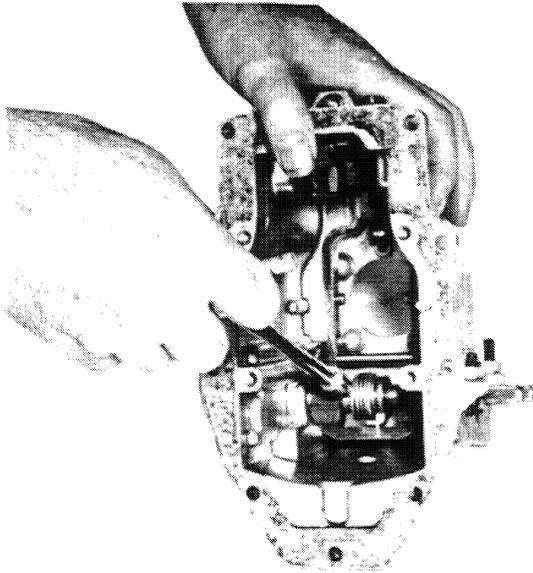


Fig. 24 Removal of Setscrew
(T-53029)

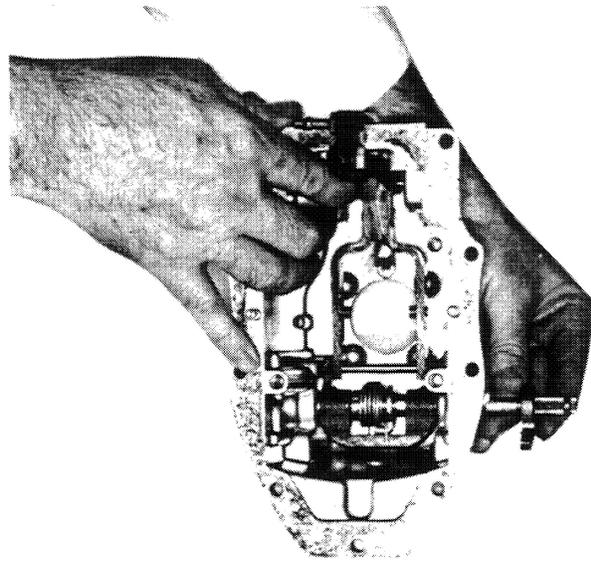


Fig. 25 Removal of Operating Shaft
(T-53030)

9. Examine the fulcrum lever assembly for evidence of wear or binding conditions. Completely disassemble it if there is any evidence of binding or wear.
10. If necessary, remove the operating lever shaft bushing and oil seal with service tool TSE 7936 from the governor housing. See Service Notes, Section 8 Page 2 for detailed procedure.
11. Remove the stop plate and bridge from the top of the governor housing.
12. The high and low idle adjusting screws and the bumper spring adjusting screws do not need to be removed unless damaged.

TOPIC 3 - INSPECTION OF PUMP PARTS

1. Examine the plungers and barrels with the aid of a magnifying glass for any sign of wear. Fine scratches, scuff marks or dull appearance indicate considerable wear and need for replacement. Invariably, this condition is caused by abrasives in the fuel. The owner should be advised to give immediate attention to the filtering system and quality of fuel oil used.

Since the plunger and barrel are mated parts, they cannot be replaced individually.

2. Examine the delivery valves and delivery valve bodies. The valve seats and the conical seating surfaces in the bodies should be free of scratches and scuff marks. If not the seats may be lapped together with fine lapping compound BM 10007. If gummy deposits prevent free movement of the valve in the body, use mutton tallow TSE 7723 and rotate the valve back and forth until the valve is free. Clean off all compound. Examine

the lapped surfaces of the plunger barrel and delivery valve that contact each other. If necessary, lap them on lapping plates with lapping compound BM 10007.

3. Place the delivery valve and body in checking device TSE 76197 (TSE 76118 for valves with copper gaskets, TSE 76116 for "B" pumps) and insert delivery valve spring. Tighten the top of the checking device to the torque specified for the delivery valve holder and connect the checking device to the nozzle tester. Pressurize to 2500 psi and inspect the checking device for leakage. If any is detected, repeat step 2 and test again.

NOTE

THE DELIVERY VALVE AND BODY ARE MATED PARTS, AND NOT SEPARATELY INTERCHANGEABLE.

4. Check the delivery valve holder and nut for freedom of movement in the housing threads and for any signs of damage.
5. If the delivery valve spring is not completely free of nicks or signs of wear (flat spots caused by coil clash or by the spring's rubbing inside of the delivery valve assembly), it must be replaced.
6. Always replace all gaskets.
7. Check the control rack and control sleeve gears for damage and wear.
8. Examine the control rack bushings and shut-off shaft bushings in the pump housing and replace if necessary. Check for freedom of movement (but no excessive play) of the control rack and shut-off shaft in their bushings.
9. If the plunger springs show nicks or signs of excessive wear, use new ones.
10. Check the tappet knob for excessive wear.
11. Inspect the spring seats for cracks. Inspect lower spring seat for wear caused by plunger knob.
12. Inspect the tappet assemblies for excessive play between the tappet shell and pin and between the roller and pin. Check for scoring of pin and roller bushing.
13. Clean the tappet assembly thoroughly. Inspect tappet knob for wear in excess of .002" inch.
14. Inspect the camshaft ball bearings for excessive play or roughness. If either of these conditions exist, the ball bearings must be replaced. Inspect the camshaft lobes for wear.
15. The center bearing of the camshaft and its journal must not be scored or show signs of excessive wear.
16. The front and rear camshaft oil seals should be replaced if not in like-new condition.
17. Examine all parts of the friction clutch assembly for wear. Lap spring side of gear face, if necessary, to obtain 4 RMS finish. Check with profilometer or standard roughness specimen kit (see tools).
18. Examine the pump housing for cracks, damaged threads or other conditions which might decrease pump efficiency and performance.
19. Replace lubricating oil baffle plate if the button end is worn.
20. Wash the pump housing in a good cleaning solvent and blow out all internal ducts with filtered dry air.
21. Replace any miscellaneous parts that appear to be damaged or worn to the extent that they will affect the performance of the pump.

TOPIC 4 - INSPECTION OF GOVERNOR PARTS

1. Replace all gaskets, "O" rings and oil seals during repair.
2. If any fastening screws or nuts are worn or damaged, replace them.
3. Examine the governor drive and driven gears for worn or broken teeth. The friction clutch is covered in the pump section of this manual.
4. The camshaft ball bearings must not have rough spots or excessive play if they are to be reused.
5. All springs must be free from nicks, rust spots and signs of corrosion.
6. Assemble the hub and torsion spring to the lower yoke arm of the fulcrum lever and insert the operating shaft (this is all done outside the governor housing). Holding the hub assembly secure, attempt to turn the fulcrum yoke radially. If there is evidence of radial movement, the torsion spring ends may be worn or the arm of the hub may be indented. Replacement of one or both parts may be required. Never attempt to salvage a spring by bending. To facilitate removal of the spring, use two pieces of high pressure tubing as handles on the spring ends.
7. Inspect the sliding sleeve assembly for wear in the grooves. The sliding sleeve thrust washer face must be free and not worn. Check the sliding sleeve bushing for wear.
8. The flyweights should move freely on the bushings and bearings, but not loosely.

NOTE

Teflon governor weights are useable until bushing wear exceeds .006".

9. Check all moving parts and bearing surfaces in the fulcrum yoke assembly. (This includes torque cam, bushings, pivot pins, control rack linkage and the link pin.)

- 10. The operating spring stop plate must be tight on the operating shaft.
- 11. The torque cam stop plate must not be worn and must be secure on the threaded stud and guide pin.
- 12. Wash the housing in a good cleaning solvent and blow it dry with filtered compressed air.
- 13. Replace any miscellaneous parts that are worn to the extent that they will affect the performance of the governor.

TOPIC 5 - INSPECTION OF FULCRUM LEVER

- 1. Refer to Figure 26. Examine for excessive play between the bracket (4) and fulcrum lever (7).
- 2. The adjusting screw (1) must turn freely in the bracket assembly (4).
- 3. Examine the roll pin in the adjusting screw (1) for wear at the point of contact with the spring plate (3).
- 4. Position the pivot pins (6) by means of the adjusting screw (1) in the mid position.
- 5. Check the fit of the bracket pin (8) with the fulcrum lever (7) and the bracket (10).
- 6. Check the pressure spring (9) for nicks or other possible damage.
- 7. Carefully examine the fulcrum lever assembly for any possible distortion.
- 8. There must not be excessive play between the pivot pins (6) and the slots in the sleeve assembly (5).

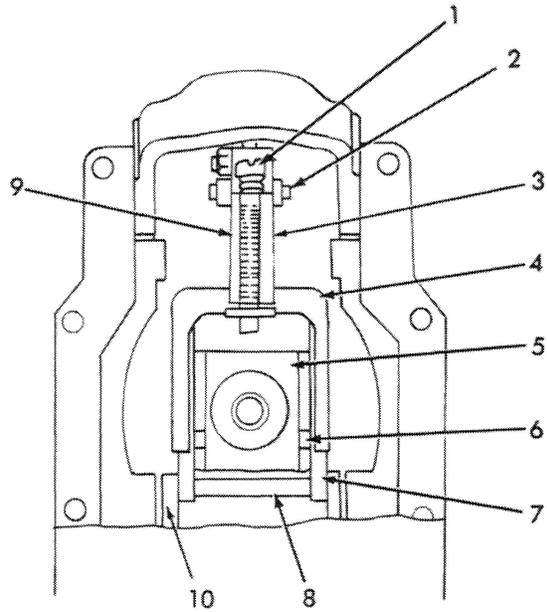


Fig. 26 Adjustable Fulcrum Lever (T-72725)

- | | |
|---------------------|--------------------|
| 1. Adjusting Screw | 6. Pivot Pins |
| 2. Roll Pin | 7. Fulcrum Lever |
| 3. Spring Plate | 8. Bracket Pin |
| 4. Bracket Assembly | 9. Pressure Spring |
| 5. Sleeve Assembly | 10. Bracket |