INDEX
545-B & 605-B WHEEL LOADERS SERVICE MANUAL SET FORM NO. 73061032

Service manual set is arranged in the following order	Individual manuals are also available in translation in form numbers listed below				
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Engine, 2900 Mark II	70687161	73111025	73111024	70668377	60406068	60406113
Turbocharger (Model T-04)	70687805	70679633	70679635	70679634		
Trans, Torque Converter, & Charging Pump	73059226	73061831	73061844		73063282	73063295
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Electrical System	73146366	73061834	73061847		73063285	73063298

The following additional Service Manuals, in English, are not included in the Manuals set, but may be ordered from a Fiatallis dealer.

Injection Nozzles and Holders..... 70682797
Injection Pump (Simms).....70681649

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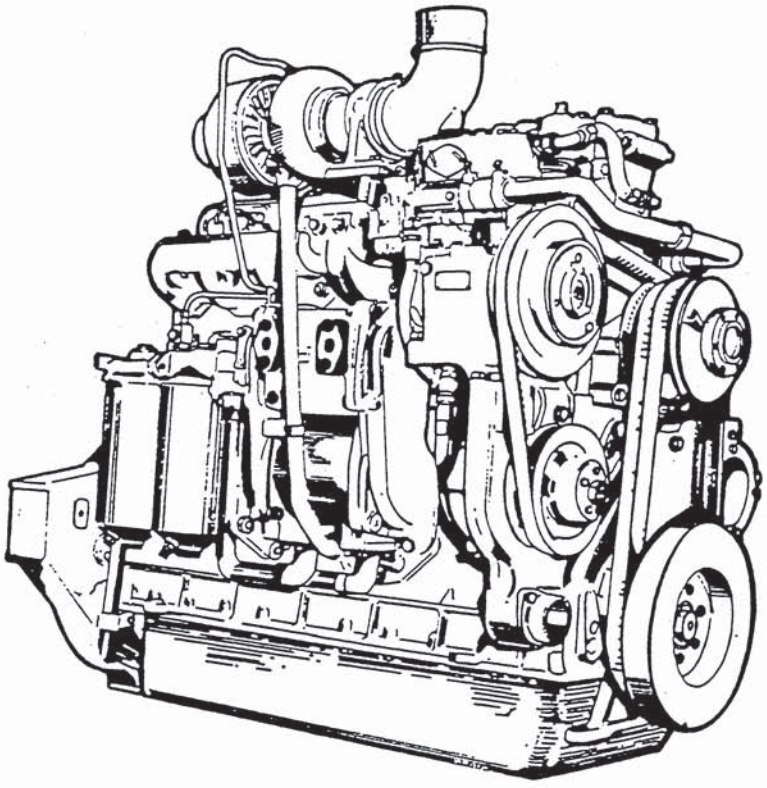
545-B & 605-B WHEEL LOADER | SERVICE MANUAL SET | FORM 73061032

FIATALLIS®

2900 MARK II

ENGINE

service manual



Form 70687161 English
3/89

2900 MARK II

ENGINE

service manual

FORM 70687161 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.

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.

TOPIC INDEX

TOPIC 1 - DESCRIPTION AND SPECIFICATIONS

1.1 DESCRIPTION

1.1.1 GENERAL

1.1.1.1
The engine covered in this manual is a six cylinder, vertical in-line, four cycle, water cooled, open combustion chamber, direct injection, full diesel.

1.1.1.2
Fuel is supplied to the cylinders by a fuel injection pump. The pump delivers accurately metered quantities of fuel, under high pressure, through fuel injection nozzles, into the cylinders at a definite timing in relation to the engine firing cycle. The fuel is ignited by heat generated by compression of the air in the cylinders.

1.1.1.3
A combustion chamber is located in the head of each piston and the fuel injection nozzles are mounted in the cylinder head. The orifices in the tip of the nozzle are drilled at a slight angle so that the fuel is sprayed directly into the combustion chamber. The shape of the combustion chamber and the angle of fuel injection, causes extreme turbulence of the air within the cylinders and results in the fuel and air being thoroughly mixed for complete combustion.

1.1.1.4
The engines are full pressure lubricated by a gear type oil pump driven by an integral gear on the camshaft. Engine cooling is accomplished by coolant, forced through the engine cooling and radiator system by a centrifugal type water pump. The water pump is belt driven.

1.1.2 PRINCIPLES OF OPERATION

In a four cycle diesel engine, a power stroke is made by each piston for every two complete revolutions of the crankshaft. The sequence of the strokes is as follows: intake, compression, power, and exhaust.

1.1.2.1 INTAKE STROKE

As the piston moves downward on the first, or intake stroke, air enters the cylinder through the air intake manifold, and the intake valve which starts to open a few degrees before the piston reaches top dead center. The intake charge consists of air only, with no fuel mixture.

1.1.2.2 COMPRESSION STROKE

Shortly after the piston starts to move upward on the second, or compression stroke, the intake valve closes. The air is compressed in the cylinder and compression of the air raises the temperature in the cylinder to approximately 1000°F. (537°C). At the proper moment during the compression stroke, a metered quantity of fuel is injected into the combustion chamber under extremely high pressure. The finely atomized fuel is ignited by heat of the compressed air and starts to burn immediately.

1.1.2.3 POWER STROKE

Expansion of the burning gases forces the piston downward on its third, or power stroke. Near the bottom of the power stroke, the exhaust valve starts to open.

1.1.2.4 EXHAUST STROKE

As the piston moves upward on the fourth, or exhaust stroke, the exhaust valve is open and burned gases are forced out of the cylinder by the upward travel of the piston. A few degrees before the piston reaches top dead center, the intake valve starts to open to admit a fresh charge of air to the cylinder. A few degrees after top dead center the exhaust valve completely closes and the cycle is repeated.

1.2 SPECIFICATIONS

1.2.1 ENGINE DATA AND CHARACTERISTICS

Number of Cylinders - - - - - - - - - - - - - - - 6
Bore - - - - - - - - - - - - - - - 3.875" (98,42mm)
Stroke - - - - - - - - - - - - - 4.250" (107,95mm)
Total Displacement - - - 301 cu. in. (4933cm^3)
Crankshaft Rotation (Viewed from Fan End) - - - - - - - - - - - - - - - - - Clockwise
Number of Main Bearings - - - - - - - - - - - - 7
Compression Ratio (Nominal) - - - - - 16.25:1
Compression Pressure (Minimum) at Sea Level 600 rpm hot - 500 psi (35,15 kg/cm^2)
Firing Order - - - - - - - - - - - - - - 1-5-3-6-2-4
Minimum Stabilized Water Temperature - - - - - - - - - 180° F. (82° C.)
Maximum Permissible Exhaust Restriction - - - - - - - - - - 2" Hg (50,8mm)

1.2.2 FUEL INJECTION

Nozzle Holder Assembly Mfr. - Allis-Chalmers
Fuel Injection Pump Mfr. - - - - - - - - - Simms
Nozzle Type - - - - - - - - Spring Loaded, Four Hole Orifices
Opening Pressure - - - - - - - - 3450 - 3500 psi (242 - 246 kg/cm^2)
Orifice Size - - - - - - - - - - 0,32mm (0.0126")
Fuel Pump Timing to Engine - - - - - - - - - - - - - 26° B. T. D. C.
Fuel Injection Pump Speed (Ratio to Crankshaft) - - - - - - - - - - - - - .5:1

1.2.3 VALVE DATA AND TIMING

1. Valve Lash Adjustment:
   Intake Valve
   Clearance - - - - - .015" (0,381mm) Hot
   .018" (0,457mm) Cold
   Exhaust Valve
   Clearance - - - - - .015" (0,381mm) Hot
   .018" (0,457mm) Cold

2. Valve Timing
   Exhaust Valve (with .0195" - 0,495mm tappet clearance):
   Opens BBDC - - - - - - - - - - - - - - 56°
   Closes ATDC - - - - - - - - - - - - - - 16°
   Duration - - - - - - - - - - - - - - - - - 252°

   Intake Valve (with .0195" - 0,495mm tappet clearance):
   Opens BTDC - - - - - - - - - - - - - - 20°
   Closes ABDC - - - - - - - - - - - - - - 48°
   Duration - - - - - - - - - - - - - - - - - 248°
   Overlap - - - - - - - - - - - - - - - - - 36°

CAUTION

Tappets must be set with .0195" (0,495mm) clearance to obtain proper valve opening and closing in degrees tabulated for the camshaft. Do not confuse this setting with valve lash adjustment data.

1.2.4 LUBRICATION

Type - - - - - - - - - - - - - - - - - - - Full Pressure
Lubricating Oil Filter - - - - - - - - - Full Flow
Lubricating Oil Specifications - - "Service CD" or "Series 3"
Oil Pump Speed (Ratio to Crankshaft) - - - - - - - - - - - - - .5:1

1.2.5 ENGINE SPEEDS

For specified high and low idle engine speeds, refer to the Operator's Manual furnished with the unit.

TOPIC 2 - COOLING SYSTEM

2.1 GENERAL

2.1.1
The engine cooling system includes the water pump, radiator, oil coolers, thermostat, thermostat housing, coolant filter, coolant temperature gauge, and water passages in the cylinder block and cylinder head.

2.1.2
A double acting valve is provided in the radiator filler cap for relieving air pressure due to heat expansion and allowing atmospheric pressure to enter when cooling contraction occurs.

2.1.3
The water pump draws coolant from the bottom of the radiator and circulates it thru the water passages in the cylinder block and cylinder head. The coolant is discharged from the cylinder head through the thermostat housing and radiator inlet hose into the upper part of the radiator. As the coolant passes from the top to the bottom of the radiator, the coolant dissipates its heat to the atmosphere by air pushed thru the radiator core by the cooling fan.

2.2 RADIATOR

2.2.1 GENERAL

The radiator, Fig. 1, consists of a top and bottom tank, core, and side members bolted together and serviced separately. The radiator is bolted to the radiator support which is bolted to the loader main frame.

2.2.2 RADIATOR REMOVAL AND INSTALLATION

2.2.2.1
Drain the cooling system; refer to Operator's Manual for detailed information.

2.2.2.2
Loosen hose clamps attaching the radiator top hose, Fig. 2 (4), and bottom hose (3) to the radiator and remove hoses from radiator.

2.2.2.3
Remove radiator grill and fan guard, Fig. 2 (5). Remove capscrews, lockwashers, and plain washers attaching the radiator to the radiator support and remove the radiator and shroud as an assembly.

2.2.2.4
Install radiator by direct reversal of removal procedure. Fill radiator to the proper level.

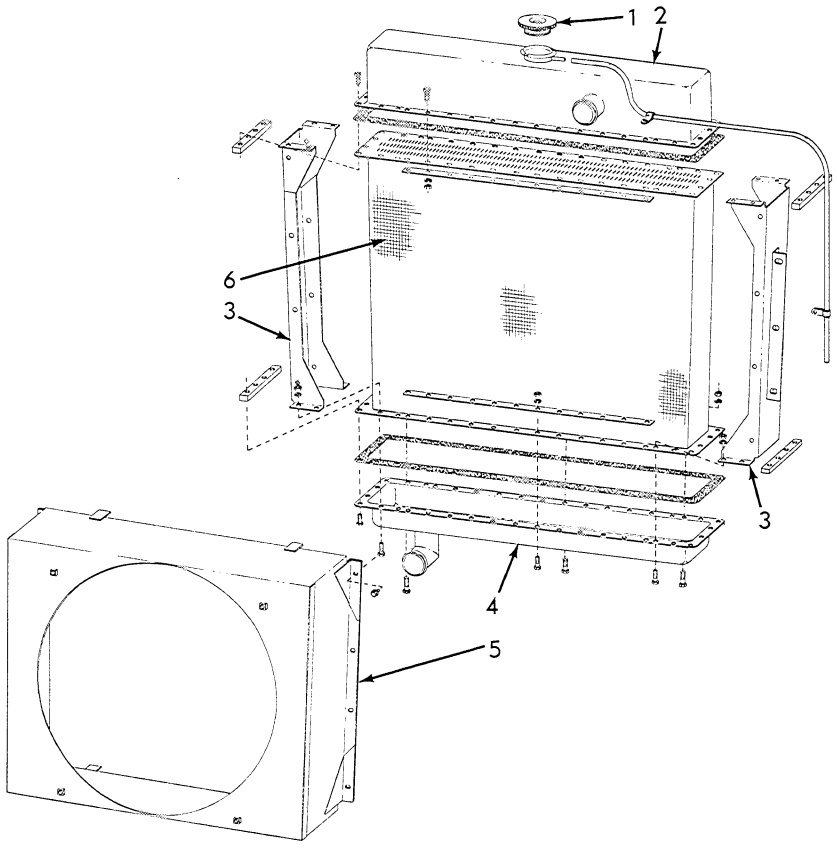


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FIG. 1 RADIATOR

1. Radiator cap
2. Top tank
3. Side members
4. Bottom tank
5. Radiator shroud
6. Core

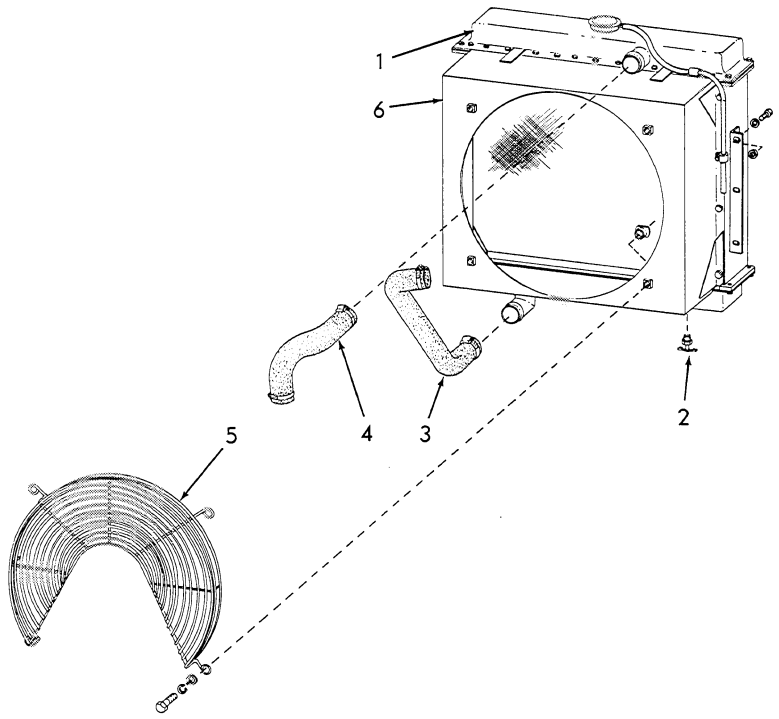

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FIG. 2 RADIATOR ASSEMBLY

1. Radiator
2. Drain cock
3. Bottom hose
4. Top hose
5. Fan guard
6. Shroud

2.2.3 RADIATOR INSPECTION AND REPAIR

2.2.3.1
Thoroughly clean exterior of radiator removing all foreign material from between cooling core tubes and fins. Be careful not bend the fins. Straighten any fins that are bent.

2.2.3.2
Inspect radiator for clogging or leakage. Test radiator under water with approximately 5 psi (0,351 kg/cm^2) of air pressure. Note the source of the air bubbles and solder any leaks. Be sure to wash off the acid after soldering as the acid will eat into the tubes if not washed off. The radiator should be repaired only by qualified personnel.

2.2.3.3
Inspect the hoses for deterioration or damage. Replace if necessary.

2.3 FAN, FAN BELTS, FAN SPACER, AND FAN PULLEY

2.3.1 GENERAL

The engine is equipped with a pusher type fan. The fan pushes air thru the radiator and the engine coolant is cooled as it circulates from the top to the bottom of the radiator core. The fan, fan spacer, and pulley are bolted to the pulley hub which is pressed on the water pump shaft. The fan and water pump are driven from the crankshaft pulley by a pair of matched V type belts.

2.3.2 FAN BELT ADJUSTMENT

The belts are properly adjusted when they can be pressed inward by hand .50" (12, 7mm) at a point halfway between alternator and crankshaft pulleys. Refer to Fig. 3 and proceed to adjust belts as follows:

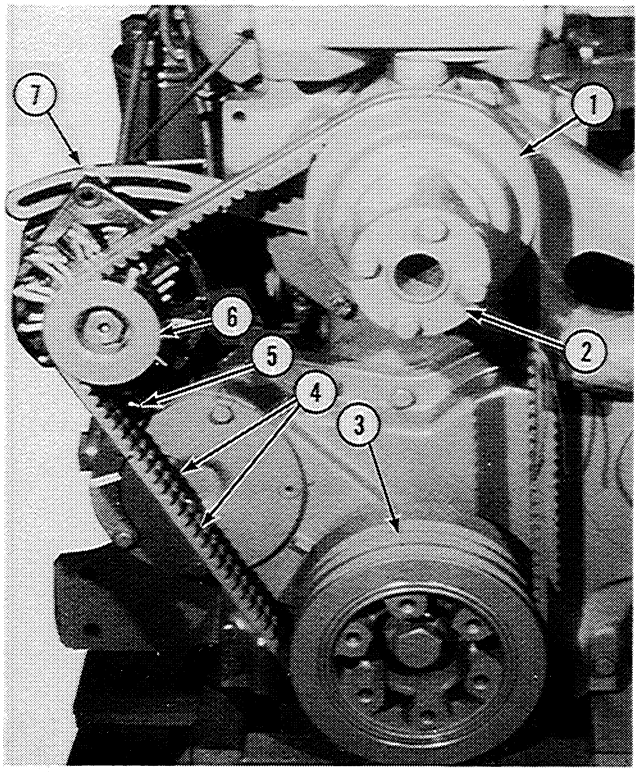

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FIG. 3 FAN BELT ADJUSTMENT

1. Water pump pulley
2. Fan spacer
3. Crankshaft pulley
4. Belts
5. Alternator supporting bracket capscrew
6. Alternator pulley
7. Adjusting brace capscrew

2.3.2.1
Loosen adjusting brace capscrew (7) and supporting bracket capscrew (5).

2.3.2.2
Move alternator in or out to obtain required belt tension; then tighten capscrews securely.

2.3.3 FAN BELT REMOVAL, INSPECTION, AND INSTALLATION

2.3.3.1
Remove fan guard, Fig. 2 (5); loosen capscrews, Fig. 3 (7) and (5). Push alternator in, and remove belts from alternator pulley. Slip belts from crankshaft pulley then over fan blades and remove the belts.

2.3.3.2
Inspect belts for excessive slickness, oilsoak, wear, tears, cracks and overstretching. The belts are a matched pair. If only one belt replacement is required, both belts must be replaced to assure satisfactory belt performance.

2.3.3.3
Install belts by a direct reversal of the removal procedure and adjust the belts; refer to 2.3.2.

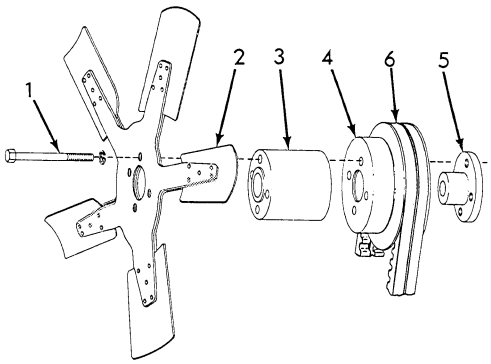

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FIG. 4 FAN, FAN SPACER, AND FAN PULLEY

1. Capscrew
2. Fan
3. Fan spacer
4. Water pump pulley
5. Pulley hub
6. Fan belts

2.3.4 FAN, FAN SPACER, AND FAN PULLEY, INSPECTION AND INSTALLATION

Fan blades seldom require service. However, bent blades are conducive to inefficient cooling and will affect the balance of the fan causing water pump bearing damage. In case of damage, the fan should be removed and the blades restored to their original contour (check by comparing with a new undamaged fan) or replace with a new fan. For removal of the fan, fan spacer, and fan pulley, proceed as follows:

2.3.4.1
Remove fan guard, Fig. 2 (5); loosen capscrews, Fig. 3 (7) and (5). Push alternator in to relieve tension on fan belts.

2.3.4.2
Remove capscrews, Fig. 4 (1), and lockwashers securing fan and fan spacer to pulley hub; remove fan (2) and fan spacer (3).

2.3.4.3
Slip fan belts off pulley (4) and remove pulley.

2.3.4.4
Inspect fan for cracks, loose rivets, or bent blades. Repair or replace if necessary.

2.3.4.5
Inspect fan spacer (3), and pulley for wear or damage. Replace if necessary.

2.3.4.6
Position pulley (4) on hub (5); position belts in pulley grooves.

2.3.4.7
Install fan spacer and fan, securing with capscrews and lockwashers. Tighten capscrews to a torque of 30 to 35 lbs.ft. (4,14-4,83 kg/m).

2.3.4.8
Adjust the fan belts; refer to 2.3.2.

2.4 THERMOSTAT

2.4.1 GENERAL

The thermostat, located in housing on upper front of engine, limits circulation of coolant to engine circulation system only until engine reaches normal operating temperature. Thermostat then maintains correct operating temperature by circulating some coolant through radiator. If engine overheats or does not reach and maintain normal operating temperature, thermostat should be removed and tested as a possible cause of trouble.

2.4.2 THERMOSTAT REMOVAL, TESTING, AND INSTALLATION

2.4.2.1 THERMOSTAT REMOVAL (Fig. 5)

2.4.2.1.1
Drain cooling system.

2.4.2.1.2
Remove two capscrews securing water outlet flange (1) to thermostat housing and remove gasket (2) and flange.

2.4.2.1.3
Remove thermostat; clean and inspect housing and examine gasket. If leakage between thermostat housing and head is evident, remove housing and replace gasket (5).

2.4.2.2 THERMOSTAT TESTING

2.4.2.2.1
Suspend thermostat in a pan of clean water so that thermostat is completely immersed.

2.4.2.2.2
Gradually heat the water and use an accurate thermometer to check the temperature of the water.

NOTE: Stir water during this procedure so that heat is evenly distributed in the volume of water.

2.4.2.2.3
Observe thermostat as temperature of water approaches 180°F. (82°C). If thermostat is functioning properly it should begin to open at 180°F. (82°C) and be fully open at 200°F. (93°C).

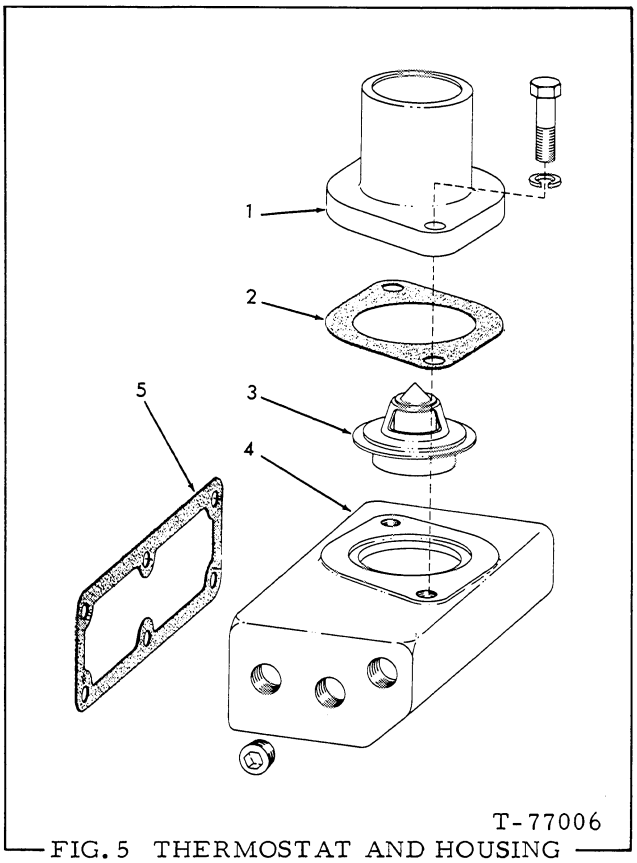

FIG. 5 THERMOSTAT AND HOUSING

1. Water outlet flange
2. Flange gasket
3. Thermostat
4. Thermostat housing
5. Housing gasket

NOTE: The thermostat is not adjustable and if it does not open within the above limits it must be replaced.

2.4.2.3 THERMOSTAT INSTALLATION(Fig. 5)

2.4.2.3.1
Place thermostat in position in housing with side stamped "TOWARD RADIATOR" facing radiator.

2.4.2.3.2
Place water outlet flange and gasket in position on thermostat housing and secure with capscrews and lockwashers.

2.4.2.3.3
Fill cooling system.

2.5 OIL COOLERS

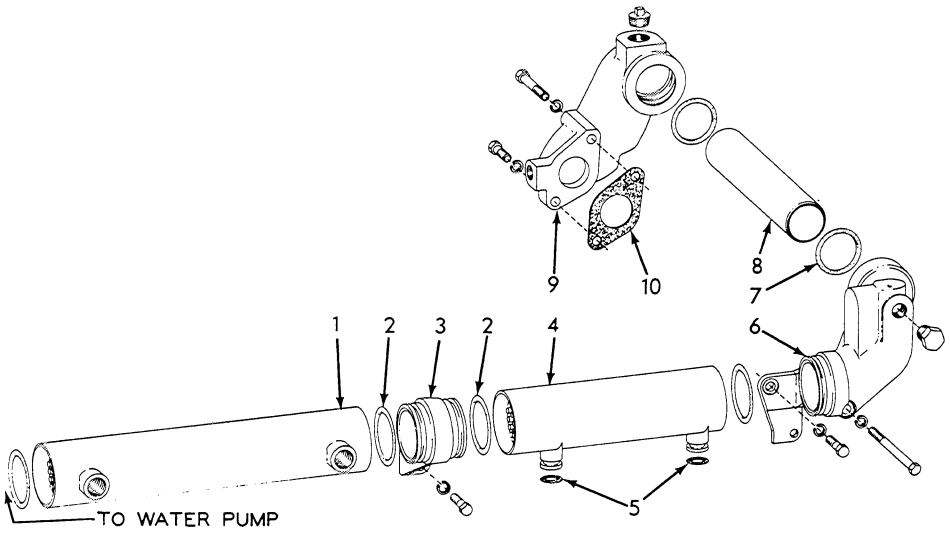

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FIG. 6 OIL COOLERS

1. Transmission oil cooler
2. O-rings
3. Supporting bracket
4. Engine oil cooler
5. O-rings
6. Elbow
7. O-rings
8. Cross-over tube
9. Elbow
10. Gasket

2.5.1 GENERAL

2.5.1.1
Located on the left side of the engine directly behind, and connected to the water pump is the transmission oil cooler, Fig. 6 (1). Directly behind the transmission oil cooler is the engine oil cooler (4). Each cooler consists of a bundle of corrosion resistant cooling tubes and a shell. The water pump circulates coolant through the tubes and the respective oil pumps circulate oil through the shell around the outside of the tubes, controlling oil temperature.

2.5.1.2
If engine and transmission oils are not serviced as recommended, dirt may build up in the cooler shells and restrict flow of oil around the cooling cores. It is absolutely necessary that the oil coolers be kept clean for proper oil cooling.

2.5.2 OIL COOLER REMOVAL AND INSTALLATION

2.5.2.1
Drain cooling system.

2.5.2.2
Close coolant filter inlet shut-off valve, Fig. 9 (3), and disconnect inlet tube (4) from elbow, Fig. 6 (9). Remove capscrews and lockwashers attaching elbow to cylinder block and remove elbow and cross-over tube (8) as an assembly. Remove gasket (10).

2.5.2.3
Remove engine lube oil filters from filter head. Remove capscrews, lockwasher, and plain washers attaching filter head and manifold to cylinder block. Pull down on filter head and manifold assembly to free it from engine oil cooler, Fig. 6 (4), and remove assembly from cylinder block.

2.5.2.4
Disconnect air compressor coolant supply line from elbow. Remove capscrews and lockwashers attaching elbow, Fig. 6 (6), to cylinder block and remove elbow and engine oil cooler (4) as an assembly. Separate elbow (6) from cooler (4).

2.5.2.5
Disconnect transmission inlet and outlet lines from transmission oil cooler (1). Remove cap-

screws and lockwashers attaching bracket (3) to cylinder block and remove bracket and transmission oil cooler (1) as an assembly. Separate cooler (1) and bracket (3).

2.5.2.6
After cleaning and inspecting oil coolers, install oil coolers and oil filters in reverse order of removal. Use new O-rings and gaskets wherever they are used.

2.5.3 OIL COOLER CLEANING

2.5.3.1
To function efficiently the oil cooler shell and tubes must be kept as clean as possible. Scale and sludge deposits reduce the cooling capacity of the oil cooler. Whenever an oil cooler is removed from the engine or if the efficiency of the cooler is impaired due to an accumulation of sludge or scale the oil cooler should be cleaned.

2.5.3.2
In many repair shops and service departments, caustic compounds are used to clean grease, dirt, paint, gasket remnants, etc., off parts. These compounds are very effective and very useful when used properly, but can cause considerable damage to certain materials.

2.5.3.3
Materials such as aluminum, rubber, fiber, sintered bronze and bonding agents are particularly sensitive to all highly concentrated caustic cleaners. There are many of these cleaning compounds on the market, under various trade names, but the majority of them are based on the same active agent - sodium hydroxide. Steam "jenny" compounds also generally contain this agent.

2.5.3.4
Some current oil coolers and radiators are being manufactured with aluminum fins. A few cleaning solutions have been found to react with aluminum to the extent of dissolving the metal.

2.5.3.5
We recommend the Trichlorethylene solvent or equivalent be used for both internal and external cleaning of oil coolers and radiators used in Allis-Chalmers units since there is no reaction between the aluminum and the solvent.

CAUTION

Trichlorethylene solvent is toxic and very volatile. Use only in a well ventilated room or area. Do not inhale the fumes for any length of time.

2.5.3.6
In all cleaning operations care should be taken in the selection of cleaning materials. When any doubt exists as to whether or not caustic compounds would damage the materials to be cleaned, the use of such compounds should be avoided.

2.5.4 OIL COOLER TESTING

2.5.4.1
Using a pipe plug, where applicable, or an improvised seal, such as a metal plate, rubber gasket and a clamp, seal either the fluid inlet or outlet opening in the oil cooler shell and attach an air pressure hose to the other opening.

2.5.4.2
Submerge the oil cooler in water heated to approximately 180°F. (82°C) and allow sufficient time for oil cooler to warm up, then test for leaks using air under pressure of 100 psi (7,03 kg/cm^2), or as near that pressure as possible.

2.5.4.3
Air bubbles observed at either open end of the oil cooler indicate that a cooling core tube may have a puncture or be defective in another way. If cooling core is faulty, the oil cooler must be replaced. If repair of oil cooler shell is necessary, the repair should be made by a reputable radiator repair shop.

2.6 WATER PUMP

2.6.1 GENERAL

A centrifugal type water pump is provided for circulating coolant through the engine and radiator. The water pump is mounted on the front of the cylinder block and is belt driven from the crankshaft pulley. Coolant is drawn through the inlet opening and forced through the outlet opening through the oil cooler, around the rear of the engine and into the cylinder block.

The water pump shaft and bearing assembly is sealed and does not require lubrication.

2.6.2 WATER PUMP REMOVAL

2.6.2.1
Drain cooling system.

2.6.2.2
Remove fan, fan spacer, and fan pulley; refer to 2.3.4.

2.6.2.3
Remove capscrews and lockwashers attaching water outlet flange, Fig. 5 (1), to thermostat housing (4); free flange from housing and remove gasket (2).

2.6.2.4
Remove capscrews and lockwashers attaching thermostat housing to mounting plate. Pull up on thermostat housing to free adapter, Fig. 7 (8), and remove thermostat housing. Disconnect air compressor coolant return line from thermostat housing.

2.6.2.5
Disconnect bottom radiator hose, Fig. 2 (3) from water pump. Remove capscrews and lockwashers securing water pump and remove water pump and gasket, Fig. 7 (7).

2.6.3 WATER PUMP DISASSEMBLY, INSPECTION, AND ASSEMBLY

2.6.3.1 DISASSEMBLY

2.6.3.1.1
Using a suitable puller or press remove pulley hub, Fig. 8 (5).

2.6.3.1.2
Place water pump assembly in a press, impeller end up. Make certain pump body is well supported and press on end of shaft until shaft and bearing is pressed out of the pump body. Remove impeller (6) and ceramic seat (2) as an assembly from the pump body.

2.6.3.1.3
If required, drive seal (3) from water pump body and pry ceramic seat (2) from impeller.

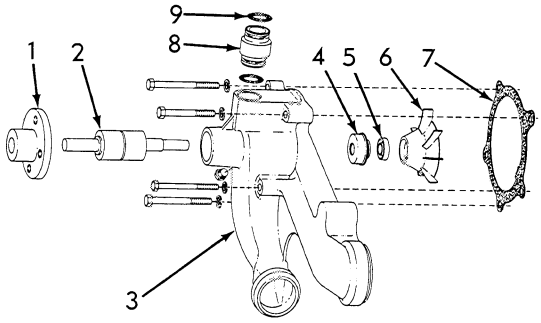

FIG. 7 WATER PUMP

1. Pulley hub
2. Shaft and bearing
3. Water pump body
4. Water pump seal
5. Ceramic seat
6. Impeller
7. Water pump gasket
8. Adapter to thermostat housing
9. O-ring

2.6.3.2 INSPECTION

2.6.3.2.1
Check shaft and bearing assembly by rotating the bearing. If the bearing is binding, running dry from lack of lubricant, or feels rough, the shaft and bearing assembly must be replaced.

CAUTION

Do not clean shaft and bearing assembly in cleaning solvent.

2.6.3.2.2
Check ceramic seat, Fig. 8 (2). If it is rough, cracked, or chipped replace the ceramic seat.

2.6.3.2.3
Thoroughly clean pump body with solvent.

2.6.3.2.4
Check bearing bore in pump body. The specfied I. D. of the bore is 1.498" -- 1.499" (38,05 -- 38,07 mm). If bore is worn, or pump body is cracked, it must be replaced.

2.6.3.2.5
Replace water pump seal, Fig. 8 (3).

2.6.3.3 ASSEMBLY

2.6.3.3.1
Position pump body in a press, impeller side up. Apply No. 3 Permatex, or equivalent to portion of seal, Fig. 8 (3) which is pressed into pump body. Press seal into pump body. Do not press on spring loaded face of seal;

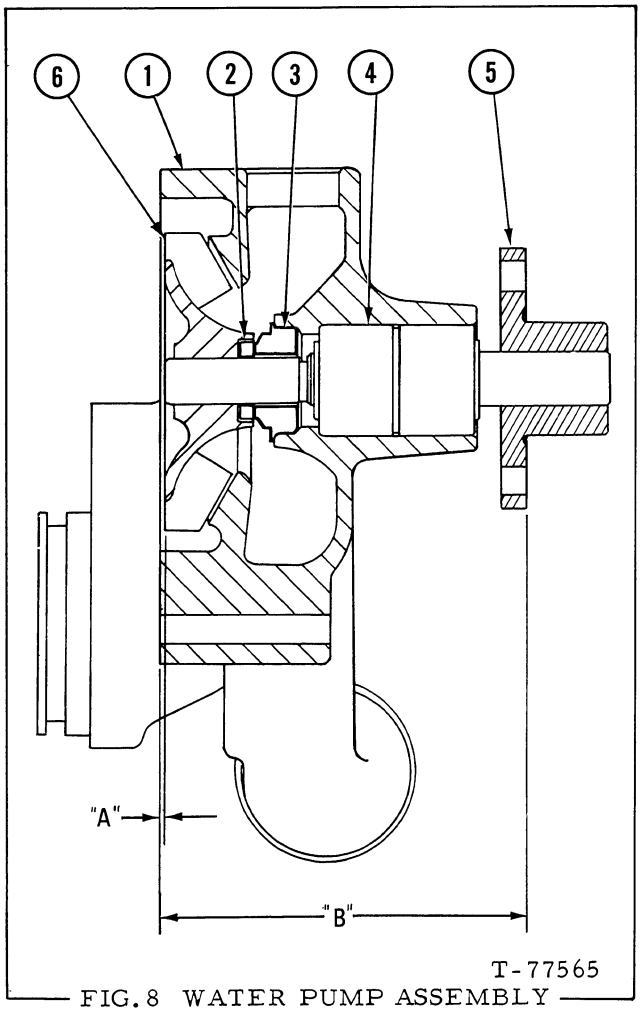

FIG. 8 WATER PUMP ASSEMBLY

1. Water pump body
2. Ceramic seat
3. Water pump seal
4. Shaft and bearing
5. Pulley hub
6. Impeller

Dim. "A" .034" -- .039" (0,863 -- 0,991mm)
Dim. "B" 5.00" (127,0mm)

use an adapter or sleeve that contacts O. D. of seal body and carefully press seal into pump body.

2.6.3.3.2
Position pump body in a press, bearing bore up. Start shaft and bearing assembly into bore, smaller diameter of shaft down. Using an adapter or sleeve so that pressure is applied to outer race of bearing, press shaft and bearing assembly into pump body until it seats on bore shoulder, Fig. 8.

2.6.3.3.3
Clean seat bore in base of impeller. Using a new ceramic seat, Fig. 8 (2), lubricate O. D. of seat and press into impeller, ceramic side facing out. Try pressing seat in using hand pressure; if more pressure is required, protect ceramic face and, using a press, carefully press seat into impeller.

IMPORTANT: Before installing impeller, ceramic face of seat in impeller and seal face in pump body must be free of oil, grease, and fingerprints.

2.6.3.3.4
Support pulley hub end of shaft in a press; using a suitable adapter, press impeller onto opposite end of shaft until face of impeller is .034" -- .039" (0,863 -- 0,991 mm) below mounting face of pump body, Fig. 8 DIM. "A".

2.6.3.3.5
Support impeller end of shaft in a press and, using a suitable adapter, press pulley hub onto opposite end of shaft until outer face is 5.00" (127,0mm) from mounting face of pump body, Fig. 8 DIM. "B".

2.6.3.3.6
Rotate pulley hub and check for proper pump operation (a slight drag caused by mating surfaces of seal and ceramic seat is normal).

2.6.4 WATER PUMP INSTALLATION

2.6.4.1
Cement new gasket, Fig. 7 (7), to water pump body. Install new O-ring on water pump outlet. Place water pump in position on engine with pump outlet in position in transmission oil cooler, Fig. 6 (1). Install pump attaching capscrews and lockwashers and tighten securely.

2.6.4.2
Connect bottom radiator hose, Fig. 2 (3), to water pump.

2.6.4.3
Install new O-rings on adapter, Fig. 7 (8), and place adapter in position on top of water pump.

2.6.4.4
Cement new gasket, Fig. 5 (5), to thermostat housing (4). Position thermostat housing (with thermostat) on adapter, Fig. 7 (8). Install housing attaching capscrews and lockwashers and tighten securely. Connect air compressor coolant return line to thermostat housing.

2.6.4.5
Cement a new gasket, Fig. 5 (2), on housing (4). Place outlet flange (1) in position on housing and secure with capscrews and lockwashers.

2.6.4.6
Install fan, fan spacer, and fan pulley. Refer to pertinent paragraphs in 2.3.4.

2.6.4.7
Fill cooling system and check for leaks; correct any leaks found.

2.7 COOLANT FILTER

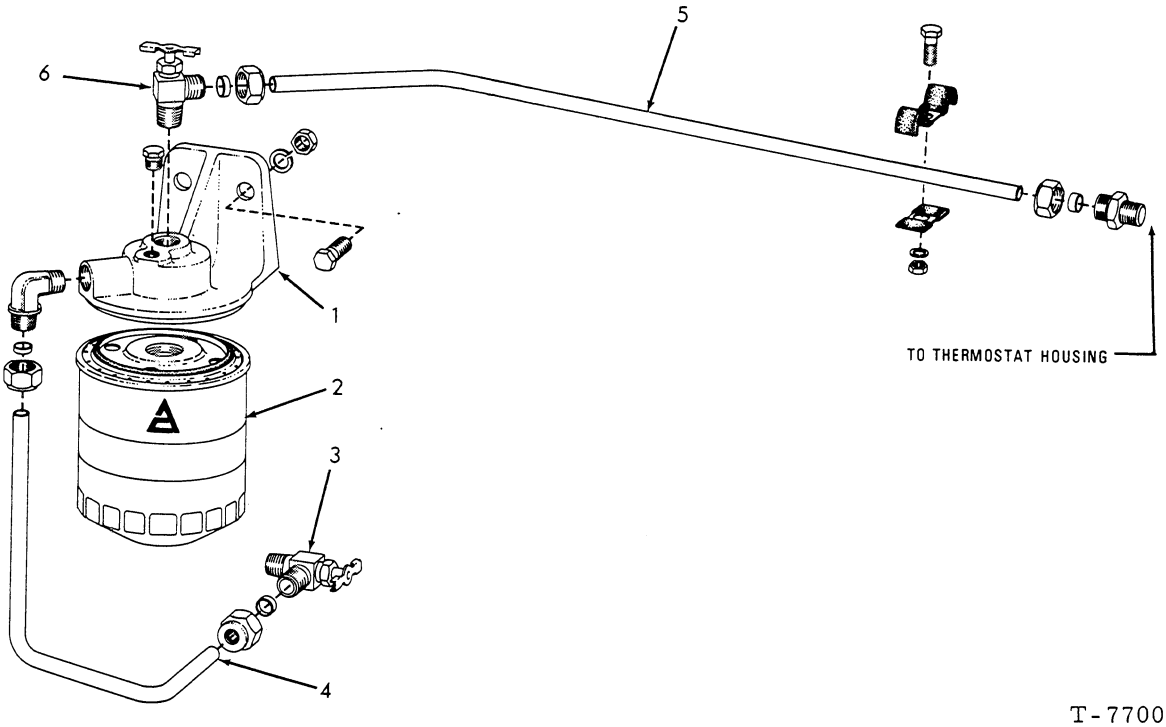

FIG. 9 COOLANT FILTER

1. Filter base
2. Element
3. Inlet shut-off valve
4. Inlet tube
5. Outlet tube
6. Outlet shut-off valve

2.7.1 GENERAL

2.7.1.1
The coolant filter, mounted on a filter base which is bolted to the right rear of the engine, is a spin-on throw-away type.

2.7.1.2
The inlet and outlet valves, Fig. 9 (3, 6) must both be open before coolant can circulate through the filter. Coolant enters through the side of the filter base, passes through the filter element, and returns to the cooling system from the top of the filter base.

2.7.1.3
The filter element is chemically activated and performs the following functions:

2.7.1.3.1
Eliminates harmful sludge and abrasive dirt suspended in the coolant.

2.7.1.3.2
Prevents the formation of scale on metal surfaces within the cooling system by removing, through an ion-exchange resin, "hard water" deposits from the coolant.

2.7.1.3.3
Reduces rust formation and corrosion, effecting the most desirable acid-alkali level.

2.7.1.3.4
Provides a protective film on cooling system surfaces through a combination of rust inhibitors.

2.7.1.3.5
Prevents pitting of metal tubes and walls within the cooling system by controlling electrolytic action through an electro-chemical corrosion resistor plate.

2.7.2 COOLANT FILTER SERVICE

The coolant filter element must be changed after each 500 hours of operation, or more often depending upon amount of coolant added to cooling system during this operating period. For detailed instructions on filter element replacement, refer to the Operator's Manual furnished with unit.

2.7.3 COOLANT FILTER REMOVAL AND INSTALLATION

2.7.3.1
Close inlet and outlet valves, Fig. 9 (3, 6). Disconnect inlet and outlet lines. Remove capscrews, nuts, and lockwashers securing filter base (1) to engine and remove filter base and element as an assembly.

2.7.3.2
Install filter by reversing the removal procedure.

TOPIC 3 - ELECTRICAL SYSTEM

3.1 GENERAL

The electrical system includes the starter, alternator and regulator, ammeter, wiring, and batteries. It is a 12 volt system throughout.

3.1.1 CHARGING CIRCUIT

The basic units of the charging circuit are the battery. alternator, and voltage regulator. The battery is the storage plant for electrical energy and must be kept fully charged. Refer to Operator's Manual for battery testing information.

Electrical energy, drained from the battery, is replaced by the alternator. Too much alternator output will usually burn the alternator or damage the battery. To prevent this, a regulator is connected into the circuit.

3.1.2 CRANKING CIRCUIT

The basic units of the cranking circuit are the battery, starter, solenoid switch, and a remote control switch. The remote control switch completes the circuit between the batteries and solenoid switch. As current flows through the solenoid, the drive pinion of the starter is shifted into mesh with the flywheel ring gear, the main contacts in the solenoid close, connecting the battery directly to the starter which turns the engine. When the engine starts and the remote control switch is released, the solenoid contacts open and the drive pinion is automatically disengaged. Never operate the starter continuously for more than 30 seconds.

3.1.3 ACCESSORY CIRCUIT

The accessory circuit is composed entirely of current-consuming devices such as lights, horn, heaters, etc. In this circuit, good connections at junction points, fuses, switches, and circuits breakers are important to prevent voltage losses which will reduce the efficiency of operation.

3.2 WARRANTY AND ADJUSTMENT

Manufacturers of the battery, starter, and alternator used on the unit are responsible for this equipment during the warranty period. Any claim for replacement or repair of any of these units must be presented to the manufacturer, not to Fiat-Allis. Suppliers of such equipment are represented by distributors or dealers in nearly all cities; they are authorized to make reasonable adjustments or replacements for their respective companies. Always give the serial number of the unit and the date the unit was delivered when presenting a claim of this nature.

3.3 WIRING SYSTEM

Heavy cables connect the battery and starter. All cables are color coded for identification purposes. Inspect wiring frequently to detect any loose connections or frayed insulation; make sure all grommets and cable protecting boots are in good condition and properly installed. Tighten connections and wrap any frayed insulation with friction tape to prevent short circuits. Check all cable clips and make certain they are properly installed and secured.

For more detailed information and wiring diagram, refer to Electrical System Service Manual.

CAUTION

To prevent the possibility of bodily injury, always disconnect the battery-to-ground cable (negative terminal) before disconnecting or repairing any of the heavy electrical cables.

3.4 ALTERNATOR

3.4.1 DESCRIPTION

The alternator features a solid state regulator that is mounted inside the alternator slip ring end frame. All regulator components are enclosed into a solid mold, and this unit, along with the brush holder assembly, is attached to the slip ring end frame. The regulator voltage setting never needs adjustment, and no provision for adjustment is provided.

3.4.2 ALTERNATOR REMOVAL

3.4.2.1
Loosen capscrew attaching alternator to supporting bracket.

3.4.2.2
Mark alternator lead wires for later identification and disconnect lead wires.

3.4.2.3
Remove capscrew and plain washer attaching alternator to adjusting brace. Push alternator in and remove drive belts from pulley.

3.4.2.4
Remove capscrew and lockwasher attaching alternator to supporting bracket and remove alternator.

3.4.2.5
Install alternator in reverse order of removal.

3.4.3 ALTERNATOR SERVICE

Complete information regarding servicing the alternator is contained in Electrical System Service Manual.

3.5 STARTER

3.5.1 DESCRIPTION

The starter is an enclosed shift lever starting (cranking) motor. The shift lever mechanism and solenoid plunger are enclosed in the drive housing. Thus the shifting mechanism is protected from exposure to dirt, splash, and icing conditions. The drive is operated by means of the shift lever and linkage from the solenoid switch mounted on the starter drive housing. Closing the control switch energizes the cranking circuit starter solenoid which shifts the starter pinion into mesh with the engine flywheel ring gear, and simultaneously closes the main circuit contacts located inside the solenoid housing. The starting motor does not require lubrication except during overhaul. For service replacement, the starting motor has a universal type mounting flange which may be rotated, if necessary, for proper fit.

3.5.2 STARTER SERVICE

Complete information regarding servicing the starter is contained in Electrical System Service Manual.

3.5.3 STARTER REMOVAL AND INSTALLATION

3.5.3.1
Disconnect battery-to-ground cable.

3.5.3.2
Disconnect starter-to-ground strap from starter. Disconnect wiring harness from solenoid switch.

3.5.3.3
Remove capscrews and lockwashers attaching starter to flywheel housing and remove starter.

3.5.3.4
Install starter by a direct reversal of removal procedure.

TOPIC 4 - FUEL SYSTEM

4.1 DESCRIPTION

4.1.1
The engine fuel system, Fig. 1, consists of two systems, the low pressure system and the high pressure system.

4.1.2
In the low pressure system, fuel is drawn from the fuel tank by the fuel feed (transfer) pump, and is forced through the fuel filter and into the gallery of the fuel injection pump.

4.1.3
In the high pressure system, the fuel is metered after entering the elements (plunger and barrel assemblies) of the injection pump. It is then forced under extremely high pressure to the nozzle holder assemblies. The nozzles spray the fuel into the engine combustion chambers. The fuel lines between the pump and the nozzles are equal in length to assure proper timing and to assure the delivery of the proper amount of fuel to each nozzle.

4.1.4
The fuel injection pump is flange mounted at the rear of the timing gear housing and is gear driven by the idler gear which is driven by the crankshaft gear. The rotation of the injection pump is clockwise, the same as engine rotation.

4.1.5
The fuel feed (transfer) pump is mounted on the side of the fuel injection pump and will deliver more fuel than is required for engine operation.

4.1.6
There is a certain amount of fuel seepage between the lapped surfaces of each fuel injection nozzle valve and its body, which is necessary for lubrication. This leakage of fuel accumulates around the spindle and in the spring compartment of each fuel injection nozzle holder and is returned through the fuel drip manifold to the fuel return line extending to the fuel tank.

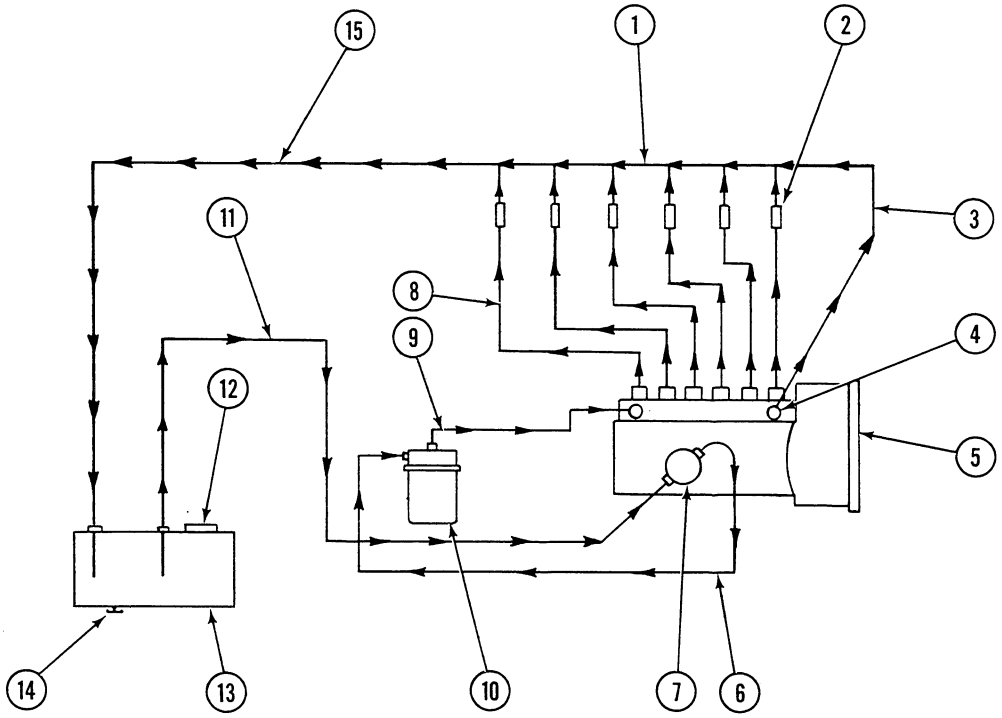

FIG. 1 FUEL FLOW SCHEMATIC

1. Drip manifold
2. Nozzle holder assemblies
3. Vent line
4. Vent plug or orifice type fitting
5. Fuel injection pump
6. Fuel feed (transfer) pump outlet to fuel filter inlet tube
7. Fuel feed (transfer) pump
8. High pressure fuel injection lines
9. Filter outlet to injection pump inlet tube
10. Fuel filter
11. Fuel tank to fuel transfer pump
12. Tank cap (must have air vent)
13. Fuel tank
14. Tank drain cock
15. Fuel return line (drip manifold to tank)

4.1.7
Current engines have an orifice type fitting in place of a vent plug. A vent tube is connected to the fitting and drip manifold to return fuel and air to the tank.

4.1.8
If necessary precautions are not taken in the storage of fuel, in the transfer of fuel to the fuel tank, and in keeping the fuel tank full to prevent condensation, foreign matter and water will enter the fuel system and damage the fuel injection pump and fuel injection nozzles. The fuel filter is installed in the fuel injection system to clean the fuel before it enters the fuel injection pump.

4.1.9
It is essential that personnel responsible for the care and operation of the engine adhere to the following maintenance recommendations:

4.1.9.1
Use only fuel meeting the recommended specifications as outlined in Operator's Manual.

4.1.9.2
Store and handle fuel with utmost care to prevent water and foreign matter from entering the fuel system.

4.1.9.3
Properly maintain fuel oil filter.

4.1.9.4
Remove injection nozzle holder assemblies at the prescribed intervals; adjust the opening pressure and check the spray pattern.

4.1.9.5
Drain the water from the fuel tank at intervals specified in Operator's Manual.

4.1.9.6
Periodically check injection pump timing.

4.1.9.7
Keep all fuel line connections, filter, injection pump and injection nozzle holder assemblies tightened securely to the engine (specified torque)

4.1.9.8
Before removing any part of the fuel injection system from the engine be sure to wash the part with cleaning solvent; also clean the surrounding area to prevent the entrance of abrasives into the system. Cover all openings immediately.

4.2 CHECKING FUEL SYSTEM

"Missing" or uneven running of the engine, excessive vibration, stalling when idling, and loss of power are indications of insufficient fuel supply to the engine. Before performing any of the following checks, be certain there is an ample supply of the proper fuel in the fuel tank and the fuel tank shutoff valve is open.

4.2.1 AIR IN SYSTEM

Loosen vent plug, Fig. 2 (4). Crank engine with starter. If fuel containing bubbles flows from around vent plug, air is being drawn into system on suction side of transfer pump. Correct this condition by tightening any loose low pressure fuel lines, connections, or filter.

4.2.2 CLOGGED FUEL FILTER OR COLLAPSED FUEL LINE

4.2.2.1
Loosen vent plug, Fig. 2 (4). Crank engine with starter. If a full flow of fuel is not obtained from around the vent plug, a clogged or collapsed fuel line or a clogged filter is indicated. If this condition exists, replace clogged filter, or clean or replace fuel lines on low pressure side.

4.2.2.2
To check the high pressure lines between the pump and fuel injection nozzles, start the engine and loosen the line nuts (one at a time) at the injectors. If no fuel is observed at the loosened line nut, the line may be clogged, collapsed, or cracked. If this condition exists, clean or replace fuel line.

4.2.3 MALFUNCTIONING FUEL INJECTION NOZZLES

"Missing" or uneven running of the engine and loss of power indicates a malfunctioning fuel injection nozzle-holder or holders. Locate malfunctioning fuel injection nozzle-holder assemblies as follows:

Run engine at low idle speed and "cut-out" each fuel injection nozzle-holder in turn by loosening the fuel injection line nut attaching the fuel injection line to the fuel injection pump.

CAUTION

Keep hands away from loosened nuts while performing this test.

A decrease in engine speed with injection line nut loosened, indicates that the fuel injection nozzle-holder for that cylinder is functioning properly. If engine speed does not decrease, the fuel injection nozzle-holder is malfunctioning and must be removed, tested, adjusted and cleaned.

4.2.4 MALFUNCTIONING FUEL INJECTION PUMP

Do not replace the fuel injection pump before making a compression test (refer to 18.1)

The compression test will indicate whether or not burned or stuck valves, worn or scored pistons and sleeves, worn or stuck rings, etc., are causing the improper engine operation.

If all causes for insufficient fuel supply have been eliminated, and the engine still runs unevenly and normal engine performance is not obtained, the injection pump may be considered at fault and should be repaired or replaced.