D262

ENGINE

service manual

Form 70667141 English
(2-90)

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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.

SUBJECT INDEX

SECTION 1 — DESCRIPTION AND SPECIFICATIONS

TOPIC 1 — DESCRIPTION

A. GENERAL

The D-262 engine is a naturally aspirated, four cycle, water cooled, overhead valve, compression-ignition diesel engine with vertical in-line cylinders.

B. PRINCIPLES OF OPERATION

The fuel system consists of a primary and secondary fuel filter, pintle type fuel injection nozzle holder assemblies, and a fuel injection pump with an integral fuel transfer pump and governor. The system cleans, prepares, and delivers accurately metered quantities of fuel under high pressure to the engine cylinders where it is ignited by heat of air compressed in the cylinders.

Proper lubrication is assured by a gear type lubricating oil pressure pump driven by a gear located in the center of the camshaft. Oil is pumped under 25 to 50 psi (1.75 - 3.51 Kg/cm^2) pressure from the main oil gallery to the crankshaft, connecting rods,-and rocker arm assembly. All other internal moving parts are lubricated by splash, spray, and oil in suspension. A filter connected into the system cleans the lubricating oil.

To maintain correct operating temperature of the engine and to prevent overheating, a V-belt driven centrifugal water pump circulates the coolant through the block, cylinder head, and radiator. The temperature of the coolant is controlled by a thermostat and the flowing of the coolant through the radiator.

To start the engine a 12-volt electrical system is required. The system consists of a 12-volt storage battery to store energy and to energize the starter motor for cranking the engine. A 12-volt generator produces the current to keep the battery charged; a voltage regulator controls the flow of current to the battery and prevents overcharge. Also in the system are the necessary wiring, switches, and gauges.

The combustion chamber, Fig. 1, is a small, specially designed space located in the cylinder head above the cylinder. At one side of the combustion chamber is the fuel nozzle. Directly opposite the fuel nozzle there is an energy cell consisting of two chambers. The minor chamber opens out into the combustion space through a small restricted opening or orifice. Another small orifice connects the major chamber to the minor. Both of these chambers and the orifices are scientifically designed and engineered as to their size, length, and position with respect to the fuel nozzle. The purpose of the energy cell is to produce rotary turbulence and to time and control the stirring action of the air and fuel.

In a 4 cycle diesel engine, a power stroke is made by each piston every two complete revolutions of the crankshaft. Sequence of strokes is intake, compression, power and exhaust.

Description

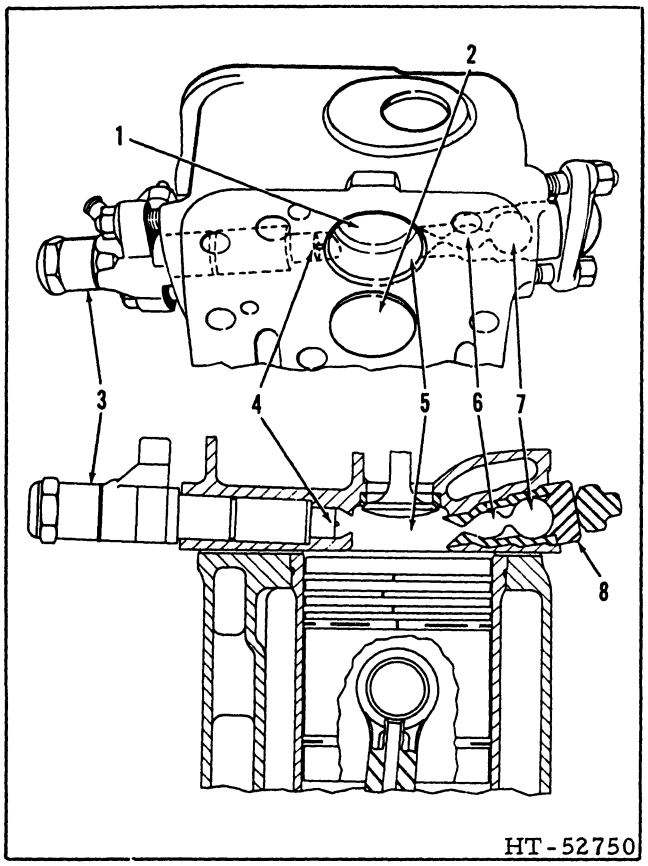

FIG. 1 COMBUSTION CHAMBER

1. Exhaust valve
2. Intake valve
3. Nozzle holder
4. Fuel nozzle
5. Main combustion chamber
6. Minor chamber
7. Major chamber
8. Energy cell

1. INTAKE STROKE

As the piston moves downward on the first, or intake stroke, air enters the cylinder through the air intake manifold and intake valve, which starts to open a few degrees before the piston reaches top dead center. The intake charge, consisting of air only, rushes into the cylinder.

2. COMPRESSION STROKE

Shortly after the piston starts to move upward on the second, or compression stroke, the intake valve closes. As the piston comes up on the compression stroke, air is compressed in the combustion chamber. The restrictions or orifices connecting the chambers of the energy cell act as gates in that they allow only a predetermined amount of air to enter the cell. Because more air is compressed in the combustion chamber than in the energy cells, the pressure in the cells is slightly less than in the combustion chamber. This "pressure drop", as it is called, is created and controlled by the design of the energy cell.

Shortly before the piston reaches the top of its compression stroke, the fuel nozzle shoots a measured amount of fuel into the combustion chamber. The fuel charge travels rapidly across the combustion chamber and a predetermined amount of fuel enters the energy cell along with additional air that is forced into the cell by the upward travel of the piston.

At the same time, ignition begins in the main combustion chamber where the finely atomized outer edge of the fuel plume contacts the hot compressed air. A fraction of a second later the flame reaches the energy cell and ignition starts in the minor chamber.

3. POWER STROKE

As the piston starts down on its power stroke, the flame having reached the major chamber of the energy cell ignites the air fuel mixture in it. Combustion in this confined space causes a sudden pressure rise at the proper time. The energy cell is designed and built to withstand the shock of this pressure, and it cushions the force and isolates it so it cannot damage working parts such as pistons, bearings and rings.

The high pressure in the energy cell pushes the hot burning gases out through the orifices of the energy cell into the main combustion chamber in the form of a directed blast or backfire. As the blast first emerges from the energy cell it contacts the concentration of fuel spray in the main chamber. The cell blast

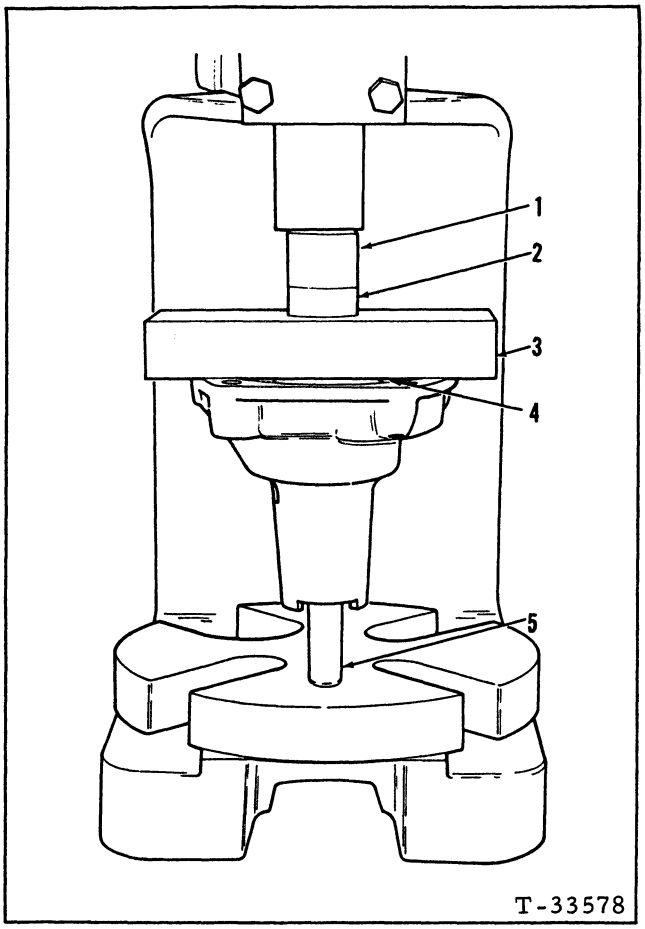

FIG. 16 INSTALLING PUMP IMPELLER (Early Models)

1. Drive tool
2. Spacer
3. Positioning plate
4. Impeller
5. Water pump shaft

3. Install bearing retaining snap ring.

4. Position pump on press with end of impeller shaft on bed plate as illustrated in Fig. 16. Ceramic impeller insert must be free of oil, grease, and fingerprints before impeller is installed. Wipe face of insert with an absorbent paper or lint-free cloth to remove all foreign material. If necessary, clean surface with trichlorethylene solvent and wipe dry.

   Position impeller on upper end of shaft. Place impeller positioning plate on machined surface of pump body as illustrated in Fig. 16. Install spacer on impeller drive tool and place drive tool in hole of fixture. Press impeller on shaft until tool bottoms on fixture. The tool will properly position impeller on shaft to a dimension of .030"-.040" (.762-1.016mm) from machined surface of impeller hub to rear face of pump body. See Figs. 14 & 17. This dimension ensures correct clearance between impeller blades and pump cover when installed with gasket.

   Rotate pulley shaft to check operation of the assembly. A slight drag caused by mating surfaces of seal assembly and impeller is normal.

5. Position pump assembly on press with impeller end of shaft firmly supported on bed plate.

CAUTION

Make sure impeller end of shaft is supported against bed plate to prevent displacement/damage to other parts of the assembly.

   Press pulley or pulley hub, as applicable, onto shaft.

   a. Press pulley onto shaft to obtain specified dimension of 5.20" (132.08mm) (See Fig. 17) from end of pulley to machined surface of pump body.

   b. Press pulley hub onto shaft to obtain specified dimension from pulley mounting face of hub to machined surface of pump body. See Fig. 17.

6. Install a new pump cover gasket and place cover on rear face of pump body. Secure cover to body with capscrews and lockwashers. Tighten capscrews to 11-13 lbs. ft. (1.52-1.79 Kg-m) torque.

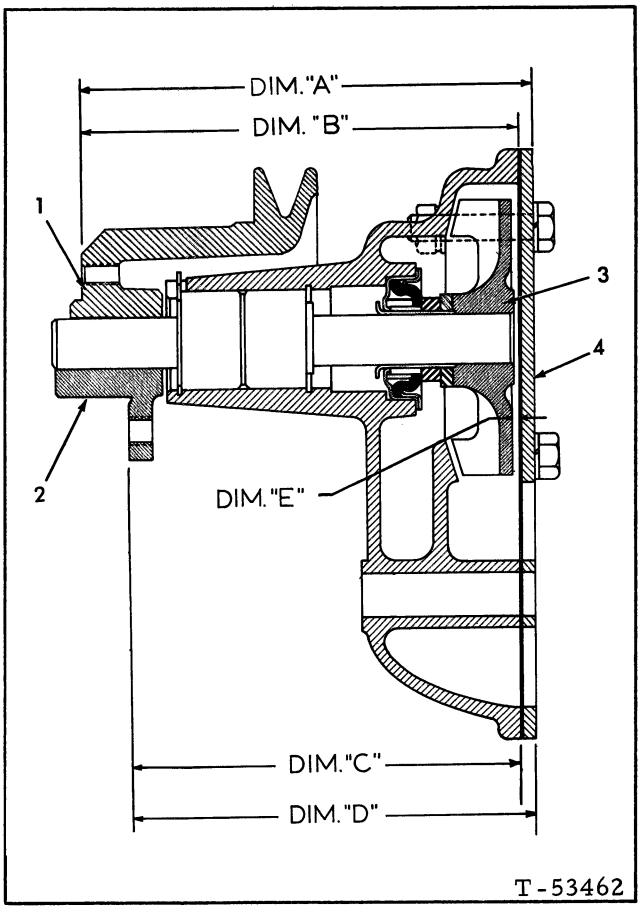

FIG. 17 PULLEY AND HUB LOCATIONS (Late Models)

1. Fan pulley
2. Pulley spacer
3. Impeller
4. Cover

Dim. "A" = 5.39" (136.90mm)
Dim. "B" = 5.20" (132.08mm)
Dim. "C" = 4.75" (120.65mm)
Dim. "D" = 4.94" (125.47mm)
Dim. "E" = .030"-.040" (.762-1.016mm)

NOTE: If pulley is pressed onto shaft, the final overall dimension of the water pump from end of pulley to outside surface of the cover is 5.39" (136.90mm). If pulley hub is pressed onto shaft, the final overall dimension of the water pump from pulley mounting face of hub to outside surface of the cover is 4.94" (125.47 mm). See Fig. 17. Compare above measurements with those made before start of disassembly.

7. Rotate pulley or pulley hub and check operation of the water pump assembly. A slight drag caused by mating surfaces of seal assembly and impeller is normal.

H. WATER PUMP INSTALLATION (Late Models)

1. Apply sealing compound to the water pump body to cylinder block gasket and place it on pump body. Assemble one end of water bypass tube to water pump body but do not tighten at this time. Place pump and bypass line in position and attach pump to cylinder block.

   NOTE: The water pump retaining and generator brace capscrew must be installed in the lower left capscrew position. Tighten capscrews to 28-33 lbs. ft. (3.87-4.56 Kg-m) torque.

2. Tighten water bypass tube connections. Make certain they are tight to prevent leakage.
3. Install pump to radiator hose.
4. Position drive pulley over pulley hub. Position fan belt over pulley. Install spacer and fan on pulley hub. Tighten capscrews to 25-27 lbs. ft. (3.45-3.73 Kg-m) torque.
5. Make certain fan drive belt is correctly positioned on fan, generator, and crankshaft pulleys. Adjust fan belt tension; install radiator.

I. WATER PUMP INSTALLATION (Early Models)

1. The water pump is equipped with either a plain gasket or a copper-asbestos type gasket with a locating pin on one side. If a plain gasket is used, apply sealing compound to the gasket and position it on pump body. If gasket is the copper-asbestos type, position it on cylinder head with locating pin in hole provided in head.

2. Position water pump on cylinder head and install retaining capscrew but do not fully tighten at this time.

3. Install fan spacer and fan. Tighten capscrews in fan pulley or pulley hub, as applicable, to 25-27 lbs. ft. (3.45-3.73 Kg-m) torque.

4. Install radiator and radiator hoses.

5. Center fan in radiator shroud by pivoting water pump on the retaining capscrew. Tighten capscrew to 68-73 lbs. ft. (9.40-10.09 Kg-m) torque.

6. Install water pump brace. Tighten capscrews to 28-33 lbs. ft. (3.87-4.56 Kg-m) torque. Install and adjust drive belts.

TOPIC 5 — THERMOSTAT

A. GENERAL

The thermostat is so positioned that, when closed, flow of coolant through radiator is completely shut off. When thermostat opens coolant flows through both radiator and engine circulating system.

Replacement of thermostat is necessary when it becomes corroded and fails to maintain normal operating temperature.

B. THERMOSTAT REMOVAL, TESTING, AND INSTALLATION

1. THERMOSTAT REMOVAL

Drain cooling system to a level below thermostat housing, refer to Fig. 18 or 19 and remove thermostat. (On early models only; if thermostat is found to be within specifications and is to be reused, be certain the rubber sealing ring, Fig. 18 (7), cemented to the flange is in good condition.)

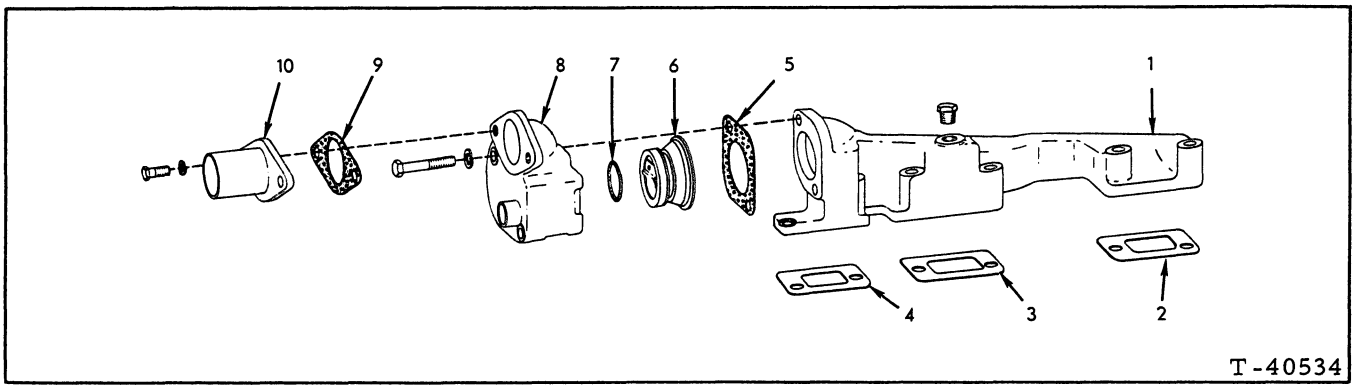

FIG. 18 THERMOSTAT AND HOUSING (Early Models)

1. Manifold
2. Gasket (rear)
3. Gasket (center)
4. Gasket (front)
5. Gasket
6. Thermostat
7. Sealing ring
8. Thermostat housing
9. Gasket
10. Outlet pipe

Thermostat

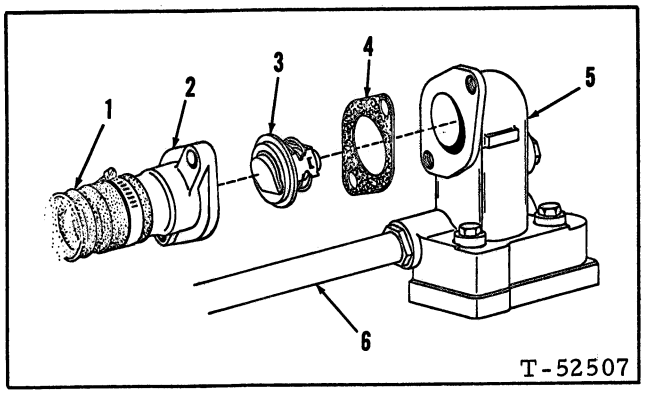

FIG. 19 THERMOSTAT AND HOUSING (Late Models)

1. Radiator hose
2. Outlet pipe
3. Thermostat
4. Gasket
5. Thermostat housing
6. Water by-pass tube

2. THERMOSTAT TESTING

a. Suspend thermostat in a container of clean water. Thermostat must be completely immersed but not touching bottom of container.

b. Heat water gradually and stir so heat is evenly distributed. Check temperature of water with a reliable thermometer. Do not overheat.

c. Observe thermostat as temperature of the water increases. If the thermostat is functioning properly, it should begin to open at approximately 180°F (82°C) and be fully open at 202°F. (94°C). The amount of travel between open and closed positions of the thermostats is approximately .50" (12.70mm).

d. The thermostat is not adjustable. If it does not operate within the above limits it must be replaced.

3. THERMOSTAT INSTALLATION

Refer to Fig. 18 or 19 and install the thermostat by reversing the removal procedure. Fill the cooling system.

SECTION 3 — ELECTRICAL SYSTEM

TOPIC 1 — GENERAL

The electrical system includes the starting motor, generator, voltage regulator, solenoid, batteries, ammeter, and engine air heater (if so equipped). The system is 12 volt throughout.

A. CHARGING CIRCUIT

The basic units of the charging circuit are the batteries, generator and voltage regulator. The batteries are the storage plant for electrical energy and must be kept fully charged. Refer to "Operating Instructions and Field Maintenance Manual" for battery testing information.

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

B. CRANKING CIRCUIT

The basic units of the cranking circuit are the batteries, 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.

C. 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 circuit breakers, are important to prevent voltage losses which will reduce the efficiency of operation.

TOPIC 2 — WARRANTY AND ADJUSTMENT

Manufacturers of the batteries, starter, generator and regulator 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 Allis-Chalmers. 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.

NOTE: On units equipped with Allis-Chalmers batteries, any authorized Allis-Chalmers Construction Machinery dealer will handle claims for battery replacement or adjustment during the warranty period.

TOPIC 3 — WIRING SYSTEM

Heavy cables connect the batteries 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.

WARNING

To prevent possibility of bodily injury, disconnect battery-to-ground cable before cleaning, repairing, disconnecting or connecting any of the heavy electrical cables.

TOPIC 4 — GENERATOR

A. DESCRIPTION

The direct current producing generator has stationary pole pieces and field windings. High output current from the armature windings (coils) is picked up by the brushes when the armature revolves.

B. GENERATOR MAINTENANCE

Inspection of generator brushes, commutator, drive belts, and terminal connections should be made periodically.

1. BRUSHES AND COMMUTATOR

Brush spring tension must not be less or ex-

ceed that specified by the manufacturer. Excessive tension will cause rapid wear of brushes or commutator; low tension will cause arcing and reduced generator output.

If the brushes are worn down to less than half their normal size, they should be replaced. New brushes, when used with a DC generator, should be seated with a brush seating stone. Do Not Use Emery Cloth! Blow out dust. If the commutator is out of round or rough, it must be trued in a lathe or replaced. After truing commutator, the mica between the segments must be undercut .03" (.762mm).

2. GENERATOR DRIVE BELT ADJUSTMENT

Keep drive belt(s) properly adjusted. When the generator belt can be pressed inward, by hand, .50" to .75" (12.70-19.05mm) at a point halfway between pulley and fan hub, the belts are properly adjusted.

3. GENERATOR REMOVAL AND INSTALLATION

a. Turn electrical system master switch to the OFF position. Disconnect wiring harness from generator; identify cables to facilitate installation.

b. Remove the capscrews and lockwashers attaching the generator and remove generator.

c. Install generator by a reversal of the above procedure.

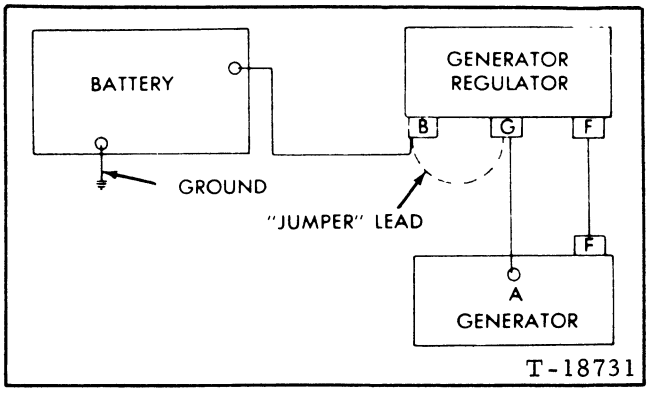

FIG. 1 POLARIZING CIRCUIT DIAGRAM

IMPORTANT: Whenever a generator has been removed or disconnected, it must be polarized.

4. POLARIZING GENERATOR

Using a short "jumper" lead, momentarily touch "jumper" lead to "BAT." (Battery) and to "GEN." (Generator) terminals of the generator regulator.

CAUTION

Do not run or test the generator on an open circuit. If it should become necessary to operate the generator without it being connected to batteries, it should be short circuited. This can be done by disconnecting the lead connected to "GEN." terminal of the regulator and connecting the end of lead to a convenient ground.

TOPIC 5 — GENERATOR REGULATOR

A. DESCRIPTION

The generator regulator, used to limit the generator output, consists of three units; the cut-out relay to prevent battery current drain when the generator slows down or stops; the voltage regulator to prevent system voltage from exceeding a specified maximum, thus protecting the battery and other voltage sensitive equipment; the current regulator to limit the current output and prevent the generator from burning out.

B. GENERATOR REGULATOR REMOVAL AND INSTALLATION

Removal of the regulator may be accomplished by disconnecting the wires, and removing the attaching capscrews, nuts, and lockwashers. Be certain to identify the wires so they can be reinstalled in the correct location.

NOTE: After installation of the regulator always polarize the system.

TOPIC 6 — STARTER

A. DESCRIPTION

The starter, mounted on the engine flywheel housing, is a 12-volt, heavy duty unit. The armature is supported by bushings. The field windings are attached to and insulated from the stationary housing.

B. STARTER SERVICE

Field service on the starter will be limited to cleaning of starter, cleaning of commutator, replacement of brushes, brush springs, or starter switch. All other adjustments or repairs require use of special equipment. For this reason, it will be necessary to remove starter and take it to a dependable electrical repair shop, when repair or adjustment is necessary. With fully charged batteries the starter will engage promptly and crank engine at an adequate cranking speed. However, in cold weather, "drag" caused by cold oil between pistons and cylinder walls, and in the bearings of engine, causes engine to crank harder and cranking speed will naturally be decreased.

IMPORTANT: The starter must never be used for more than 30 seconds at any one time without a pause to allow it to cool. The starter must NEVER be used to move the vehicle.

Failure to observe these rules may result in failure of starter.

1. If starter fails to operate properly, remove and inspect commutator and brush connections. The commutator should be clean, not out of round or excessively worn, and without high mica or burned bars. A glazed or blued commutator does not indicate a condition requiring service, as this is a normal and satisfactory condition on a used unit. All electrical connections should be kept clean and tight, brush spring tension should be 35 ounces (1 Kg), and brushes must not be worn shorter than half their original length. The brush spring tension can be tested by attaching a small spring scale to each brush, directly under head of screw that holds brush in arm.

2. A dirty commutator should be cleaned with #00 sandpaper. Never use emery paper.

   If dust and dirt have accumulated in starter, it should be cleaned with compressed air as such accumulations are likely to interfere with operation of both starter and starter drive assembly.

3. Continued cranking of starter, after starter switch button has been released, indicates shorted turns in the solenoid switch windings (if so equipped), or that the solenoid switch is mounted out-of-line causing binding of the solenoid plunger. Chattering of the solenoid switch indicates shorted turns in windings or run-down batteries. It is recommended that the solenoid switches be taken to a dependable electrical repair shop when repair or adjustment is necessary.

C. STARTER REMOVAL AND INSTALLATION

1. Disconnect battery-to-ground cable.
2. Disconnect starter-to-ground strap from starter and any wiring harness or linkage.
3. Remove capscrews and lockwashers attaching starter to flywheel housing and remove starter (and starter adapter if so equipped).
4. Install starter by a direct reversal of removal procedure.

SECTION 4 — FUEL SYSTEM

TOPIC 1 — GENERAL

The fuel system consists of a fuel tank, primary and secondary fuel filters, transfer pump, fuel injection pump, fuel injection nozzles, and fuel lines. There are two fuel pressure systems, low pressure and high pressure.

The low pressure system is comprised of the fuel tank, primary and secondary fuel filters, transfer pump, fuel lines between the fuel tank and the fuel pump, and leakage return lines.

The high pressure system begins in the fuel injection pump where the fuel is forced by the action of cam-actuated plungers into the outlet ports and thru the high pressure fuel lines connected to the fuel injection nozzles.

The fuel is drawn from the fuel tank through the primary and secondary filters by the transfer pump located at the rear of the fuel injection pump. The fuel is then forced by the transfer pump to the cam-actuated plungers which force the fuel under high pressure through the fuel lines to the fuel injection nozzles from which the fuel enters the combustion chambers in the form of a fine, cone-shaped spray.

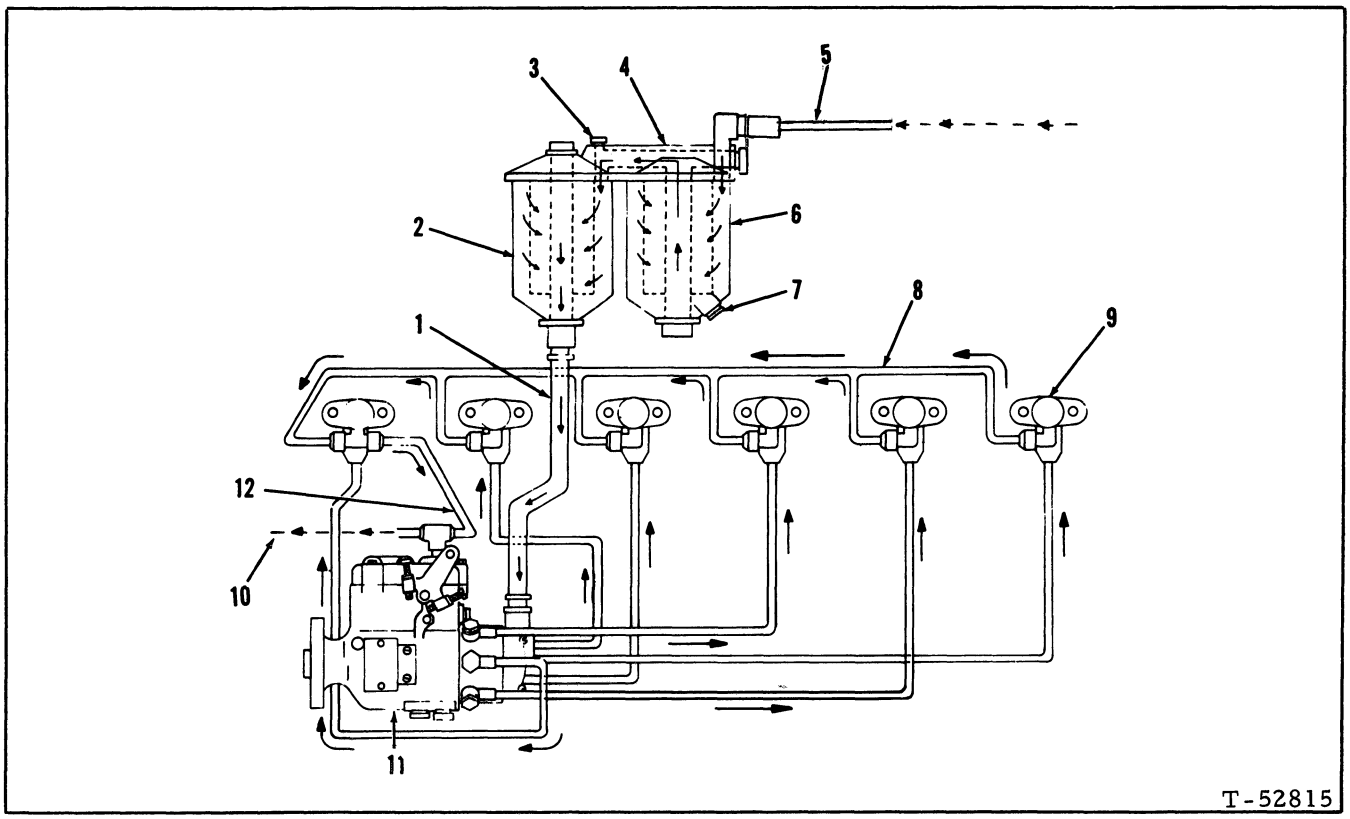

FIG. 1 FUEL FLOW

1. Fuel inlet line (Filter-to-transfer pump)
2. Second stage fuel filter
3. Vent plug
4. Filter head
5. Fuel supply line (From fuel tank)
6. First stage fuel filter
7. Drain plug
8. Fuel return manifold
9. Nozzle holder
10. Fuel return line (To fuel tank)
11. Fuel injection pump
12. Fuel return line

General

The fuel transfer pump delivers more fuel to the fuel sump of the fuel injection pump than is required for engine operation. A line extending from the top of the fuel injection pump to the fuel tank conveys the surplus fuel back to the fuel tank.

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 return manifold to the fuel return line, extending to the fuel tank. The excess fuel delivered to the fuel injection pump by the fuel supply pump is also returned to the fuel tank through the fuel return line.

A regulating valve in the pump end plate allows a large percentage of the fuel to be bypassed back to the inlet side. The fuel bypassed increases in proportion to speed, and the regulating valve is designed so the transfer pump pressure also increases with speed.

TOPIC 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, make certain there is an ample supply of the proper fuel in the fuel tank and the fuel tank shutoff valve is open.

A. CHECK FOR ADMISSION OF AIR INTO SYSTEM

Remove the fuel return line from the fitting in the injection pump cover. Insert a length of hose on the fitting. Place the other end of the hose in a container partially filled with fuel oil. Run engine at approximately 800 to 1000 rpm and observe the end of the hose in the container for bubbles. Occasional bubbles are permissible, however excessive bubbles or foaming indicates air is being drawn into the system. Correct this condition by tightening any loose low-pressure fuel line connections and filter connections.

B. CHECK FOR CLOGGED FUEL FILTERS AND CLOGGED OR COLLAPSED FUEL LINES

A clogged filter or restrictions in the fuel lines will cause low power, engine stall or erratic operation. A simple method of eliminating these troubles is to remove the fuel filters, blow out all low pressure fuel lines with filtered compressed air and install new filter elements.

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 nozzles. If no fuel is observed at the loosened line nut, the line may be clogged, crimped or cracked. In any case the line must be replaced.

Check the strainer, Fig. 2 (2), in the end-plate of the injection pump. Remove any foreign matter if the screen is clogged.

C. CHECK FOR INOPERATIVE FUEL TRANSFER PUMP

If the engine is still erratic after making the checks listed in Steps "A" and "B" above, operate the engine until the normal operating temperature is reached, then shut off the engine. Install a vacuum gauge between the filters and inlet side of pump, and run the engine at full throttle. Indicated vacuum should be 15-25 inches (381-635mm) of mercury. If vacuum is insufficient, check for air leaks on suction side or malfunction of end plate and transfer pump parts.

The end plate pressure regulating valve may be checked by installing a pressure gauge in the port opposite the pump inlet and running the engine at full throttle under full load; pressure

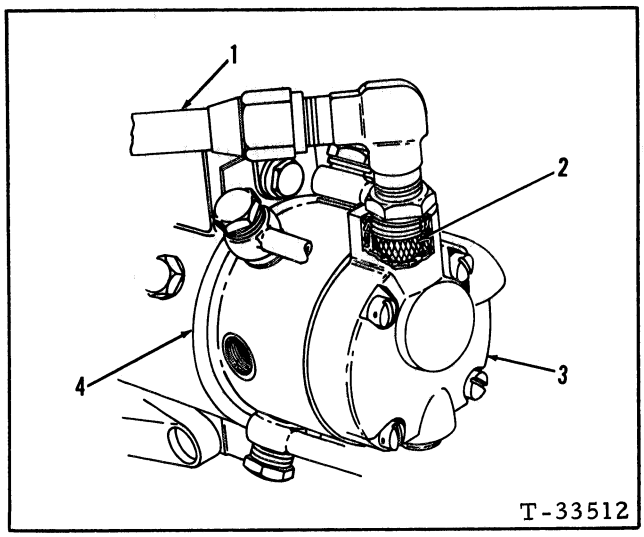

FIG. 2 FUEL STRAINER LOCATION

1. Filter-to-pump inlet line
2. Strainer
3. End plate
4. Fuel injection pump

should be 65-71 psi (4.56-4.99 kg/cm^2). If pressure is insufficient, the regulating valve or the end plate may be malfunctioning.

D. CHECK FOR INOPERATIVE FUEL INJECTION NOZZLES

"Missing" or uneven running of the engine and loss of power are also indicative of an inoperative fuel injection nozzle, or nozzles. To locate a faulty fuel nozzle, use the following procedure:

1. Run the engine at low idle speed and "cut-out" each fuel nozzle in turn by loosening the line nut attaching the high pressure line to its corresponding fuel nozzle.

2. A decrease in engine speed with the line nut loosened indicates that the fuel nozzle for that cylinder is functioning properly.

3. If the engine speed does not decrease, the fuel nozzle is inoperative and should be repaired or replaced.

E. CHECK FOR INOPERATIVE FUEL INJECTION PUMP

Do not replace the fuel injection pump before making a compression test. The compression test eliminates the possibility of burned or stuck valves, worn or scored pistons and sleeves, worn or stuck rings, etc., to be causing improper engine operation.

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

IMPORTANT: Do not replace the fuel pump until making certain that all other possible causes for improper engine operations have been eliminated.

TOPIC 3 — FUEL FILTERS

A. DESCRIPTION

There are two filters in the fuel injection system, a primary filter and a secondary filter. Both filter bodies are mounted in a common header and are located to the rear of the fuel pump. Necessary hoses are installed to connect the filters into the fuel system. Each filter body contains a replaceable-type element. Any dirt, water or sediment which may pass through the primary filter will be trapped in the secondary filter and prevented from entering the fuel injection pump. A drain plug is provided in the bottom of the primary filter body for the draining of water or sediment.

B. SERVICE

At the beginning of each day's operation in warm weather and at the end of each day's operation in freezing weather, remove the drain plug in bottom of the primary filter and allow water and sediment to flow out. Replace drain plug as soon as clean fuel is evident. No daily service is normally required for the secondary filter. Remove and discard the element in each filter after every 400 hours of operation (more often if conditions warrant), or when the fuel filters become clogged. Clogged filter elements are usually indicated by irregular engine performance.

C. FUEL FILTER REPLACEMENT

NOTE: The first stage filter does not contain an element when unit is equipped with a Heavy-Duty Fuel Filter (Special Equipment).

1. FIRST STAGE FILTER

   a. Close fuel tank shut-off valve. Clean all dirt from around filter head and body. Loosen vent plug at top of head and drain cock in bottom of filter body and allow filter to drain.

   b. Loosen body until it is free from centerbolt, and remove body from filter head.

   c. Remove and discard filter element and gasket, and head gasket. Wash and dry interior of body.

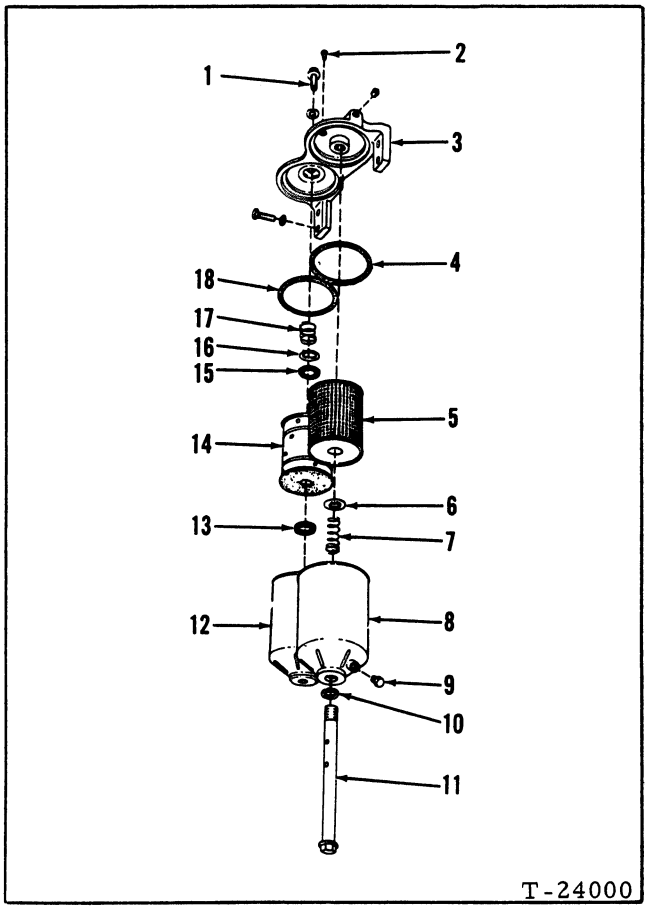

FIG. 3 FUEL FILTERS

1. Retaining capscrew
2. Vent plug
3. Filter head
4. Gasket
5. First stage filter element
6. Spring washer
7. Spring
8. First stage filter body
9. Drain plug
10. Gasket washer
11. Center bolt
12. Second stage filter body
13. Gasket
14. Second stage filter element
15. Gasket
16. Spring washer
17. Spring
18. Gasket

   d. Install a new filter element, and push it down firmly.

   e. Install centerbolt into filter body; be certain the washer is in good condition, and position the element spring and spring washer onto centerbolt.