

INDEX

FL7 & FL7B

SERVICE MANUAL SET

FORM NO. 73158157

Service manual set is arranged in the following order		Individual manuals are also available in translation in form numbers listed below			
Service Manuals	ENGLISH Form No.	ESPAÑOL (Spanish)	FRANÇAIS (French)	ITALIANO (Italian)	DEUTSCH (German)
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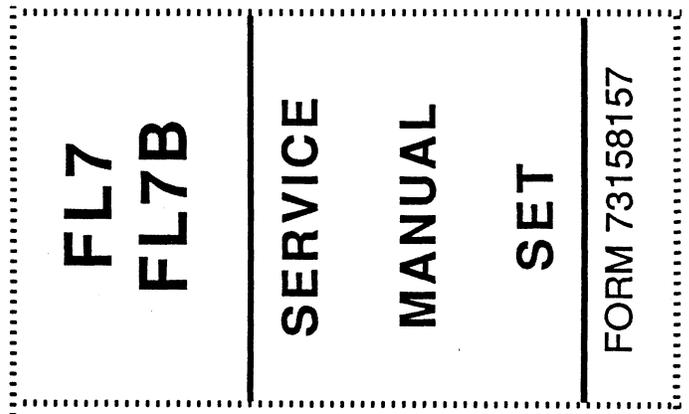


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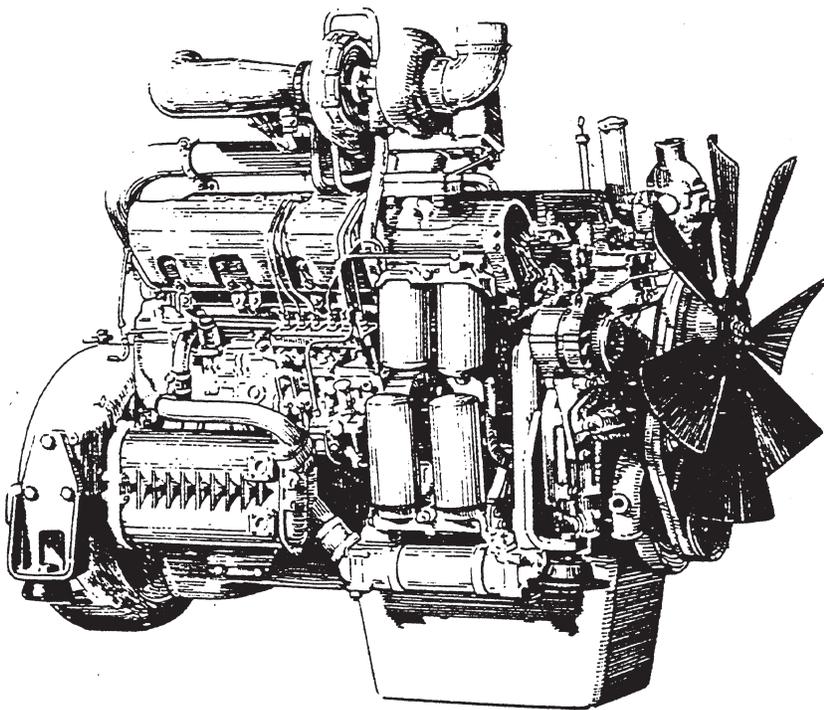
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8065 ENGINE

service manual



8065 ENGINE

service manual

Form 73121213 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 over-pressurization of the tank..

Never drive the machine near open fires.

Use the correct fuel grade for the operating season.

FOREWORD

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

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

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

Illustrations show standard and optional items.

IMPORTANT

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

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

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

This manual contains service instructions for parts common to class 8065 engines listed below.

ENGINE MODEL	APPLICATIONS	
8061.105.017	65B	Motor Grader
8065.04.089	65B	Motor Grader
8065.04.095	FD7,FL7	Crawler Tractor, Crawler Loader
8065.04.097	FE18	Excavator
8065.05.290	FR10B	Wheel Loader
8065.05.295	FD7,FL7	Crawler Tractor, Crawler Loader
8065.05.297	FE18	Excavator
8065.24.091	FR10	Wheel Loader
8065.24.092	FR12	Wheel Loader
8065.24.098	FE18R	Excavator (rubber tire)
8065.25.080	FH200	Excavator
8065.25.092	FR12,FR12B	Wheel Loader
8065.25.094	FR130	Wheel Loader
8065.25.095	FD9	Crawler Tractor
8065.25.096	FA120	Crawler Tractor (Agriculture)
8065.25.097	FL10E	Crawler Loader
8065.25.098	FE18R	Excavator (rubber tire)
8065.25.099	FD10E	Crawler Tractor
8065.SI25.003	FR10	Wheel Loader
8065.SI25.004	FR11	Wheel Loader

The terms front, rear, left and right as used in this manual are defined as follows:

- FRONT - Fan end of engine
- REAR - Flywheel end of engine
- LEFT - Alternator side of engine
- RIGHT - fuel injection pump side of engine

Study SAFETY RULES in the front of this manual thoroughly for the protection of machine and safety of personnel.

(Revised July 1990)

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Study SAFETY RULES in the front of this manual thoroughly for the protection of machine and safety of personnel.

DESCRIPTION & OPERATION

1.1 GENERAL DESCRIPTION

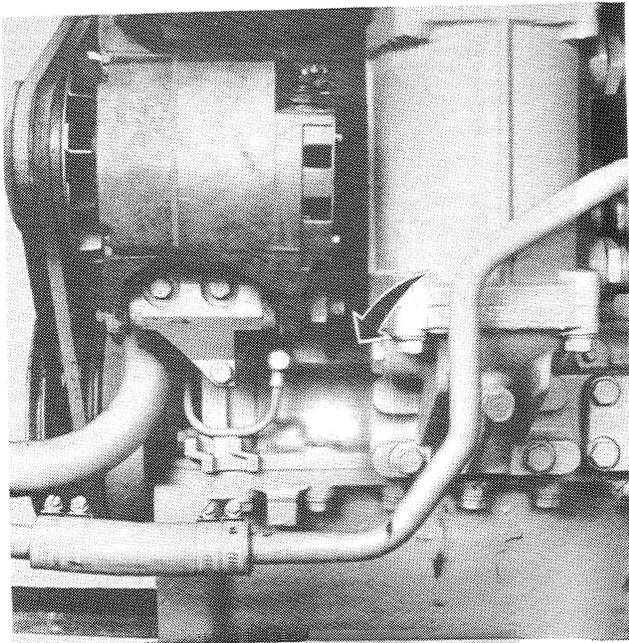
1.1.1

The Iveco 8065 engines discussed in this manual are six cylinder, vertical in-line, four-cycle, water cooled, diesel engines. The 5th digit of the model number indicates a design feature of the engine shown as follows:

0=naturally aspirated engine
2=turbocharged engine

1.1.2

The identification and serial number for each engine is stamped into the left side of the block just below the alternator.



T-81809

Serial Number Location

1.1.3

The engine block has seven main bearings and six cylinder sleeves. The aluminum alloy pistons each have one chrome plated compression ring, one oil scraper ring and one slotted, spring loaded, oil control ring.

1.1.4

The cylinder head has push rod operated overhead valves and integral valve guides and seats.

1.1.5

The air intake system incorporates two dry filter elements.

1.1.6

The fuel system is of the direct injection type using a Fiat/Bosch injection pump. Some older models includes an advance variator which gives an automatic fuel injection advance above 500 rpm variator or 1000 rpm engine.

1.1.7

Lubrication is supplied by a gear type pump; pressure is controlled by a relief valve.

1.1.8

Cooling is supplied by a centrifugal water pump; temperature controlled by a thermostat.

1.1.9

The electrical system is 24 volt.

1.2 PRINCIPALS OF OPERATION

1.2.1

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.

1.2.2

As the piston moves downward on the first (intake) stroke, air enters the cylinder through the intake manifold and the intake valves, which start to open a few degrees before the piston reaches top dead center. The intake charge consists of air only.

1.2.3

Shortly after the piston starts to move upward on the second (compression) stroke, the intake valves close. The air is compressed in the cylinder, and compression of the air raises the temperature in the cylinder to approximately 1000°(538°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 the heat of the compressed air and starts to burn immediately.

1.2.4

Expansion of the burning gases forces the piston downward on its third (power) stroke. Near the bottom of the power stroke, the exhaust valves start to open.

Study SAFETY RULES in the front of this manual thoroughly for the protection of machine and safety of personnel.

DESCRIPTION & OPERATION

1.2.5

As the piston moves upward on the fourth (exhaust) stroke, the exhaust valves are 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 valves open to admit a fresh charge of air to the cylinder. A few degrees after top dead center, the exhaust valves close and the cycle is repeated.

1.3 GUIDE TO USE OF THE MANUAL

1.3.1

Specifications listed throughout this manual cover two generations of the 8065 Iveco engine determined by the common differences of the cylinder sleeve bores and the stroke of the piston. Where appropriate, they have been further divided between a turbocharged engine and one that is naturally aspirated.

1.3.2

Maintenance and operation procedures are common among all 8065 engines unless otherwise noted.

TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSE	TOOLS REQUIRED	TEST	SOLUTION	
ENGINE <i>Engine will not turn</i>	Batteries weak	Hydrometer	Check specific gravity	Recharge or replace batteries	
	Starter switch inoperative	Volt-Ohm meter	Check voltage at switch	If bad replace defective switch	
	Starter inoperative	Volt-Ohm meter	Check voltage at starter	Replace if voltage is present and starter does not turn over	
	Engine locked or seized	Barring mechanism	Rotate the engine by hand. If it does not rotate, remove head and inspect for cause	Due to extended idle, storage periods, or improper preparation of engine for storage, parts may be rusted or corroded and seized Broken piston rings, gears, etc., may also cause locking. Repair or replace defective parts	
	Hydro-static lock		Rotate the engine by hand opposite of crankshaft rotation. Check degree of movement. Remove head and inspect where liquid is coming from	Rain water entering uncovered exhaust pipe, leaking head. Repair or replace defective parts	
	<i>Engine will not start</i>	Slow cranking speed	Hydrometer	Check battery specific gravity	Specific gravity of batteries too low. Charge batteries
		Engine controls out of adjustment		Check starter torque	Starter not delivering maximum torque. Repair or replace defective parts
		Insufficient supply of fuel to fuel injection nozzles			Use cold weather start aids if applicable
		Fuel injection nozzles not operating properly	Nozzle tester	Check linkage adjustment	Correct all engine control linkage adjustment
		Fuel injection pump im-properly timed	Timing light	Remove fuel nozzle and check fuel volume during cranking Pop the nozzles for pressure, pattern and sound Flow time the pump to the engine	Check fuel system and clean sediment bowl Repair or replace defective parts Time fuel injection pump

Study SAFETY RULES in the front of this manual thoroughly for the protection of machine and safety of personnel.

TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSE	TOOLS REQUIRED	TEST	SOLUTION
<i>Engine hard to start</i>	Batteries weak	Hydrometer	Check specific gravity	Recharge or replace batteries
	Insufficient fuel in tank		Check dipstick	If low, fill with specified fuel
	Incorrect grade of fuel	Operator's manual	Contact fuel supplier for fuel data and compare with machine specifications	Drain fuel system. Fill tank with specified fuel
	Clogged filter or sediment bowl		Inspect sediment bowl	Replace filter or clean sediment bowl
	Fuel injection nozzles not operating properly	Nozzle tester	Pop the nozzles for pattern, pressure and sound	Repair or replace nozzles
	Fuel transfer pump not operating properly	In line pressure gauge	Check pump pressure	Repair or replace fuel transfer pump
	Air in fuel system		Bleed the air from the primary fuel system	Correct leaks in suction side of fuel system. Vent fuel system
	Insufficient air supply to cylinders		Check air restriction indicator for too high restriction	Clean air system
	Fuel injection pump improperly timed	Timing light	Flow time the pump to the engine	Time fuel injection pump
	Valve lash incorrect			Correct valve lash
	Piston rings or cylinder liners worn	Compression test equipment	Compression test	If compression is low teardown and replace defective parts
	Valves warped or pitted			If compression is low recondition or replace valves and/or valve guides
	<i>Engine stops frequently</i>	Idling speed too low	Tachometer	Check RPM at low idle
Restricted fuel supply		Engine diagnostic kit	Run engine performance test	Check fuel system lines and filters
<i>Engine stops suddenly</i>	Out of fuel		Check dipstick	Fill fuel tank with specified fuel and vent the fuel system
	Restricted fuel supply	Engine diagnostic kit	Run engine performance test	Check fuel system lines and filters
	Broken or loose fuel lines		Visual	Correct or replace defective parts
	Fuel transfer pump or fuel injection pump inoperative	Pressure gauge	Install pressure gauge in transfer pump to filter line and check pressure while engine is running	If low, repair or replace defective parts

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TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSE	TOOLS REQUIRED	TEST	SOLUTION
<p><i>Engine Overheats</i></p> <p><i>(Determine for certain that cause of overheating is engine related.)</i></p>	External leak in cooling system		Visual	Correct all leaks and fill cooling system
	Radiator core clogged internally	Engine diagnostic kit	Install the low temperature probes at the top and bottom of the radiator. Run engine and check temperature differences	Clean and flush radiator
	Radiator air passages clogged	Flashlight	Visual check	Remove debris from radiator core
	Fan or water pump drive belts too loose	Belt tension gauge		Adjust fan drive belts to proper tension
	Thermostat inoperative		Remove thermostat and check opening temperature	Replace thermostat
	Engine oil cooler clogged	Engine diagnostic kit	Install the low temperature probes at the top and bottom of the radiator. Run engine and check temperature differences	Clean or replace the oil cooler core
	Improper engine lubrication	Pressure gauge	Install pressure gauge in instrument panel pressure gauge port	If pressure is low and oil level good, remove the pan and check pump
	Water pump malfunctioning		Check for leaks at pump or pulley drive loose	Repair or replace water pump
	Fuel injection pump improperly timed	Timing light	Flow time the pump to the engine	Time fuel injection pump
	<p><i>Engine shows loss of power</i></p>	Insufficient air supply to cylinders	Engine diagnostic kit	Run engine diagnostic test
Insufficient supply of fuel to fuel injection nozzles		Engine diagnostic kit	Run engine diagnostic test	If test shows fuel problem, check fuel system
Governor not operating properly		Engine diagnostic kit	Run engine diagnostic test	If test shows fuel problem, inspect and adjust governor
Air in fuel system. Observe fuel sediment bowl for aeration if bowl is on engine or pump				Vent fuel system. Check for leaks on suction side of fuel transfer pump
Clogged fuel filter		Engine diagnostic kit	Run engine diagnostic test	Change filter element
Improper valve lash				Adjust valve lash
Fuel tank vent clogged			Remove fuel tank cap	Clean vent

Study SAFETY RULES in the front of this manual thoroughly for the protection of machine and safety of personnel.

TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSE	TOOLS REQUIRED	TEST	SOLUTION	
<i>Engine shows loss of power(continued)</i>	Fuel injection pump improperly timed	Timing light	Flow time the pump to the engine	Time the fuel injection pump	
	Inoperative fuel injection pump or fuel injection nozzles	Engine diagnostic kit	Run engine diagnostic test	Repair or replace defective parts	
	Cylinder "cutting" out		Locate "missing" cylinder as follows: Run engine at low idle speed and cut out each injection nozzle in turn by loosening the fuel injection line nut attaching the line to the fuel pump	A decrease in engine speed indicates the nozzle for that cylinder is functioning properly. If engine speed does not decrease, nozzle is malfunctioning and must be replaced	
<i>Engine runs unevenly and vibrates excessively</i>	Loss of compression	Compression tester	Compression test	May be due to leaking valve or worn piston rings or cylinder sleeves. Repair or replace defective parts	
	Governor not operating properly		Check pump and throttle linkage	If tight or loose, adjust governor and linkage	
	Fuel supply erratic or insufficient	Engine diagnostic kit	Run diagnostic test	If fuel system fault, check fuel system	
	Engine operating temperature too low	Engine diagnostic kit	Run diagnostic test	If cooling system fault, check thermostat	
	Fuel injection pump malfunctions	Engine diagnostic kit	Run diagnostic test	Check fuel injection pump	
	Valves in bad condition			Recondition or replace valve	
	Cylinder "cutting" out		Locate "missing" cylinder as follows: Run engine at low idle speed and cut out each injection nozzle in turn by loosening the fuel injection line nut attaching the line to the fuel pump	A decrease in engine speed indicates the nozzle for that cylinder is functioning properly. If engine speed does not decrease, nozzle is malfunctioning and must be replaced	
	Fuel injection nozzle malfunction	Nozzle tester	Check nozzle popping pressure, pattern and sound	Repair or replace nozzle	

Study SAFETY RULES in the front of this manual thoroughly for the protection of machine and safety of personnel.

TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSE	TOOLS REQUIRED	TEST	SOLUTION
<i>Engine emits black smoke from exhaust</i>	Air system clogged	Engine diagnostic kit	Run test and compare results	Check engine air intake system
	Fuel injection pump not properly timed or worn	Timing light	Check engine timing	Retime or repair fuel injection pump
	Improper fuel	Operator's manual	Check fuel specifications with supplier	Drain fuel system and refill with specified fuel
	Lack of good fuel injection spray pattern	Nozzle tester	Check nozzle popping pressure, pattern and sound	Clean and adjust nozzles
	Engine operating temperature too low	Engine diagnostic kit	Run diagnostic test	Check thermostat
	Clogged fuel injection nozzles	Nozzle tester	Check nozzle popping pressure, pattern and sound	Clean and adjust nozzles
	Low compression	Compression tester	Run compression test	If low, make necessary repairs
	Early fuel injection pump timing	Timing light	Time fuel pump to engine	Test and adjust pump timing
	Fuel pump improperly timed	Timing light	Time fuel pump to engine	Time fuel pump
	Loose bearings		Oil analysis	Replace bearings
<i>Engine detonates or knocks</i>	Loose piston		Oil analysis	Inspect piston assembly and replace defective parts
	Loose flywheel			Check tightness of flywheel bolts. Tighten or replace parts as required
	Improperly adjusted valve(s)			Check and adjust valves
	Foreign material in cylinder(s)			Make necessary repairs
STARTING SYSTEM				
<i>Starter will not crank engine</i>	Batteries weak	Hydrometer	Test specific gravity	Check batteries
	Cables or connections loose or corroded		Visual	Clean corrosion from all terminals and tighten all loose connections
	Starter switch inoperative	Volt-Ohm meter	Test starter switch for voltage across contact when in starter position	If no voltage, replace switch
	Starter brushes worn or not contacting properly			Install new brushes or fit brushes to contour of commutator

Study SAFETY RULES in the front of this manual thoroughly for the protection of machine and safety of personnel.

TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSE	TOOLS REQUIRED	TEST	SOLUTION
<i>Starter will not crank engine(Continued)</i>	Starter brush springs weak			Check spring tension and replace if necessary
	Starter commutator dirty or worn			Polish and/or machine commutator and under-cut mica if necessary
	Starter armature shaft bushings worn (armature drags on fields)			Replace worn bushings and related parts
	Starter armature burned out			Replace armature
<i>Starter pinion will not engage with flywheel ring gear</i>	Grease or dirt in starter drive mechanism			Disassemble and clean the drive assembly
	Broken or excessively worn parts			Replace broken or worn parts
FUEL SYSTEM				
<i>Insufficient fuel supply to fuel injection nozzles</i>	No fuel in fuel tank		Observe dipstick reading	Fill fuel tank with specified fuel. Vent fuel system
	Inoperative fuel transfer pump	Vacuum gauge	Install gauge between tank and pump and run engine tests	If vacuum is below specification, repair or replace transfer pump
	Fuel injection nozzle valve binding in valve body	Nozzle tester	Pop nozzles for pressure, pattern and sound	Replace valve assembly in nozzle holder body
	Fuel lines, filter, sediment bowl clogged	Engine diagnostic kit	Visual, run engine performance test and compare results	Clean fuel system components. Replace fuel filter
	Fuel injection pump malfunctioning	Engine diagnostic kit	Run engine performance test and compare results	Repair or replace fuel injection pump
	Fuel injection nozzles improperly adjusted	Nozzle tester	Pop nozzles for pressure, pattern and sound	Adjust fuel injection nozzles
	<i>Air in fuel system</i>	Loose fuel line fitting or leak in fuel line on suction side of fuel transfer pump		Visual
Damaged gasket on fuel filter			Visual	Replace gasket

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TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSE	TOOLS REQUIRED	TEST	SOLUTION
AIR INTAKE SYSTEM				
<i>Insufficient air supply to cylinders</i>	Air cleaner clogged	Engine diagnostic kit	Run engine performance test and compare results	Replace air filter element
	Foreign material lodged in turbocharger impeller or turbine		Visual	Disassemble and clean
	Excessive dirt buildup in compressor in short period of time		Visual	Thoroughly clean compressor assembly
	Leaks in engine intake and/or exhaust manifold reducing turbocharger efficiency	Pressure gauge, air pump and hose and soap solution	Run test by pressurizing air cleaner. Apply soap solution over joints and check for soap bubbles.	Tighten loose manifold retaining nuts or capscrews. Replace manifold gaskets
	Turbocharger rotating assembly bearing seized		Visual, spin turbocharger by hand	Overhaul turbocharger
<i>Rapid wear on parts</i>	Dirt admitted with intake air	Pressure gauge, air pump and hose and soap solution	Run test by pressurizing air cleaner. Apply soap solution over joints and check for soap bubbles	Inspect air cleaner assembly and related parts thoroughly for cracks or openings which would allow air to enter engine without passing through air cleaner element. Make necessary repairs
	Dirty lubricating oil		Visual	Change engine oil and oil filter elements at recommended intervals
	Improper fuel	Operator's manual	Check the fuel specification with supplier specifications	Use the proper fuel
COOLING SYSTEM				
<i>Engine operating temperature too high with ample coolant in system</i>	Temperature gauge inoperative	Test gauge	Install gauge and compare results after machine warms up	Replace if necessary
	Radiator air passages restricted	Engine diagnostic kit	Run engine performance test and compare results	Clean exterior of radiator
	Thermostat inoperative	Remove thermostat and check operating temperature		If thermostat does not open, replace thermostat

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TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSE	TOOLS REQUIRED	TEST	SOLUTION	
<p><i>Engine operating temperature too high with ample coolant in system (Continued)</i></p>	Loose or broken fan drive belts	Belt tension gauge	Compress belt and compare with specification	Adjust or replace fan drive belts	
	Lime deposits in water passages of radiator, cylinder heads and/or cylinder block		Visual	Thoroughly clean affected parts	
	Water passages in oil cooler restricted	Engine diagnostic kit	Run engine performance test with temperature probes connected to the cooler. Compare results	Remove and clean oil cooler core	
	Water pump inoperative		Leaks around front seal or excessive pulley play	Repair or replace water pump	
	Engine pulling excessive load		Observe load size	Reduce load	
	Engine speed set too high	Engine diagnostic kit	Run engine performance test and compare results	Adjust speed to within specified rpm limits	
	<p><i>Engine operating temperature too high due to loss of coolant</i></p>	External leaks		Visual	Repair affected parts
		Ruptured oil cooler core (oil in coolant)		Pull oil sample and check for coolant in oil	Replace oil cooler core
		Engine cylinder head gaskets leaking		Visual	Replace gaskets and/or retorque head bolts
		Cylinder head cracked		Antifreeze in oil	Replace cylinder head
Cylinder block cracked			Antifreeze in oil	Replace cylinder block	
<p><i>Engine operating temperature too low</i></p>	Thermostat stuck in the open position		Pull thermostat and check if open all the time	Replace thermostat	
	Operating in extremely cold weather		Observe ambient temperature	Provide necessary cold weather protection	

Study SAFETY RULES in the front of this manual thoroughly for the protection of machine and safety of personnel.

TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSE	TOOLS REQUIRED	TEST	SOLUTION
LUBRICATING SYSTEM				
<i>No lubricating oil pressure</i>	Insufficient oil in crankcase		Pull dipstick	Fill crankcase to proper level
	Oil pressure gauge inoperative	Second pressure gauge	Install second gauge in place of original. Note if operating pressure is OK	Replace gauge
	Lubricating oil pump screen clogged		Visual with engine sump removed	Remove and clean the screen
	Lubricating oil pump inoperative		Visual with engine sump removed	Repair or replace oil pump
	Oil line loose or broken inside crankcase		Visual with engine sump removed	Repair or replace affected parts
	Oil pressure gauge inaccurate	Second pressure gauge	Install second gauge in place of original. Note if operating pressure is OK	Replace if necessary
	Oil pressure relief valve or regulator valve stuck in the open position		Observation after teardown of valve	Clean, repair, or replace affected parts
	Oil line in crankcase loose or broken		Visual with engine sump removed	Repair or replace affected parts
	Improper lubricant	Operator's manual	Compare oil specifications with factory specifications	Fill crankcase with specified lubricant
	Main and/or connecting rod bearings worn	Micrometer	Engine teardown and measurement	Replace bearings
Camshaft bearings worn	Micrometer	Engine teardown and measurement	Replace bearings	
Lubricating oil pump worn		Visual with engine sump and pump removed	Repair or replace oil pump	
<i>Excessive lubricating oil pressure</i>	Pressure gauge inaccurate	Pressure gauge	Install second gauge and run engine test	Replace if necessary
	Oil pressure regulating valve improperly adjusted	Pressure gauge	Install second gauge and run engine test	Adjust valve to obtain proper pressure
	Improper lubricant	Operator's manual	Compare oil specifications in the manual with those of oil supplier	Fill crankcase with specified lubricant

Study SAFETY RULES in the front of this manual thoroughly for the protection of machine and safety of personnel.

TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSE	TOOLS REQUIRED	TEST	SOLUTION
Overheating of lubricating oil	Insufficient oil in crankcase		Check dipstick	Fill crankcase to proper level
	Improper lubricant	Operator's manual	Compare oil specifications in the manual with those of oil supplier	Fill crankcase with specified lubricant
	Engine oil cooler clogged	Engine diagnostic kit	Install the low temperature probes on the engine oil heat exchanger inlet and outlet. Run engine Performance test. Check temperature drop across exchanger	Check or replace the oil cooler
Excessive oil consumption	External oil leakage (gaskets, etc)		Visual	Correct all external leaks
	Engine oil seals worn or damaged		Tear-down	Replace oil seals
	Lubricating oil too light	Operator's manual	Compare specifications to those of the oil	Fill crankcase with specified lubricant
	Pistons, rings, and/or cylinder sleeves worn	Engine diagnostic kit	Run engine performance test. Observe blue smoke	Replace affected parts
	Oil control rings stuck in piston ring grooves	Engine diagnostic kit	Run engine performance test. Observe blue smoke	Clean ring grooves and replace rings
Excessive oil consumption during first 250 hours of operation and no improvement	Valve guides worn	Engine diagnostic kit	Run engine performance test. Observe blue smoke	Replace valve guides. Check related parts
	Rings not sealed properly	Operator's manual	Compare specifications and break-in procedure	Allow more time for "break in". Make certain specified lube oil is used and engine is operating at proper temperature
	Engine oil viscosity too light	Operator's manual	Compare specifications	Use recommended viscosity
Rapid wear on engine parts	Lubricating oil contaminated		Oil analysis	Fill system with clean engine oil. Replace engine oil filters
	Improper engine lubricating oil	Operator's manual	Compare specifications	Fill system with specified engine lubricating oil

Study SAFETY RULES in the front of this manual thoroughly for the protection of machine and safety of personnel.

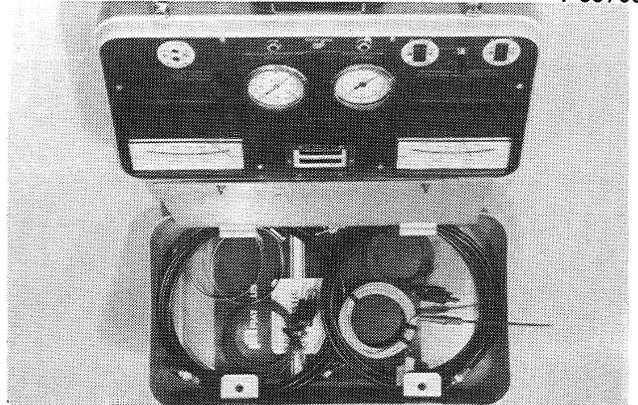
TESTING

3.1 ENGINE DIAGNOSTIC KIT

T-85795

3.1.1

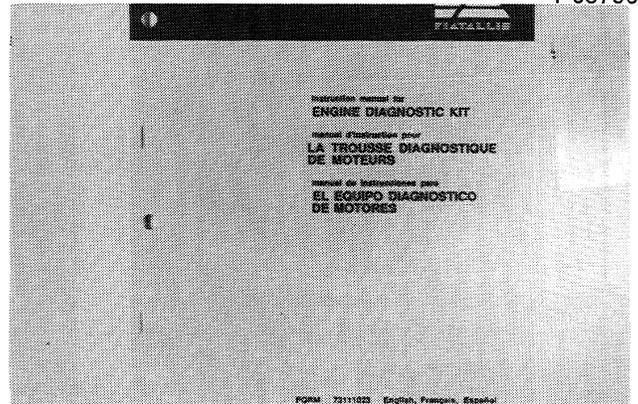
When testing an engine, use the Engine Diagnostic Kit, P/N 75300772 and Troubleshooting Guide P/N 75300010. The diagnostic kit allows the engine rpm, engine intake manifold pressure, exhaust manifold temperature and air cleaner restriction to be monitored with relatively easy hook-ups. In addition there are two thermo-couples that can monitor low temperatures that occur in the radiator or heat exchanger.



T-95796

3.1.2

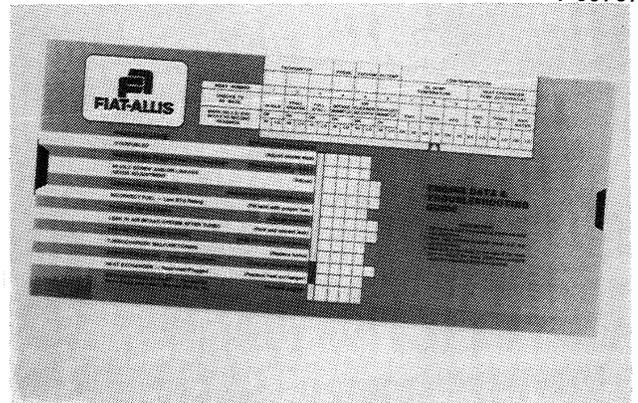
Install the engine sensors as described in Service Manual P/N 73111023. Conduct the engine tests after the engine has come up to operating temperature. Record all results of the test.



T-85797

3.1.3

Use the data in the engine specification section of this manual along with the Troubleshooting Guide to pin point possible problems that occur in the engine's different systems.

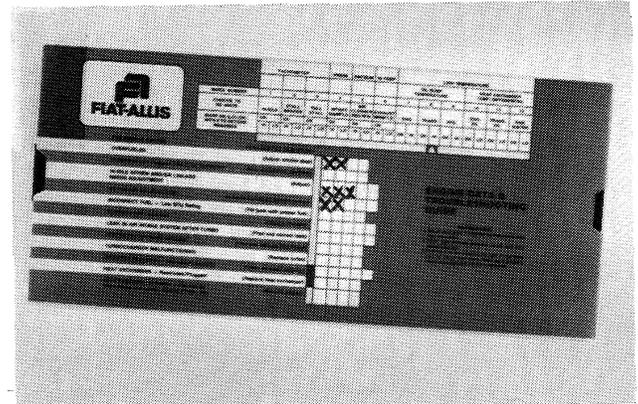


T-85798

3.1.4

Align the white triangle under the different results in the solution-area of the guide.

Use a pencil (NO PEN) and mark wherever a black line appears in the solution area. After recording all data note that some boxes have more marks than others. Try to repair those items which have the highest number of pencil marks because that is probably the cause of the problem.



Study SAFETY RULES in the front of this manual thoroughly for the protection of machine and safety of personnel.

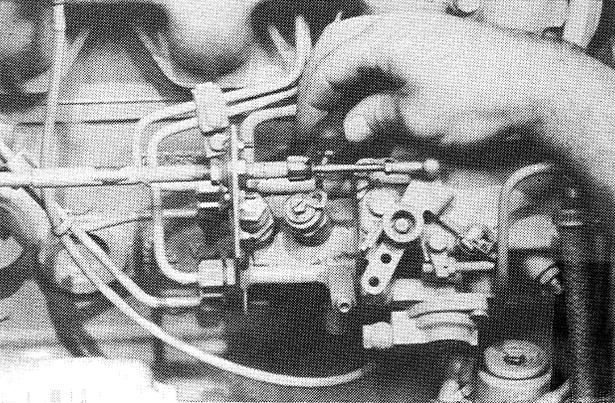
TESTING

3.2 COMPRESSION TESTING

3.2.1

Check engine compression pressure after the engine has warmed to operating temperature. Shut the engine off.

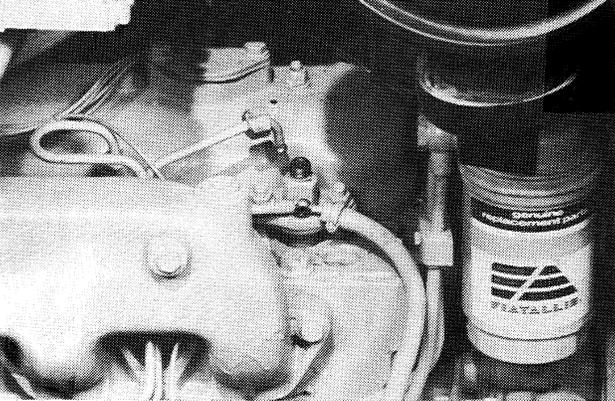
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3.2.2

Disconnect electric fuel shut-off wire from the fuel pump where applicable.

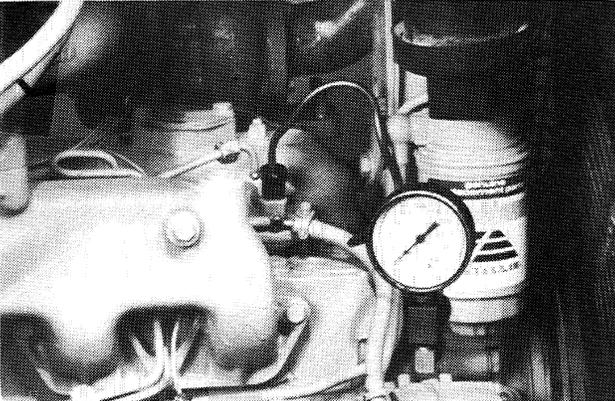
T-91316



3.2.3

Disconnect the fuel supply and fuel return lines from the injection nozzle of the cylinder being tested.

T-91318



3.2.4

Install adapter tool FA P/N 75292631 and compression test gauge P/N 75291310 in place of the injection nozzle. An adapter tool can be made using the same injection nozzle with the nozzle tip removed.

Study **SAFETY RULES** in the front of this manual thoroughly for the protection of machine and safety of personnel.

3.2.5

Position the throttle lever in the shut-off position for units without electric fuel shut-off.

3.2.6

Crank the engine with the starter and read the compression gauge. See Specifications for acceptable compression pressure.

3.2.7

Check the compression of each cylinder. The maximum pressure differential between cylinders should not exceed 2.9 bar(42.7 psi).

Note: The compression pressures listed in the Specifications are calculated at sea level. As altitude increases from sea level, the compression pressure will decrease approximately one percent per 100 meters (328 ft.) of rise.