



**FE18**  
**FE20**  
**FE28**  
excavators

**Service Information  
manual**

## AVOID ACCIDENTS

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

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

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

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

### WARNING

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

### CALIFORNIA

#### Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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**FE18**

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FORM 73141432 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, overhangs, timber, demolitions, fire, high walls, dropoff, backfills, 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 dropoffs 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 handholds 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 shutdown 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.

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.

# SAFETY RULES

## 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** machine before mounting. Sound horn. Obey flagman, 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 loadability 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 drawbars, 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 OPERATORS COMPARTMENTS 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 lower 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 elements 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.

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 as 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 breakover 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 dropoffs, in congested areas or on ice or slippery surfaces.

# SAFETY RULES

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 dropoffs.

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 hillside proceed slowly. Never turn sharply uphill or downhill.

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

In steep downhill operation, do not allow engine to overspeed. Select proper gear before starting downgrade.

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 an 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 overhead 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 brushpiles, logs or rocks. DO NOT DRIVE THE MACHINE ONTO BRUSHPILES, LOGS, LARGE ROCKS or other surface irregularities that break traction with the ground especially when on slopes or near dropoffs.

Avoid operating equipment too close to an overhang or highwall either above or below the machine. Be on the lookout for caving edges, falling objects and slides. Beware of concealment by brush and undergrowth 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 for approaching traffic.

Move the machine away from pits, trenches, overhangs and overhead 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.

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 multipurpose 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 Manuals. 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.

# SAFETY RULES

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, hands, and fingers 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, fingers, feet 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.

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 cardboard 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 Manuals 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 makeshift 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 handholds 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.

## SAFETY RULES

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.

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

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

Know and understand the job site traffic flow patterns.

Keep the machine in the same gear going downhill as used for going uphill.

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.

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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.



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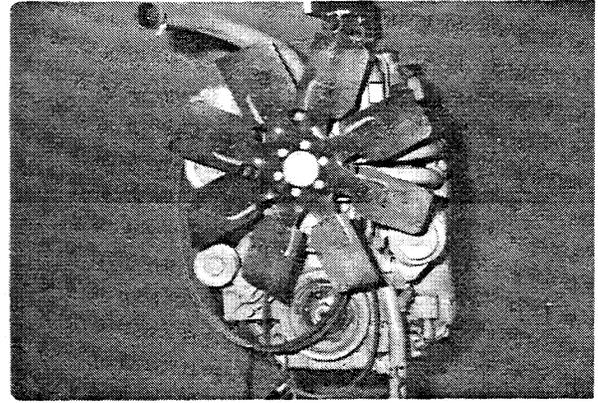
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FE18,FE20,FE28 ENGINE 8065

A1001 ENGINE ON HOOK

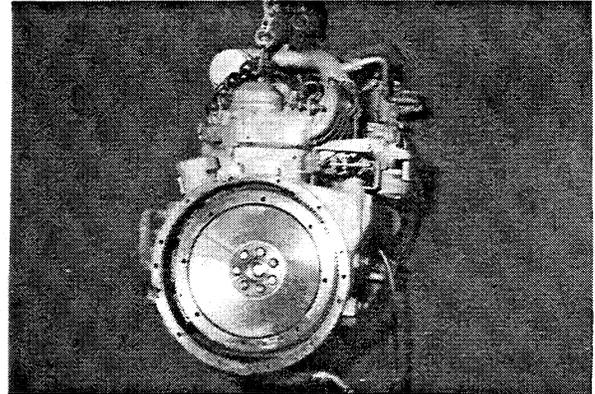
THE ENGINE DEPICTED IN THE REBUILD SECTION OF THIS COURSE IS A REPRESENTATIVE ENGINE. ALL COMPONENTS MAY OR MAY NOT BE ON YOUR PARTICULAR ENGINE, HOWEVER TEARDOWN PROCEDURE REMAINS THE SAME.



A1

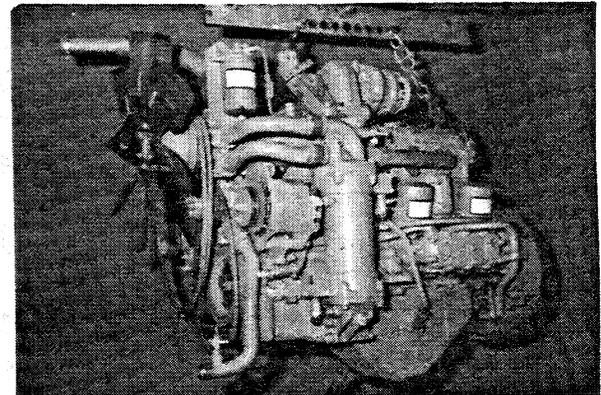
A1002 8065 OVERALL

THE 8065 ENGINE IS A SIX CYLINDER, IN-LINE, OPEN COMBUSTION CHAMBER DESIGNED ENGINE. THERE ARE REPLACEABLE DRY CYLINDER SLEEVES AND FIVE OVER SIZED PISTONS TO GO INTO THE CYLINDERS. THE ENGINE UTILIZES A HIGH PRESSURE FUEL SYSTEM. THIS ENGINE CAN BE EITHER TURBOCHARGED OR NON-TURBOCHARGED DEPENDING UPON MACHINE APPLICATION. THE TURBOCHARGED VERSION IS FOUND ON THE FE28.



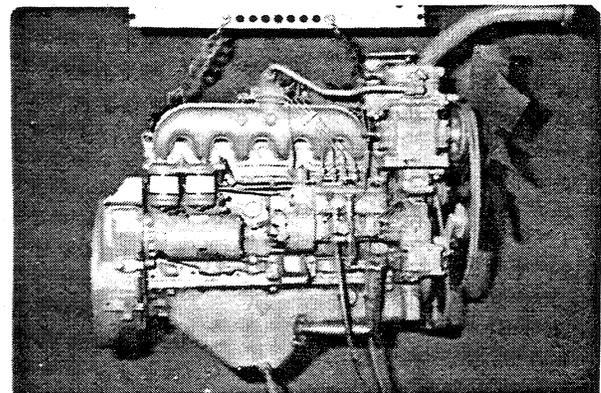
A1003 RIGHT SIDE OF 8065

THE RIGHT SIDE OF THE 8065 CONTAINS THE ALTERNATOR, EXHAUST MANIFOLD, TRANSMISSION HEAT EXCHANGER, OIL FILTERS, ENGINE OIL HEAT EXCHANGER AND COOLANT CONDITIONER. THE ENGINE OIL DIPSTICK MAY BE ON THE LEFT SIDE.

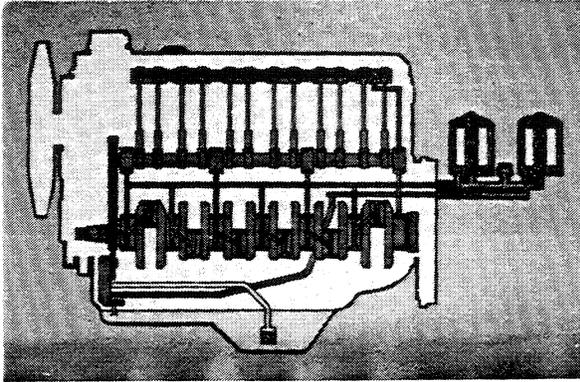


A1004 LEFT SIDE OF 8065

THE LEFT SIDE OF THE ENGINE CONTAINS THE FUEL INJECTION PUMP, FUEL FILTERS AND CRANKING MOTOR. AN AIR COMPRESSOR MAY ALSO BE ATTACHED TO THE RIGHT SIDE ALONG WITH THE TURBOCHARGER.



A1



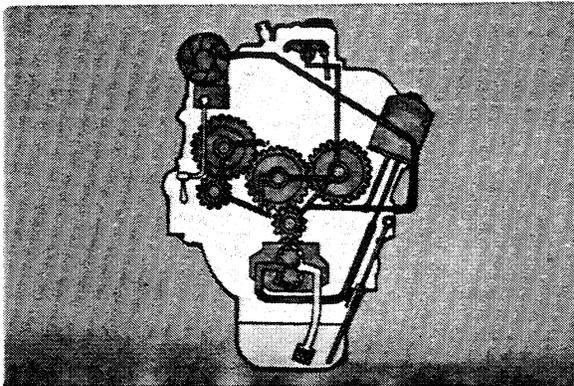
A1005 NATURALLY ASPIRATED LUBE SCHEM 1 OF 2

THE LUBRICATION SCHEMATIC ON 8065 ENGINE WILL ACTUALLY BE TWO SCHEMATICS: ONE FOR NATURALLY ASPIRATED AND ONE FOR TURBOCHARGED ENGINES. OIL IS HELD IN THE SUMP AND BROUGHT TO THE GEAR PUMP. AFTER THE OIL LEAVES THE PUMP, OIL WILL GO INTO THE FILTER HOUSING. TEED AFTER THE PUMP IS A RELIEF VALVE. THE FILTERS ARE IN PARALLEL AND FILTER ALL THE OIL. LOCATED IN THE HOUSING IS A PRESSURE SENDER WHICH SIGNALS LUBRICATION OIL

A1005A CONT'D

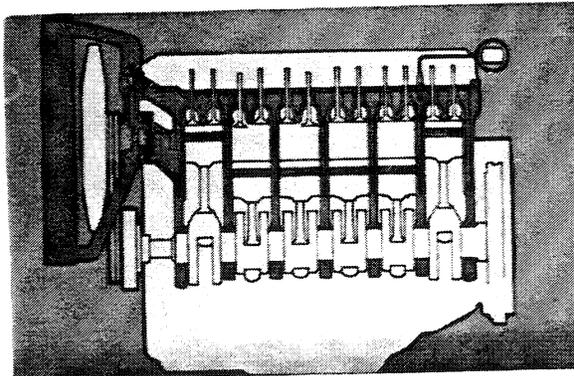
2 OF 2

PRESSURE. THE OIL THEN GOES INTO THE GALLERY FOR ENGINE LUBRICATION. THE GALLERY IS CONNECTED TO THE CRANKSHAFT PASSAGES. THE WRIST PIN IS LUBRICATED BY MEANS OF A DRILLING IN THE CONNECTING ROD. THE CAM BEARINGS ARE ALSO LUBRICATED BY MEANS OF THE OIL GALLERY. THE VALVE TRAIN IS LUBRICATED OFF THE CAM BEARINGS.



A1006 TURBOCHARGED LUBRICATION SCHEMATIC

THE MAIN DIFFERENCE IN THE TURBOCHARGED LUBRICATION SYSTEM THAN THE NATURALLY ASPIRATED SYSTEM IS THAT THERE IS AN EXTERNAL LINE RUNNING FROM THE FILTER AREA TO THE TURBOCHARGER.



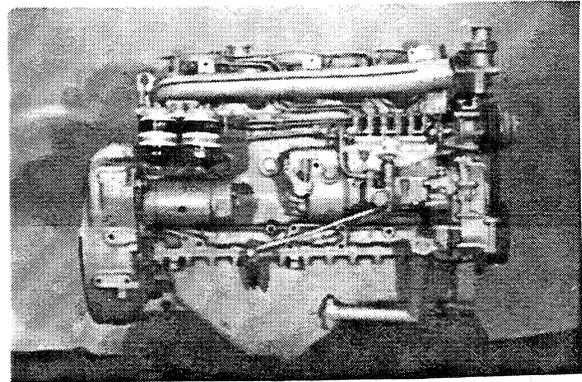
A1007 COOLING SYSTEM

THE COOLING SYSTEM INCLUDES A CENTRIFUGAL WATER PUMP, ONE THERMOSTAT, HOSES, RADIATOR AND ENGINE BLOCK. THE THERMOSTAT PREVENTS COOLANT FROM FLOWING TO THE RADIATOR PRIOR TO THE COOLANT GETTING TO 81 DEGREES C (180 DEGREES F). THERE IS A COOLANT CONDITIONER USED ON TURBOCHARGED ENGINES. THE COOLANT PUMP IS BELT DRIVEN.

FE18,FE20,FE28 ENGINE 8065

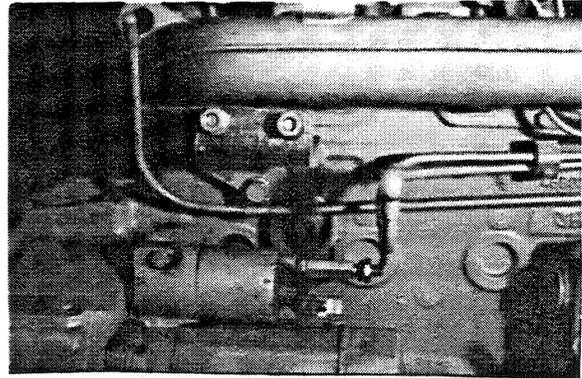
A1008 8065 ON STAND

THE 8065 ENGINE IS MOUNTED IN A ROLLOVER STAND FOR EASE OF DISASSEMBLY. ALL FLUIDS SHOULD BE DRAINED FROM THE ENGINE PRIOR TO DISASSEMBLY. PRIOR TO INSTALLATION ON THE TEARDOWN STAND, THE FOLLOWING ITEMS WERE REMOVED: HEAT EXCHANGERS, OIL FILTERS, AND ENGINE BREATHER.

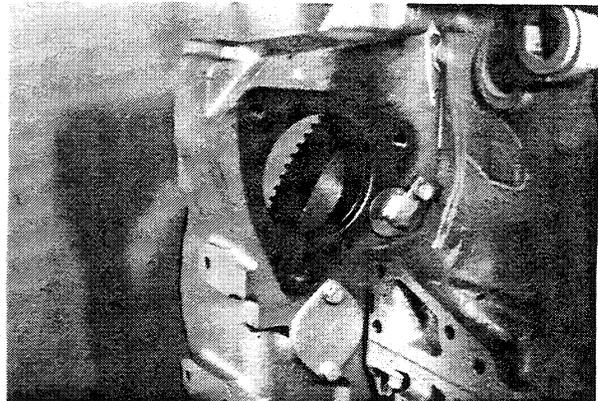


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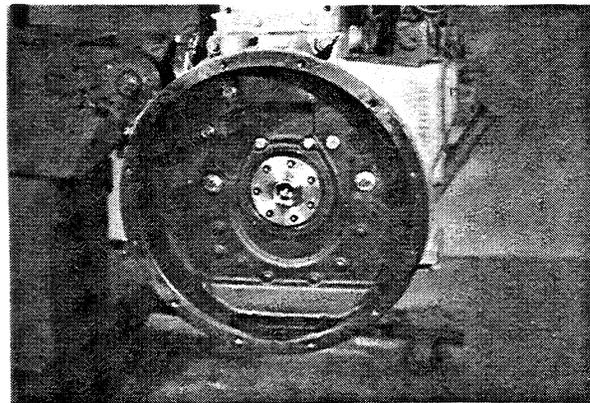
A1009 REMOVE FUEL FILTERS & SUPPORT ASSEMBLY



A1010 REMOVE SHIELD AND CRANKING MOTOR



A1011 REMOVE FLYWHEEL



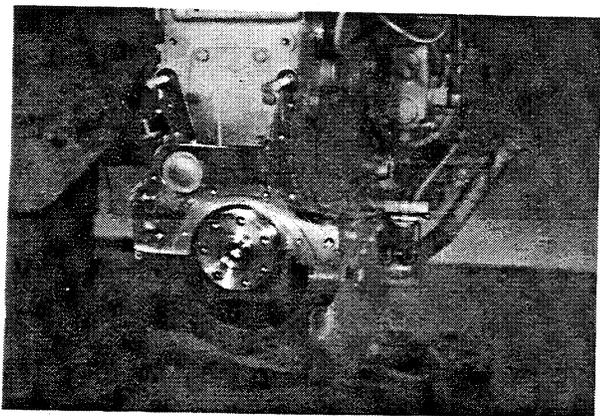
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**⚠ WARNING** - LIFT AND HANDLE ALL HEAVY PARTS WITH A LIFTING DEVICE OF PROPER CAPACITY. BE SURE PARTS ARE SUPPORTED BY PROPER SLINGS AND HOOKS. USE LIFTING EYES IF PROVIDED. WATCH OUT FOR PEOPLE IN THE VICINITY.

FE18, FE20, FE28 ENGINE 8065

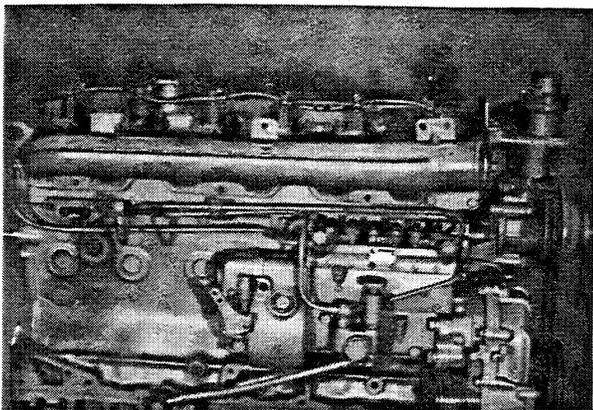
A1012 REMOVE FLYWHEEL HOUSING

A1



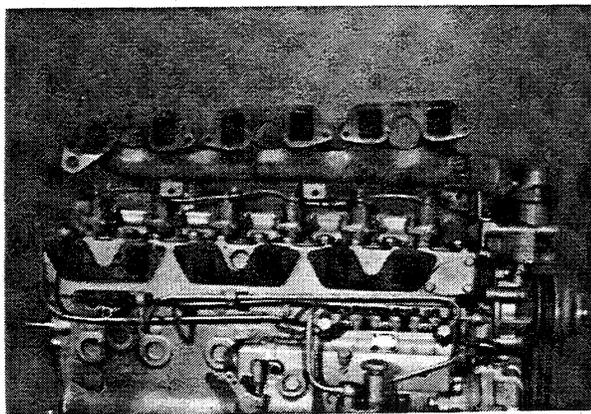
A1013 REMOVE INJECTION NOZZLE LINES

INJECTION NOZZLE LINES MUST BE REMOVED PRIOR TO REMOVAL OF AIR INTAKE MANIFOLD.



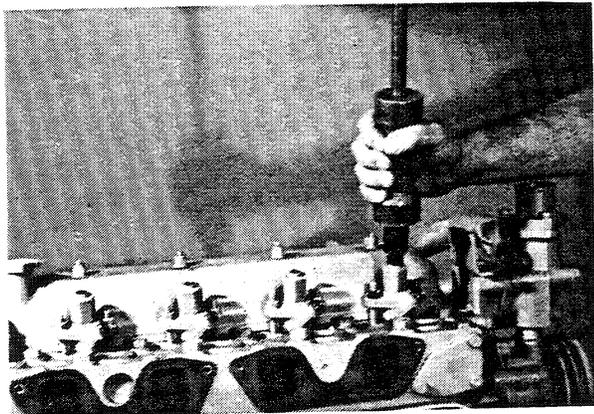
A1014 REMOVE INTAKE MANIFOLD

THE INTAKE MANIFOLD IS ONE-PIECE. THE LIFTING BRACKET IS PART OF AIR INTAKE MANIFOLD.



A1015 NOZZLE REMOVAL

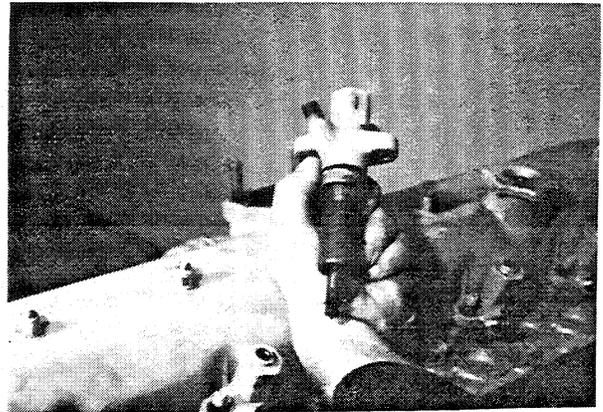
A SLIDE HAMMER MAY NEED TO BE USED TO REMOVE THE FUEL INJECTION NOZZLE. AN ADAPTER P/N 75300415 IS USED WITH THE HAMMER.



FE18,FE20,FE28 ENGINE 8065

A1016 FUEL NOZZLES

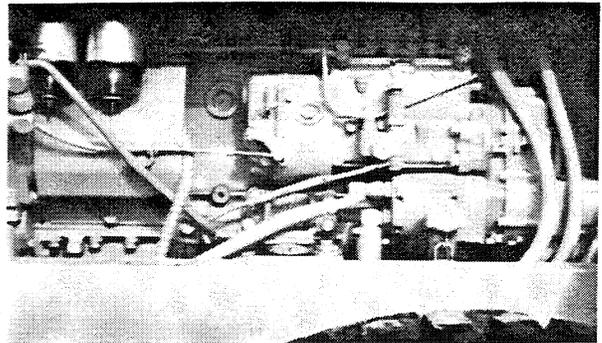
THERE ARE FOUR SUPPLIERS FOR THE FUEL NOZZLES ON THIS ENGINE. DO NOT INTERMIX SUPPLIER NOZZLES ON AN ENGINE. THERE IS A DUST SEAL WHICH FITS BETWEEN THE NOZZLE AND THE NOZZLE TUBE.



A1

A1017 REMOVE HYDRAULIC PUMPS

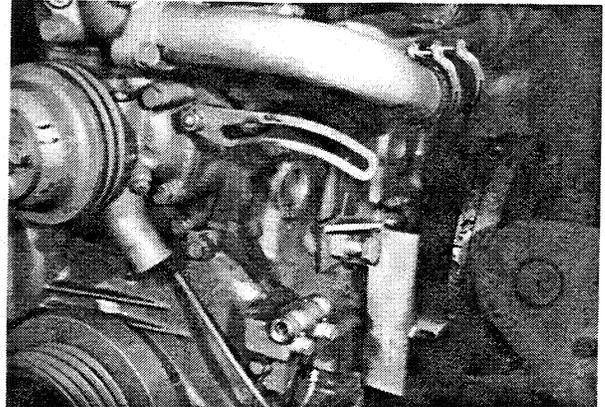
REMOVE ANY ENGINE MOUNTED HYDRAULIC PUMPS.



NOT APPLICABLE ON FE18.

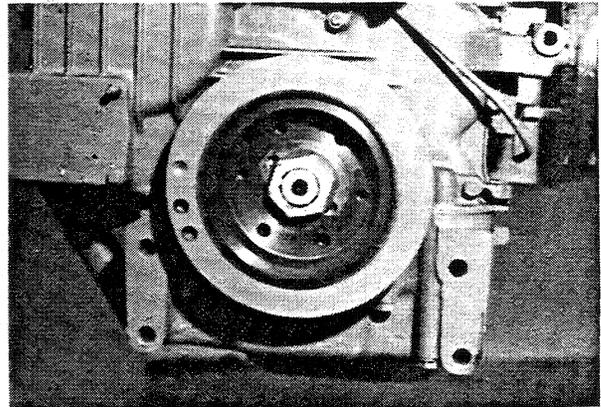
A1018 REMOVE ALTERNATOR

REMOVE ALTERNATOR, FAN AND BELTS.

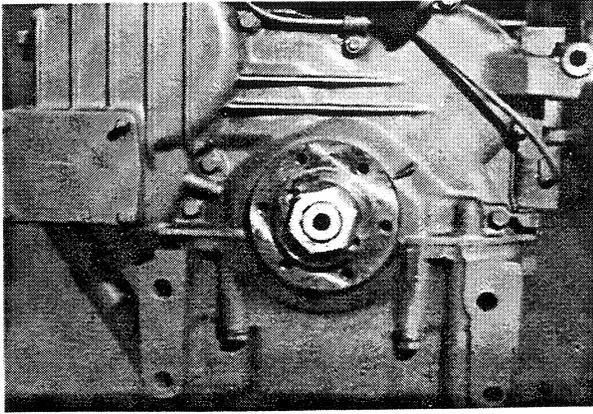


A1019 REMOVE DAMPER CAPSCREWS

REMOVE THE CAPSCREWS WHICH HOLD THE PULLEY AND DAMPER IN LOCATION. THE DAMPER IS MOUNTED ON A HUB. THE DAMPER SHOULD COME OFF THIS HUB EASILY, BUT IF IT DOES NOT, THE DAMPER MAY HAVE TO BE DESTROYED DURING REMOVAL.



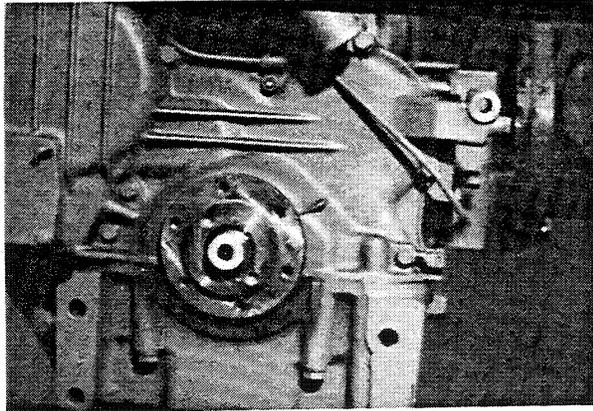
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FE18, FE20, FE28 ENGINE 8065

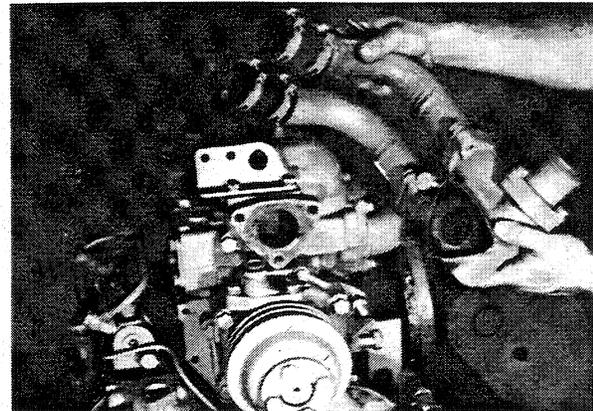
A1020 LOOSEN NUT

UNLOCK THE CRANKSHAFT NUT AND LOOSEN THE NUT.  
BLOCK THE CRANKSHAFT FROM TURNING WHILE  
LOOSENING THE NUT.



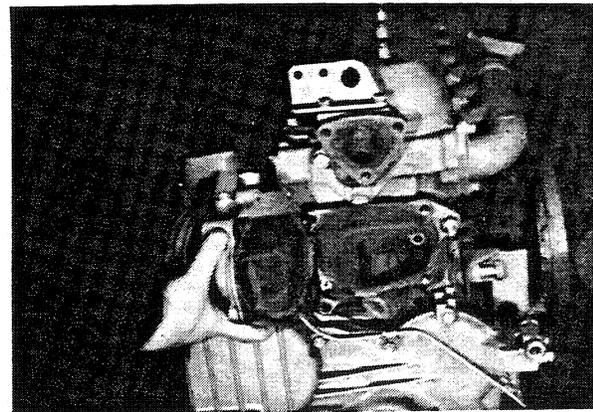
A1021 REMOVE DAMPER HUB

REMOVE THE DAMPER HUB USING TOOL P/N  
75300882. KEEP THE NUT ON THE SHAFT TO  
KEEP THE DAMPER FROM JUMPING OFF THE SHAFT.



A1022 THERMOSTAT HOUSING

REMOVE THE THERMOSTAT HOUSING AND BRACKETS.



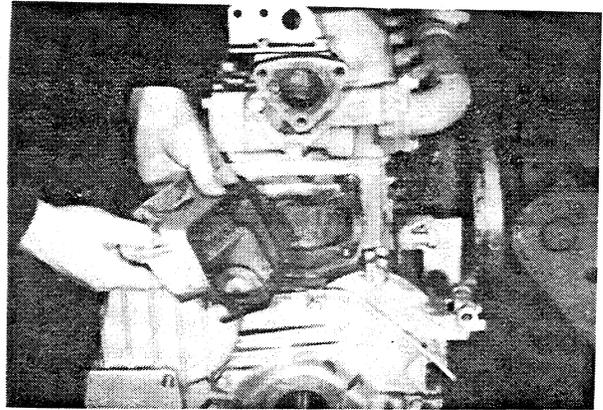
A1023 WATER PUMP

REMOVE THE WATER PUMP FROM ADAPTER PLATE.  
ONE INTERNAL BOLT PREVENTS REMOVAL OF THE  
PUMP AND ADAPTER PLATE TOGETHER.

FE18, FE20, FE28 ENGINE 8065

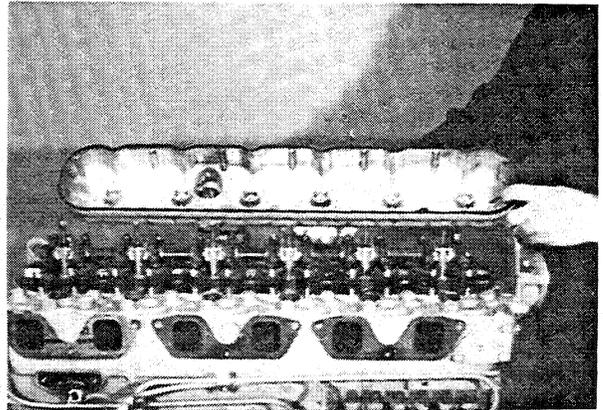
A1024 PUMP ADAPTER PLATE

REMOVE WATER PUMP ADAPTER PLATE.

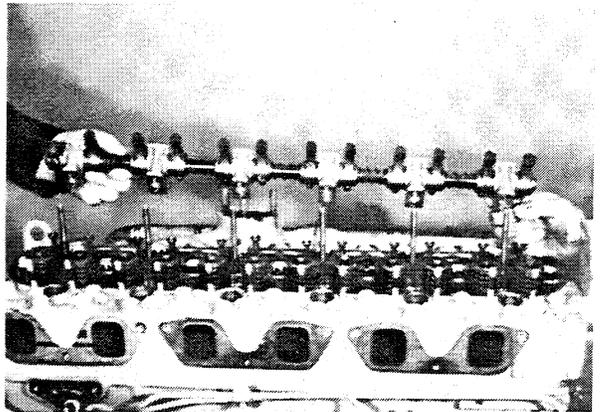


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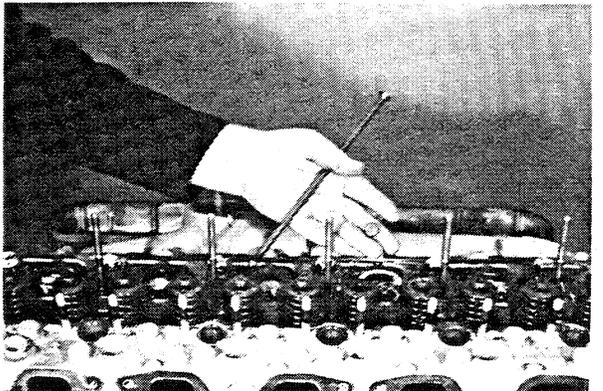
A1025 REMOVE THE ROCKER COVER



A1026 REMOVE ROCKER ARM SHAFT ASSEMBLY



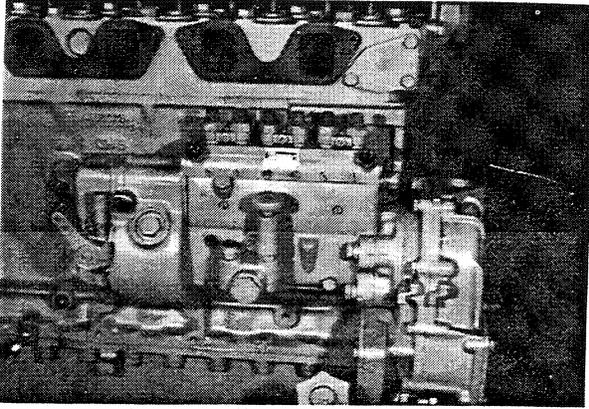
A1027 REMOVE PUSH RODS AND VALVE STEM CAPS



FE18, FE20, FE28 ENGINE 8065

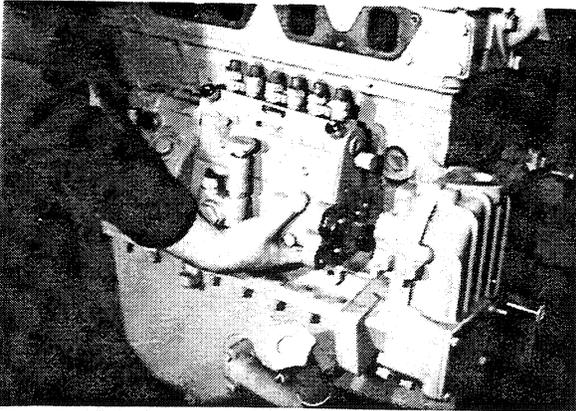
A1028 REMOVE FUEL INJECTION TUBES

REMOVE FUEL INJECTION TUBING, TAKING CARE NOT TO BEND THE TUBING.



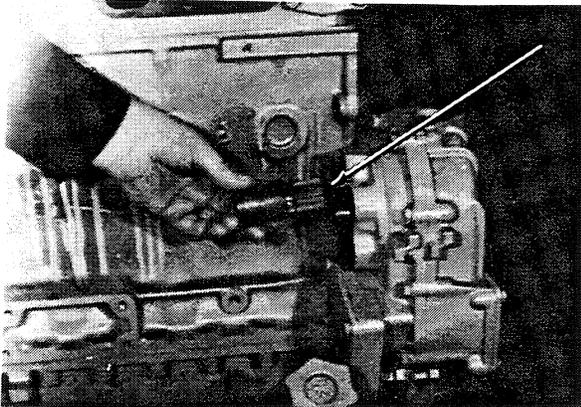
A1029 REMOVE FUEL PUMP

REMOVE THE FUEL INJECTION PUMP FROM THE ENGINE. THE FUEL PUMP IS SPLINED INTO THE DRIVE GEAR BY MEANS OF AN ADAPTER SLEEVE. THIS SLEEVE MAY STAY IN THE HOUSING.



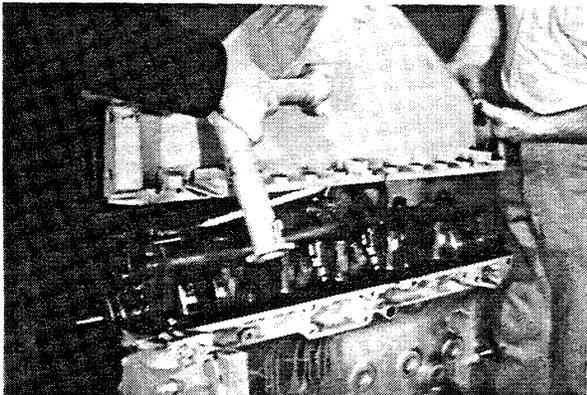
A1030 ADAPTER SLEEVE

REMOVE THE ADAPTER SLEEVE THAT IS JOINED TO THE SPLINE COUPLING. THIS SLEEVE HAS A BLIND SPLINE.



A1031 OIL PAN

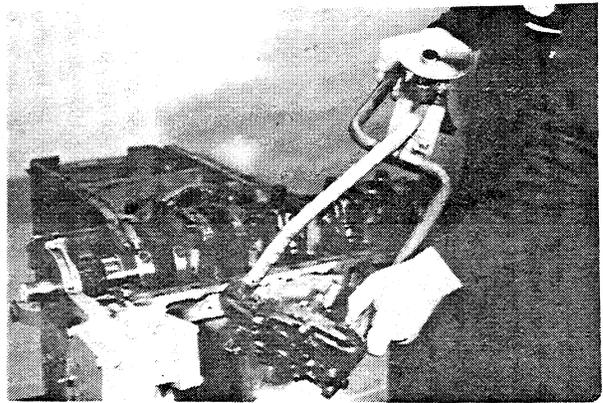
REMOVE THE OIL SUMP AND FILL TUBE. THE OIL PAN MUST BE REMOVED PRIOR TO REMOVING THE TIMING GEAR COVER BECAUSE THE OIL PAN HOLDS A CRANKSHAFT SEAL IN PLACE.



FE18,FE20,FE28 ENGINE 8065

A1032 OIL PUMP

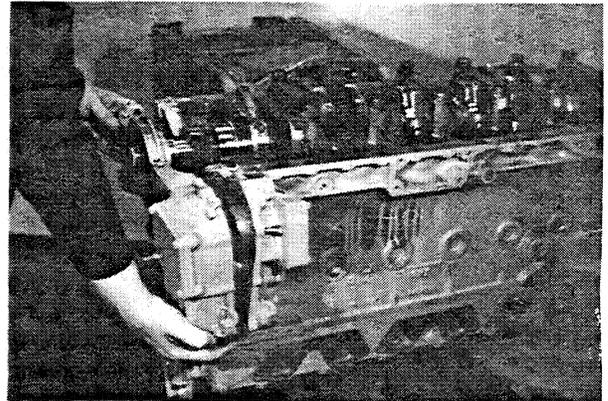
REMOVE OIL PUMP AND PIPING FROM THE BLOCK.



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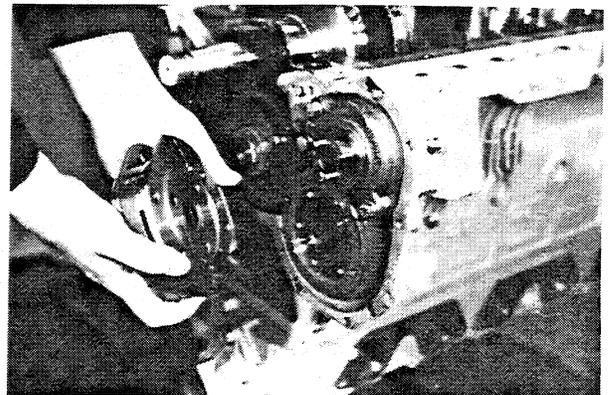
A1033 TIMING GEAR COVER

REMOVE TIMING GEAR COVER AND ALTERNATOR SUPPORT.



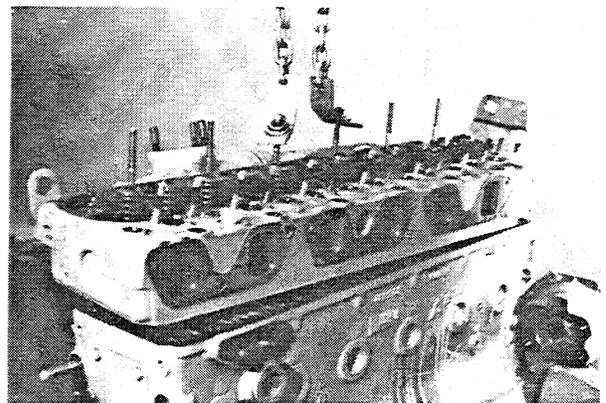
A1034 VARIATOR REMOVAL

REMOVE THE VARIATOR, IF ONE IS PRESENT, FROM THE INJECTION PUMP DRIVE GEAR PLUS ANY LOOSE IDLER GEARING.



A1035 CYLINDER HEAD

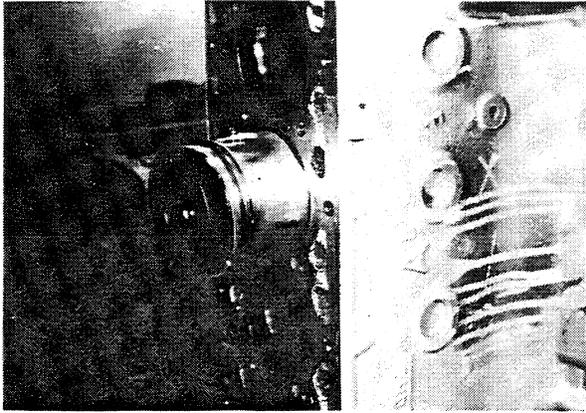
REMOVE CYLINDER HEAD. THE HEAD WEIGHS APPROXIMATELY 70 KG (154 LBS.).



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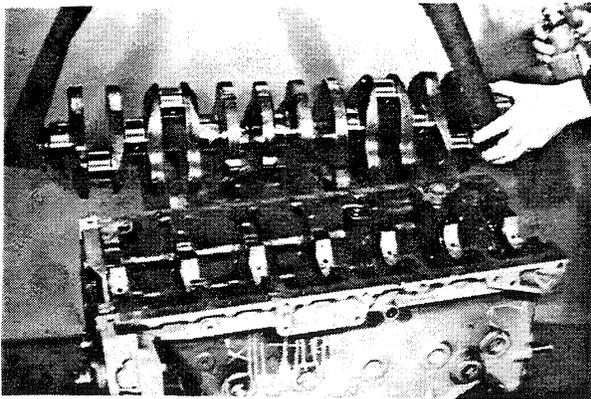
**⚠ WARNING** . LIFT AND HANDLE ALL HEAVY PARTS WITH A LIFTING DEVICE OF PROPER CAPACITY. BE SURE PARTS ARE SUPPORTED BY PROPER SLINGS AND HOOKS. USE LIFTING EYES IF PROVIDED. WATCH OUT FOR PEOPLE IN THE VICINITY.

**A1**



**A1036 PISTON REMOVAL**

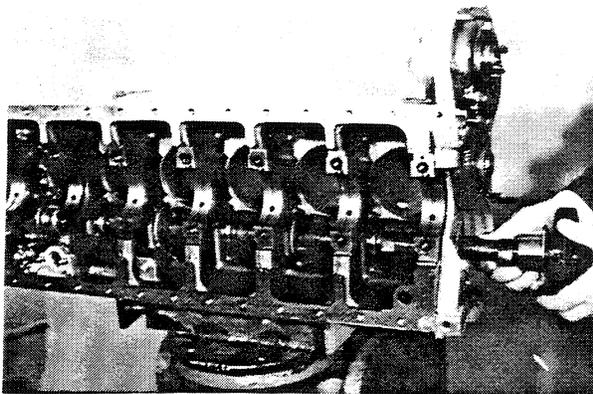
TURN THE ENGINE ON END TO REMOVE THE PISTON AND CONNECTING RODS. BE SURE TO KEEP THE CONNECTING ROD CAP WITH ITS ASSOCIATED CONNECTING ROD. REMOVE ANY CARBON RIDGE ON THE SLEEVE PRIOR TO PISTON REMOVAL.



**A1037 LIFT CRANKSHAFT**

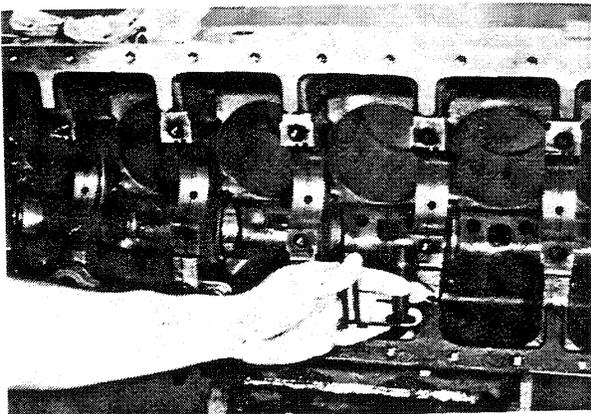
ROTATE THE ENGINE SO THAT THE TOP DECK IS DOWNWARD. REMOVE THE MAIN BEARING CAPS AND BEARING SHELLS. LIFT THE SHAFT FROM THE BLOCK. MATE THE BEARING HALVES WITH THE CORRESPONDING MAIN BEARING CAP.

**⚠ WARNING** • =====  
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.



**A1038 CAMSHAFT REMOVAL**

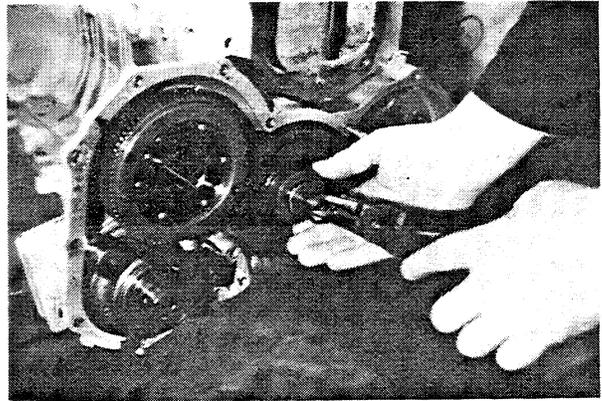
ROTATE THE CAMSHAFT GEAR SO THAT THE THRUST PLATE SCREWS CAN BE REMOVED. AFTER THE CAPSCREWS ARE REMOVED, THE CAMSHAFT CAN BE PULLED. BE CAREFUL TO NOT DAMAGE THE BUSHINGS IN THE REMOVAL PROCESS.



**A1039 CAM FOLLOWERS**

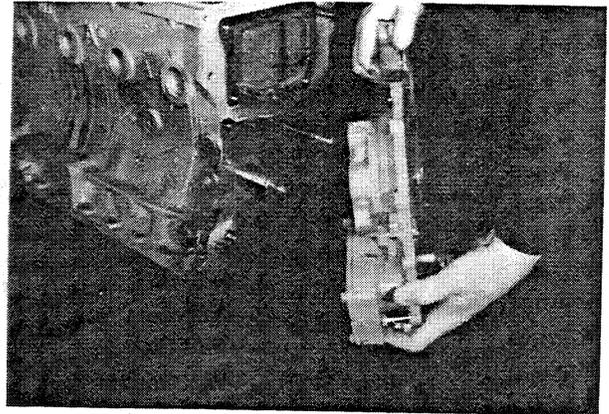
REMOVE THE CAM FOLLOWERS FROM THEIR BORES.

A1040 REMOVE IDLER GEAR



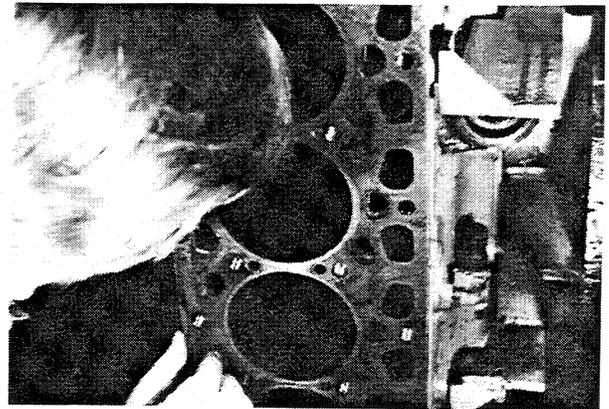
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A1041 REMOVE TIMING GEAR HOUSINGS



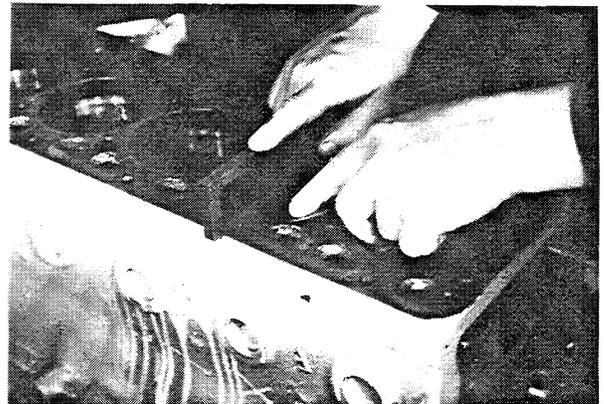
A1042 INSPECTION

WHEN REBUILDING AN ENGINE, MEASUREMENTS MUST BE TAKEN TO INSURE PROPER TOLERANCE OF THE ENGINE COMPONENTS. THE BLOCK MUST BE FREE FROM CRACKS, DISTORTION, OR EROSION. DYE CHECK KIT P/N 75300416 IS USED TO CHECK FOR CRACKS.

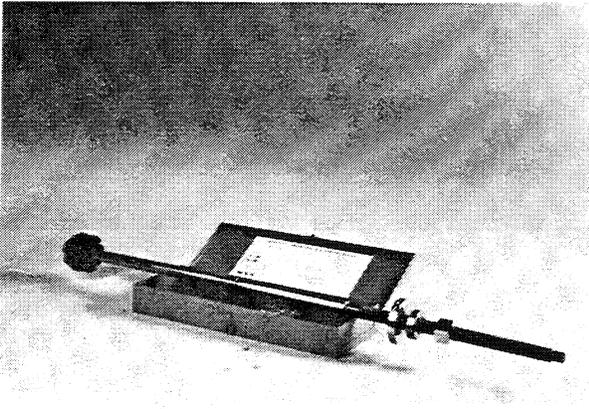


A1043 BLOCK DISTORTION

TO DETECT CYLINDER BLOCK DISTORTION, USE A STRAIGHT EDGE TOOL P/N 75291174 AND THICKNESS GAUGE.



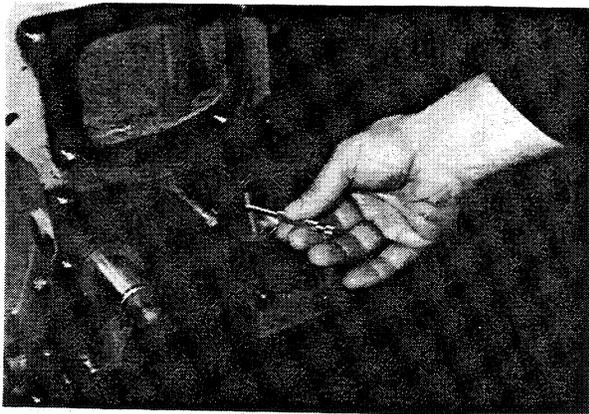
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FE18, FE20, FE28 ENGINE 8065

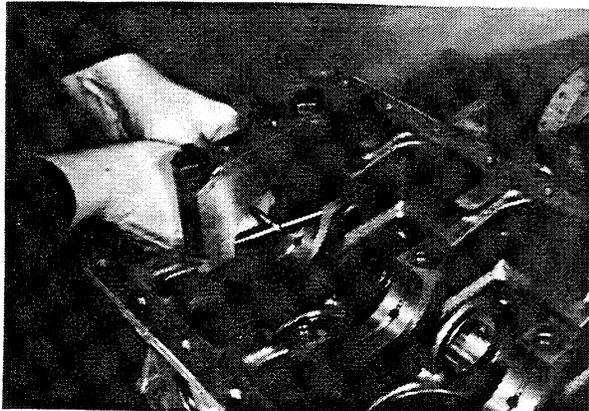
A1044 CAMSHAFT BUSHING TOOLS

REMOVE THE CAMSHAFT BUSHINGS USING TOOL P/N 75294892.



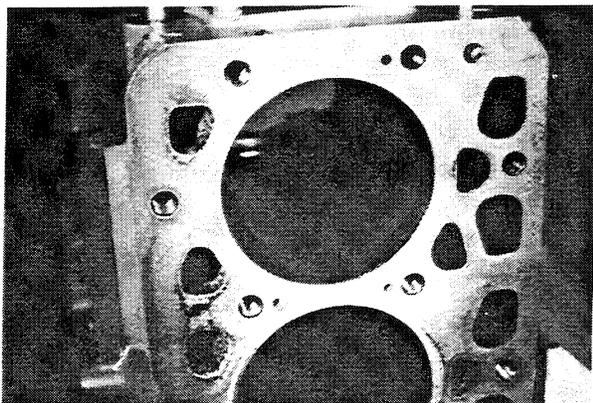
A1045 MEASURE CAMSHAFT BORE

DETERMINE WHETHER ANY OF THE BUSHING BORES ARE OUT OF ALIGNMENT OR DISTORTED.



A1046 MAIN BEARING MEASUREMENT

CHECK FOR ALIGNMENT OF THE MAIN BEARINGS SUPPORT AREA. INSTALL MAIN BEARING CAP ON EACH SUPPORT AREA. TIGHTEN CAPSCREWS TO THEIR SPECIFIED TORQUE. WITHOUT ANY BEARINGS IN PLACE, MEASURE THE MAIN BEARING BORE.



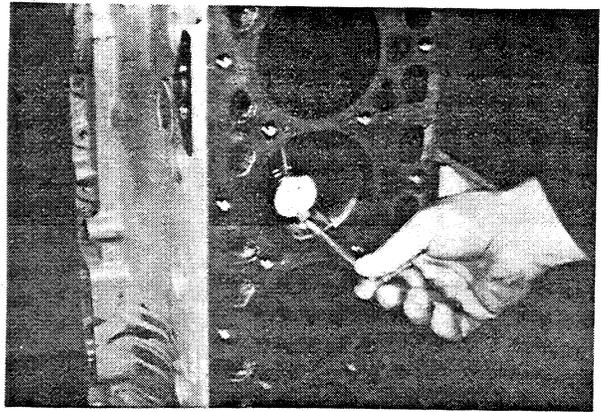
A1047 SLEEVE INSPECTION

INSPECT THE CYLINDER SLEEVES FOR SIGNS OF SEIZING, SCORING, OR OUT-OF-ROUNDNESS. RE-BORING OF THE CYLINDER SLEEVE IS PERMISSIBLE.

FE18, FE20, FE28 ENGINE 8065

A1048 SLEEVE DIAMETER

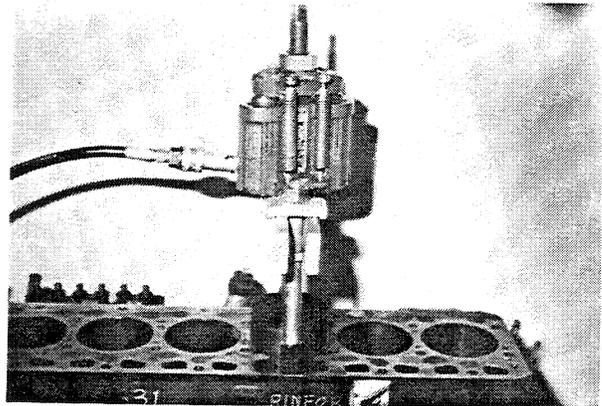
THE INSIDE DIAMETER OF EACH CYLINDER MUST BE MEASURED AND RECORDED. SLEEVE TAPER MUST BE WITHIN SPECIFICATIONS.



A1

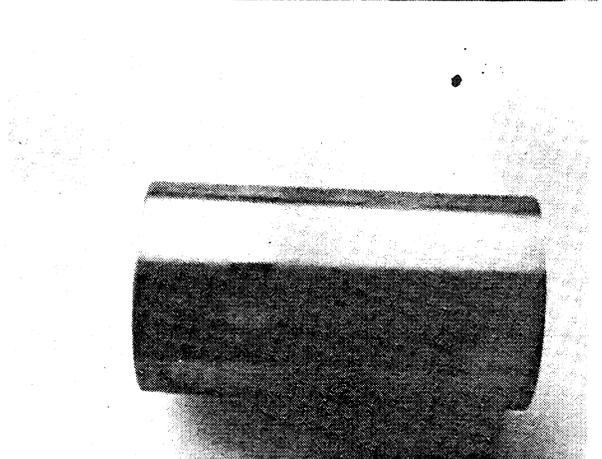
A1049 SLEEVE REMOVAL

TO REMOVE A CYLINDER SLEEVE, ROTATE THE BLOCK SO THAT THE TOP DECK IS UP. POSITION THE REMOVAL PLATE TOOL P/N 75300181 ON THE SLEEVE AND PRESS THE SLEEVE OUT THE TOP. AFTER THE SLEEVE IS REMOVED, THE BLOCK BORE MUST BE CHECKED FOR CONCENTRICITY AND SIZE.



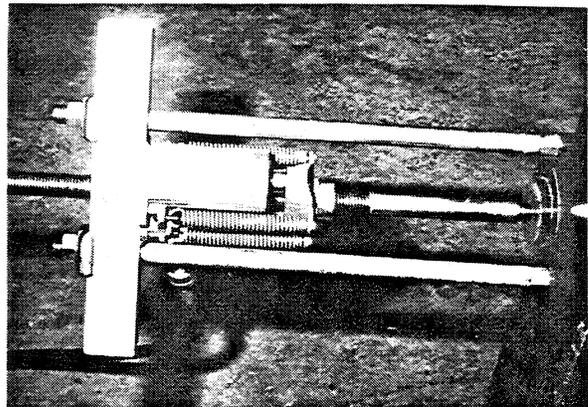
A1050 SLEEVE SIZE

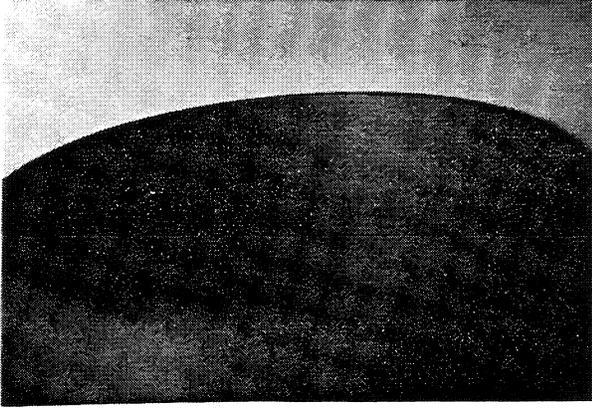
SLEEVES ARE AN INTERFERENCE FIT INTO THE BORE. THEY ARE DESIGNED WITH APPROXIMATELY .12 MM (.005 IN) INTERFERENCE. THERE ARE TWO SIZES OF CYLINDER SLEEVES.



A1051 SLEEVE INSTALLATION

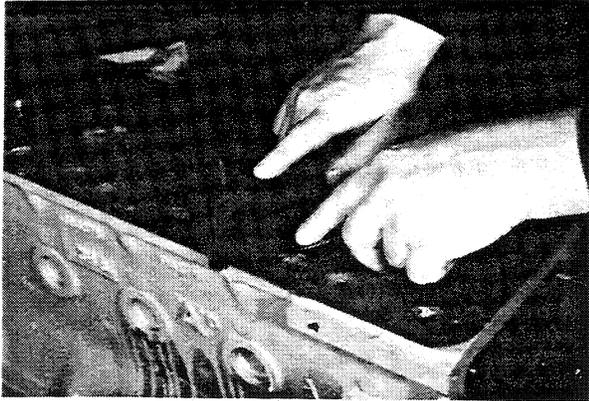
WHEN INSTALLING THE CYLINDER SLEEVE, IT IS RECOMMENDED THAT THE WALLS OF THE BLOCK CYLINDER HOLE BE LUBRICATED WITH A LIGHT COAT OF MINERAL OIL. BE SURE THAT THE CYLINDER SLEEVE IS CORRECT FOR THE BORE. THE SLEEVE IS PRESSED INTO THE BLOCK USING TOOLS, PRESS P/N 75300882 AND PLATE P/N 75300182.





A1052 SLEEVE FINISH

AFTER INSTALLING THE CYLINDER SLEEVES, THE SLEEVES MUST BE BORED AS THEY ARE SEMI-FINISHED. AGAIN THERE IS A SPECIFIED DIMENSION IN BORING. IT IS RECOMMENDED THAT A RELIABLE MACHINE SHOP DO THE BORING AND INSTALLATION IF THE SHOP DOES NOT HAVE THE FACILITIES.



A1053 BLOCK FLATNESS

AFTER THE SLEEVES ARE BORED AND HONED, THE TOP DECK SHOULD BE INSPECTED FOR FLATNESS. AT ANY RATE THE TOP DECK SHOULD BE SKIMMED TO REMOVE ANY RIDGES OR BURRS THAT MAY HAVE DEVELOPED DURING THE SLEEVE INSTALLATION PROCEDURE.



A1054 PISTON PIN REMOVAL

THE PISTON PINS CAN BE PRESSED OUT OF THE PISTON BY MEANS OF A DRIFT AND HAMMER. WHEN PLACING THE CONNECTING ROD IN A VISE, BE SURE THE VISE HAS SOFT JAWS SUCH AS LEAD, WOOD, OR ALUMINUM.



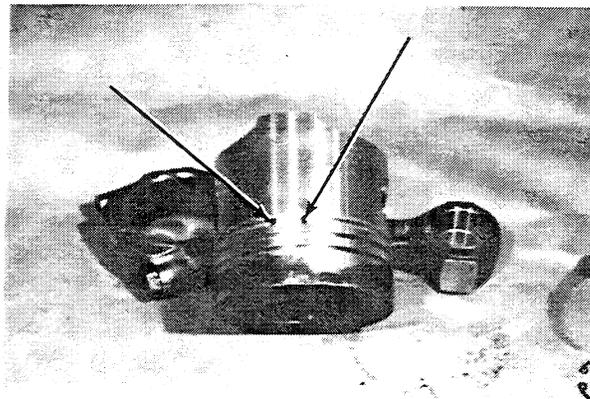
A1055 PISTON HEAT CRACKS

HEAT CRACKS OR CHECKS AROUND THE CIRCUMFERENCE OF THE COMBUSTION CHAMBER ARE CONSIDERED NORMAL. REPLACE ANY PISTON WITH HEAT CHECKS OVER 10 MM (.397 IN) LONG.

FE18,FE20,FE28 ENGINE 8065

A1056 PISTON DRILLINGS

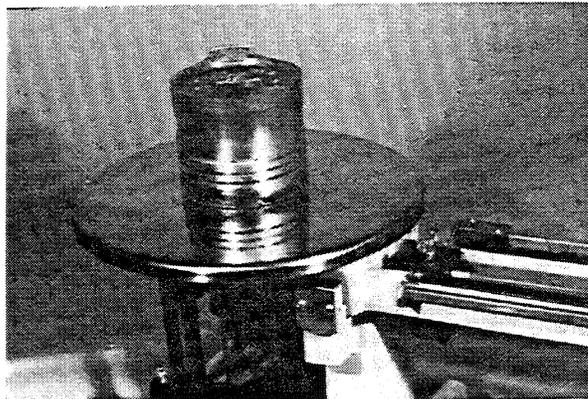
THE PISTONS ARE INTERNALLY DRILLED TO PROVIDE DRAINBACK OF THE OIL SCRAPED OFF THE CYLINDER SLEEVE BY THE OIL SCRAPER RING.



A1

A1057. PISTON

BECAUSE THE CYLINDER SLEEVE CAN BE REBORED THERE ARE FIVE OVERSIZE PISTON SIZES. WHEN SELECTING NEW PISTONS FOR AN ENGINE, BE SURE THAT THE PISTON WEIGHTS ARE WITHIN SPECIFICATIONS.



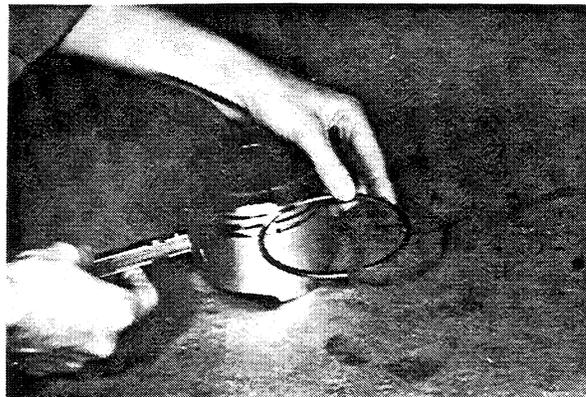
A1058 PISTON RINGS

THERE ARE THREE RINGS ON THE PISTON. THERE ARE TWO COMPRESSION RINGS. THE TOP RING IS CHROME-PLATED WHILE THE SECOND IS CAST IRON. ON THE CAST IRON RING THE NOTCH ON THE OUTER CIRCUMFERENCE GOES DOWN. THE THIRD RING IS THE OIL CONTROL RING AND CONSISTS OF A SPRING OF COILED STEEL PLUS A SLOTTED RING. THE ENDS OF THE SPRING MUST BE 180 DEGREES AWAY FROM THE CONTROL RING GAP.

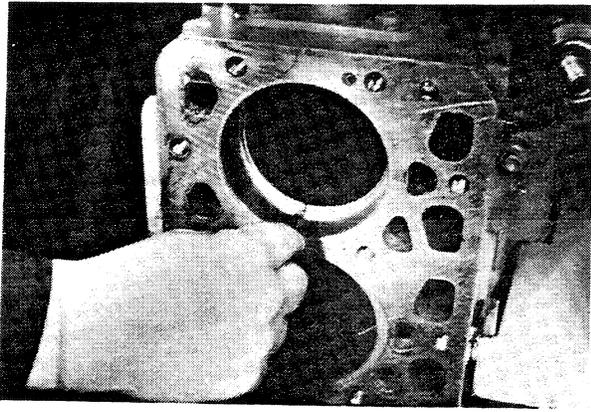


A1059 PISTON RING CLEARANCE

WHEN INSTALLING NEW RINGS ON A PISTON, THE SECOND AND THIRD RINGS MUST HAVE A PROPER GAP. AFTER MEASUREMENT, KEEP THE PISTON AND RINGS TOGETHER. IF THE GAP IS TOO GREAT, THE PISTON MUST BE DISCARDED.



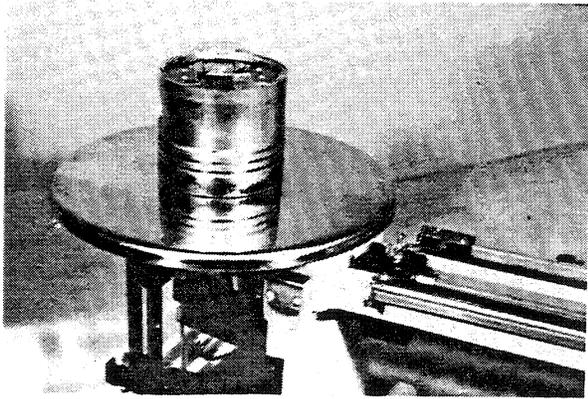
A1



FE18,FE20,FE28 ENGINE 8065

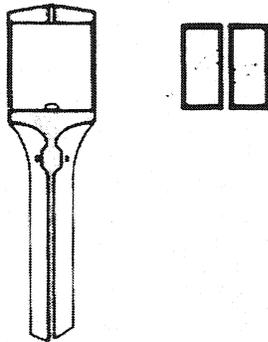
A1060 RING GAP

THE RING MUST ALSO HAVE THE CORRECT RING GAP WHEN INSERTED IN ITS RESPECTIVE CYLINDER SLEEVE BORE. AS THE RING IS INSTALLED IN THE SLEEVE, A PISTON SHOULD BE USED TO PUSH IT DOWN SO THAT IT IS SQUARELY IN THE BORE. RINGS CAN BE DRESSED TO INCREASE THE RING GAP BY CAREFUL GRINDING.



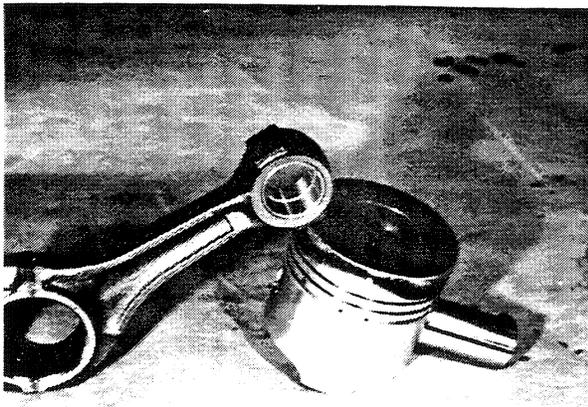
A1061 PISTON WEIGHT

ALL PISTONS MUST WEIGH WITHIN TEN GRAMS (1/3 OUNCE) OF EACH OTHER. METAL CAN BE REMOVED FROM THE BASE OF THE PISTON PIN BOSS.



A1062 PISTON PIN BUSHINGS

THERE ARE TWO BUSHINGS WHICH ARE INSERTED IN THE CONNECTING ROD.

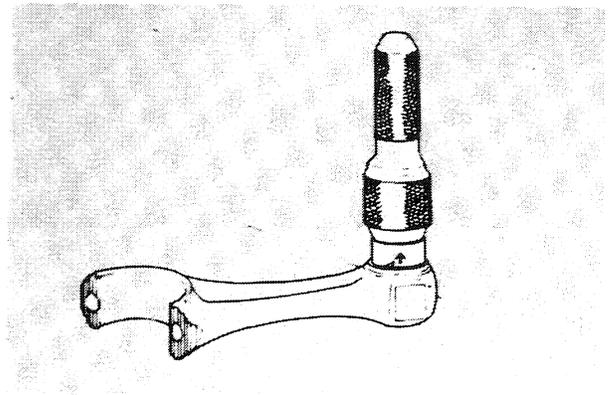


A1063 PISTON PIN

TWO SIZES OF OVERSIZE PISTON WRIST PINS ARE AVAILABLE. THE BUSHINGS CAN BE REMOVED TO ACCEPT THESE OVERSIZE PINS.

A1064 INSTALL PIN BUSHING

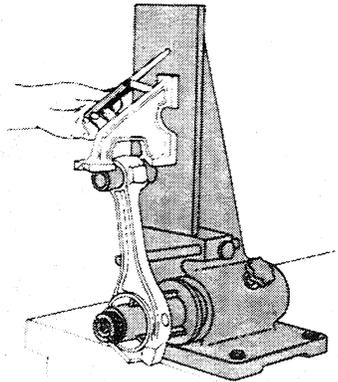
WHEN INSTALLING A CONNECTING ROD BUSHING, THE BUSHING MUST BE INSTALLED PROPERLY. AN ARROW LOCATED ON EACH BUSHING MUST POINT AWAY FROM THE CENTER OF THE CONNECTING ROD.



A1

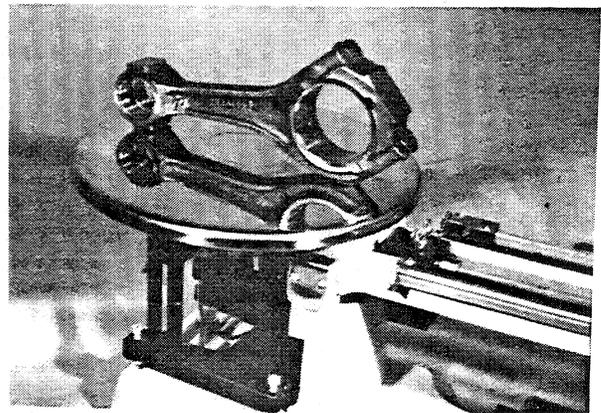
A1065 ROD PARALLELISM

CONNECTING RODS MUST BE CHECKED FOR PARALLELISM AND SQUARENESS. A TEST FIXTURE SUCH AS THE ONE SHOWN, AIDS IN CHECKING. THE ROD MUST BE STRAIGHTENED OR REPLACED IF THE ROD DIMENSION DOES NOT MEET SPECIFICATION.



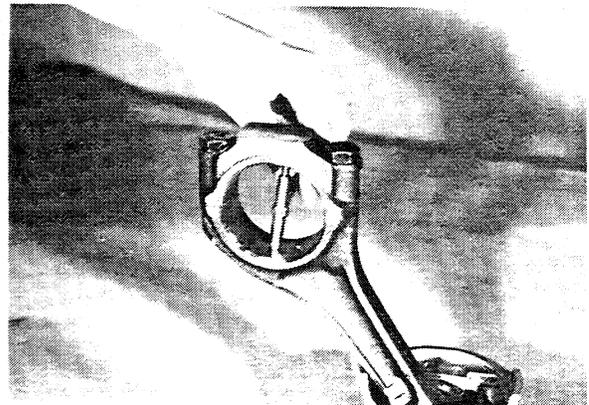
A1066 ROD WEIGHT

ALL CONNECTING RODS MUST BE OF A SPECIFIED WEIGHT. MAXIMUM DIFFERENCE BETWEEN ALL RODS IN AN ENGINE IS 10 GRAMS (1/3 OUNCE). IT IS POSSIBLE TO REMOVE METAL FROM THE SMALL END AND CAP TO EQUALIZE WEIGHTS.



A1067 ROD DIAMETER

TIGHTEN THE CAPSCREWS TO SPECIFICATION. THE LARGE END OF THE CONNECTING ROD MUST BE MEASURED WITHOUT BEARINGS. THE MEASUREMENT IS RECORDED FOR LATER USE FOR REINSTALLATION. TAKE TWO MEASUREMENTS 90 DEGREES FROM ONE ANOTHER AND AVERAGE THE RESULTS.



A1



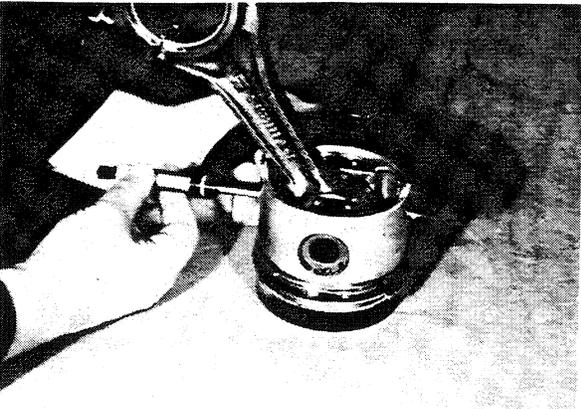
A1068 PISTON PIN FIT

THE PISTON PIN MAY FIT WITH AN INTERFERENCE FIT INTO THE PISTON. THE PISTON SHOULD BE HEATED IN HOT WATER PRIOR TO ASSEMBLY.



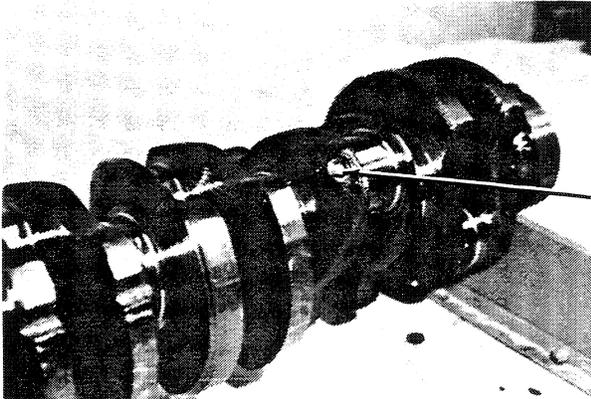
A1069 PISTON RINGS

WHEN INSTALLING THE PISTON RINGS ON THE PISTON, POSITION THE GAPS 180 DEGREES FROM ONE ANOTHER AND POSITIONED AT RIGHT ANGLES TO THE WRIST PIN.



A1070 PISTON MEASUREMENT

THE CORRESPONDING PISTON AND SLEEVE HAVE A MAXIMUM AND MINIMUM CLEARANCE. THE PISTON IS MEASURED AT A SPECIFIC HEIGHT. MEASURE THE PISTON DIAMETER WITH A MICROMETER. THE PISTON DIAMETER MEASUREMENT IS SUBTRACTED FROM THE CYLINDER SLEEVE DIAMETER TO OBTAIN THE WORKING CLEARANCE.



A1071 CRANKSHAFT DRILLINGS

THE CRANKSHAFT CARRIES THE LOAD ON SEVEN MAIN BEARINGS. THE CRANKSHAFT IS INTERNALLY DRILLED TO PROVIDE LUBRICATING OIL TO ALL WORKING SURFACES. PLUGS, PRESSED INTO THE CRANKSHAFT, BLOCK THE PASSAGES. IF ONE OF THESE PLUGS SHOULD COME OUT, OIL WILL FLOW BACK INTO THE OIL SUMP, AND OIL PRESSURE WILL DROP.

Sample of manual. Download All 118 pages at:

<https://www.aresairmanual.com/downloads/fiatallis-fe18-fe20-fe28-excavator-service-information-manual/>

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