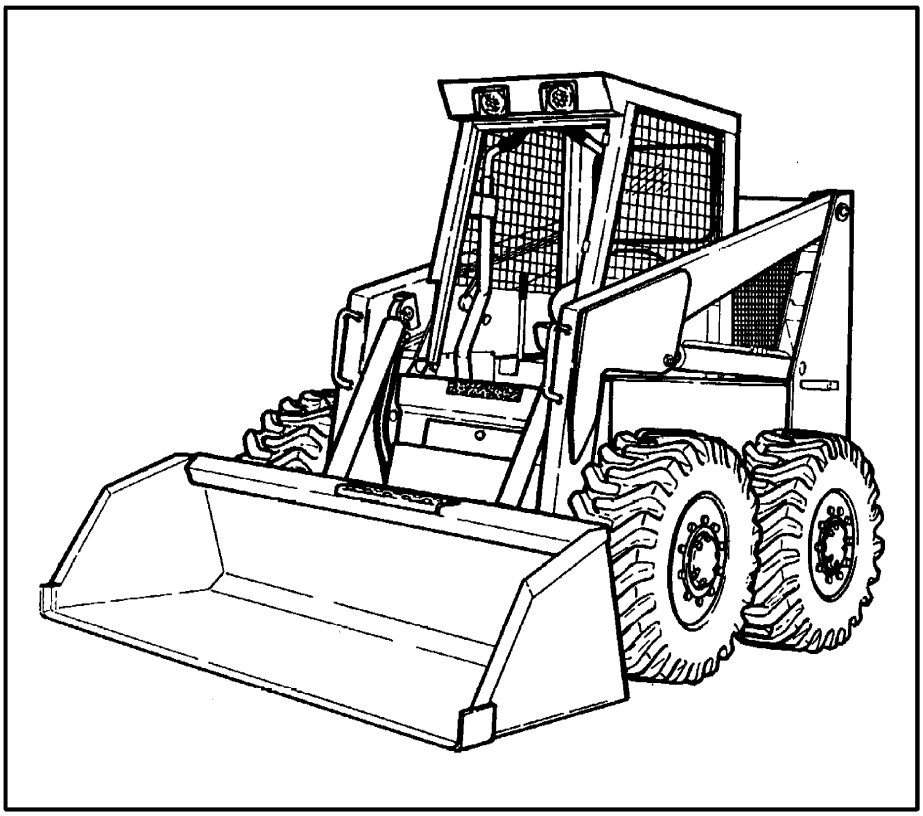
M970

Service Manual

(Diesel and Gasoline)



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6545690(6-81) Revised (5-85) Printed in U.S.A.

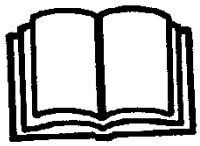
MAINTENANCE SAFETY

WARNING

Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual, Operator's Handbook and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments, repairs or service. Untrained operators and failure to follow instructions can cause injury or death. W-2003-0903

Safety Alert Symbol: This symbol with a warning statement, means: "Warning, be alert! Your safety is involved!" Carefully read the message that follows.

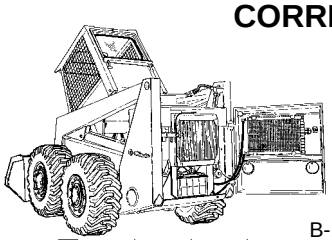
CORRECT



B-10731a

Never service the Bobcat Skid-Steer Loader without instructions.

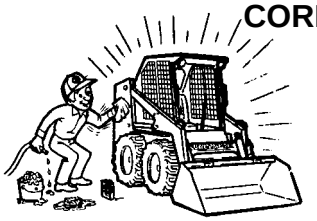
CORRECT



B-11103

Use the correct procedure to lift or lower operator cab.

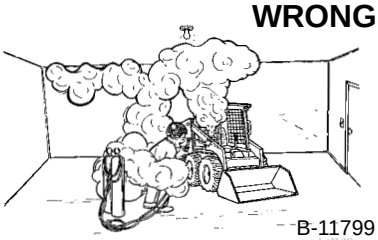
CORRECT



B-7469

Cleaning and maintenance are required daily.

WRONG



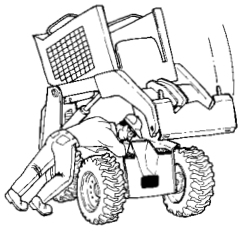
B-11799

Have good ventilation when welding or grinding painted parts.

Wear dust mask when grinding painted parts. Toxic dust and gas can be produced.

Avoid exhaust fume leaks which can kill without warning. Exhaust system must be tightly sealed.

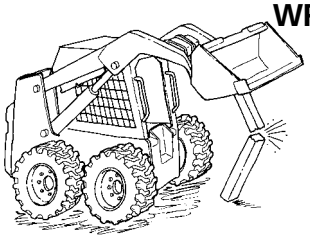
WRONG



B-15231

Disconnecting or loosening any hydraulic tubeline, hose, fitting, component or a part failure can cause lift arms to drop. Do not go under lift arms when raised unless supported by an approved lift arm support device. Replace it if damaged.

WRONG

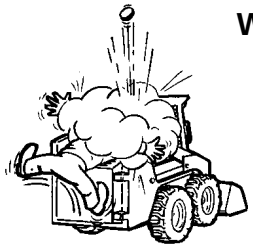


B-15280

Never work on loader with lift arms up unless lift arms are held by an approved lift arm support device. Replace if damaged.

Never modify equipment or add attachments not approved by Bobcat Company.

WRONG



B-6590

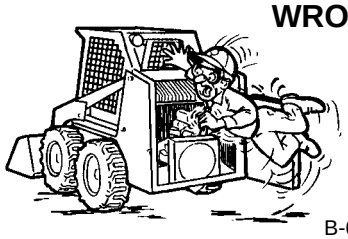
Stop, cool and clean engine of flammable materials before checking fluids.

Never service or adjust loader with the engine running unless instructed to do so in the manual.

Avoid contact with leaking hydraulic fluid or diesel fuel under pressure. It can penetrate the skin or eyes.

Never fill fuel tank with engine running, while smoking or when near open flame.

WRONG



B-6580

Keep body, jewelry and clothing away from moving parts, electrical contact, hot parts and exhaust.

Wear eye protection to guard from battery acid, compressed springs, fluids under pressure and flying debris when engines are running or tools are used. Use eye protection approved for type of welding.

Keep rear door closed except for service. Close and latch door before operating the loader.

WRONG

B-6589

Lead-acid batteries produce flammable and explosive gases.

Keep arcs, sparks, flames and lighted tobacco away from batteries.

Batteries contain acid which burns eyes or skin on contact. Wear protective clothing. If acid contacts body, flush well with water. For eye contact flush well and get immediate medical attention.

Maintenance procedures which are given in the Operation & Maintenance Manual can be performed by the owner/operator without any specific technical training. Maintenance procedures which are **not** in the Operation & Maintenance Manual must be performed **ONLY BY QUALIFIED BOBCAT SERVICE PERSONNEL. Always use genuine Bobcat replacement parts.** The Service Safety Training Course is available from your Bobcat dealer.

MSW02-0805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FOREWORD

This manual has been written as a guide to the performance of Dealer Service on the Melroe Bobcat Loader. Read the instructions carefully and follow them.

Refer to the applicable Bobcat Owner's Manual for routine service and adjustments.

When performing service on any Bobcat Loader, be sure to note the machine and engine serial numbers. They are necessary in obtaining prompt parts and service information.

Certain information and illustrations are contained in this publication through the courtesy of the following: Aeroquip Corporation, Continental Motors, Perkins Motors, Sundstrand Corporation.


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CONTENTS


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INSTRUMENTATION (Figure 1)

1. FUEL GAUGE indicates the level of fuel remaining in fuel tank.
2. TACHOMETER/HOUR METER GAUGE indicates engine RPM and registers engine running hours.
3. AMMETER GAUGE indicates charging rate of alternator.
4. KEY/START SWITCH (ignition/start switch on gasoline models).
5. REAR LIGHTS SWITCH
6. FRONT LIGHTS SWITCH
7. FLASHER LIGHTS SWITCH
8. HYDROSTATIC/HYDRAULIC FLUID INDICATOR: When illuminated, oil temperature is excessive, or pressure is low. Immediately shut engine down and troubleshoot.
9. ENGINE OIL PRESSURE INDICATOR: When illuminated, the oil pressure is low. Shut the engine down immediately and troubleshoot.
10. ENGINE TEMPERATURE INDICATOR: When illuminated, engine temperature exceeds safe operating limits. Shut down engine immediately and troubleshoot.

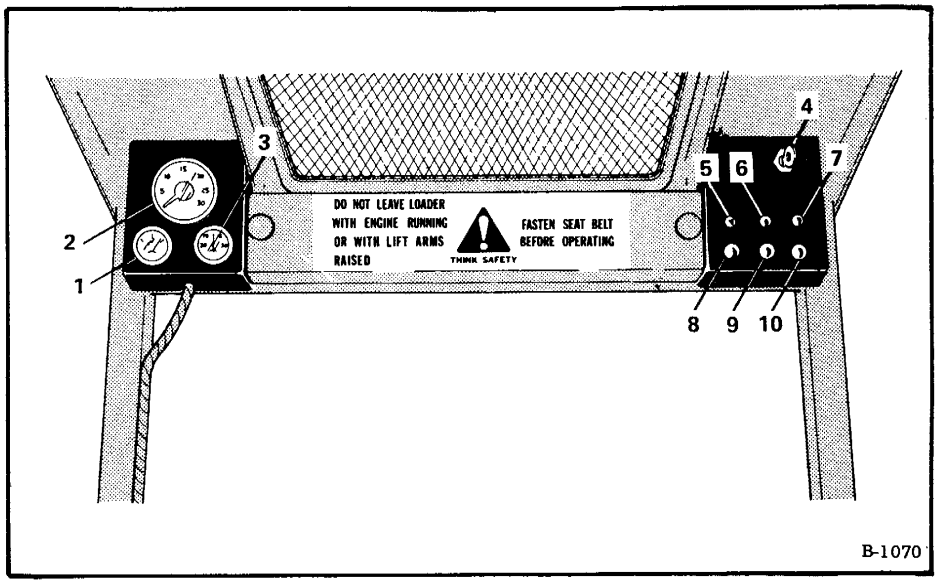

Fig. 1 Instrumentation

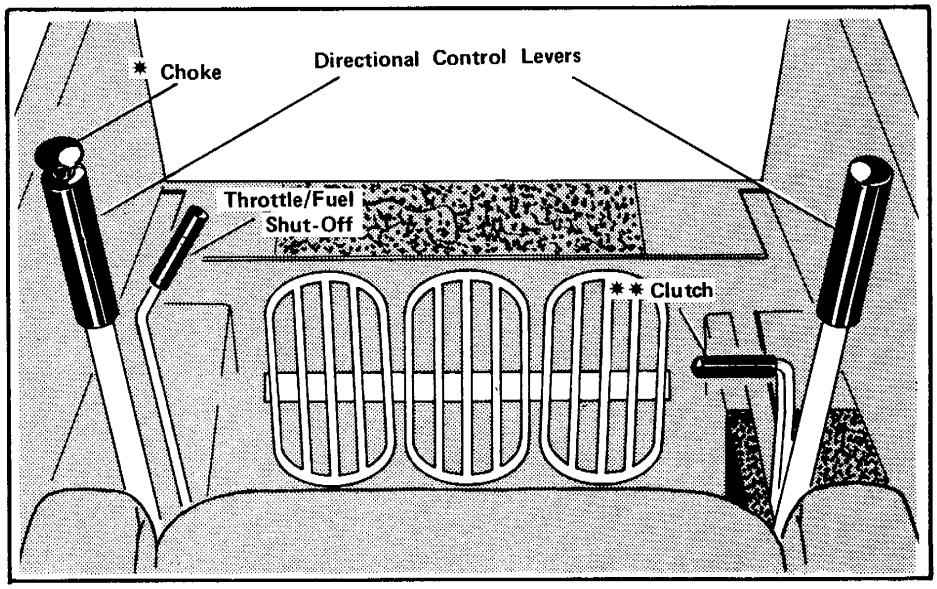

Fig. 2 Engine & Drive Controls * Gasoline Only ** Diesel Only

ENGINE CONTROLS (Figure 2)

The throttle/fuel shut-off control is located immediately to the left of the operator seat. Move the lever forward to increase the engine RPM. Move the lever backward to decrease the engine RPM. On diesel models moving the lever all the way back will actuate the fuel shut-off and stop the engine.

The choke control, on gasoline equipped models, is located on the top of the left direction control lever. Pull button up to close choke valve. Push button down to open choke valve.

The start/power switch (ignition/start switch on gasoline equipped models) is located in the upper right instrument panel. Turn key fully to right to engage starter. Release to disengage starter (Figure 1). Be certain to turn power switch to "OFF" position on diesel models after engine shut-down.

DRIVE CONTROLS (Figure 2)

TO ENGAGE CLUTCH (Diesel Only), slowly push clutch control lever, located to lower right of operator, completely forward. To disengage, pull lever backward. The clutch should be disengaged during cold weather for easier starting and longer starter life.

The clutch engages or disengages the engine from the hydrostatic drive and implement hydraulic system.

NOTE: **Control levers and hydraulic control pedals must be in neutral position before engaging clutch.**

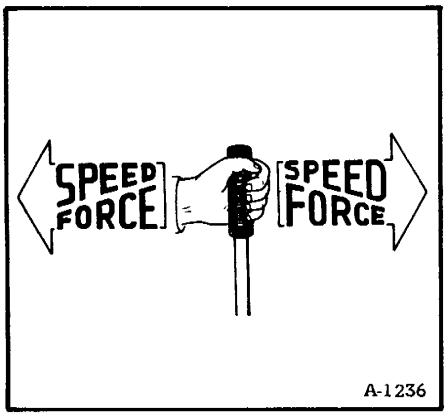

Fig. 3 Speed-Force

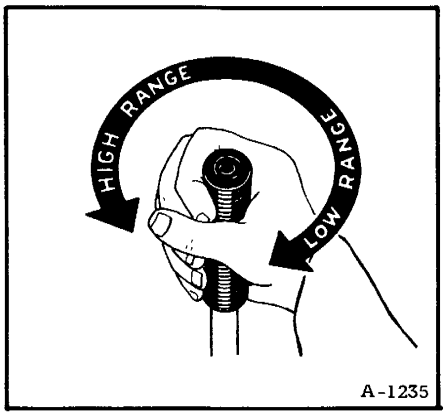

Fig. 4 Speed Range

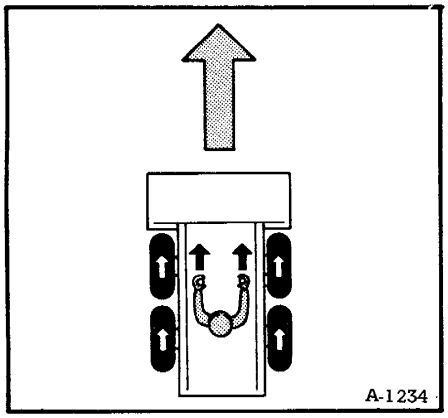

Fig. 5 Forward Travel

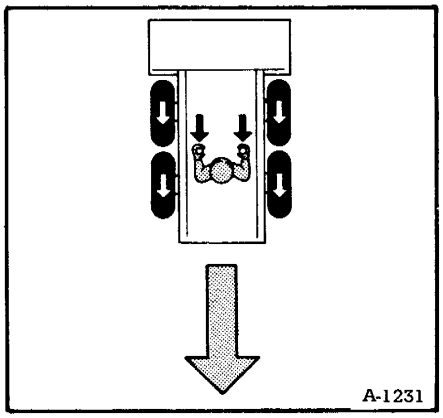

Fig. 6 Backward Travel

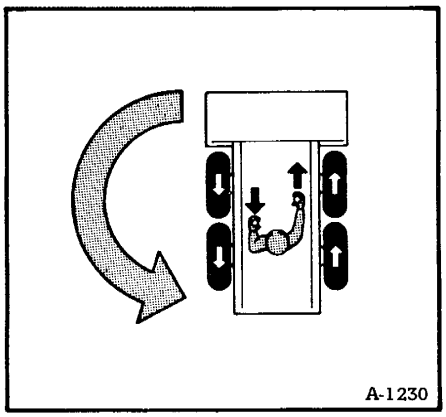

Fig. 7 Pivot Left

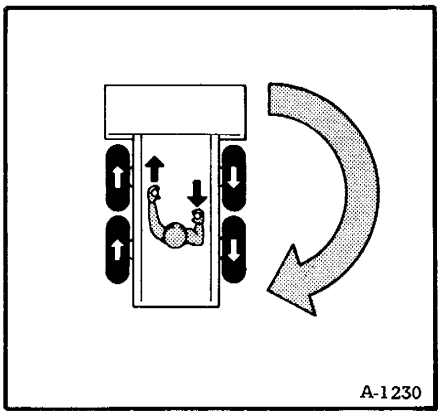

Fig. 8 Pivot Right

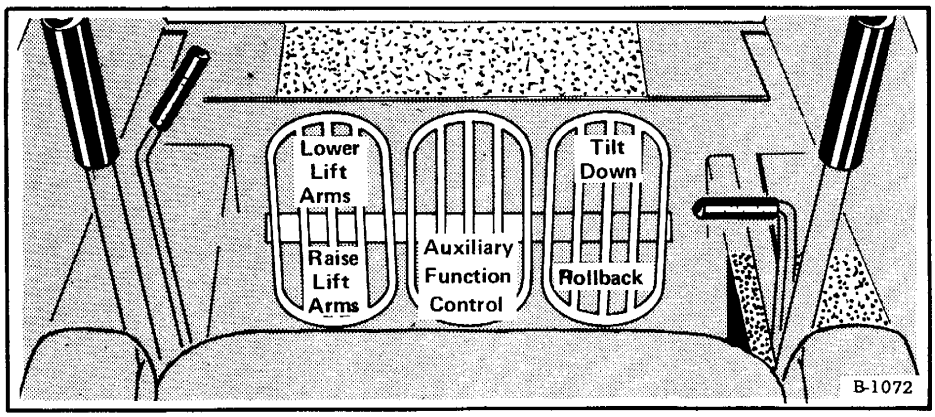

Fig. 9 Loader Controls

WARNING

Engagement of clutch with control actuated will submit hydraulic/hydrostatic systems to excessive pressure resulting in possible damage to system.

The forward, reverse, ground speed, and turning functions are all controlled by two hand levers located on either side of the operator.

By increasing lever travel, the machine speed is increased proportionally (Figure 3). Releasing levers will automatically put drive in neutral. With levers in the neutral position, the hydrostatic systems provides the M-970 with automatic braking.

OPERATING RANGES, (Figure 4) may be selected "on the go" by twisting the grip of the right control lever.

TO TRAVEL FORWARD: (Figure 5) push both levers forward an equal amount.

TO TRAVEL BACKWARD: (Figure 6) pull both levers backward an equal amount.

TO TURN: (Figures 7 and 8) move one lever further from neutral than the other to make a wide smooth turn. To pivot, move the levers in opposite directions. The loader will turn "in its tracks."

LOADER CONTROLS (Figure 9)

TO RAISE LIFT ARMS, press heel of left control pedal. To lower lift arms, press toe of control pedal.

NOTE: Pressing toe of the left pedal to maximum down position will lock lift valve in float position. This permits the lift arms to follow the contour of the ground.

TO TILT bucket or attachment down, press toe of right control pedal. To roll back bucket or attachment, press heel of right control pedal.

NOTE: Pressing toe of the right pedal to maximum down position will increase tilt (or dumping) speed.

AUXILIARY CONTROL: Press the heel of the center pedal to actuate auxiliary attachments. Press with heel to maximum down position to lock pedal in detent.

AUXILIARY FLOW SELECTOR (Figure 10) The M-970 is equipped with a hydraulic flow control. The operator may select, at his option, fast or slow auxiliary hydraulic functioning. Moving selector lever up will provide for 14 GPM delivery. Moving selector down will provide for 40 GPM. The Auxiliary Flow Selector Control lever is located immediately below the operator seat.

WARNING

To actuate this lever, engine must be shut down and toe of tilt control pedal must be in FULL down position.

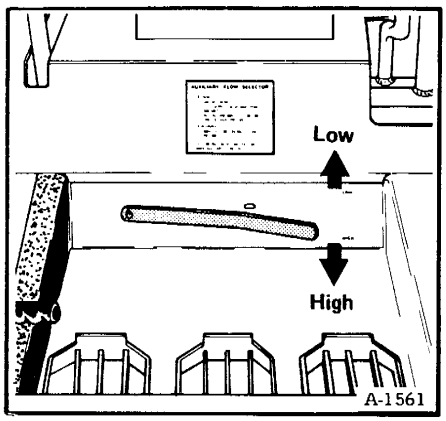

Fig. 10 Auxiliary Flow Selector

PRESTART CHECK

It is good practice to make this check at the beginning of each shift and when servicing loader (See also Engine Service Section).

1. Make a visual inspection for signs of damage or leaks. Make repairs or adjustments promptly.

2. Check the Condition Indicator on the engine air cleaner (Figure 11). If the red ring appears in a viewing window, replace filter element (See Air Cleaner Service, page 12). Check filter can for any damage which could provide access for unfiltered air. Check inlet hoses for breaks and clamps for tightness. Make repairs or adjustments immediately to eliminate the resultant possibility of more costly repairs.

3. Check engine oil level. Oil level must be between add and full mark on dipstick. Add if necessary (See Engine Oil Specifications, page 14).

4. Check coolant level in the radiator. Check only when engine is cool and add if necessary (See page 18 for coolant information). Clean debris from radiators.

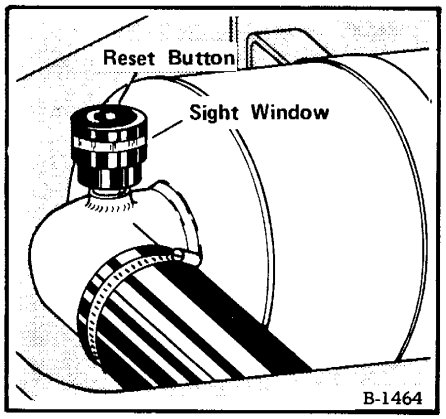

Fig. 11 Condition Indicator

STARTING PROCEDURE

When preparing to operate, observe the following procedure:

1. Adjust the seat so that all controls are within convenient reach. This will help prevent operator fatigue.

2. Adjust and fasten seat belt.

3. Disengage clutch and place directional control levers and hydraulic control pedals in neutral position.

4. Advance throttle 1/3 to 1/2 and turn start switch to "start" position. (On gasoline models, choke as necessary.)

5. If engine does not start within 15 seconds, release start switch and wait 60 seconds before trying again. If engine will not start after several attempts, refer to Troubleshooting Section (Diesel - page 111; Gasoline - page 139).

6. After engine starts, allow a short warm-up period.

NOTE: IDLING ENGINE FOR LONG PERIODS OF TIME CAN RESULT IN ENGINE OIL DILUTION AND EXCESSIVE WEAR.

7. Engage clutch slowly and allow hydrostatics a short warm-up period.

WARNING

Do not engage clutch unless hydraulic control pedals and Directional Control Levers are in neutral position.

COLD WEATHER STARTING

If start up temperatures are below 32°F, the following starting procedure is recommended:

1. Equip engine with a block heater and/or a Cold Weather Starting Aid approved by engine manufacturer.

2. Replace engine crankcase oil with recommended type and viscosity for the anticipated starting temperature (See Oil Specifications, page 14).

3. Use winter grade fuel (See Fuel Specifications, page 15).

4. Maintain battery(ies) at full charge.

5. Disengage engine clutch (Diesel Model Only - See Page 1) to remove pump load. Engage clutch slowly immediately after engine starts. Clutch should be engaged only when engine is idling at a low RPM.

6. Where starting temperatures below −20°F are anticipated, a means of warming the hydraulic/hydrostatic oil must be used. House machine in a building where temperatures remain above 0°F if possible. If such housing is not available, install an immersion type heater in the hydraulic oil reservoir.

WARNING

Starting the engine at a low enough temperature to cause hydrostatic oil starvation (cavitation) will seriously damage the hydrostatic drive system.

OPERATING THE M-970 BOBCAT

With engine running at 3/4 throttle and speed range control in low range (right directional control lever grip) proceed slowly to actuate the various functions. Move controls slowly avoiding jerky operation. Resting arms on seat rests and use of finger or wrist action will help eliminate jerky operation.

Remember, if you become confused, release the Directional Control Levers, the controls will immediately return to neutral position, and machine will stop moving.

BREAK-IN

Follow this procedure for loader and engine break-in:

1. Do not run engine at continuous maximum load or RPM for the first 15 hours.

2. Avoid overloading the engine or loader.

3. Allow the engine to warm up before applying a load.

4. Avoid rough or jerky operation.

5. Check the engine oil frequently. A new engine may use oil at a higher rate until piston rings seat.

LOADER SERVICE AND MAINTENANCE


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BOB-TACH SYSTEM (Figure 12)

The Bob-Tach system provides for rapid changes of buckets or attachments.

Procedure for mounting attachment:

1. Tilt Bob-Tach forward slightly with lift arms in down position. Locking levers must be in unlocked up position.
2. Maneuver machine until upper lip of Bob-Tach is aligned directly beneath mounting flange on bucket or attachment (Figure 13).
3. Raise lift arms until Bob-Tach contacts mounting flange and lift attachment slightly.
4. Roll back Bob-Tach allowing attachment to swing into position on lower portion of Bob-Tach frame (Figure 14).
5. Engage locking mechanism by rotating levers downward into locked position (Figure 12).

WARNING **Be certain both locking wedges are fully engaged before placing unit into operation.**

Procedure for dismounting attachment:

1. Lower lift arms fully with attachment in rollback position.
2. Release locking mechanism by rotating levers up.
3. Tilt Bob-Tach forward and slowly back Bobcat away.

TRANSPORTING THE M-970

Emergency Towing:

The "Neutral Brake" feature of the hydrostatic drive system prevents the loader from being towed if the engine is not running. In order to allow the M-970 to be towed short distances, a set of bypass valves are designed into the drive system. Opening these valves will provide a hydraulic fluid "bypass" allowing the loader to be towed slowly, for a short distance, to a convenient repair or loading area.

The towing valves are located at the rear of the hydraulic control pedal mounting plate. It is necessary to tilt the operator enclosure to gain access to them (Figure 15).

WARNING **Do not tow the loader at more than 2 MPH or for a distance of greater than 50 yards or serious transmission damage may result.**

TRANSPORTING BY TRUCK OR TRAILER

Use steel ramps of a suitable length to load the Bobcat onto the transporting vehicle. Planks should not be used as a substitute.

With bucket empty, back up ramps. When loaded, drop bucket to floor and chain Bobcat in place.

HOISTING THE M-970

When using the single point lift for hoisting the M-970, the lift arms must first be locked to the frame.

On machines equipped with lift bails, be certain chains or cables are fastened securely. Be careful not to damage any hydraulic lines when hoisting. Do not attach hoisting cables or chains to any place other then lift bails.

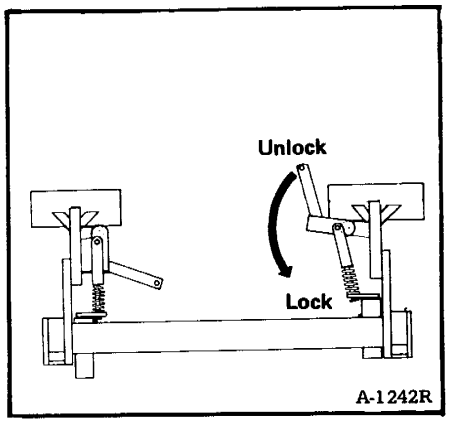


Fig. 12 Bob-Tach System

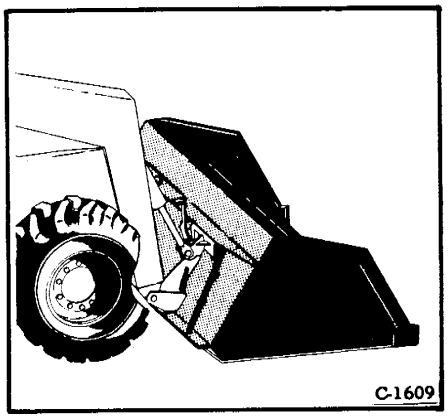


Fig. 13 Alignment Position

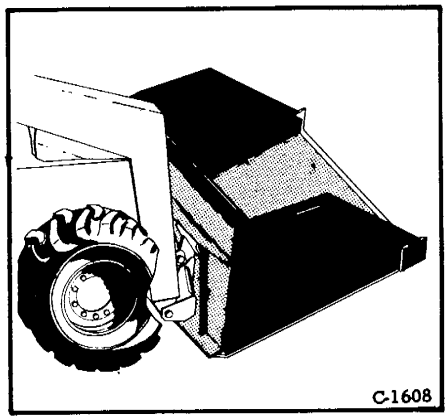


Fig. 14 Locking Position

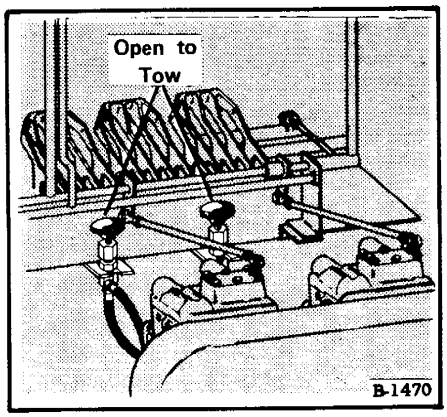


Fig. 15 Towing Valves

M-970 BOBCAT PREVENTATIVE MAINTENANCE SCHEDULE

ENGINE		MACHINE	HOURS					
Diesel	Gasoline	Drive and Loader	8-10	50	100	200	500	As Req'd
Check coolant level Check oil level. Check air cleaner condition indicator. Check for oil, fuel or coolant leaks. * Retorque Cylinder head.	Check coolant level. Check oil level. Check air cleaner condition indicator. Check for oil, fuel, or coolant leaks.	Check tires for damage and air pressure. Check wheel nuts. Check for loose assemblies and fluid leaks. Grease all pivot points. Check hydraulic fluid level.	■					
Drain and replace oil and filter. Retorque head bolts, if not done during pre-delivery inspection. Reset valve tappet clearance. Check oil flow to rocker arms. Adjust fan belt tension. Check condition of battery cases, tighten cable clamps and check electrolyte level.	Drain and replace oil and filter. Adjust fan belt tension. Check battery electrolyte level. Check battery case for condition. Check battery clamps for tightness.	Check final drive chain and adjust if necessary. Check fluid level in final drive chaincase.		■				
Clean fuel water trap.		Check fluid level in reduction gearcases. Initial 100 hours replace 10 micron filter element.			■			
	Regap, clean and/or replace spark plugs. Regap, clean and/or replace breaker points. Clean distributor cap.	Remove drain plug on hydraulic fluid resorvoir and drain off condensation.				■		
Replace fuel filters. Clean lift pump sediment chamber. Check hoses and clamps.	Adjust valve tappet clearance. Adjust fuel mixture and idle speed on carburetor. Replace fuel filter.	Replace 10 micron filter element every 500 hours.					■	
Drain, flush and refill cooling system. Have authorized personnel check and adjust engine timing and fuel system.	Drain flush and refill cooling system.	Drain and refill reduction gearcase fluid. Drain, flush and replace final drive chaincase fluid.						■
* Upon delivery or prior to 25 hours elapsed running time.								

M-970 SERVICE SCHEDULE

EVERY 10 HOURS

1. ENGINE OIL: Check, do not overfill.

2. RADIATOR COOLANT LEVEL: Check when the engine is cool, radiator capacity is approximately 17 quarts - Gas; 19 quarts - Diesel.

3. ENGINE AIR CLEANER: Check indicator, service or replace filter element as required.

4. HYDRAULIC RESERVOIR: Check fluid level, to refill use only Dexron®.

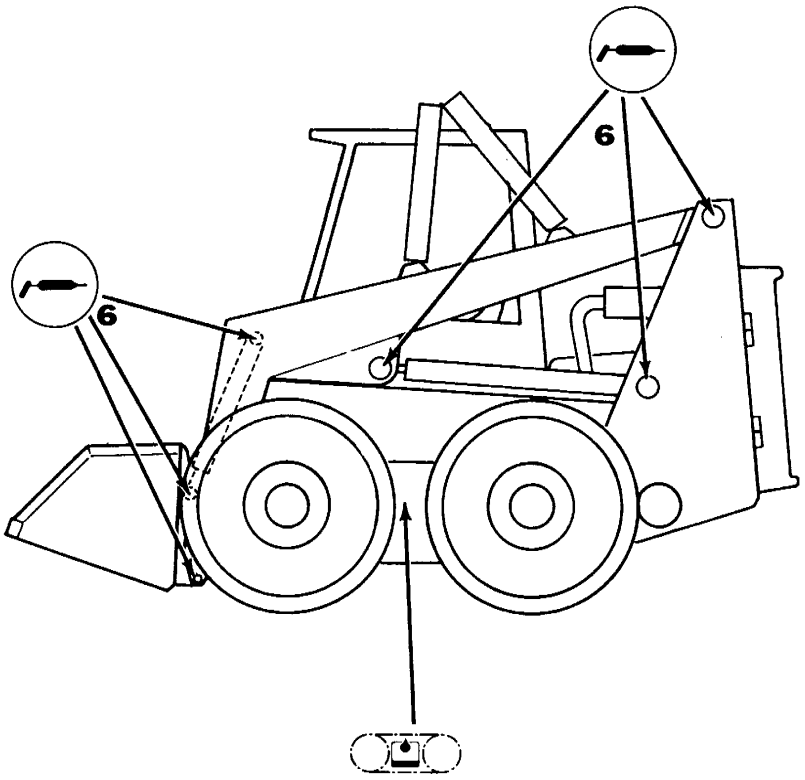
NOTE: Use extra care to prevent dirt from entering the hydraulic system.

5. LOADER LIFT ARM GREASE FITTINGS: Lube 12 points, see illustration at right.

6. CHECK TIRES: Inflate 15 x 19.5 to 55 PSI.

7. PRE-START "WALK AROUND" CHECK: Look for loose wheel nuts, signs of excess wear, loose or broken parts, oil leaks, etc. Make any needed corrections or repairs promptly.

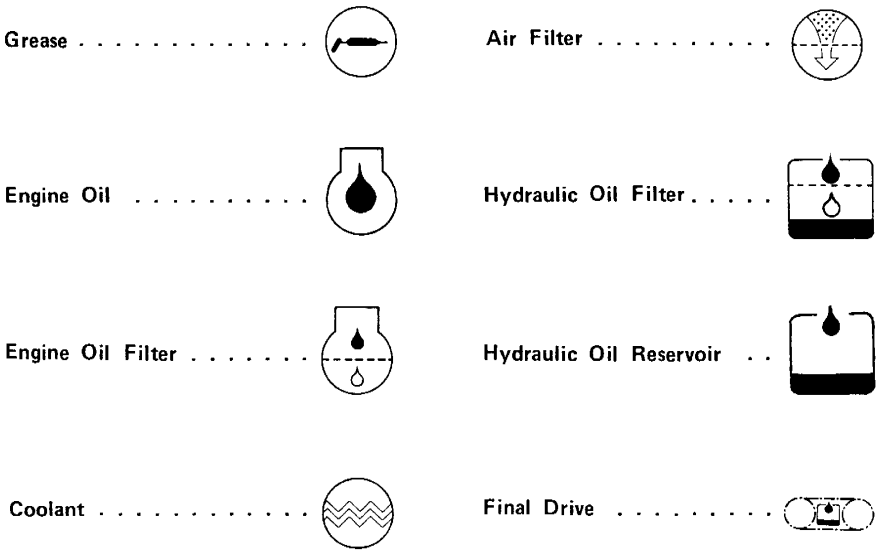
NOTE: Consult your Owner's Manual for a list of special services to be performed, following the 50 hour "Break-in" period.

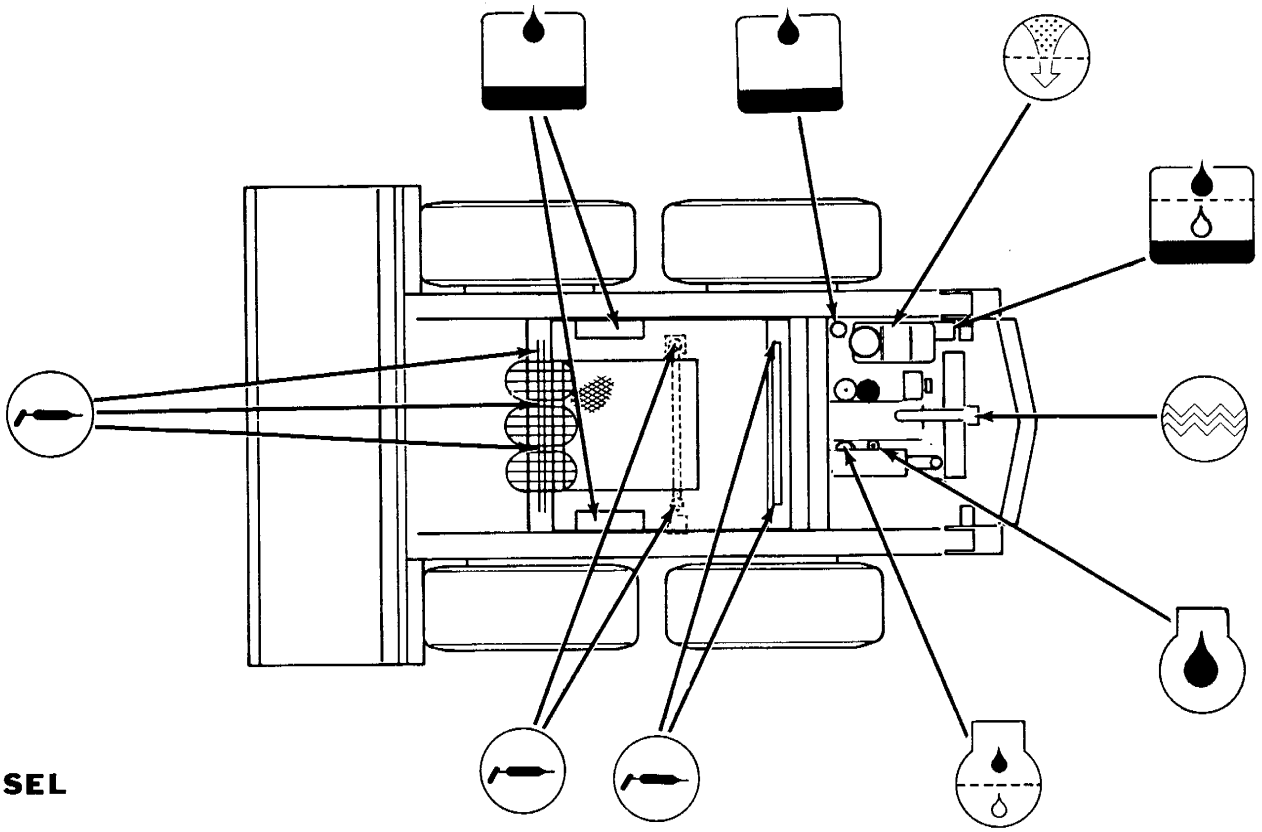


EVERY 50 HOURS

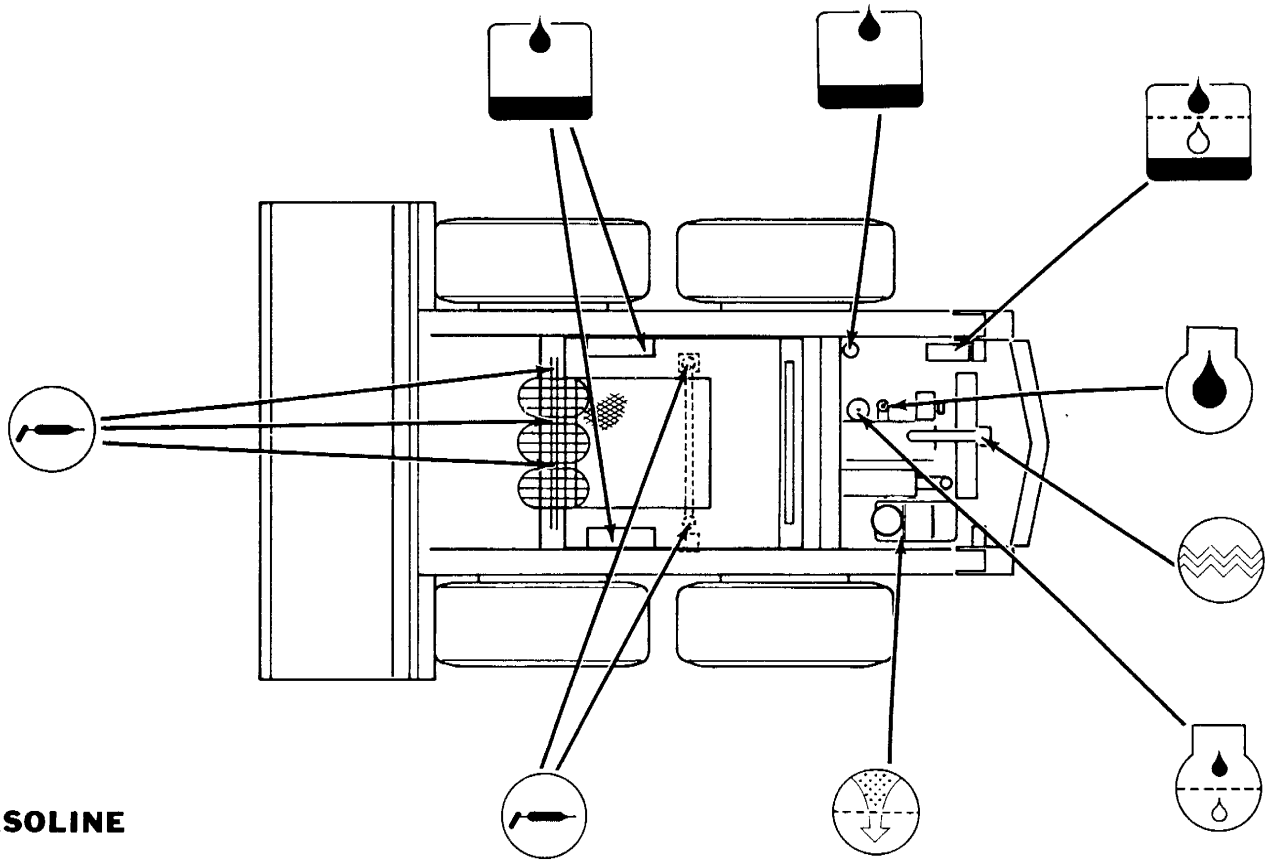
1. CHASSIS GREASE FITTINGS: Lube 7 points, see illustrations on the following page.

2. FINAL DRIVE CHAINS: Check tension on both sides, raise one side of the loader until both tires clear the ground, rock the wheels, if there is any "free play" the chain requires adjustment. Consult the Owner's Manual for instructions.





DIESEL



GASOLINE

TIRE MAINTENANCE (Figure 16)

A variety of tires are available to fit the application of the M-970 Loader. It is important that the Bobcat be equipped with the correct tires for the application. The following basic tires are recommended for usage, as indicated:

15 x 19.5 - 12 Ply All Service Tread –	Standard, regular construction loading, excavating, etc.
15 x 19.5 - 12 Ply Bar Lug Steel Cap –	Ideal for traction in wet or loose ground conditions.
15 x 19.5 - 12 Ply Rock Lug Steel Cap –	Ideal for applications where sharp protruding rock structures exist.
10:00 x 20 - Solid Durocushion –	For use in foundries, scrap metal handling, etc.
38:00 x 20 - 16.1 Ribbed Flotation –	For use in sand such as desert, beaches, etc.

The standard 15:00 x 19.5, 12 ply duplex tires should be inflated to 55 PSI. Optional flotation tires should be inflated to 25 PSI. Keep pressure equal in all four tires. Unequal tire pressures result in rapid tread wear and difficult operating control.

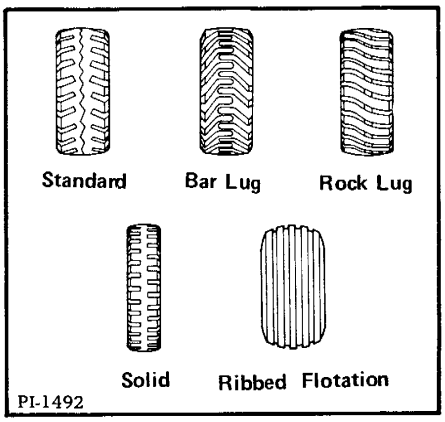


Fig. 16 Types of Tires

All M-970 loaders equipped with tire size 15 x 19.5, except woods machines, are shipped with the rear tires ballasted with calcium chloride. This is to permit better handling of the loader. A special gauge is required to check pressure in ballasted tires.

When the difference in tire tread wear between the front and rear tires becomes more than 1/8", rotate the tires to the opposite end of the machine. Uneven tire wear may be caused by improper inflation, or operating the machine with the front wheels held off the ground (Figure 17).

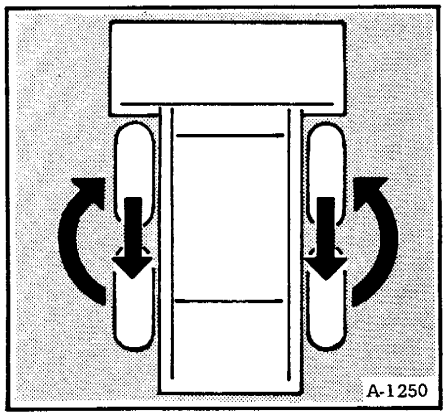


Fig. 17 Tire Rotation

If you need to replace a damaged or worn tire, be sure the replacement is the same size as the tires still on the machine. If two new tires are purchased to replace two worn tires, put them both on the same side of the machine. Put the two used tires (same diameter) on the other side of the machine. Torque wheel nuts to 300 ft-lbs.

Failure to maintain identical tire outside diameters on the same side of the machine will result in excessive sprocket, chain, and tread wear.

BELLY PAN

The loader has a two part belly pan to protect the internal parts of the machine. Two styles of belly pans are used on M-970 Bobcats. On the earlier model Bobcats either of the pans can be removed separately. On later model Bobcats (Pulpwood Special - serial number 110386 and up; Diesel - serial number 110409 and up; Gasoline - serial number 100267 thru 100293, 100298 and up), the rear pan must first be removed before the front pan can be removed

To remove the early style rear pan:

1. Open the grill and place a block under the front edge of the pan.

2. Loosen the four mounting nuts and slip the two rear carriage bolts out of the support brackets while supporting the rear of the pan.

3. Lower the rear of the pan onto blocks and remove the front bolts from the supports. Slide the pan out from under the machine.

To remove the front pan on older machines and the front and rear pan on current machines, first remove the carriage bolts from their support brackets and lower the pans using a floor jack.

To reinstall the pans:

Reverse the above procedure to reinstall the pans. Always install the front pan first on machines featuring the later style pans.

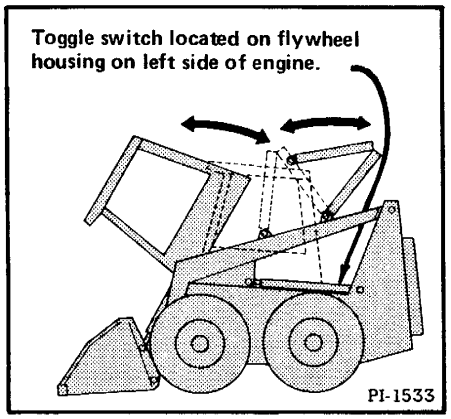


Fig. 18 ROPS Assembly

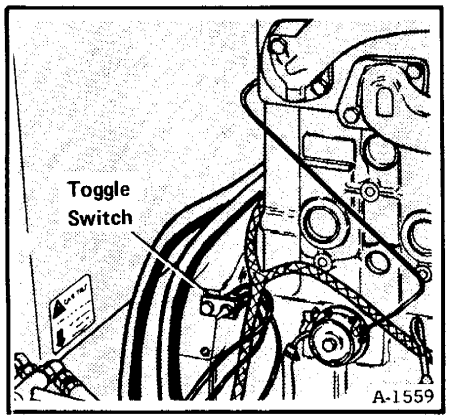


Fig. 19 Control Switch

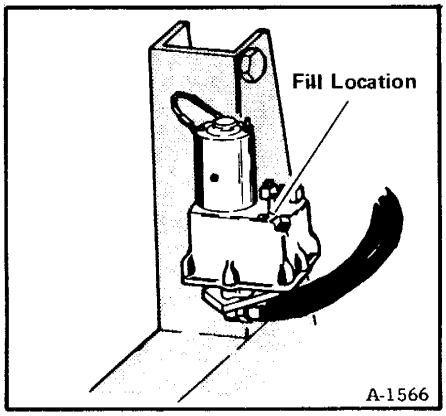


Fig. 20 Refill Location

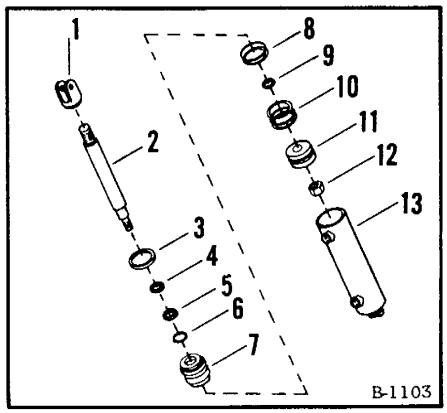


Fig. 21 Seal Kit Assembly

OPERATOR ENCLOSURE TILT CONTROL

The M-970 is designed with a tilting Operator Enclosure providing easy access to all servicable systems. To tilt forward:

1. Lift arms must be in down position. Slide operator's seat to the rear, and set throttle about 3 inches ahead of left steering lever. Connect seat belt together so that it cannot drop through the slots in the seat pan.
2. On loaders equipped with Roll Bar, raise lift arms and install lift arm cylinder stops or remove front two mounting bolts of Roll Bar and swing structure back (Figure 18).
3. Unhook the hold-down latches located on either side at the rear of the enclosure.
4. Actuate the toggle switch located on left front engine mount (Figure 19). Lift switch up to tilt enclosure forward, push down to lower. Check when tilting to insure control levers clear.
5. Position the Safety Leg and lower Enclosure until weight is supported by it.

To lower Operator Enclosure:

1. Tilt forward enough to remove weight from Safety Leg. Swing Safety Leg up into storage position.
2. Position the throttle lever and direction control levers so that they do not strike enclosure as it is lowered and press toggle switch down.
3. Fasten hold-down latches, reposition roll bar and replace mounting bolts and nuts.

ENCLOSURE TILT CONTROL SERVICE

The cab tilting mechanism normally requires very little service attention.

If the cab does not raise to its full height, check the fluid level in the electric/hydraulic pump reservoir. Use Dexron® type fluid to refill (Figure 20).

A seal kit is available for repair of the Overhead Guard tilt cylinders. Install the parts in the order as shown in Figure 21.

If the tilt pump fails to operate, disassemble as follows:

1. Raise the Overhead Guard manually and secure with the Safety Leg. (Disconnect the cylinders if necessary.)
2. Disconnect the hydraulic hoses and wiring.
3. Remove the four pump assembly mounting screws and remove the unit from the machine.

If the motor has failed, it may be disassembled by removing the two thru bolts. Check condition of the brushes and armature. Repair as necessary.

If the pump has failed, the valve body and gearcase must be replaced as an assembly. Install new reservoir gasket when reassembling the unit.

ENCLOSURE REMOVAL AND REINSTALLATION

1. Tilt the cab forward and attach a chain hoist to secure the cab.
2. Remove the two 1/2" x 1-3/4" long pivot screws from the rod end of the cab tilt cylinders.
3. Remove the two 7/8" x 10-1/2" cab pivot screws.
4. Disconnect the wiring harness at the coupler.
5. Raise the cab to remove it from the machine.

To reinstall the Enclosure, reverse this procedure.

ENCLOSURE LATCHES

On some older machines, enclosure latch hooks may turn and come loose when latch is unhooked and engine is running. Check the lock nut (Figure 22), if it is missing or loose, install and tighten after adjusting the latch to lock well with cab lowered. Solder the bottom end of the adjusting rod to the pivot plate. On newer models the latch has been redesigned to correct this problem.

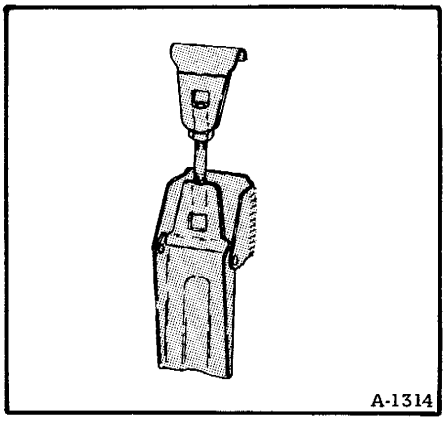


Fig. 22 Latch Repair

ENCLOSURE CONTROL SWITCH RELOCATION
If the cab tilt switch is located under the left hand rear cab support pad, it should be relocated to the engine flywheel housing (Figure 23). Kit No. 6509716 should be ordered to facilitate relocation of the switch.

CONTROL LEVER LOCK (Figure 24)

A control lever lock is supplied with every M-970 Bobcat. It consists of a hook bolt and wing nut. They are sealed into a plastic bag at the factory.

The control lever lock keeps the operating levers in neutral position, so they can't be accidentally moved while you are running the engine during service.

To install the lock:

1. Raise the cab.
2. Pass the hook of the bolt through the tab on the floor (Item 1).
3. Raise the centering arm. Pass the bolt through the hole in the centering arm (Item 2).
4. Turn the wing nut tightly onto the bolt.

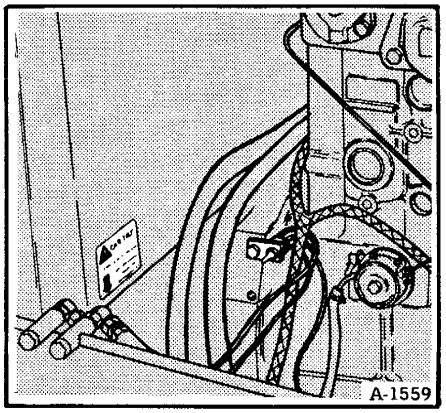


Fig. 23 Switch Relocation

The control lever lock MUST be installed if the engine is to be run during servicing.

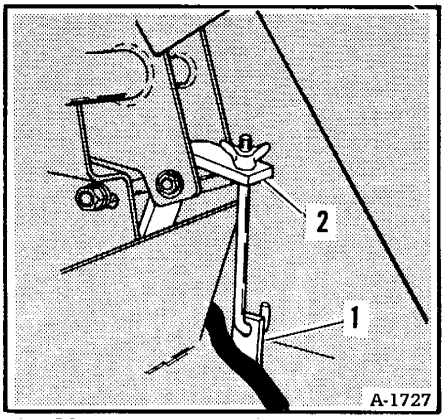


Fig. 24 Control Lever Lock

LIFT ARM PIVOT REPLACEMENT

1. Remove the three capscrews from the ball pivot joint retaining flange (Figure 25) and drive the ball pivot assembly from its position in the lift arm using a hammer and a large drift pin.
2. Carefully align the new pivot sleeve with the bore in the lift arms.
3. Using a driver that contacts only the outer shoulder of the sleeve, drive the sleeve into the bore until it contacts the shoulder stop. Be careful not do damage the bore of the sleeve. Do not drive on the inside swivel of the ball pivot assembly.
4. Position the retaining flange and install and tighten the mounting screws.

To remove the lift arms:

1. Remove the bucket or other attachment from the Bob-Tach coupler. Roll the Bob-Tach back with the tilt control pedal and lower lift arms. Stop the engine.
2. Press the tilt control pedal once each way to release all hydraulic pressure. Press the lift pedal once each way to release all hydraulic pressure.
3. Disconnect the tilt hoses from the junction block at the right upright. Cover the open ports with poly bags, fastening the bags to the hoses with rubber bands.
4. Remove the 1" x 3-1/2" pivot screws from the rod end of the lift cylinders.
5. Attach a chain hoist to the lift arms being careful not to damage the hydraulic lines.

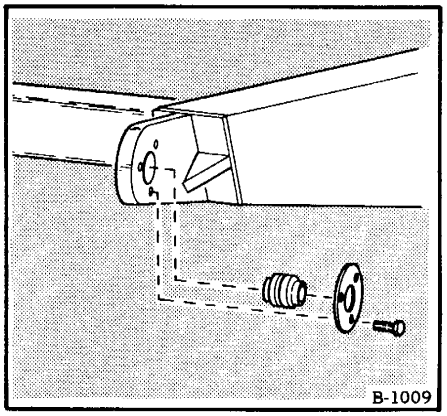


Fig. 25 Pivot Replacement

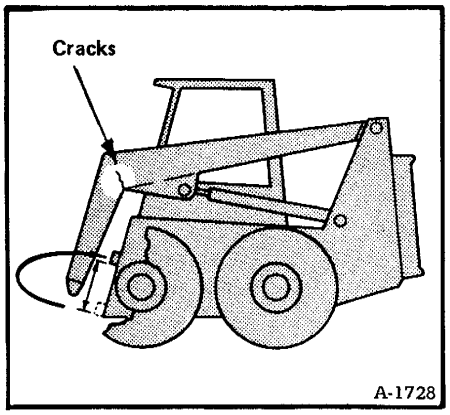


Fig. 26 Reworking Lift Arm

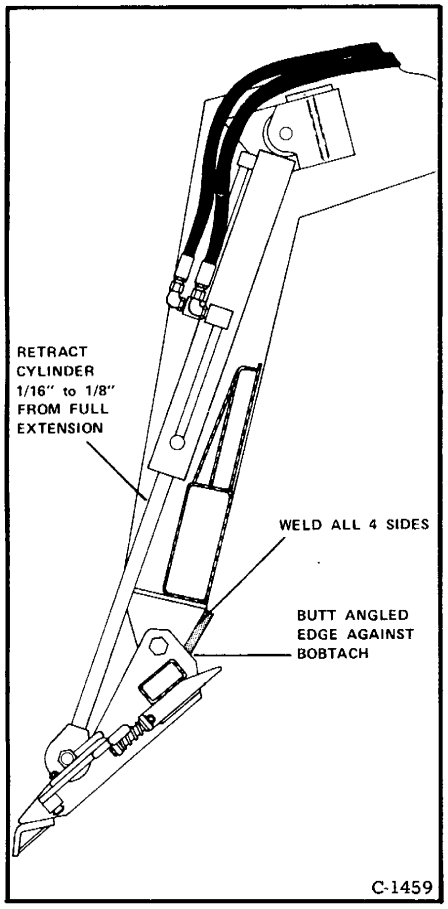


Fig. 27 Tilt Cylinder Stop Blocks

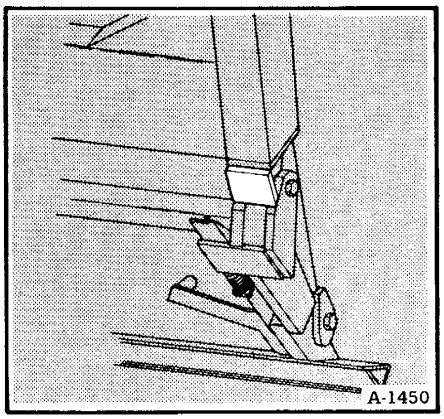


Fig. 28 Tilt Cylinder Stop Blocks

7. Remove the 1" x 3-1/2" pivot screws from the upright support beams.

8. Using the hoist, raise the lift arm assembly clear of the uprights.

To reinstall the lift arms:

1. With a chain hoist, carefully lower the lift arm assembly into place.

2. Install the 1" x 3-1/2" lift arm pivot screws and torque to 800 ft-lbs.

3. Install the 1" x 3-1/2" lift cylinder rod end pivot screws. Torque them to 800 ft-lbs.

4. Attach the base end tilt cylinder hose to right hand port of the junction block.

5. Attach the rod end tilt cylinder hose to the left hand port of the junction block.

6. Start the engine and cycle the tilt cylinder circuit to purge all air from the lines and to check the fittings for possible leakage.

REWORKING THE LIFT ARM ASSEMBLY

Lift arms may require reworking on some M-970 Loaders. On machine serial numbers 100093, 100088, 100086, 100079 and below, cracks might appear in the cover plate at the knee section of the lift arm. These cracks should be ground out and rewelded. The lift arm stops should also be relocated to a point 16" higher on the tank (Figure 26) to minimize stress on the welded joint.

Damage may occur to the tilt cylinder rod end when the bucket is rolled fully down and used for pushing or scraping. To prevent this damage, stop blocks (Figures 27 & 28, Part No. 6506226) should be welded onto the lift arms to limit Bob-Tach travel. Extend the tilt cylinders to their full length, then retract them 1/16" to 1/8" and install the stops as shown.

WARNING

Lift arms are designed to withstand the stresses encountered in normal loader operations, however, if the machine is subjected to extreme stresses such as driving one corner of the bucket hard against a solid object (rock, concrete, etc.), structural damage to the lift arm could occur.

A sprung or twisted lift arm must be replaced with a new lift arm. An inspection should also be made of the lift arm uprights for cracked welds etc.

SIDE PANEL (Fender) REMOVAL

Loosen the five retaining nuts and the nut from the cab tilting pivot screw.

NOTE: The right hand fender also includes the gas tank filler neck and cap. It is necessary to disconnect the gas tank filler hose before fender removal is possible. Plug tank filler pipe to keep out dirt.

GRILL REMOVAL

1. Remove the two 7/8" x 6" hinge pins from the right hand side of the grill access door.

2. Swing open the grill access door and disconnect the wiring harness from the rear lights.

3. Connect a chain hoist to the grill.

4. Remove the two 7/8" x 6" hinge pins from the left hand side of the grill and hoist the assembly clear of its mounting points.

FUEL TANK

To remove the fuel tank:

1. Remove Operator Enclosure.
2. Disconnect the clutch linkage rod (Diesel Only).
3. Disconnect the control pedal linkages and auxiliary spool lock linkage. Remove the floorboard and foot pedal assembly.
4. Disconnect the fuel level gauge sending wire.
5. Disconnect the fuel tank filler hose and engine fuel line.
6. Remove the tank hold-down strips and lift the tank from its mounting brackets.

FUEL PICKUP TUBE

Check valves are installed on some early model M-970 Loaders. These valves may stick or clog and cause fuel problems. To prevent this from happening the check valve should be removed and discarded. A pickup tube (part no. 6507609) should be installed as shown in Figure 29.

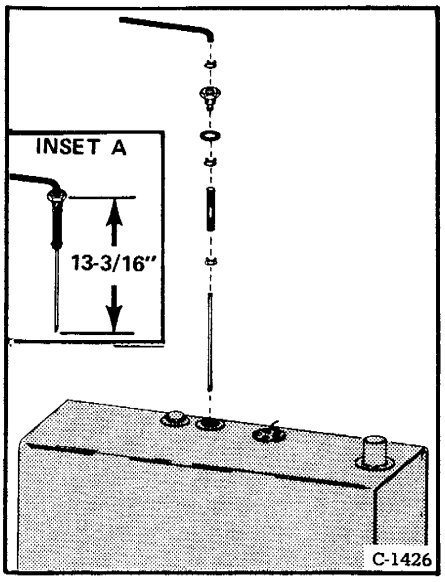


Fig. 29 Fuel Pick ›› Tube

ENGINE HOOD (Figure 30)

The engine hood helps protect the engine and wiring from moisture and foreign material.

The hood is removed by removing four 3/8" screws on the top and sides.

Check to see that the hood does not interfere with the air cleaner hose (diesel only). This could cause a hole to be worn in the hose which would allow dust and dirt to enter the air system and damage the engine. If the hood interferes with the air cleaner hose, the front hood support brackets may be lengthened to raise the hood.

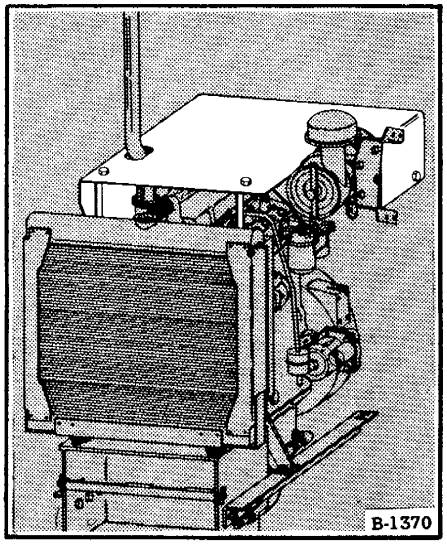


Fig. 30 Engine Hood

INTRODUCTION TO ENGINE SERVICE

The M-970 Bobcat Loader is equipped with either a diesel or gasoline engine. Note that service procedure may vary between engine types.

To insure a long and reliable engine life, it is good practice to make a daily inspection of the following:

1. Coolant level and clean radiator cores.
2. Lubricating oil level
3. Air cleaner condition indicator
4. Breaks or leaks in air cleaner hoses and connections.
5. Oil and coolant leaks.
6. Leaks in fuel system.

INITIAL 50 HOUR SERVICE

After 25 - 50 hours of running time, dependent on operating conditions, the following service must be performed on the new engine.

1. Retorque cylinder head, if not done during pre-delivery inspection. (See page 17 for Diesel, page 138 for Gas)
2. Reset valve tappet clearance (See page 97 for Diesel).
3. With engine hot, drain crankcase oil and replace filter element. Refill with proper grade and type for operating conditions (see page 14).

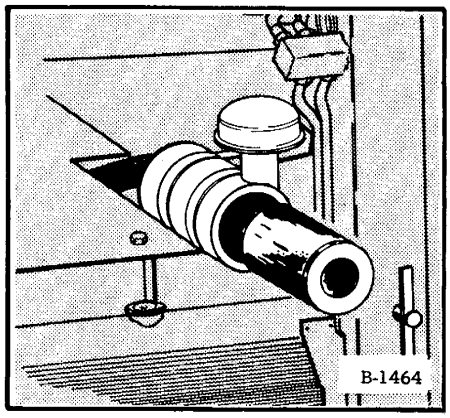


Fig. 31 Standard Air Cleaner

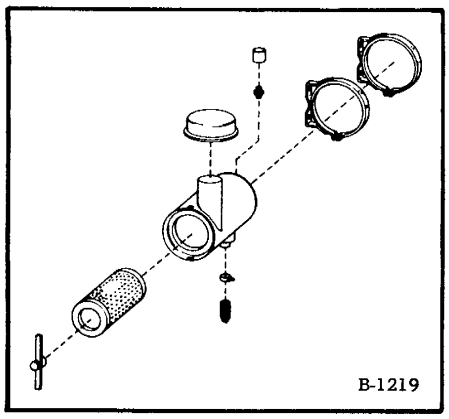


Fig. 32 Air Cleaner Assembly

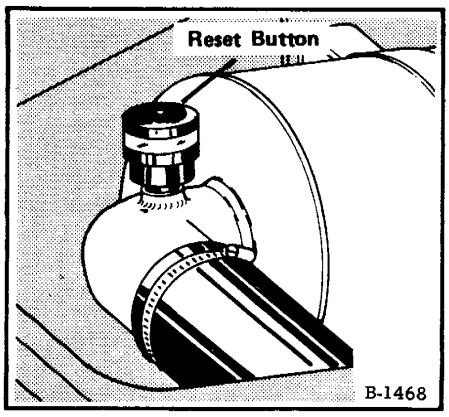


Fig. 33 Condition Indicator

4. Check tension of fan belt. Adjust if necessary (see page 18).

5. Check for tightness, all external nuts, set screws, mountings, etc.

6. With engine running, check for fuel, coolant, and oil leaks. Check oil flow to rocker arm assembly (Diesel Only).

AIR CLEANER SERVICE

The engine air cleaner must be serviced regularly. However, overservicing does not fully use the air cleaner features. Do not service until red ring appears in condition indicator window.

1. Remove element by loosening retainer bar and wipe out inside of housing.

2. Insert new element and reassemble (Figure 31 & 32)

3. Press down on button located on top of condition indicator to retract red ring from sight window (Figure 33).

Take these precautions when servicing the air cleaner:

1. If air cleaner has been dented or otherwise damaged, check all connections immediately.

2. On gasoline models, examine carburetor shafts for wear which will permit unfiltered air to enter engine.

HEAVY DUTY, TWO STAGE, MULTIPLE ELEMENT AIR CLEANER WITH ASPIRATOR (Figure 34)

This air cleaner, installed on loaders for work in heavy concentrations of dust, should be serviced as follows:

1. When the red ring appears in the sight window of the condition indicator, remove the precleaner from the housing and remove and install a new element. No attempt should be made to clean or reuse a dirty element.

2. Clean the precleaner by using an air hose to blow out foreign matter and wipe out inside of housing.

3. Inspect the housing and all fittings for signs of damage. Be sure that all connections are tight.

4. Reset the condition indicator by pressing the button on top of the indicator.

Take these precautions when servicing the air cleaner:

1. Check all connections for tightness.

2. If the air cleaner has been dented or damaged, check all connections immediately. Replace damaged parts, if necessary.

3. Inspect the intake manifold gasket for condition.

FIELD SERVICING THE AIR CLEANER (DONALDSON ONLY)

If the red ring appears in the sight window of the condition indicator while in the field, the Bobcat may continue to be operated as long as the engine performs satisfactorily. The red ring is merely an indication that the element is getting dirty and will need attention. If engine performance is affected, the air cleaner may be serviced as follows:

1. As a temporary expedient, remove the element and clean it by tapping the side or end carefully against the palm of the hand.

WARNING

Do not tap the element against a hard surface. the element may be damaged in doing so.

2. Compressed air if available may be used to blow out dust from within the element. Air pressure must not exceed 30 PSI. With the element removed, insert the air nozzle inside the element and blow out dust. Clean the dust from the outside of the element by holding the nozzle at least 6" from the element.

3. An even and fine pattern of light through the element, when a light is held inside the element, indicates that the element is clean. Any large spot of light indicates that the element is damaged and unfit for use. Replace the element.

   After cleaning the element, check the condition of the gasket on the end of the element. If the gasket is damaged or missing, replace the element.

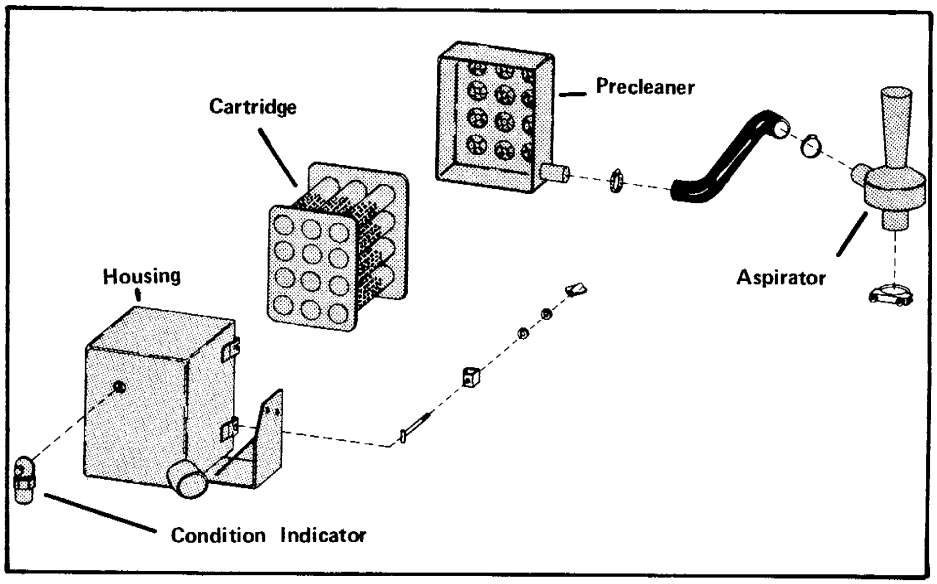


Fig. 34 Two Stage Air Cleaner with Aspirator

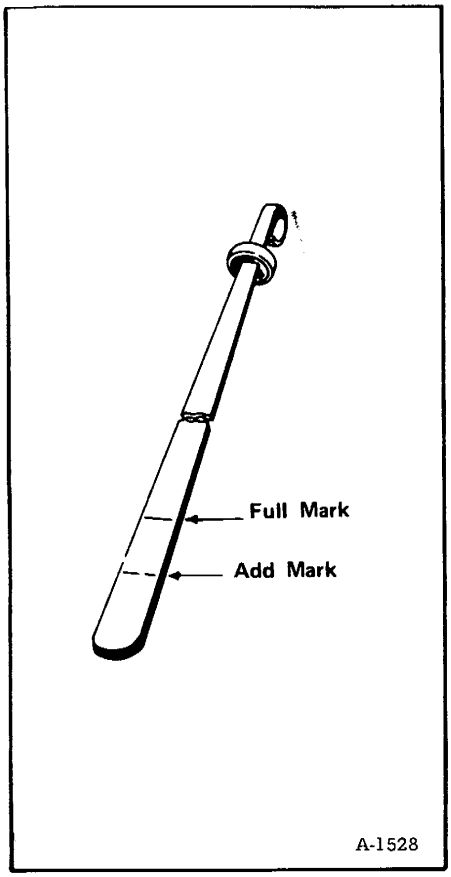


Fig. 35 Do not overfill

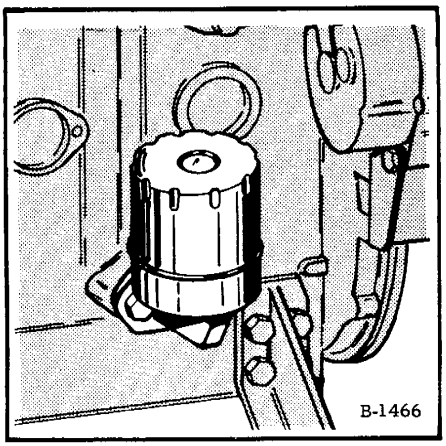


Fig. 36 Diesel Oil Filter

ENGINE LUBRICATION SERVICE

After the initial 25 - 50 hours of running time, the lubricating oil and filter element should be changed. Thereafter, change the oil and filter element every 200 hours, more frequent changes may be required if operating under extreme hot, cold, dusty, or corrosive conditions. The lubricating oil should have a minimum viscosity index of 80 and meet the requirements of the U.S. Ordnance Specification MIL/L/46152 (API Service CC), for diesel. For gasoline models use API Service Classification SE.

The following chart lists oils which meet these requirements. However, other brands which conform to these specifications are suitable. If in doubt as to grade of a certain oil, contact engine manufacturer for recommendations.

RECOMMENDED OIL SPECIFICATIONS

COMPANY	BRAND	SAE DESIGNATION		
		0°/30°F	30°/80°F	OVER 80°F
American Oil Co.	American Supermil Motor Oil	10W	20W/20	30
BP Canada Limited	BP Vanellus	10W	20W/30	30
	BP Vanellus	10W/30	10W/30	10W/30
Chevron Oil Co.	RPM DELO Multi-Service Oil	10W	20W/20	30
Continental Oil Co.	Conoco Tracon Oil	10W	20W/20	30
Gulf Oil Corporation	Gulflube Motor Oil X.H.D.	10W	20W/20	30
Mobile Oil Co.	Delvac 1200 Series	1210	1220	1230
Shell Oil Co.	Shell Rotella T Oil	10W	20W/20	30
Sun Oil Co.	Sunfleet MIL-B	10W	20W/20	30
Texaco, Inc.	Ursa Oil Extra Duty	10W	20W/20	30

CHANGING ENGINE OIL

Follow this procedure:

1. Remove the crankcase drain plug (located at the end of the crankcase drain hose). Drain the oil when the engine is hot.
2. Remove the engine oil filter cartridge.
3. Clean filter mounting surface.
4. Install a new cartridge.
5. After the oil has drained from the crankcase, replace the plug.
6. Fill to dipstick "Full" level. Do not overfill (Figure 35).
7. Start the engine and run it for about 5 minutes. If there are no leaks around the filter. the filter cartridge and gasket are installed correctly.
8. Stop the engine. Check the oil level.

OIL FILTER REPLACEMENT

A by-pass type oil filter (Figure 36) is provided to remove dirt and foreign elements from the oil. Grit, sludge and foreign particles cause filter elements to clog and become ineffective. The element should be replaced at every oil change.

To replace filter cartridge, follow this procedure:

1. Unscrew filter cartridge and discard.
2. Clean filter mount with cleaning solution.
3. Mount the new cartridge and hand tighten.
4. Run engine and check for oil leaks.

FUEL SYSTEM SERVICE

The diesel engine is equipped with two fuel filters, a secondary and a primary filter (Figure 37).

Both filters require replacement every 500 operating hours.

The primary filter is also fitted with a water trap bowl. The water trap bowl will trap any water present in the fuel.

Drain contents of the bowl periodically or whenever water can be seen at the bottom.

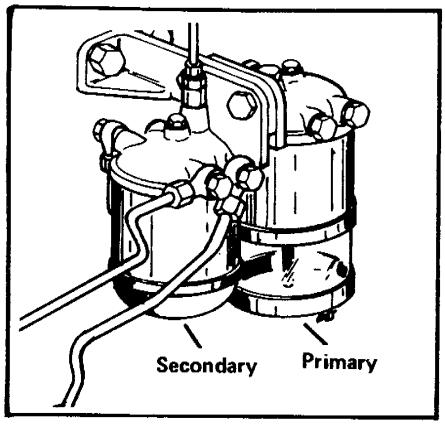


Fig. 37 Diesel Fuel Filters

To replace fuel filter element (Diesel) follow this procedure:

1. Carefully clean area.
2. Loosen and remove retaining screws of both primary and secondary filters (Figure 38, Item 1).
3. Remove and discard filter cartridges and o-ring seals.
4. Clean water trap and fuel bowl.
5. Replace filters with identical type. Hold firmly in position while inserting and tightening retaining screw. Do not tighten excessively.
6. After filters are reassembled, it is necessary to remove air from the fuel system. See page 16 for venting procedure.

To replace filter element (gasoline) see figure 39. The filter is located on the fuel line near the carburetor. Replace only with the same type.

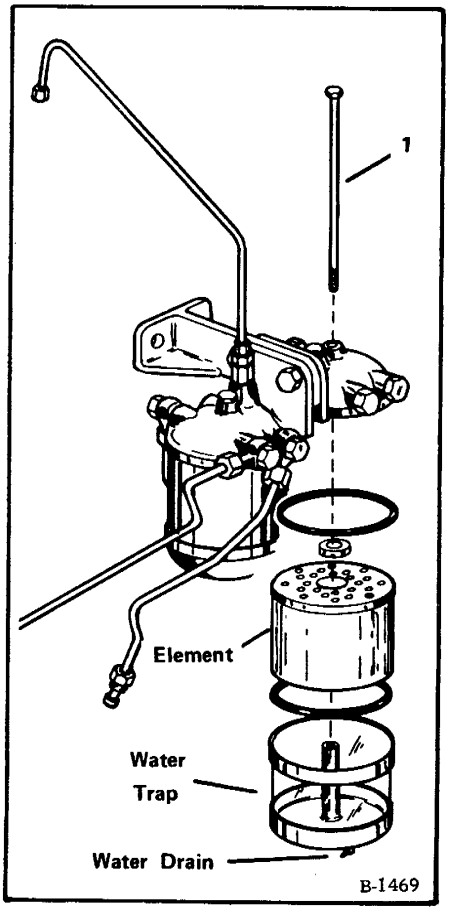


Fig. 38 Filter Assembly

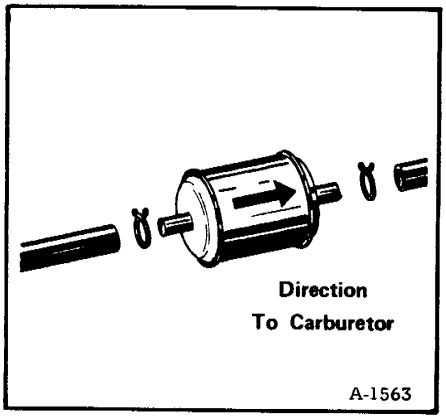


Fig. 39 Gasoline Fuel Filter

FUEL SPECIFICATIONS

On gasoline engines, use a good grade of regular gasoline only.

On diesel engines, use No. 2 diesel fuel. (Extreme low ambient temperatures may require using No. 1 diesel fuel).

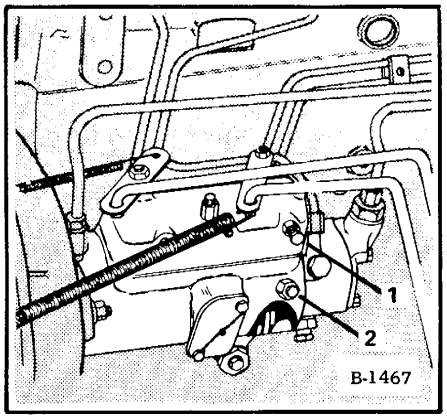


Fig. 40 Governor Vent

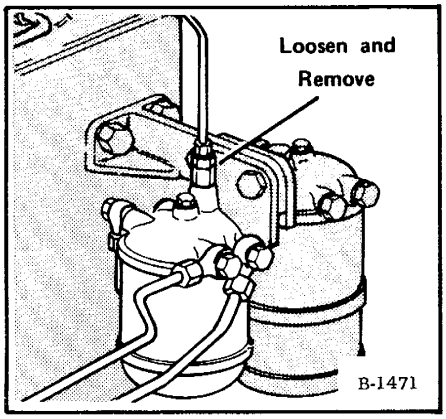


Fig. 41 Fuel Filter Vent

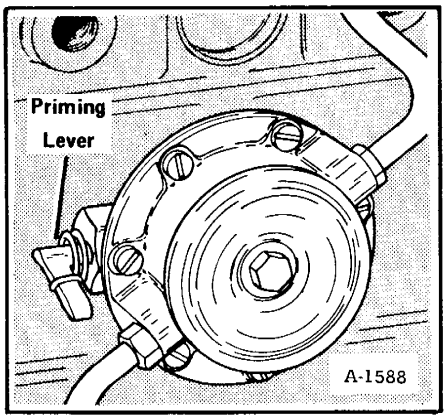


Fig. 42 Priming Pump

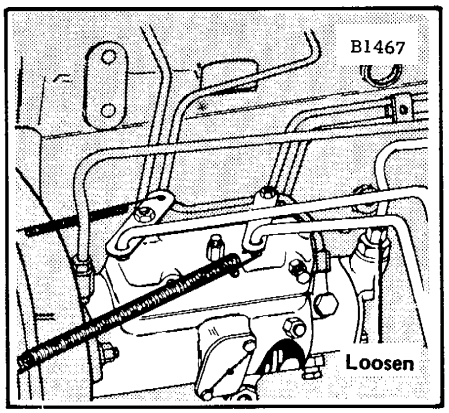


Fig. 43 Fuel Injection Pump Inlet

VENTING FUEL SYSTEM (Diesel)

The presence of air in the fuel lines, pumps or filters can cause difficult starting, erratic running and a loss of power.

Running out of fuel, breaks in fuel lines, leaks in pump assemblies, changing filters, or the removal or other disturbance of any fuel system connection can result in air entering the fuel system.

To remove the air from fuel system, the system must be vented.

To vent, proceed as follows:

1. Loosen vent screw located near top of governor control cover (Figure 40, Item 1).
2. Loosen vent screw located on the side of fuel pump (Figure 40, Item 2).
3. Loosen and remove fuel outlet pipe assembly on top of filter cover (Figure 41).
4. Operate priming lever of fuel lift pump, forcing fuel and air bubbles through vent points (Figure 42).
5. When air bubbles cease from all vent points, tighten vent screws in the following order:
   a. Fuel filter outlet pipe assembly (Figure 41).
   b. Fuel pump vent screw (Figure 40, Item 2).
   c. Governor vent screw (Figure 40, Item 1).
6. Loosen pipe nut at fuel injection pump inlet (Figure 43).
7. Operate priming lever until air-free fuel flows from threads.

NOTE: **It will not be possible to operate priming lever of fuel lift pump if the cam lobe of the engine camshaft is at maximum lift position.**

If this situation occurs, crank engine one complete revolution and proceed with venting operation.

8. Retighten pipe nut.
9. Loosen pipe nuts on injector end of each of the high pressure fuel lines (Figure 44).
10. Set throttle to full open position and crank engine until air-free fuel flows from both fuel lines.
11. Retighten nuts. Engine is now ready to start.

If engine starts and then stops and inspection finds fuel system is again full of air, a leak in the suction side is indicated. Locate leak and repair. After repairing, the fuel system must again be vented.

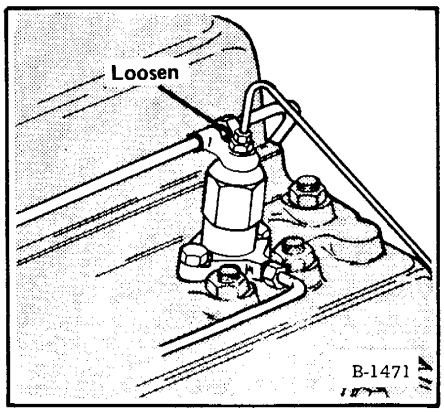


Fig. 44 Injector Vent

INJECTOR SERVICE (Diesel Only)

Faulty injectors may result in difficult starting, engine misfire or loss of power.

To detect which injector(s) is faulty, proceed as follows:

1. Run engine at fast idle speed.

2. Loosen one injector high pressure fuel line nut and note sound of engine when doing so (Figure 44).

   If the injector is faulty, loosening the fuel line will have little or no effect on the engine. Continue this procedure with the rest of the injector fuel lines until faulty injector is found.

3. Replace injector.

To replace an injector, proceed as follows (Figure 45):

1. Loosen pipe nuts on both ends of injector fuel line.

2. Remove pipe completely. Do not bend fuel line pipes.

3. Loosen retaining nuts and remove faulty injector and old copper washer.

4. Install a new seating washer and a new injector, as squarely as possible, into the head and tighten retaining nuts.

NOTE: When tightening retaining nuts, retorque to 12 ft.-lbs. Turn each nut 1/8 turn at a time, in turn to pull injector evenly into place. This is very important.

5. Replace fuel line pipe.

6. Start engine and listen by a new injector for any "blow-by". "Blow-by" will indicate injector is not properly seated.

   If "blow-by" is evident, carefully loosen retaining nuts slightly and retighten evenly until "blow-by" stops (Figure 46).

7. Check fuel line for leaks at connections.

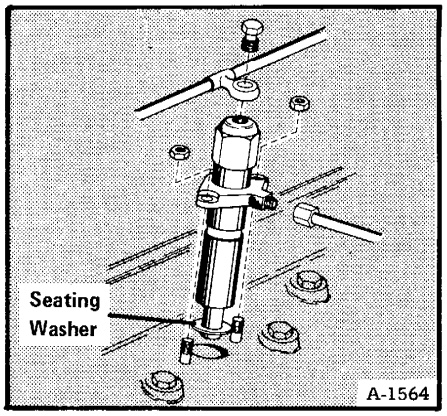


Fig. 45 Injector

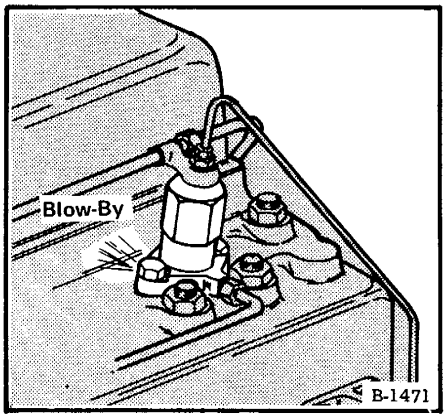


Fig. 46 Injector Blow-By

WARNING

Do not start engine before retaining nuts are tightened. The compression may blow the injector out.

CYLINDER HEAD RETORQUING (Diesel Only)

Cylinder heads should be retorqued prior to the initial 25 hours of running time. This should be accomplished with the engine at operating temperature.

To check torque, follow this procedure:

1. Remove valve cover and the rocker assembly.

2. Torque head screws to 85 ft.-lbs. (See Figure 47 for proper sequence).

If engine must be torqued "cold", torque to 100 ft.-lbs.

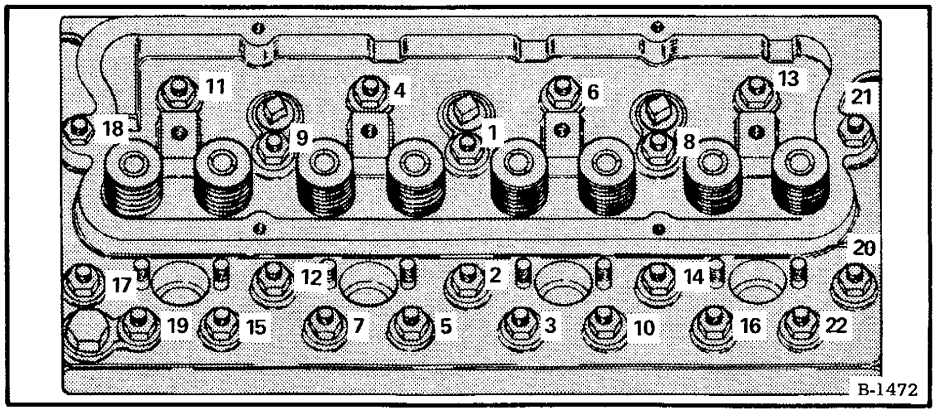


Fig. 47 Cylinder Head Tightening Order

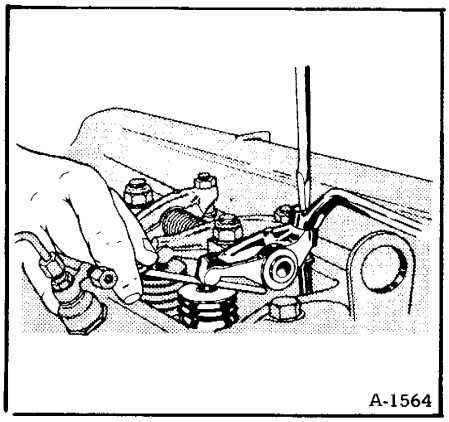


Fig. 48 Tapped Adjustment

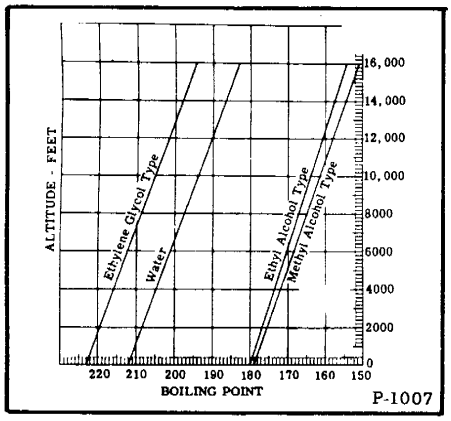


Fig. 49 Coolant Boiling Points

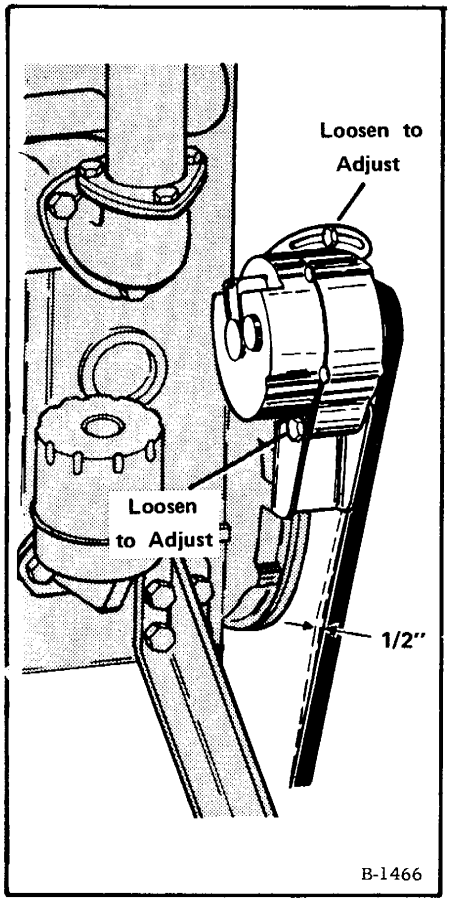


Fig. 50 Fan Belt Adjustment

VALVE CLEARANCE ADJUSTMENT (Diesel Only)

Valve tappet clearances should be measured and set with engine cold. Correct clearance is .012 in. on both intake and exhaust valve tappets. (Figure 48).

To properly insure that cams on both the intake and exhaust valves are at maximum freeplay the following procedure is recommended when setting tappets:

1. Turn engine until number 4 cylinder is at the period between intake valve opening and exhaust valve closing, then adjust number 1 cylinder tappets.

2. Follow the same procedure on the remaining cylinders, in their firing order; ie. (1, 3, 4, 2).
   At cylinder no. 2 intake opening, exhaust closing, adjust no. 3 cylinder tappets.

3. At cylinder no. 1 intake opening, exhaust closing, adjust no. 4 cylinder tappets.

4. At cylinder no. 3 intake opening, exhaust closing, adjust no. 2 cylinder tappets.

NOTE: With engine running at fast idle, check to see that oil is flowing to rocker arm assembly.

Replace rocker arm cover after checking condition of gasket. Do not tighten nuts excessively. Each time cylinder head is disturbed or retorqued, valve tappet clearance must be readjusted.

COOLING SYSTEM SERVICE

The M-970 cooling system contains a permanent type ethylene glycol anti-freeze solution and is protected to -30^{0} F. See Figure 49 for boiling temperatures of various coolant solutions.

NOTE: If you are operating in freezing temperatures, check coolant solution to be sure cooling system will be protected. If you add water to the radiator, recheck the strength of the anti-freeze solution after running engine.

Clean debris from radiator cooling fins often when operating under dirty conditions. Installation of a "puller" type fan may be feasible, during cold weather operation, to provide faster engine warm up.

NOTE: Coolant should be drained and replaced after 12 months use.

When draining system, be sure to also drain engine block. It may be necessary to clean drain hole while draining to eliminate it blocking with sludge. If cooling system is particularly dirty, flush until clean before refilling with clean anti-freeze solution.

RADIATOR COOLING FANS

Either push or pull type fans are available for both gasoline and diesel model engines. The push type fan is recommended for use on hot climate operating conditions since it directs the air away from the engine and operator. The pull type fan is recommended when quicker engine warmup is desired.

FAN BELT ADJUSTMENT (Figure 50)

1. Loosen alternator mounting screw adjustment linkage nuts.

2. Adjust tension so there is 1/2" deflection in the belt midway between alternator and water pump pulleys.

3. Retighten all screws.

Do not overtighten belt as this places an overloaded condition on water pump and alternator bearings. Overtightening may also result in early belt failure. To replace a belt, "wind" it on by turning both belt and pulley. Do not pry belt in place as belt may be damaged by this method. After replacing the belt, recheck tension after a short running period. Additional adjustment may be necessary to compensate for initial belt stretching.