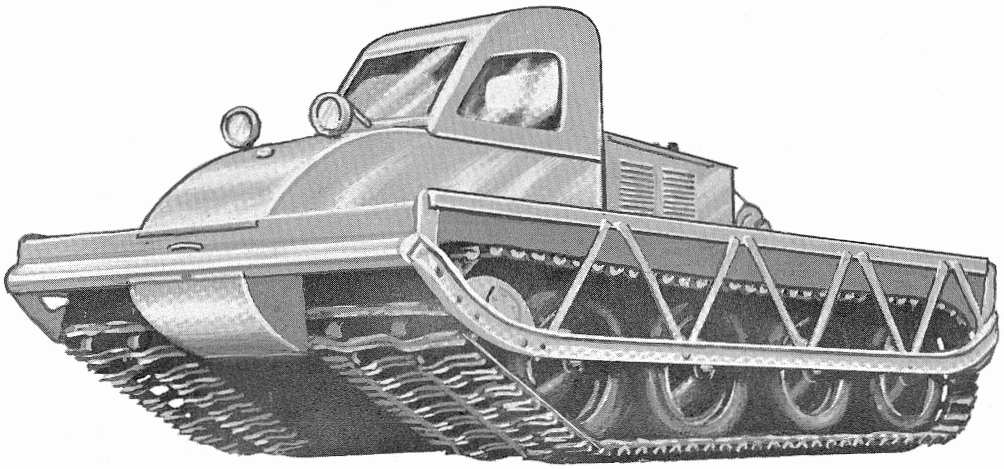
''MUSKEG'' TRACTOR



Operator's Manual

BOMBARDIER LTD. – VALCOURT, QUE., CANADA

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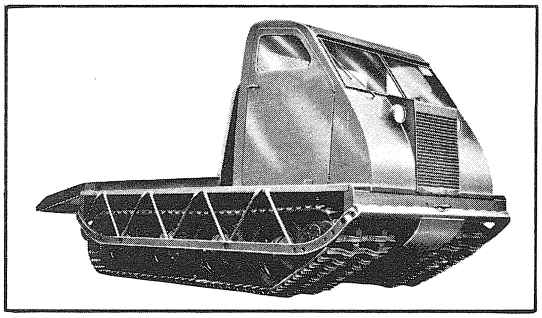
INTRODUCTION

This book covers the Muskeg tractor and the Muskeg Carriers models H.D.W. and S.

You are now among the numerous users of BOMBARDIER vehicles.

In order that the use of this machine satisfies your expectations, it is essential that you have a basic knowledge of the principles of construction of the machine, its operation and maintenance. Therefore we strongly recommend that you read and study the following pages so that you may take full advantage of its capabilities, yet prevent abuse and consequent down time.

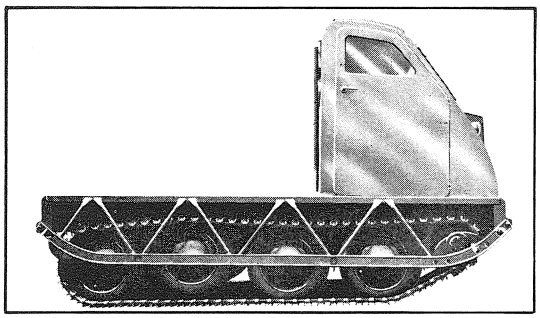
Your machine has been built with care and the best known materials were used but good maintenance will ensure long satisfactory service.



BOMBARDIER

MUSKEG CARRIER

Model H.D.W.



BOMBARDIER

MUSKEG CARRIER

Model S

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OPERATION

Instrument panel

The instrument panel includes the following standard items: ignition switch, starter switch, ammeter, temperature gauge, oil pressure gauge, fuel gauge, windshield wiper switch and on certain models, the headlight switch, dome light switch and hand throttle button.

Control

The steering levers replace the steering wheel of ordinary vehicles and are also used for braking. A right turn is made by pulling on the right hand lever, a left turn by pulling on the left hand lever. By pulling a lever right back, the brake band holds the brake drum on that side of the differential, then through the planetary gears, the speed of one drive axle is reduced and the other incrased. To brake or stop the machine, depress the clutch and pull both levers.

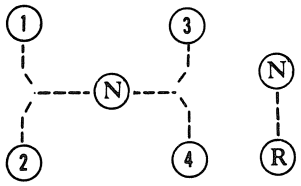
The other controls include the following items : clutch pedal, accelerator pedal, gearshift lever and on certain models, brake pedal, transfer case lever, winch clutch fork lever, mechanical brake for the winch and control lever for the hydraulic system.

Starting the engine

Place the transmission gearshift lever in neutral and depress the clutch pedal to release the engine of the transmission load. Turn ignition switch and press on the starter switch. The Muskeg Carrier is supplied with an automatic choke. The Muskeg tractor is equipped with a hand choke located at the left of the driver's back rest. After the engine has started, let it run a few minutes at idle speed, so that all the moving parts will be properly lubricated before running the engine under load. Check all the gauges before moving off.

Transmission gearshift controls (Muskeg Tractor)

Gearshift lever positions :



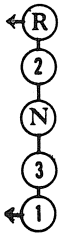
GEAR	
1	Move the left hand lever to the left and push forward
2	Move the left hand lever to the left and pull backward
3	Move the left hand lever to the right and push forward
4	Move the left hand lever to the right and pull backward
REVERSE	Pull the right hand lever backward

Note :

Only one speed is obtainable at a time, therefore, it is necessary to return the lever to neutral before shifting the other lever to any forward speed and vice versa.

Transmission gearshift controls (Muskeg Carriers)

Gearshift lever positions :



REVERSE	Pull lever to left and push forward
1 st	Pull lever to left and backward
2 nd	Push lever straight forward
3 rd	Pull lever straight backward

Hydraulic sytem

When the machine is equipped with an hydraulic system, the operation of the equipment is controlled by a lever or levers. The hydraulic system may operate the loading mast, the scraper, the loader of the platform if such equipment is installed.

Transfer case

The transfer case available on the Muskeg Carriers reduces the speed and increases the power transmitted to the differential and is used to transfer the power from the transmission to the winch or any other piece of machinery powered through the transfer case.

The operating lever for the transfer case is above the winch in a horizontal position pointing forward. To transfer the power from the differential to the winch or other equipment, press the clutch pedal; then push the lever to the right. If the gears of the transfer case do not engage properly, move the vehicle backward or forward until the gears mesh.

You have three forward speeds and one reverse on the transfer case through the transmission.

Winch Muskeg Carrier

The winch on the Muskeg Carrier is operated through the transfer case. Transfer the power from the differential to the winch as per foregoing instructions and engage the drum by lifting up the lever which engages the drum clutch into the drum.

To load heavy objects in the Muskeg Carrier by means of the platform and winch proceed as follows :

Raise the platform until the rear end touches the ground then hook the winch cable to the object to be loaded and engage the winch as per instructions given above to pull it onto the platform. When the object reaches the point of balance on the platform, press down the hydraulic control lever and the platform will be brought down as the winch pulls the object to the front; then lock it into position by lifting up the mechanical brake at the right of the driver's seat and shift the transfer case to the drive position.

Note :

Make sure that the control levers of the transmission, the transfer case and the winch drum are always pushed as far as they will go in order to engage the gears properly.

Side mounted winch (Muskeg Tractor)

This winch can be engaged forward or into reverse by the lever at the left of the operator in front of the transmission front plate. Pull the lever upward to engage the winch forward and push it downward to engage it into reverse.

To engage the cable drum, push the lever which engages the drum clutch into the drum.

Rear mounted winch (Muskeg Tractor)

The rear mounted winch can be engaged forward or into reverse by two levers. One of them is inside the cab on the left hand side in front of the transmission front plate and the other one is behind the fan guard.

When the lever inside the cab is used, you pull it upward to engage the winch forward and push it downward to engage it into reverse. When the lever behind the fan guard is used, you pull it towards the left to engage the winch forward and push it towards the right to engage it into reverse. When a scraper is installed, there is only one lever and it is installed behind the fan guard as there is no room for it inside the cab.

To engage the cable drum, push the lever which engages the drum clutch into the drum.

Memo :

MAINTENANCE INSTRUCTIONS

General information

Do not operate the machine at excessively high speed over rocky ground, stumps, logs, etc. as this can become a cause of damages.

We recommend that you install a screen on the radiator when working in places where there are leaves or other things that may block the radiator.

On a new machine keep the drive sprockets wet whenever possible.

Recommendations for daily and weekly check-ups as well as a lubrication chart are given in this operator's manual. For trouble free operation, we strongly recommend that these instructions be studied and followed carefully by the operator.

To remove the track

1) Jack up the machine.

2) Loosen the adjusting screw nut and tube or bleed the hydraulic track adjuster (if so equipped) until the rear wheels touch the rear tandem axle cross tube.

3) Remove the side beam by removing the bolts at each end of the tractor, the nuts from both cross shafts and all the bolts holding it to the mud-guard.

4) Remove five consecutive cross links and turn the track so that the part where the cross links were removed is on the drive sprocket. This will give the necessary slackness to remove the track.

5) Remove the track by pulling it off the rear wheels, then from the front wheels and sprockets.

To install the track

1) Spread out the tracks alongside the vehicle and remove five consecutive cross links.

2) Install the part of the track where five cross links were removed over the drive sprockets.

3) Push the rear part of the track underneath the exterior rear wheel and let the tractor down to facilitate the installation of the track over the exterior rear wheel.

4) Jack up the machine again and push the track underneath the interior rear wheel. Finally, let the tractor down to install the track over the second wheel.

5) Replace the side beam, the two bolts at each end of the vehicle, the bolts holding it to the mud-guard and finally the nuts of the cross shafts.

6 Turn the track so that the cross links can be reinstalled easily from underneath between the sprockets and front wheels.

Adjustment of the tracks

The tension of the track is normal and ideal when the track is as loose as it can be without jumping over the sprocket teeth. Properly adjusted tracks promote better traction and reduce wear. To adjust, tighten or loosen the adjusting screw, be sure to tighten the lock nut and install the bolt which prevents the lock nut from coming loose. If the machine is equipped with the hydraulic track adjuster, use the Bombardier 629-0008 bleeder to release the tension and a grease gun to readjust it.

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Installation of differential axles

The differential axles are of the full floating type and can be removed easily if you proceed as follows :

1) Remove the six bolts retaining the axle and bracket cap.

2) Pull on the nut of the axle pull rod with pliers.

3) If the axle does not come out, move the machine forward or backward to release the tension on the axle. To reinstall, push the axle inside and make sure that the splines fit easily. Turn the hub forward or backward until the splines come in place. Install the seal on the pull rod support and reinstall the axle end bracket cap with gasket.

Replacement of sprockets

We recommend the following procedure for the replacement of sprockets.

1) Remove ten consecutive cross links opposite the rear wheels.

2) Push the track forward to release the sprockets completely.

3) Remove the differential axle as mentioned above and the bearing lock inside the axle end bracket (Part No. 601-0040).

4) Install a jack to support the sprockets and remove the bolts from the axle end bracket.

5) Make a half-turn on the axle end bracket and pull it out.

6) The sprockets and the drive axle hub can now be removed.

7) When you replace the drive sprockets, make sure that the sprocket teeth are in line.

Replacement of wheels or tires

The replacement of wheels or tires is done very easily when the machine is jacked up and the tracks removed.

However, you can replace any wheel or tire WITHOUT REMOVING THE TRACK if you proceed as follows :

1) The four central wheels on each side can be removed easily when the vehicle is jacked up.

2) To remove the two front wheels on each side, install a wooden block 2″ x 4″ and 22″ long inside the exterior belt if you want to remove the front exterior wheel and inside the interior belt if you want to remove the front interior wheel. Install that wooden block at an angle at about 8″ behind the axle hub and turn the track by means of the starter switch so that the wooden block comes in a vertical position. This will spread the two sides of the track apart giving the necessary clearance to remove the wheel.

3) To remove one of the four rear wheels, proceed as follows :

A) Jack up the machine.

B) Remove two bolts from fourteen consecutive cross links on the exterior belt beside the wheel and on the center belt.

C) Push the belt towards the front to obtain the necessary clearance and remove the wheel.

Note :

The method described above is used to remove any of the interior or exterior rear wheels.

Adjustment of wheel bearings

To adjust the wheel bearings tighten the wheel nut firmly, then back off 1/4 of a turn and install the cotter pin.

Adjustment of the flexible joint bearings

To adjust the flexible point bearings of the front suspension, we recommend that you tighten the nut firmly so that the bearings are well adjusted and install the cotter pin.

Adjustment of the control levers

For perfect adjustment, leave a free play of about 3" at the top of the levers. If a readjustment is required, tighten or loosen the adjusting nut on the steering and brake yoke at the bottom of the steering levers. On the Muskeg Carriers the adjustment of the control levers can also be made by means of the adjusting clevises on the steering rods.

When manoeuvering the machine, pull the levers right in and out with a firm motion taking advantage of any undulation on the ground to facilitate steering. Do not slip the bands as this may cause overheating and scoring of the brake drums.

Adjustment of the clutch rods

The adjustment of the clutch pedal rod is done by means of the bolts located on the clutch release fork lever. This should be checked once in a while to make sure that there is from 1/4" to 1" free play on the clutch pedal.

Accelerator

The adjustment of the accelerator rod can be done on the rod lever near the carburetor.

Adjustment of the control rod of the transfer case

The adjustment of the control rod of the transfer case is made by tightening or loosening the adjuster near the transfer case.

Brake

On the Muskeg Carriers various brakes are used at the transmission, transfer case and winch, etc. The adjustment of these brakes is made by the bolts on the brake band or nuts on the brake rod.

INSTRUCTIONS FOR REPAIRING THE DIFFERENTIAL ASSEMBLY

Remove the differential from the chassis

Remove the differential axles cover and the brake bands. Unscrew the bearing adjusters on each side of the differential carrier until the differential can be lifted out of the chassis.

Dissassemble differential assembly

Remove the differential side bearings 105-0024 (cup) 105-0025 (cone) at both ends of the differential case using a bearing remover, part no. 608-9958. Lift the steering brake drum (608-0002) including the brake drum gear (608-0011), off the differential case. Hold the plalnetary gears (608-0015) stationary using a wedge between the planetary gears and the center part of the side case. Remove the cotter pins and castellated nuts that secure the three planetary gears to the differential pinion gears (608-0026) at each side of the case. Insert a heavy screwdriver between the planetary gears and the case and pry the gears off the differential pinion gears.

Each planetary gear is marked to match the differential pinion gear to assure proper installation. Remove the cotter pins and nuts from the six differential case bolts.

Use a brass hammer, if necessary, to tap the case apart. Remove the differential pinion gears (608-0026) and axle to differential pinion gears (608-0024) from the case The differential case is marked to assure proper installation.

Differential assembly inspection

The crown and pinion gears are furnished in matched sets, and, if either is damaged, both must be replaced. Replace the crown gear if it has chipped or missing teeth following the procedure outlined under crown gear replacement below. Replace the bushings in the differential case if they are worn. Replace the differential pinion thrust washer if the thickness is worn to less than 0.090 inch. Replace the brake drum gear thrust washers of the thickness is worn to less than 0.180 inch. Replace any differential pinion gears that have chipped or missing teeth or if the bearing surface at the small end of the gear is worn to less than 0.996 inch or the large end is worn to less than 1.246 inch. Replace any planetary gears or axle to differential pinion gears that have chipped or missing teeth or have worn splines. Replace the steering brake drum if it is chacked, scored or badly worn. However, if the scores in the brake drum are not too deep in the drum surfaces, the drum may be reworked in a brake drum lathe.

Crown gear replacement

Remove the lock wire and the 12 bolts that secure the crown gear to the differential case. Using a brass hammer, tap the crown gear off the case. To install the crown gear, lay it on a bench with the teeth facing downward. Place the case on the crown gear and line up the holes. Install the 12 bolts that secure the gear to the case. Lock the bolts with the locking wire.

Differential pinion gear bushing replacement

Remove the differential pinion gear bushings from the differential case, using a suitable driver. To install a new bushing, place it in position on the case and install it with a suitable driver. Assemble the differential case without the gears being sure the matching numbers on the case are in line with each other. Line ream the bushings if necessary and disassmble the case.

Differential case center bushing replacement

Place the center case (608-0028) of the differential case in a vise. Remove the two bushings. To install new bushings place one of the bushings in position on the case being sure the oil holes are in line with each other. Install the bushings using suitablle bushing replacer. Install the other bushing on the opposite side, using the same procedure. If the bushings do not have oil holes, or the oil holes do not line up after the bushings are installed, select a drill slightly smaller than the hole in the case and drill a hole through the bushing. Clean the burrs from around the driller holes. To remove the bushings from the side cases, insert a center punch between the bushing and the case and pry the bushing out of the case. To install new bushings, place the bushing in position on the case and using a suitable driver, drive the bushing into the case.

Brake drum gear bushing replacement

Remove the steering brake drum (608-0002) from the brake drum gear (608-0011 and remove the bushings. To install new bushings, place one of the bushings in position in the brake drum gear being sure the oil holes in the bushing are in line with the holes in the gear. Drive the bushing in place with a suitable driver. Install the other bushing on the opposite side using the same procedure. If the bushings do not have oil holes, select a drill slightly smaller than the hole in the gear and drill a hole through the bushing. Clean the burrs from around the drilled holes in the bushing.

Steering brake drum repair

Remove the lock wire, six cap screws and nuts that secure the brake drum gear to the steering brake drum and remove the gear from the drum. Turn down the brake drum on a lathe until all evidence of scores is removed. If the brake drum does not clean up at a diameter of 10-7/16 inches or more, the brake drum must be discarded.

Drive pinion gear inspection

The drive pinion gear is furnished in matched sets only with the crown gear, and if either is damaged, both must be replaced. Replace the bearing cups if they are cracked, pitted, corroded or discolored due to over heating. Replace the pinion gear if it has chipped or missing teeth or damaged threads.

DIFFERENTIAL REASSEMBLY

Install the axle to differential pinion gear in the differential case

Place the differential case left side (608-0030) with crown gear attached on a bench. Place a thrust washer in position in each hole provided for the six differential pinion gears being sure the side having the radius is facing away from the case surface (upward). Place the axle to differential pinion gear (608-0024) in its bearing on the case.

Note :

The hub in the axle to differential pinion gear is identical on both sides and can be installed either side up.

Install center case in differential case

Place the center case on the axle to differential pinion gear being sure the matching marks on the center case are in line with the marks on the differential case. Tap the center case with a brass hammer until it is seated firmly in the dowels.

Install differential pinion gears

Holding one of the differential pinion gears with the splined end of the gear facing downward, insert it into one of the larger differential pinion gear holes in the case. Turn the differential pinion gear until the tooth on the gear having the reference mark is in mesh with the axle to differential pinion gear. Do not turn the axle to differential pinion gear after the first differential pinion gear has been installed. Insert the other two differential pinion gears in the large holes in the case in the same manner so that the reference mark on the teeth also mesh with the axle to differential pinion gear.

Note :

All six of the pinion gears have a punch mark (reference mark) on one of the splines at the spline end of the gear. The reference mark on one of the teeth of each of these gears is on the tooth which is in line with the mark on the splined end of the gear. In some cases the mark on the teeth does not appear, in which case select the tooth which lines up with the mark on the splined end of the gear and mesh this tooth in the axle to differential pinion gear.

Install upper part of differential case (Right Side 608-0017).

Place the axle to differential pinion gear in the bushing on the center case. Place the six thrust washers on the differential pinion gears being sure the side having the radius is facing away from the case surface (downward). Place the upper part of the differential case (608-0017) on the differential pinion gears, being sure the matching marks on the upper case is in line with the mark on the center case. Tap the case with a brass hammer until it is seated firmly on the center case. Insert the six differential case bolts through the case assembly and install the castellated nuts and cotter pins on the bolts.

Install planetary gears

Place the brake drum gear thrust washer in position on the case with its radius facing upward. This must be done before the planetary gears are installed. Place a planetary gear (608-0015) on each of the differential pinion gears, being sure the punch mark on each planetary gear is in line with the punch mark on the spline of each differential pinion gear. Install the flat washers and nuts that secure the planetary gear to the differential pinion gear. Use a wedge to hold the planetary gears stationary while tightening the nuts. Use the same procedure to assemble the planetary gears on the other half of the case.

Assemble and install steering brake drum

Place the brake drum gear in position on the steering brake drum and install the six cap screws and nuts that secure the brake drum gear to the drum. Lock the six cap screws with locking wire. Place the assembly on the differential case and install the differential side bearing.

Assemble the drive pinion

Insert the drive pinion including the inner bearing into the housing. Place the spacer and original thickness of shims on the pinion gear. If the original thickness of shims is unknown, install shims totalling approximately 0.035 inch thick and place the outer bearing on the pinion. Place the pinion flange on the pinion. Do not install the oil seal at this time. Install the bolt, flat washer, and lock washer that secure the flange to the pinion and draw the flange down tight. The pinion bearing adjustment is correct when the pinion turns freely but there should not be any free play. If the pinion turns with difficulty, shims will have to be added behind the outer bearing. If the pinion is loose shims will have to be removed. After the correct adjustment is obtained, remove the pinion flange, install a new oil seal in the pinion housing, install the pinion falnge, the flat washer, lock washer and bolt.

Check crown gear and pinion backlash

Install the differential assembly in the differential carrier, install the carrier stiffener and adjust the carrier bearings. Check the backlash which must not be less than 0.008 inch or more than 0.012 inch. If the backlash is less than 0.008 inch, unscrew the bearing adjuster on the left and screw the bearing adjuster on the right until the correct backlash is obtained. If the backlash is more than 0.012 inch, inscrew the bearing adjuster on the right and screw the bearing adjuster on the left until the backlash is within the specified limits. Lock the bearing adjusters through the adjuster bearing lock bolts.

PROTECTING TRACTOR ENGINE DURING STORAGE

The recommended procedure for rust preventive treatment when the tractor is not operated during 30 days or more is outlined below :

1 — Remove carburetor air cleaner.

2 — Run engine at a fast idle speed until normal operating temperature has been reached. While engine is running, slowly pour one pint of rust preventive lubricant through the carburetor air intake. The speed of pouring should be sufficient to slow down the engine speed slightly without stalling. The addition of rust preventive lubricant in this manner should take approximately one minute.

3 — Provide adequate ventilation while introducing the rust preventive, as considerable smoke will be exhausted.

4 — Stop the engine after the rust preventive has been added.

METHOD OF DRAINING MOTOR AND RADIATOR

1 — Install a flexible plastic or rubber hose on the engine drain cock located between the oil filler pipe and the distributor. This hose should have a maximum inside diameter of ½ inch and should be 4 feet long.

2 — From the drain cock, this hose should pass over the mud-guard and the end should come down below the level of the drain cock so that it will act as a siphon to drain the engine block completely.

3 — To drain the radiator, remove the plug.

Memo :

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RECOMMENDATIONS FOR DAILY CHECK-UP

General

Keep the bottom of the chassis clean.

Follow the instructions for lubrication.

Track

Check the tension of the track which is correct when the track is as loose as it can be without jumping over the sprocket teeth.

Wheels and tires

Maintain the tire pressure at 90 to 100 lbs.

Remove mud or any foreign body which may be on the rear suspension and springs causing friction on the wheels and tires.

Suspension

Check the condition of the springs and spring links.

Control system

Keep the levers and rods of the control system well adjusted; steering levers, clutch pedal, accelerator, transmission, transfer case, winch, brakes.

Engine

Check the oil pressure and look for possible oil or gas leaks.

Check the condition of the air filter.

Electrical system

Check the condition of the battery and the level of the electrolyte.

Check all the gauges.

Cooling system

Check the level of the coolant in the radiator and look for possible leaks.

Check the adjustment of the fan belt.

Check the temperature gauge.

RECOMMENDATIONS FOR WEEKLY CHECK-UP

Tracks

Check the condition of the belts and look for worn cross links.

Tighten the cross link bolts if necessary.

Drive sprocket

Check the condition of the rubber on the drive sprockets and tighten the bolts if necessary.

Suspension

Check condition of the suspension bearings.

Check wheel alignment.

Control system

Adjustment of the accelerator and clutch rods if necessary.

Check condition of the steering brake band linings.

Check differential cover and carrier bolts; tighten if necessary.

Check universal joints of the drive shaft.

Check adjustment of the pinion bearings.

Engine

Pay attention to motor valves.

Tighten spark plugs, manifold, exhaust and cylinder head gaskets if necessary.

Tighten fan bolts if necessary.

Electrical system

Battery terminals; clean and tighten.

Check wiring system.

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LUBRICATION

Crankcase

Check oil level daily; if oil level indicator is at "add oil", replenish.

Change the oil at every 50 hours of operation.

Use a high quality, detergent type, heavy duty oil represented by the oil supplier as officially meeting the requirements of U.S. Military, Specification MIL-L-2104A and thereby suitable for A.P.I. Service Classification M.S. D.G.

An oil surpassing the above specification by having detergency characteristics qualifying it under "Supplement 1" requirements will give even better results under severe service conditions.

For Ambient Temperatures Use	Above + 40° F SAE 30	+ 40° F to − 10° F SAE 20W/20	+ 10° F to − 20° F SAE 10W	Below − 20° F SAE 5W *

If the engine is not run for a period exceeding 30 days, replace the oil (Four imperial quarts).

Carburetor air cleaner

At every 100 hours of operation, drain, wash and dry the reservoir and the filter element. Refill to indicated level with engine oil of seasonal grade. When the machine operates in excessively dusty conditions, service more often.

Oil filter

Replace the oil filter at every 200 hours of operation, when changing the oil in the crankcase. Add the necessary amount of oil to compensate for the oil absorbed by the oil filter. In excessively dusty conditions, the oil filter should be changed more often.

Distributor

A few drops of light oil in the oil cup at every 100 hours of operation.

Oil filler pipe cap

Remove, wash in kerosene and re-oil the filter element with engine oil SAE 30 at every 50 hours of operation.

Generator

A few drops of oil in each oil cup at every 100 hours.

Transmission

Check the level and condition of the oil every 50 hours. Drain at every 200 hours of operation and refill with two quarts of oil according to the specifications given below.

Differential

Check the level and the condition of the oil in the differential daily. If the oil is clean and does not contain water due to condensation, it may be kept in the differential. If it is contaminated, drain, rinse and refill with four gallons of oil as specified below. Change the oil in the differential at every 100 hours of operation. If the vehicle operates in water or mud, change the oil more often. Make sure you drain the differential carrier when you change the oil in the differential. There is a drain plug underneath the pinion housing.

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* If equipment is operated continuously or garaged during shut-down periods, the next higher viscosity grade may be used.

Speed reducer and transfer case (H.D.W. & S)

Check the level of the lubricant at every 50 hours of operation and all oil if necessary. Drain and refill with gear oil as speficied below at every 300 hours of operation.

Winch

Check the level and condition of the oil at every 50 hours of operation. Use gear oil as specified below. The bearings at the end of the winch drum shaft should be repacked in grease when overhauling the vehicle.

Transmission, speed reducer, transfer case, winch

Use a multi-purpose, non corrosive, non-hypoid gear oil.

Above + 40° F	+ 40° F to − 10° F	+ 10° F to − 20° F	Below − 20° F
SAE 90	SAE 80 or SAE 90	SAE 80	SAE 75

Differential

Use Esso Torque # 56 or any equivalent.

Recommended lubricant

Use a high quality multi-purpose grease suitable for the lubrication of both plain and anti-friction bearings. The grease should possess :

1 — Superior shear stability so that it will neither harden nor become fluid in service;

2 — Controlled adhesiveness to assure good sealing and stay put characteristics;

3 — Excellent stability and oxidation resistance to assure long life;

4 — Superior water resistance, rust and corrosion prevention.

The grease selected must meet the above performance requirements at the operating temperature. At very low ambient temperatures, the grease selected must have satisfactory dispensing characteristics.

NOTE : The hydraulic track adjuster does not require lubrication; the grease fitting is used ONLY to adjust the track (see page 5).

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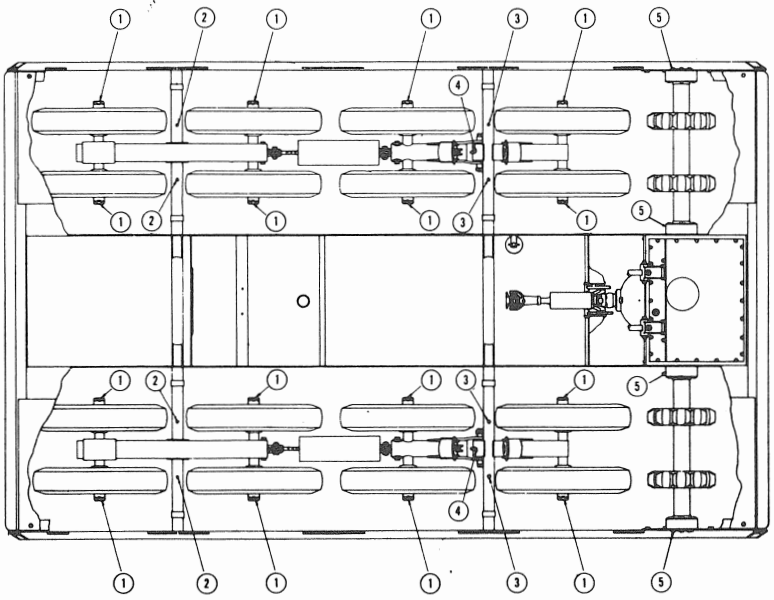
LUBRICATION CHART

In difficult conditions such as in mud, water or dust, lubricate more often.
For all grease lubricated part see RECOMMENDED LUBRICANT - Page 15.



LUBRICATION SCHEDULE

Ref. No.	Part	Where lubricated	Lubricant	When required
1	Wheel bearings	Fitting (16) on wheel cap	Grease	Twice a week
2	Rear tandem axle	Fitting (4) on rear tube	"	" " "
3	Front axle body	Fitting (4) on front cross tube	"	" " "
4	Flexible joint bearings	Fitting (2) on top of front axle body	"	" " "
5	Sprocket hub bearings	Fitting (4) at each end of hub tube	"	" " "
	Steering and brake levers	On the joints	Oil	Once a month
	Clutch pedal	Bushing at the bottom	"	" " "
	Throttle pedal	Bushing at the bottom	"	" " "
	Propeller shaft U-joints	Fitting (3) on each propeller shaft	Grease	" " "
	Brake pedal	Fitting (1) at bottom	"	" " "
	Clutch release fork (Muskeg Carrier)	Fitting (2) one on each side	"	" " "
	Clutch release fork (Muskeg tractor)	In the hub	Oil	" " "
	Control rods	In joints or points of support	"	" " "
	Winch drum clutch	On drum shaft	"	" " "
	Platform hinge pins	On each pin	"	Once a day

ENGINE TROUBLE SHOOTING

NOTE : In this section, the possible causes of trouble are given in order of frequency. Therefore, when diagnosing an engine abnormal condition, always make the checks by following the order of the list given under "possible causes" section and "repairs or corrective measures."

Trouble	Possible Causes	Repairs or Corrective Measures
1) When starting, engine does not turn over	a - Dead battery	Check battery specific gravity; recharge if too low.
	b - Battery or starter connections loose	Check connections; tighten if loose.
	c - Battery with a dead cell	Replace battery.
	d - Open or short circuit in the starter	Repair or change starter.
	e - Starter pinion not engaging into flywheel ring gear	Repair or change bendix drive, or overrunning clutch assembly, if these seem to be defective.
	f - Engine seized	Try to turn engine by hand, if impossible, repair the engine.
2) When starting, cranking speed is normal but engine does not start	a - Carburetor flooded	For the complete operation, hold throttle wide open and with choke open, engage starter for periods of 30 seconds on, 60 seconds off, until engine is running.
	b - Moisture on ignition wires and distributor	Dry out ignition wires, distributor cap and coil.
	c - Dirty or corroded distributor breaker points	Clean or change. Readjust breaker points according to specifications.
	d - Faulty carburetion *(fuel line, fuel pump, carburetor)*	A - Check for water in fuel line. Clean the line if necessary. B - Check action of the fuel pump and repair if necessary. Clean carburetor if you have any doubts about its cleanliness.

(to be cont'd.)

ENGINE TROUBLE SHOOTING (Cont'd.)

Trouble	Possible Causes	Repairs or Corrective Measures
2) When starting, cranking speed is normal but engine does not start (cont'd.)	e - Faulty ignition *(spark plug gap, loose connections, coil, condenser).*	A - Check spark plug gap. Readjust if off specifications. B - Check all connections attached to distributor and coil. Tighten or clean any doubtful connections. C - Check coil and condenser. If one of them seems defective, replace it.
	f - Improper ignition timing	Check and, if necessary, readjust ignition timing.
3) Engine does not start because of a slow, weak or erratic cranking speed	a - Weak battery	Check specific gravity of the battery. Recharge or change battery if it seems defective.
	b - Starter	A - Check the starter and battery connections. If they are loose, tighten them. B - Check starter for an open or shorted field. In any of these cases, repair or change the starter.
	c - Faulty starter	Check solenoid. If defective, repair or change.
4) Engine stalls while idling	a - Idle speed too low	Adjust idle speed with the idle speed adjusting screw.
	b - Improper idle mixture	Adjust idle mixture with the idle mixture adjusting screw(s) (2 barrels).
	c - Faulty choke	Check choke for free operation and lubricate the choke shaft if necessary. Check choke thermostat spring adjustment. If needed, readjust it.
	d - Improper fuel level in carburetor	Check and correct carburetor float setting.
	e - Faulty coil or condenser	Check all coil and condensed connections for looseness, test the coil and condenser. Change the defective part(s) if needed.

(to be cont'd.)

ENGINE TROUBLE SHOOTING (Cont'd.)

Trouble	Possible Causes	Repairs or Corrective Measures
5) When idling, engine misses	a - Moisture on ignition system	Dry out ignition wires, distributor cap and spark plugs.
	b - Worn, dirty spark plugs or incorrect gap	Remove spark plugs, check, clean and readjust the gap before replacing them on the engine.
	c - Faulty fuel system	A - Check and adjust carburetor idle adjustment. B - Check and adjust carburetor float level.
	d - Ignition system	A - Check for burnt or pitted breaker points, change them if necessary. B - Check for broken or loose ignition wires. If they are broken change them. C - Check for burnt, cracked or worn distributor rotor and distributor cap. If they are defective, change the faulty part(s). D - Check for faulty coil or condenser. Change them if necessary. E - Check for excessive play in distributor shaft, change shaft or distributor assembly if there is too much play.
	e - Engine	A - Check for burnt, warped or pitted valves. If needed, repair or change the faulty parts. B - Check for inequal compression between cylinders. If the compression is uneven, repair as required.
6) When accelerating, engine misses	a - Ignition timing	A - Check, clean and readjust breaker points which are dirty or improperly gapped. B - Check, clean and readjust spark plugs which are dirty or the gap set too high.
	b - Ignition system	A - Check for defective coil or condenser. Replace the faulty part(s). B - Check and, if needed, readjust the ignition timing.

(to be cont'd.)

ENGINE TROUBLE SHOOTING (Cont'd.)

Trouble	Possible Causes	Repairs or Corrective Measures
6) When accelerating, engine misses (cont'd.)	c - Fuel system	A - Check and clean dirt accumulation. B - Check if the carburetor accelerating pump works properly. If not, repair it. C - Check the fuel pump for erratic operation; if needed, repair the pump.
	d - Engine	Check for burnt, warped or pitted valves. Repair or change the defective valve(s).
7) Engine missing at high speed	a - Dirt or water in fuel line or carburetor	Clean the fuel line and, if necessary, the carburetor.
	b - Breaker points, spark plugs, rotor, coil and condenser	A - Clean breaker points and readjust the gap. B - Check, clean and readjust spark plugs which are dirty or with too wide a gap. C - Check for a burnt, cracked or worn rotor. Change if necessary. D - Check and test coil and condenser. If needed, change the defective part(s).
	c - Dirty carburetor high speed jet(s)	Clean or change the jet(s) if necessary.
	d - Incorrect ignition timing	A - Check and, if needed, readjust the ignition timing with engine turning at both, low and high speeds. B - Check the vacuum and centrifugal advance mechanism. If faulty, repair or change it.
	e - Distributor shaft	A - Check for excessive play in distributor shaft, change distributor assembly, if necessary. B - Check distributor shaft for worn cam. Change distributor shaft or distributor assembly if needed.
8) Engine with low effenciency (loss of power) (to be cont'd.)	a - Spark plugs *(wrong gap or dirty)*	Check, clean and adjust spark plugs.

ENGINE TROUBLE SHOOTING (Cont'd.)

Trouble	Possible Causes	Repairs or Corrective Measures
8) Engine with low efficiency (loss of power) (cont'd.)	b - Fuel system *(dirt or water, float level, fuel pump)*	A - Check for water or dirth in fuel feed line and carburetor. Clean if needed. B - Check and, if needed, readjust the carburetor float level. C - Check the fuel pump pressure and output. Repair or change the fuel pump if it seems defective.
	c - Ignition timing	Check ignition timing. Adjust if necessary.
	d - Valve clearance	Check and, if necessary, readjust valve (tappet) clearance.
	e - Distributor advance	A - Check, repair or change the vacuum advance mechanism, if necessary. B - Check the functioning of the centrifugal advance mechanism. Repair if the mechanism seems defective.
	f - Exhaust system	Check for plugged or restricted exhaust pipes or muffler. Repair or change the faulty part(s).
	g - Ignition system	A - Check for defective coil or condenser. If necessary, change the defective part(s). B - Check for worn rotor or distributor cap. Change them if necessary. C - Check for excessive play in distributor shaft. Change shaft or distributor if the play is excessive. D - Check for a worn distributor shaft cam. If needed, change distributor shaft or distributor assembly.
(to be cont'd.)	h - Engine	A - Check engine valve timing and, if necessary, make necessary repairs or adjustments. B - By taking a compression test, determine the condition of the valves. If their condition seems bad, proceed to the needed repairs. C - Also, with the compression test, check for a damaged cylinder head gasket. Change the gasket if necessary.

ENGINE TROUBLE SHOOTING (Cont'd.)

Trouble	Possible Causes	Repairs or Corrective Measures
9) Engine with noisy valves	a - Valves	A - Check for excessive clearance (valve tappet or lifter). Readjust if necessary. B - Check for runout of valve seat and valve face. Install new valve and valve seat if necessary. C - Check for broken or weak valve spring(s). Change the faulty spring(s) if necessary.
	b - Valve guides and tappets	A - Check for worn valve guides. If the clearance (stem to guide) is too big, make the necessary changes. B - Check for worn tappet. If, according to specifications, there is too much clearance, repair.
10) Oil pressure drop or too low	a - Oil	A - Check oil level. Add if necessary. B - Check for thin or diluted oil. If oil is too thin, use higher S.A.E. number. If oil is diluted, check for coolant leak, and repair if necessary.
	b - Oil system	A - Check if the oil pump relief valve is stuck open. If needed, disassemble the valve. Change as necessary. B - Check for excessive bearing clearance and, if needed, change the bearings. C - Check for worn parts in the oil pump, repair if necessary. D - Check, repair or change bent or misaligned oil pump suction tube. E - Check for oil leaks at the fittings, tubes, etc. Repair if necessary.
11) Excessive oil consumption (to be cont'd.)	a - External leaks	A - Check, visually, for oil leaks around the oil pan and at the front and rear oil seals. If necessary, change pan gasket or crankshaft oil seal(s). B - Check the crankcase ventilation system for proper functioning. (Breather pipe and filter, crankcase ventilator outlet pipe, P.C.V. valve). Repair as required.

ENGINE TROUBLE SHOOTING (Cont'd.)

Trouble	Possible Causes	Repairs or Corrective Measures
11) Excessive oil consumption (cont'd.)	b - Engine	A - Check for cracked valve stem oil shield(s) Change defective part(s). B - Check for excessive clearance between valve stem and guide. Change faulty part(s). C - Check for worn, scored or broken rings. If needed, change the rings. D - Check for rings too tight in their grooves. Repair if necessary. E - Check for too much side clearance between rings and piston grooves. Il needed, change rings, piston(s), or both. At the same time, check for clogged oil ring slots. F - Check cylinder wear (out of round or taper). If necessary, restraighten the cylinder(s). G - Check for proper ring seating. Repair if necessary.
12) Connecting rod bearings noisy	a - Low oil pressure	Refer to "oil pressure drop or too low" in this section. (Trouble # 10)
	b - Insufficient oil supply to the bearings.	Check and clean oil galleries and oil passages.
	c - Connecting rod bearings	Check connecting rod bearing clearance. If the clearance exceeds specifications, change the bearings.
	a - Vibration pulley damper	Check for loose vibration pulley damper. Repair if necessary.
	b - Low oil pressure	Refer to "oil pressure drop or too low" in this section. (Trouble # 10)
(to be cont'd.)	c - Insufficient oil supply to the main bearings	Check and clean oil galleries and oil passages.

ENGINE TROUBLE SHOOTING (Cont'd.)

Trouble	Possible Causes	Repairs or Corrective Measures
13) Crankshaft main bearings noisy (cont'd.)	d - Main bearings	Check main bearings clearance. If clearance is out of specification, make the needed repair(s) or change(s).
	e - Flywheel	Check for loose flywheel and repair if defective.
	f - Crankshaft end play	Check for an excessive crankshaft end play and, if necessary, correct the end play.

ENGINE TROUBLE SHOOTING (COOLING SYSTEM)

Trouble	Possible Causes	Repairs or Corrective Measures
1) External leakage	a - Radiator	A - Check and tighten loose hose clamps. B - Check and change any defective rubber hose. C - Check for broken radiator seams. Repair radiator if necessary.
	b - Engine	A - Check for worn water pump. Change or repair if defective. B - Check and change loose core hole plugs. C - Check and change damaged gaskets. D - Check for (a) warped cylinder head(s). Repair if necessary. E - Check for (a) cracked cylinder head(s). Repair or change defective head(s). F - Check for (a) cracked cylinder block(s). Repair or change if defective. G - Check for cracked thermostat housing. Repair or change defective housing. H - Check and repair leaks at exhaust manifold center studs.
2) Internal leakage	a - Cylinder head	A - Check, change or repair (a) warped cylinder head(s). B - Check and change blown cylinder head gasket(s).
	b - Cylinder block	A - Check for cracked cylinder walls. Change cylinder block if necessary. B - Check and tighten loose cylinder head bolts. C - Check for cracked valve port(s). Change cylinder block or cylinder head(s) if necessary. D - Check for cracked block in valve chamber. Repair or change block or cylinder head if necessary.
3) Overcooling (to be cont'd.)	a - Thermostat	Check and change defective thermostat.

ENGINE TROUBLE SHOOTING (COOLING SYSTEM) - (cont'd.)

Trouble	Possible Causes	Repairs or Corrective Measures
3) Overcooling (cont'd.)	b - Temperature gauge assembly	Check for inaccurate temperature gauge assembly. Change faulty item(s). (temperature pick-up plugs or cable, gauge).
4) Loss of coolant by overflow system	a - Cooling system	Refer to the section "poor circulation" Trouble # 5.
	b - Boiling	A - Refer to the section "Poor circulation" trouble # 5. B - Check and clean excessive sludge formation in engine crankcase. C - Check for plugged radiator core. Clean radiator if necessary. D - Check for obstruction in front of radiator. If needed, clean all dirt or dust accumulation in front of radiator.
	c - Cylinder head	Check for leak in cylinder head gasket(s). Change gasket(s) if leaking.
	d - Radiator overfilling	Check if radiator has not been overfilled.
5) Poor circulation of Coolant	a - Engine	A - Check for restricted water jacket. Clean cooling system if restricted. B - Check for scale build-up in cylinder block. If necessary, clean cooling system with scale remover solution.
	b - Radiator	A - Check for too low coolant level. Add coolant if level too low. B - Check and change defective or collapsed radiator hose.
	c - Water pump	A - Check for too loose water pump impeller on its shaft. If impeller too loose, repair or change. B - Check for loose fan belt. Readjust belt according to specifications.

(to be cont'd.)

ENGINE TROUBLE SHOOTING (COOLING SYSTEM) - (cont'd.)

Trouble	Possible Causes	Repairs or Corrective Measures
6) Corrosion or rust build-up into cooling system.	a - Coolant	A - Check for impurities in water or coolant. Drain system if necessary. B - Check for improper previous cooling system draining and service.
	b - Cooling system	A - Check and repair air leaks into system. (Water-pump, hoses). B - Check and repair exhaust gas leakage. (Cylinder head gaskets).
7) Overheating	a - Crankcase radiator	Refer to trouble # 5, possible cause "B".

NOTE : FACTORS WHICH MAY CAUSE ENGINE OVERHEATING :

a) Incorrect ignition timing

b) Incorrect valve timing

c) Oil level too low

d) Tight engine

e) Defective heat control valve (manifold)

f) Plugged or defective muffler

g) Overloading

h) Excessive engine idling

ENGINE TROUBLE SHOOTING (FUEL PUMP)

Trouble	Possible Causes	Repairs or Corrective Measures
1) Fuel pump leaks (fuel)	a - Housing	A - Check and re-tighten loose housing screws. B - Check and tighten, if necessary, loose inlet or outlet line fittings.
	b - Diaphragm	A - Check and replace, if necessary, worn, ruptured or torn fuel pump diaphragm. B - Check and change fuel pump diaphragm mounting plates.
2) Fuel pump leaks (oil)	a - Fuel pump pull rod	Check for deteriorated pull rod seal. Change seal if defective.
	b - Fuel pump assembly	A - Check for loose rocker-arm pivot pin. Change pin if defective. B - Check and tighten, if necessary, loose fuel pump mounting bolts. C - Check for defective fuel pump gasket. Change gasket if necessary.
3) Fuel pump is noisy	a - Fuel pump	Check and tighten loose fuel pump mounting bolts.
	b - Rocker-arm	A - Check for scored or worn rocker-arm. Change fuel pump rocker-arm if needed. B - Check for weak or broken rocker-arm spring. Change spring if necessary.
4) Insufficient fuel delivery	a - Fuel line *(tank to pump)*	A - Check, clean and repair restricted or blocked fuel tank air. B - Check for leaks in fuel line and fittings up to fuel pump (when running fuel pump can draw air in). Repair line if necessary. C - Check for dirt or restriction into fuel tank. Clean or repair if necessary. D - Check for frozen gas line. If necessary, use special anti-freeze or deicer.
	b - Fuel pump and fuel filter	A - Check for worn, torn or ruptured diaphragm. Change fuel pump diaphragm if necessary. B - Check for improperly seated fuel pump valves. Change fuel pump valves if defective. C - Check for weak main spring on fuel pump. If necessary, change the spring (follower spring). D - Check for restricted fuel filter. Change or clean filter if needed.

ENGINE TROUBLE SHOOTING (CARBURETION)

Trouble	Possible Causes	Repairs or Corrective Measures
1) Poor idle (refer to engine trouble, section 5-3-A, troubles 5 & 6)	a - Faulty idle circuit	Check for carbonized or plugged : 1 - Idle tube 2 - Idle air bleed 3 - Idle discharge holes If necessary, clean faulty parts or whole carburetor assembly.
	b - Defective carburetor assembly	A - Check for carbonized throttle body or worn throttle shaft. Clean or change defective part(s). B - Check for leaking joint (gasket) between carburetor and intake manifold. Tighten joint or change gasket. C - Check and change damaged or worn idle mixture adjusting screw(s). D - Check and readjust incorrect float level. E - Check if choke operates properly. Repair choke if necessary. F - Check and tighten carburetor main body to throttle body loose screws.
	c - Engine and ignition system	Refer to engine trouble shooting - section 5-3-A, troubles 5 & 6
	d - Manifold (intake and exhaust)	A - Check and repair intake manifold leaks. B - Check and repair manifold heat control valve if stuck.
2) Poor performance (mixture too rich) (to be cont'd.)	a - Ignition system	Refer to troubles # 6, 7, 8, in engine trouble shooting (section 5-1).
	b - Carburetor *(main jet, vacuum piston, float, choke)*	A - Check and change damaged main metering jet(s). B - Check for a worn or stuck vacuum piston. Change or repair if necessary. C - Check and readjust too high float level. D - Check automatic choke for proper functioning. Repair choke if needed.

ENGINE TROUBLE SHOOTING (CARBURETION) - (cont'd.)

Trouble	Possible Causes	Repairs or Corrective Measures
2) Poor performance (mixture too rich) (cont'd.)	c - Engine *(fuel pump, heat control valve)*	A - Check fuel pump pressure. Repair pump if necessary. B - Check functioning of manifold heat control valve (stuck open). Repair if valve stuck.
3) Excessive fuel consumption	a - Carburetor (choke, fuel level)	A - Check and repair sticky choke. B - Check and correct too high fuel level.
	b - Ignition timing and ignition system	Refer to section 5-1, troubles # 6, 7 and 8.
	c - Engine *(manifold heat control valve, low engine compression, sticking valve)*	A - Check and repair sticky manifold heat control valve. B - Check engine compression. If compression too low or erratic, make needed repairs. C - Check and repair any sticky valve(s).
4) Carburetor is leaking or flooding	a - Carburetor	A - Check for cracked carburetor body. If cracked, change carburetor body. B - Check for defective body gaskets. If defective, change gaskets and tighten body. C - Check and correct too high float level. D - Check and clean if foreign materials are inserted between needle valve and its seat.
	b - Fuel pump	Check for excessive fuel pump pressure; if pressure too high, repair.
5) Poor acceleration	a - Carburetor	A - Check and repair stuck step-up piston in down position. B - Check functioning of accelerating pump. If defective, repair. C - Check and readjust too high or low fuel level. D - Check automatic choke for proper functioning, repair if necessary.
	b - Engine	A - Check, repair or change worn or defective throttle linkages. B - Refer to engine trouble shooting, section 5-1, troubles 6, 7 and 8.

POWER TRAIN TROUBLE SHOOTING (CLUTCH)

Trouble	Possible Causes	Repairs or Corrective Measures
1) The clutch is slipping	a - Adjustments	A - Check clutch release lever adjustment. Correct lever adjustment if necessary. B - Check clutch linkage adjustment. Correct adjustment if needed.
	b - Clutch mechanism	A - Check and change weak or broken clutch pressure plate spring(s). B - Check for worn or glazed facings on clutch disk. Change clutch disk assembly if necessary. C - Check for oil or grease on clutch disk facings. Clean or change clutch disk if necessary. D - Check for a warped clutch disk. Change clutch disk assembly if needed. E - Check for a warped or scored pressure plate. If necessary, get pressure plate machined. F - Check for binding clutch release lever. Change levers if they seem defective.
2) The clutch is noisy (chattering)	a - Clutch release lever	Check for improper clutch release lever adjustment. If needed, correct the adjustment.
	b - Disk facings	Check for oil or grease on disk facings. Clean or change the clutch disk assembly if necessary.
	c - Transmission shaft	Check for worn spline on transmission shaft or on clutch disk hub. If necessary, change transmission shaft or clutch disk assembly.
	d - Pressure plate	Check for binding pressure plate and repair defective parts if necessary.
	e - Clutch release lever	Check for binding release lever. If necessary, change lever or assembly.
(to be cont'd.)	f - Clutch disk	A - Check for a binding clutch disk hub. If necessary, change disk assembly or repair faulty part(s). B - Check for bent clutch disk. Change disk if needed.

POWER TRAIN TROUBLE SHOOTING (CLUTCH) - (cont'd.)

Trouble	Possible Causes	Repairs or Corrective Measures
2) The clutch is noisy (chattering) (cont'd.)	g - Clutch release lever spring	Check for uneven release lever spring pressure. If necessary, change the spring(s).
	h - Alignment	A - Check transmission to clutch housing alignment. If necessary, take corrective measures to realign. B - Check clutch housing to engine alignment. If alignment incorrect, repair faulty items.
	i - Clutch disk	A - Check for loose clutch disk facing. If the facings are loose, change clutch disk assembly. B - Check for glazed disk facing. If necessary, change clutch disk.
3) The clutch is grabbing	a - Adjustments	A - Check and readjust improper clutch release lever adjustment. B - Check and repair transmission to clutch housing misalignment.
	b - Clutch disk	A - Check for oil or grease on clutch facing. Clean or change disk if necessary. B - Check for clutch disk hub sticking on transmission shaft. Investigate on condition of spline and repair if needed. C - Check for worn or glazed facings (clutch disk). If necessary, change the clutch disk assembly.
	c - Clutch mechanism	A - Check for worn pressure plate or flywheel. If one of them defective, remachine faulty item(s). B - Check for worn or binding clutch release lever. If lever is found defective, change it. C - Check and change broken or weak clutch release springs.
(to be cont'd.)	d - Engine mounting support	Check and change loose or deteriorated engine mounting support, if necessary.

POWER TRAIN TROUBLE SHOOTING (CLUTCH) - (cont'd.)

Trouble	Possible Causes	Repairs or Corrective Measures
4) The clutch is dragging	a - Adjustments	A - Check adjustment of clutch release lever. If necessary, correct it. B - Check adjustment of clutch linkages. Correct it if necessary.
	b - Clutch assembly	Check for dust or dirt accumulation into clutch assembly. Clean assembly if too dirty.
	c - Clutch mechanism	A - Check for worn or broken disk facings. If necessary, change clutch disk assembly. B - Check for binding clutch disk hub on transmission shaft. If necessary, change the faulty part(s). C - Check for binding transmission shaft into flywheel pilot brushing. Correct or repair defective part(s). D - Check for sticking clutch release bearing sleeve. Repair or change defective part(s) E - Check for a warped pressure plate. If necessary, remachine pressure plate. F - Check for improper transmission to clutch housing alignment. Repair if necessary.

POWER TRAIN TROUBLE SHOOTING (TRANSMISSION)

Trouble	Possible Causes	Repairs or Corrective Measures
1) Transmission hard to shift	a - Clutch mechanism	A - Check and readjust an incorrect clutch pedal free play. B - Check for binding of the clutch throw out bearing. Change or repair defective parts. C - Check the alignment of clutch housing with transmission housing. Repair if housings are misaligned.
	b - Transmission mechanism	A - Check for binding of shaft linkage and adjustment off. Readjust, repair or change defective part(s), if necessary. B - Check for worn part(s) in shift housing. Repair or change defective part(s). C - Check for burred splines or defective shifting parts. Change or repair faulty items. D - Check if lubricant used in transmission is of the correct type. Drain and change oil if necessary.
2) Transmission is noisy	a - Internal mechanism	A - Check and change badly worn, pitted or chipped gears. B - Check and change badly worn, pitted or chipped bearings. C - Check for excessive clearance (play) due to worn shaft(s). Change the shaft(s) if the play is out of specifications.
	b - Transmission assembly	A - Check for loose transmission mounting bolts. Tighten bolts or change mounting(s) if necessary. B - Check if transmission is well lined up with engine and drive line. Correct or repair if necessary. C - Check transmission oil level. Correct the level if needed.

(to be cont'd.)

POWER TRAIN TROUBLE SHOOTING (TRANSMISSION) - (cont'd.)

Trouble	Possible Causes	Repairs or Corrective Measures
3) Transmission does not stay in gear	a - Shifting mechanism	A - Check for broken or weak shift rail poppet notch, worn interlock and poppet balls. Repair or change any defective part(s). B - Check for sprung or loose transmission shift fork or loose gear shift cover bolts. If necessary, change the defective part(s) and tighten the bolt(s).
	b - Transmission assembly	A - Check for proper alignment of transmission, clutch housing and flywheel. If necessary, correct the alignment. B - Check end play of transmission main shaft. If out of specifications, repair or correct the transmission main shaft end play. C - Check linkage adjustment. If necessary, readjust to the specifications.
4) Transmission oil leak	a - Oil	A - Check for overfilled transmission. Correct transmission oil level if needed. B - Check type of oil used. Drain transmission oil if oil type is incorrect.
	b - Transmission assembly	A - Check for excessive bolt threads clearance. Repair if necessary. B - heck for broken or misaligned gasket(s) and oil seal(s). Change defective part(s) if necessary.

POWER TRAIN TROUBLE SHOOTING (DIFFERENTIAL)

Trouble	Possible Causes	Repairs or Corrective Measures
1) Axle noisy on drive	a - Ring gear and pinion	Check for scored ring gear and pinion. If needed, repair or change defective part(s).
	b - Carrier bearings	Check and change worn carrier bearings.
2) Axle noisy on coast	a - Ring gear and pinion	Check for lash between ring gear and pinion. If so is the trouble, replace bearings and/or ring and pinion.
	b - Pinion	Check for end play in pinion. If necessary, adjust the bearings.
	c - Ring gear and pinion	Check and change scored ring gear and pinion.
3) Axle noisy on both drive and coast	a - Ring gear and pinion and/or differential bearings	Check and replace damaged pinion and gear or bearings (or both).
	b - Ring gear and pinion	Check and replace scored ring gear or pinion.
4) Excessive backlash	a - Axle flange nuts	Check for loose axle shaft flange nuts. If needed, change gasket and re-tighten flange nuts.
	b - Side gears and pinions	Check for worn side gears and idling pinions. Replace faulty part(s) if necessary.
	c - Universal joints	Check and replace worn universal joint part(s).
	d - Ring gear and pinion and/or differential side bearing.	Check for worn ring gear and pinion and/or differential side bearing. Repair or change faulty part(s).
5) Lubricant leaks	a - Differential carrier housing	Check if there is a leak at differential housing. If so, change the gaskets.
	b - Pinion housing	Check for leak at pinion housing. Replace gasket and oil seal if necessary.
	c - Sprocket	Check for leak at sprocket and replace the hub oil seals if necessary.