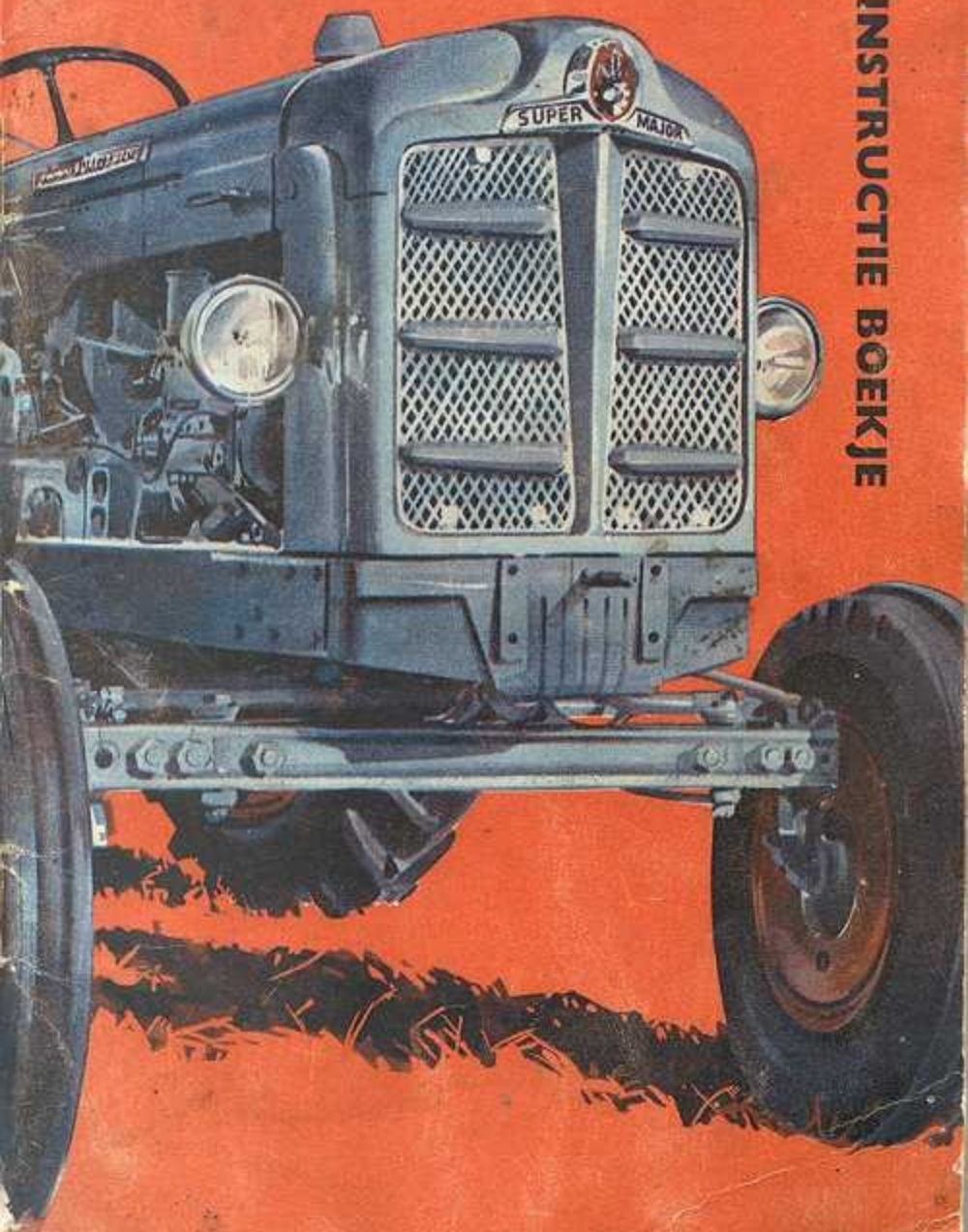


FORDSON

Super major

INSTRUCTIE BOEKJE



INSTRUCTION BOOK
FOR THE
SUPER MAJOR

MANUFACTURED IN ENGLAND
by
FORD MOTOR COMPANY LIMITED
DAGENHAM

FORWARD

SECTION 1 OPERATION

Describes the functioning of the tractor controls instruments as and when you will use them.

SECTION 2 LUBRICATION

Deals with the points which require regular attention to ensure maximum efficiency from your Super Major.

SECTION 3 MECHANICAL MAINTENANCE

Gives details of the mechanical adjustments which should be made to provide optimum performance and details routine operations and checks which should be made.

SECTION 4 FAULT FINDING

Details a method of systematically diagnosing any troubles which may arise.

SECTION 5 OPTIONS AND ACCESSORIES

Gives operating and maintenance instructions on auxiliary equipment which may be fitted during production, or supplied as an accessory through your Authorised Dealer.

SECTION 6 PETROL ENGINED SUPER MAJOR

Provides details of operation and maintenance of the items which are particular to the petrol engine.

GENERAL SPECIFICATIONS

INDEX

FOREWORD

The Fordson Super Major, the latest in the line of Fordson tractors, incorporates a number of new features without losing the original design conception which has proved so successful throughout the world. These features include such items as Qualitrol/Position Control Hydraulics, Differential Lock and Disc Brakes, all of which serve to provide better performance, efficiency and safety.

This book tells you how to make the most of your Super Major, and details the routine maintenance tasks essential to a long and trouble-free service life.

Use only genuine Fordson parts and do not be tempted to try to economise by purchasing inferior parts or lubricants, or by omitting maintenance tasks.

If you have any service problems, remember that your Dealer has experience, trained mechanics and facilities which he will be happy to place at your disposal.

We hope that you will read carefully the whole of this book before starting to work your tractor, but to assist you the book has been divided into sections, as summarised on the preceding page of contents. Keep the book handy for reference at all times and do not fail to look up any point on which you may have any doubt.

**SERVICE OPERATIONS,
SERVICE DEPARTMENT,
TRACTOR DIVISION,
FORD MOTOR COMPANY LIMITED**

OPERATION

The following section deals with starting the tractor and the use of the various controls and instruments in the order that the driver is most likely to encounter them.

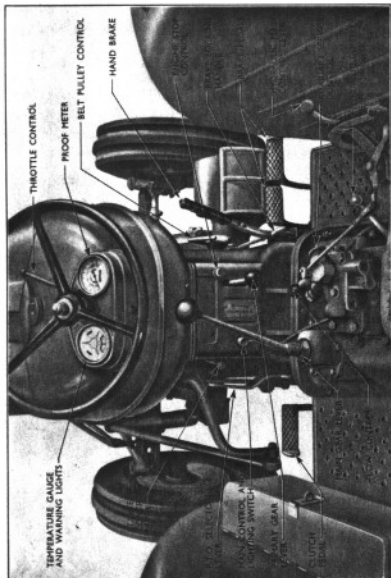


Fig. 1. Instruments and Controls

Before any attempt is made to start the engine, or operate the tractor, attention should be paid to the points laid down in the Lubrication Section and in particular the oil and water levels. Check that there is fuel in the tank, if the tractor has run out of fuel or air has entered the fuel lines the engine will not start and it will be necessary to bleed the fuel system, as described on page 38.

To assist starting under cold conditions the fuel injection pump fitted to the Super Major diesel tractor incorporates a device which supplies fuel in excess of normal requirements. To bring the excess fuel device into action, depress the control button (Fig. 3) prior to starting the engine. It will return automatically to its normal position as soon as the engine starts.

Tractors supplied to countries which experience extreme cold conditions are fitted with a decompressor which holds the valves off their seats when the decompressor lever, located at the front of the valve rocker cover (see Fig. 4), is placed in its fully raised position. This enables the diesel engine to be rotated by hand prior to starting, thus breaking the oil film on the moving parts and reducing the load on the battery when the starter is operated. In order to start the engine the lever must be returned to the downward (inoperative) position before operating the starter motor.

TO START THE ENGINE

Unless otherwise mentioned, the instruments and controls mentioned in the following procedure are illustrated in Fig. 1.

1. Ensure that the fuel tap, mounted on the right-hand side underneath the fuel tank (see Fig. 2), is turned on. Turn anti-clockwise to the "on" position, and *vice versa*.

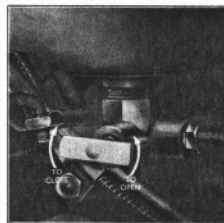


Fig. 2. Fuel Tap

Operation

Fig. 3. Excess Fuel Device

1. Under extreme cold conditions, depress the excess fuel device button (Fig. 3). Where a decompressor is fitted, move the control lever (Fig. 4) to its upper position, turn the engine by hand and return the lever to the "down" position.
2. Ensure that the main gear lever is in the neutral position.
3. Ensure that the engine stop control is pushed fully in.
4. Insert the main control key in the switch, turn to right and check that both the generator and oil pressure warning lights become illuminated.
5. Move the throttle lever clockwise to slightly more than the half-open position.
6. Depress the clutch pedal, to reduce drag on the engine, and press downwards on the starter control lever.

As soon as the engine starts, release the starter control lever. If the engine does not start at the first attempt, do not press the starter control again until the engine has come to rest.

Under no circumstances should the engine be run if the green oil pressure warning light (Fig. 6) does not go out after the engine has been started, or comes on when the engine is being operated, as this indicates dangerously low oil pressure. Pull out the stop control immediately and investigate the cause.

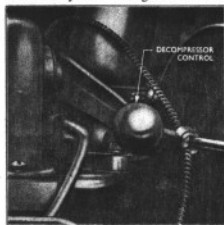
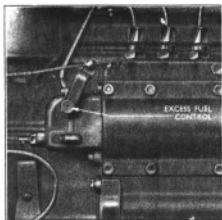


Fig. 4. Decompressor Control

Operation

If the generator charging light (Fig. 6) remains illuminated when the engine is running it indicates that the battery is not being charged and, although this condition is not as serious as low oil pressure, it should be investigated, otherwise the battery may become fully discharged.

TO STOP THE ENGINE

1. Close the throttle lever, pull out the stop control knob and hold it out until the engine has stopped.
2. Switch off the main control key. The switch should not be left on when the engine is stopped as the warning lights will remain on and tend to discharge the battery.

Instructions have now been given on how to start and stop the engine, but before proceeding on to driving the tractor the functioning of the following controls and equipment should be noted.

BRAKES

Disc brakes are fitted to the transmission of the Super Major, enabling braking action to be applied to either or both rear wheels. Two pedals, located on the right-hand side of the tractor, may be operated independently to assist short turns or may be latched together to provide even braking when operating at higher speeds on the road.

A brake locking device or a handbrake is fitted to hold the tractor on inclines. To operate the brake locking device, depress the foot pedals and pull up the "T" lever until it can be given a quarter turn.

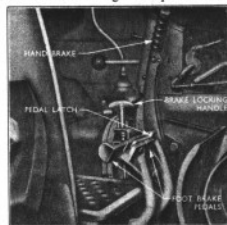


Fig. 5. Brake Controls

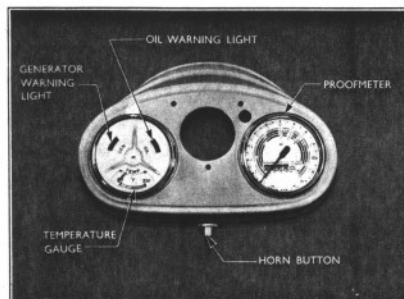


Fig. 6. Instrument Panel

PROOFMETER

The proofmeter (Fig. 6) is located to the right of the instrument panel. This instrument indicates not only the speed of the engine, but also the total hours worked, ground speed in 1st, 2nd, 3rd and 4th gears, and correct engine speeds to British Standard Specifications for Standard P.T.O., Raised P.T.O. (when fitted) and Belt Pulley operated equipment.

The outer scale of the meter is calibrated in hundreds of revolutions per minute, therefore the figures indicated by the needle must be multiplied by 100 to obtain the speed of the engine; i.e., an indicated figure of 6 corresponds to an engine speed of $6 \times 100 = 600$ r.p.m., and so on.

To run the Standard P.T.O. shaft at the British Standards speed of 540 r.p.m., engage the P.T.O. selector lever (Fig. 1) and set the engine speed so that the proofmeter needle cuts the marking "STD. P.T.O." on the dial.

Similarly, if a Raised P.T.O. is fitted, engage both the Standard P.T.O. lever and the Raised P.T.O. lever and set the engine speed so that the proofmeter needle cuts the words "RAISED P.T.O." on the dial.

To obtain the B.S.S. belt speed of 3,100 ft./min. (945 m./min.), place the primary lever of the gearbox in the "High Speed" position, engage the belt pulley dog clutch and set the engine speed (1,400 r.p.m.) so that the proofmeter needle cuts the word "PULLEY" on the dial.

In field operations such as planting, baling, combining and spraying, correct ground speed is important, and the proofmeter assists in this respect by incorporating four coloured bands on the dial showing the ground speed of the tractor in miles per hour in the four gears most likely to be used. (For certain export territories the proofmeter is calibrated in kilometres per hour.)

Suppose, for instance, that it is desired to work at 2 m.p.h. in third gear. The necessary gear selection is made by the operator and the engine speed is adjusted until the needle of the proofmeter cuts figure 2 on the red band.

Similarly, ground speeds may be obtained in first, second or fourth gear by selecting the appropriate gear and adjusting the engine speed so that the dial needle cuts the required m.p.h. figure on the corresponding band.

The "total hours" worked by the tractor are recorded in an aperture in the face of the instrument, the right-hand figure registering in 1/10 hours. The working hours recorded are based on an average engine speed calculated from the varying types of work on which the tractor is employed over a period. As such, they are not actual working hours, but are sufficiently accurate for normal purposes. By keeping a check on the operating hours, the operator can arrange to have the periodic services carried out at the correct intervals.

LIGHTING SWITCH

When the tractor is fitted with lighting equipment the five position switch is located on the lower left-hand side of the control panel. The switch lever positions are as follows:—

Straight down	Off
First right	Side and rear lamps
First left	Side, rear and dipped headlamps
Second left	Side, rear and main beam headlamps
Third left	Main beam headlamps only

Operation

THE HORN

A horn button is located at the lower side of the instrument panel (Fig. 6), the horn itself being mounted beneath the fuel tank.

DRAWBAR

A swinging drawbar is located at the rear of the tractor, on which provision is made for vertical and horizontal adjustment. The height from the ground to the top of the clevis may be set (with standard tyres) at 13.62 ins. (34.6 cm.), 16.50 ins. (41.9 cm.), or 19.38 ins. (49.2 cm.). Lateral adjustment is possible, 12 ins. (30.5 cm.) either side of the centre line, although the drawbar may be left swinging to enable extremely short turns to be made with trailing implements if so desired.

POWER TAKE-OFF OPERATION

Before connecting up the drive shaft to operate equipment from the P.T.O. shaft it is necessary to remove the shaft cover, which is secured to the rear axle housing (or Raised P.T.O. housing) by two bolts. Refit the two bolts securely.

Install the coupling, ensuring that the guard is in position and the drive shaft is correctly aligned to the equipment.

To engage the drive to the P.T.O., start the engine, depress the clutch pedal fully and move the P.T.O. shifter rearwards. (If a Raised P.T.O. is fitted, the Raised P.T.O. shifter lever must also be engaged.) Release the clutch pedal gradually to ensure that the drive is taken up smoothly.

It should be noted that where a Raised P.T.O. is fitted it is possible to disengage the drive to the implement without stopping the hydraulics.

"LIVE" POWER TAKE-OFF

On tractors incorporating this feature, continuous operation of the driven equipment is possible, irrespective of forward movement of the tractor. By depressing the clutch pedal through approximately half its travel the tractor can be halted for manoeuvring or gear changing without interrupting the drive to the P.T.O. Both tractor and P.T.O. (and hence the hydraulics) may be halted by depressing the pedal through the whole of its travel.

Where equipment is in use which is not being driven by the P.T.O. it is desirable that the P.T.O. clutch is not subjected to unnecessary slip due to involuntary operation of the clutch pedal. In addition it is sometimes advantageous when operating external equipment from

Operation

the hydraulic system to be able to change gear without interrupting the drive to the hydraulic pump. Holes are therefore provided in the lower end of the stop bracket to enable a stop pin to be inserted thus limiting movement of the release mechanism so that it operates only on the transmission clutch.

Caution: In order that the P.T.O. drive may be readily stopped in an emergency, the stop pin should never be used when P.T.O. driven equipment is being operated.

DRIVING THE TRACTOR

The method of controlling the speed of the tractor is by selecting the correct gear ratio to suit the load conditions. Always use the highest gear ratio on which the tractor will give the necessary pull, but do not permit the engine to "labour" when in gear—select the next lower ratio if necessary.

For optimum performance the cooling system should be maintained at a temperature of 160°-190°F. (71°-88°C.). This temperature is indicated by a green sector on the temperature gauge (Fig. 6), and during operation the gauge needle should be kept within this sector —if necessary blanking off the radiator to assist in doing so.

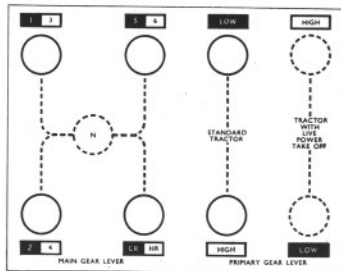


Fig. 7. Gear Lever Positions

TO SET THE TRACTOR IN MOTION

1. Fully depress the clutch pedal and start the engine.
On tractors with "Live" power take-off depress the clutch pedal only until a definite increase in resistance to pedal movement is felt (approximately halfway down). This will disconnect the engine from the transmission, but leave the power take-off still engaged.
2. Select the desired gear ratio by combining the positions of the primary gear lever and main gear lever in accordance with the positions shown in Fig. 7.
It should be noted that on standard tractors, "low" ratios are obtained by moving the primary lever upwards, and "high" ratios by moving the lever downwards, whereas when a "Live" P.T.O. is fitted the same ratios are selected by reversing the position of the primary lever; i.e., down for "low," and up for "high."
3. If the gears will not mesh readily, return the main gear lever to the neutral position, momentarily engage the clutch again, depress the pedal and re-select the gears.
4. Release the handbrake or footbrake locking device, move the throttle control clockwise and, as the speed increases, allow the clutch pedal to return slowly by gradually raising the foot, so setting the tractor in motion.

TO STOP THE TRACTOR

Slow down the engine by moving the throttle control lever anti-clockwise, apply the brakes evenly and depress the clutch as the tractor comes to rest. Stop the engine by pulling the stop control, turn off the main control key and apply the handbrake or brake locking device before leaving the tractor.

You will have now become familiarised with starting, stopping and generally driving the tractor, but before commencing work it is important that you fully understand two outstanding features of the Super Major, namely, the Qualitrol/Position Control Hydraulics and the Differential Lock. Special attention has been given to these two items in the following pages.

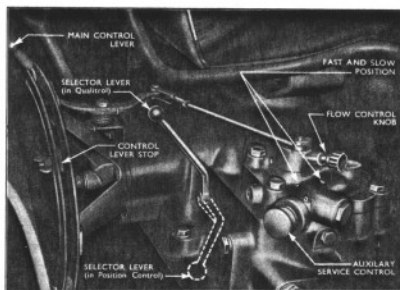


Fig. 8. Hydraulic Controls

OPERATING THE HYDRAULICS

The Super Major hydraulic system gives the operator a choice of control over the implements in use by Qualitrol, which adjusts the working depth in accordance with the draft of the implement, or by Position Control, which is a means of controlling the implement height relative to the tractor.

In either system, one main control lever situated on the right-hand side of the tractor, adjacent to the driving seat, is used to set the working depth (or height) and to raise or lower the implement. A second lever immediately in front of the main control lever selects whichever system the operator considers best suited to the job in hand.

The hydraulic pump is driven from the P.T.O. shaft, and the P.T.O. selector lever must be in the engaged position in order to operate the hydraulics. Providing such engagement is made the hydraulic pump is in continuous operation whenever the clutch is engaged.

Where a "Live" P.T.O. is fitted, however, the transmission clutch may be disengaged without affecting the operation of the pump.

Operation

QUALITROL

Where ground contour and soil conditions constantly change, or when surface conditions are such that loss of wheel grip would normally be expected, Qualitrol enables work to be completed which would be impossible without such a system.

To engage Qualitrol, place the selector lever in the upward position and move the main control lever down the quadrant until the implement reaches the desired working depth (Fig. 8).

This depth may be changed at any time by repositioning the lever; i.e., the lower the lever is placed in the quadrant, the greater the working depth obtained, and vice versa.

The implement will now operate at this depth as long as the draft remains constant, but if a heavy patch of soil or an obstruction is encountered, the hydraulic system will respond by raising the implement. At the same time this action transfers weight to the rear wheels, giving increased wheel grip to assist the tractor, until such time as the draft decreases, when the implement will be automatically repositioned at its former depth. Such corrections enable the tractor to maintain a steady rate of work without loss of wheel grip.

Implement draft forces are transmitted to the tractor hydraulics through a rocker (Fig. 9), which has two pivot pin positions. For all normal operations the pivot pin should be placed in the lower holes in the rocker and bracket. Only where extremely heavy draft operations are being undertaken should the alternative (upper) position be used. Never attach the top link directly to the pin fixing the top of the rocker to the hydraulics.

POSITION CONTROL

This control enables the operator to set an implement at any required position relative to the tractor, and this will then automatically be maintained irrespective of changes in soil resistance. It is particularly suitable for maintaining a high quality of work when cultivating or ploughing ground which is reasonably level, provided the conditions are such that excessive wheel spin is not experienced, and also for implements such as mowers, weeders and sprayers.

To operate under Position Control, place the selector lever horizontally and then position the main control lever within the quadrant to give the required depth (or height) to the implement. As with Qualitrol, the lower the control lever is placed in the quadrant, the lower the implement will operate.

Operation

FLOW CONTROL DEVICE

Under certain conditions of operation it is desirable to be able to control the rate of flow of oil to the ram cylinder or auxiliaries. When ploughing, for instance, only a slow oil feed is required, whereas when using auxiliary equipment, such as front end loaders, a fast rate is required. For this reason a flow control device is incorporated (Fig. 8).

The rate of flow is controlled by screwing the control knob in or out, thus moving the control to the required position between the "F" (fast or maximum flow) and "S" (slow or minimum flow) positions, as marked on the auxiliary service control valve housing.

Regardless of the position at which the flow control device is set, when the main control lever is moved to the top of the quadrant the quadrant lever will operate the linkage to the flow control device, moving it to the "Fast" position so that a quick raise of the implement can be effected.

The correct rate of flow will depend on the implement, speed of operation, operating conditions, etc., and the optimum position for any particular unit can only be found under actual operating conditions.

ADJUSTABLE CONTROL LEVER STOP

Once the desired working depth (or height) has been obtained, the adjustable stop on the quadrant may be set to contact the main control lever so that after any particular cycle of operations the implement may be returned to the same working position simply by moving the control lever on to the stop. (See also "Auxiliary Service Control.")

The use of this stop does not in any way interfere with the Qualitrol

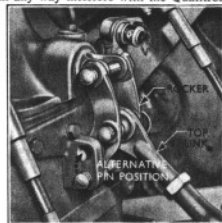


Fig. 9.
Rocker Pivot Pin Positions

operation, which will continue to make adjustments to the working depth above and below the mean depth, as set by the stop, in order to maintain continuous work at a steady pace.

When the stop is used in conjunction with Position Control, a rapid yet completely accurate depth setting is assured each time the implement is returned into work after turning on the headlands.

RAISING IMPLEMENTS TO THE TRANSPORT POSITION

Lift the control lever until it abuts the top stop within the quadrant. The implement will then be lifted to the fully raised position, where it will remain until the main control lever is again moved down the quadrant.

When operating in Qualitrol, any intermediate position may be obtained by holding the control lever against the upper stop until the desired height is reached and then moving it downwards off the stop for a short distance. Although this movement is comparatively small, it is sufficient to enable the internal control linkage to find a neutral position, and a little practice will soon familiarise the operator with this position for the control lever.

Under Position Control the height of the implement is directly governed by the position of the lever in the quadrant, and it is therefore possible to raise to any desired intermediate position for transport simply by moving the control lever up the quadrant—the further the lever is moved up the quadrant, the higher the implement will be raised. To avoid imposing excessive shock loading on the hydraulics do not travel at high speed, particularly over rough ground, with the implement in the raised position.

AUXILIARY SERVICE CONTROL

This unit permits the use of hydraulic power to operate remote cylinders on such equipment as loaders and tipping trailers and it is recommended that the main hydraulic selector lever be in the Qualitrol (upward) position when the auxiliary service is in operation.

The lift arms and auxiliaries cannot be operated together, and there are two positions only for the auxiliary control; i.e., "In" to operate the lift arms, and "Out" to operate the auxiliaries.

In either position the actual raising and lowering is controlled by the main hydraulic control lever, but when operating with the auxiliary control in the "Out" position it should be noted that if the lift arms are fully raised, the hydraulic linkage will be placed automatically in a neutral position. Under these circumstances, to effect a raise it will be necessary to take the main control lever past the fixed stop at the upper end of the quadrant, and in order to do this the spacer fitted between the main control lever and the flow control valve linkage must first be moved around to the side of the lever. The spacer is fitted to the end of a spring strip which is free to swivel and enable such movement to be made.

CAUTION

The auxiliary control should not be moved to change from ram cylinder (lift arms) to auxiliary service feed, or vice versa, unless the hydraulics are in a neutral position.

When the lift arms are in the fully raised position the hydraulics will be automatically positioned in neutral, but should the arms be not fully raised it will be necessary to find a neutral position by first moving the control lever to a point on the quadrant where neither raising nor lowering takes place and setting the adjustable stop on the quadrant at this point. Neutral can thereafter be very quickly obtained by returning the main control lever to the stop.

It is important to remember that certain equipment requires special operating techniques, therefore the recommendations of the equipment manufacturers regarding operation must be strictly observed.

Remote cylinders will be operated by oil initially drawn from the rear transmission housing and, although the quantity of oil available is sufficient for normal operation with approved equipment, it may be necessary to top up the oil level if a number of auxiliaries are operated simultaneously.

Remember that any auxiliary which is disconnected when extended represents a loss to the rear transmission oil level and this must be replaced by adding a corresponding quantity of oil to the rear transmission.

All hoses should be cleaned before connecting up and the open ends of all unions should be covered with dust caps when not in use.

"LIVE" HYDRAULICS

If your choice of tractor has been one with "Live" power take-off, then the hydraulics will also be "Live" and may still be operated independently of forward motion of the tractor. This is a decided advantage where lifting operations are required to be continuous, even though gear changing is in progress and the main transmission clutch disengaged.

Just as with the "Live" power take-off, depression of the clutch pedal for approximately half its travel will disconnect the drive to the rear wheels but will not stop the operation of the hydraulic pump. On the other hand, if an emergency arises whereby both the tractor and the hydraulics require to be stopped, pushing the clutch pedal through its full range of travel will disconnect the engine drive from both the transmission and the hydraulic pump.

Operation

HYDRAULIC LIFT LINKAGE

By changing the swivel balls at the outer ends of the lower links and also the outer section of the top link with the alternative parts which are supplied loose with each tractor, either Category 1 or Category 2 implements may be used.

To change from Category 2 to Category 1 implements, or *vice versa* :

1. Remove the outer section of the top link and screw in the alternative section.
2. Release the spring-retaining clips and rotate the swivel balls until they can be removed from the outer ends of the lower links. Install the alternative swivel balls and retain with the spring clips.
3. Move the check chain shackles to the alternative position, i.e., with Category 2 implements the pin retaining the check chain shackle to the anchor bracket on the rear axle housing should be positioned in the inner holes in the shackle. With Category 1 implements the outer holes in the shackle should be used.

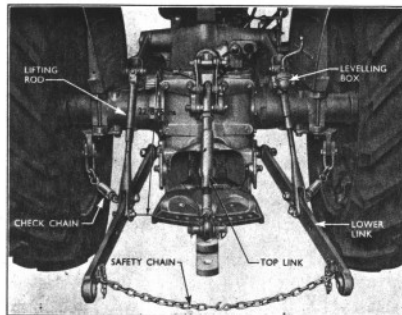


Fig. 10. Hydraulic Lift Linkage

Operation

The right-hand lifting rod incorporates a levelling box to enable the rod to be adjusted for length and so control the level of the implement in work. The left-hand lifting rod is also adjustable for length, but for all normal agricultural operations it should be set to a length of 22.75 to 23 inches (57.78 to 58.4 cm.). The dimension is most important for the correct operation of the hydraulic lift.

The lift rods must be connected to the third hole (numbered from the front swivel ball) in the lower links. The first hole is for standard check chains, the second hole for applications other than the Super Major, and the fourth hole for heavy-duty check chains.

By rotating the centre turnbuckle the length of the top link may be adjusted to control the pitch of the implement. Always tighten the turnbuckle locknut after making adjustments.

No lubricant should be applied to the swivel balls in the top link or in the lower link, otherwise grit will accumulate and cause rapid wear.

DIFFERENTIAL LOCK

On many farming operations where wet or soft patches of soil require negotiation, wheelspin on one wheel results in the tractor being either brought to a halt or, at the best, considerably slowed down. With a conventional differential, holding one wheel results in the majority of the drive being transferred to the opposite wheel. This, broadly speaking, is the action which takes place when one wheel of the tractor is on firm, and the other on soft, ground. Under these circumstances the drive is transferred to the soft side, where it does the least good in driving the tractor, the wheel being unable to grip and the drive dissipated in wheelspin.

Providing one wheel is able to obtain a grip, the differential lock fitted to the Super Major overcomes the disability and enables additional traction to be obtained from the wheel which is on firm ground, thus enabling the tractor to pull through the soft patch.



Fig. 11. Differential Lock Pedal

The lock is engaged by depressing the differential lock operating pedal which is mounted on the right-hand disc brake cover (Fig. 11). This action engages a splined coupling with the differential side gears, locking them together and preventing one wheel from rotating independently of the other.

Hold the pedal down until the lock is definitely felt to engage, and then release the pedal. It will then remain in the engaged position until the soft patch is negotiated, after which it will automatically return to the disengaged position (i.e., the pedal will be seen to come up).

If the pedal is slow to return to the released position, either momentarily depress the clutch pedal or briefly apply the brake corresponding to the wheel which has been spinning, to assist the disengagement of the differential lock.

It should be noted that the differential lock must always be disengaged before attempting to turn the tractor, otherwise there will be a danger of loss of steering control.

WEIGHT TRANSFERENCE

Reference has previously been made to weight transference to the rear wheels when operating rear mounted equipment, and it will be appreciated that such action removes weight from the front wheels.

The tractor may be operated satisfactorily under all normal conditions providing that when 7.50 x 16 front wheels are fitted, standard 70 lbs. (31.8 kgs.) wheel weights are added to each front wheel.

If, however, it is intended to operate on steep slopes using heavy rear mounted equipment, it will be necessary to add extra weight, either by water ballasting the front tyres or by securing suitable weights of up to 300 lbs. (136 kg.) to the front cross-member, irrespective of the type of front wheels in use.

No increase in tyre pressure is necessary because of extra weight if 7.50 x 16 front tyres are fitted, but where 6.00 x 19 front tyres are fitted the tyre pressure should be increased in accordance with the amount of additional weight as follows:—

Total extra weight 100-200 lbs. (45-91 kg.)—tyre pressure 28 lbs./sq. in. (1.969 kg./sq. cm.).

Total extra weight 200-300 lbs. (91-136 kg.)—tyre pressure 32 lbs./sq. in. (2.25 kg./sq. cm.).

RUNNING-IN THE TRACTOR

To obtain the best service from the tractor it should be carefully run-in and the extra attention given during the first few weeks of use will be amply repaid during its subsequent working life.

In the Lubrication and Maintenance sections will be found the periodic attentions necessary during the working life of the tractor.

In addition to these recommendations, which in some cases apply also during the running-in period, the following points should be observed :—

The engine should not be run at high speeds or be allowed to "labour." It is advisable to run the engine slowly at first and gradually increase its speed as it becomes run-in. It should be noted that maximum engine power will not normally be obtained until at least 200 hours "running in" has been completed.

During the first 50 working hours, special care should be taken to see that the engine, gearbox and rear axle have the proper quantity of oil of the correct grade and that the radiator has sufficient water.

Do not overlook the oil in the air cleaner.

At the end of each day tighten the wheel nuts until it is no longer possible to obtain any further movement of the nuts, which will then be securely "bedded in."

When the belt pulley is fitted, the hexagon nut securing the pulley to the shaft should be tightened after it has been used for a short period. This will prevent any tendency for it to work loose subsequently.

If an inertia starter is fitted, it is important that after the first 50 hours the oil is drained and the starter flushed out with diesel fuel oil. Refill with half a pint of clean engine oil.

Operation

FOR BETTER PERFORMANCE AND

SAFE OPERATION

- DO**—carry out the Daily Maintenance Tasks every day without fail.
- DO**—keep the air cleaner clean and the oil at the correct level.
- DO**—ensure that the correct grade of approved lubricating oil is used and that it is replenished and changed at the recommended intervals.
- DO**—fit new sealing rings when filter elements are renewed.
- DO**—watch the warning lights and temperature gauge and investigate any abnormality.
- DO**—keep the radiator filled with clean water. In cold weather use anti-freeze—drain the system only in an emergency and refill before starting the engine.
- TAKE THE WATER TO THE TRACTOR—NOT THE TRACTOR TO THE WATER.**
- DO**—keep all fuel in clean storage and use a filter when filling the tractor tank.
- DO**—read all the running-in instructions.
- DO**—attend to minor adjustments and repairs as soon as the necessity is apparent. When in doubt consult your Authorised Dealer.
- DO**—ensure that the handbrake is fully released before moving off.

- DON'T**—run the engine without the air cleaner or with the governor pipe disconnected, otherwise the engine speed may increase rapidly and cause damage.
- DON'T**—run the tractor downhill out of gear or with the clutch pedal depressed.
- DON'T**—attempt to make sharp turns by using the steering brakes when travelling at high speed.
- DON'T**—engage the clutch suddenly or drive with your foot resting on the clutch pedal.
- DON'T**—allow the tractor to run out of fuel as it will then be necessary to bleed the fuel system.
- DON'T**—interfere with the fuel injection pump; if the seal is broken your Warranty becomes void.
- DON'T**—allow the engine to idle for long periods or excessive carbon will be formed on the injectors; the engine starts easily and such idling is wasteful.
- DON'T**—drive the tractor at speed with implements in the raised position, particularly over rough ground.
- DON'T**—remove the radiator filler cap when the engine is near boiling point.

LUBRICATION

Your new Super Major represents an investment which you will wish to safeguard by regular servicing to ensure the best performance over many years.

Every Fordson tractor is backed by the world-wide Fordson Tractor Dealer Organisation and your local Dealer will be only too happy to discuss the question of regular servicing with you. It is obviously desirable for servicing to be carried out by skilled mechanics, as the tractor can at the same time be inspected for maladjustments which can be corrected before they become serious.

Should it not be possible to have this work carried out by your Dealer, then you will find the information you require to carry out the all-important lubrication checks on the Lubrication Chart enclosed at the end of this book, whilst items requiring periodic adjustments are covered in Section 3 of this book.

Regular attention to the points covered in these two sections will be amply rewarded by economical and reliable operation, with freedom from breakdowns.

It is recommended that the Lubrication Chart be detached from the book and displayed on the walls of the area where you perform your servicing operations so that it is handy for quick reference.

Lubrication

The most important function of a lubricant is to prevent friction. An oil of the correct grade will maintain a thin film between the working surfaces of the bearing or gear teeth, preventing metal-to-metal contact, cooling the metals and above all preventing friction. To do this effectively a good quality lubricant approved for the particular application must be used. An incorrect lubricant may not be able to maintain a film of oil between the working parts and once the film breaks down, wear and eventual failure of the parts is inevitable.

In addition to eliminating friction, the engine oil of any diesel engine has the important task of keeping the engine clean and free from sludge and products of combustion which would otherwise block oil-ways and cause piston rings and valves to stick. Some good quality lubricants have special additives which make them specially suited to the diesel engine. Use an approved oil and be sure your tractor will not let you down through faulty lubrication.

Oils have a limited useful life, after which the effects of time, moisture due to condensation and, in the case of the engine, the effects of heat and combustion by-products, will combine to reduce its lubricating properties. It is therefore unwise to use a lubricant for longer than the specified period. The recommended intervals between oil changes have been decided on after prolonged tests and have proved to be the most suitable for normal operation. In extremely arduous operating conditions it may be necessary to change oils more frequently, and this point should be discussed with your local Dealer.

STORAGE OF LUBRICANTS

Particular care has been taken in design to provide adequate filtration of engine and hydraulic lubricant under normal conditions of operation and the recommended periodic services are based on the assumption that the owner takes every precaution to ensure that lubricant in store is adequately protected against contamination by dirt or water. Make a point, therefore, of always making sure that the bungs are replaced in any oil drums which may be used and use only clean containers when replenishing the oil levels.

Lubrication

ENGINE LUBRICATION

The engine has a forced feed lubrication system which requires no attention from the operator except to ensure that the oil level is kept up to the "FULL" mark on the dipstick and that the oil is changed and filter elements renewed at the recommended intervals. Use only heavy-duty oils of the correct grade as detailed under "Specifications."

Under no circumstances must the oil in the engine be allowed to get below the lower mark on the dipstick, which is located on the left-hand side of the engine. The correct way to ascertain the oil level is as follows:—

With the tractor standing level, and the engine stopped, pull out the dipstick, wipe it with a clean rag, re-insert fully and again remove it, when the mark made by the oil indicates its level.

The oil pump incorporates an oil pressure relief valve and is driven from the engine auxiliary drive shaft, drawing oil through a gauze-type screen which is submerged in the oil in the engine sump. Oil under pressure is then pumped to a full flow filter, fitted externally to the right-hand side of the engine and containing a renewable element which must be changed not later than every 200 working hours.

An oil pressure warning light switch is located on the left-hand side of the cylinder block and is directly connected to the main oil gallery. Should the oil pressure drop to a point where it would be dangerous to continue to run the engine, the switch contacts close and a warning light is illuminated on the instrument panel. (See Fig. 6.)

Whilst not acting directly as a lubricant, the regular replenishment and renewal of oil in the engine air cleaner and crankcase breather has a decided influence on the engine lubrication system. Servicing instructions for the air cleaner are detailed on page 40.

The crankcase breather oil should be changed every 200 hours (more often under very dusty conditions) and the breather gauze rinsed in paraffin to remove any excessive accumulation of foreign matter.

Lubrication

GEARBOX, REAR AXLE AND STEERING LUBRICATION

Due to the heavy and continuous use to which the gearbox oil is subjected, it is recommended that the gearbox is drained and flushed every six months or 1,000 working hours and then refilled with the correct grade of lubricant. (See "Specifications.")

It should be noted that the left-hand bolt holding the fuel tank mounting bracket to the top of the gearbox housing is drilled to act as a breather for the gearbox. Periodically, this bolt should be removed and checked to ensure that the drillings are not blocked by foreign matter.

The rear axle lubricant is also used to operate the hydraulic lift and before passing into the hydraulic pump, the oil is drawn past magnetic filters in the base of the rear transmission housing and through a wire gauze filter in the pump pedestal. A proportion of the oil passes through a further oil filter when being exhausted from the hydraulic system. This filter will not normally require servicing, except when a major overhaul of the rear axle is being undertaken.

Every 12 months, or 2,000 working hours, the rear axle should be drained, flushed and refilled with clean oil of the correct grade. At the same time the hydraulic pump inlet filter screen and cover should be removed and the gauze screen and magnetic filters cleaned before being replaced. When replacing these items care should be taken to ensure that the sealing gasket is not damaged or mislocated.

The steering box lubricant will not require changing, but the oil level should be checked and replenished, if necessary, after every 200 working hours.

CLUTCH RELEASE BEARING

Where a standard single or double clutch is fitted, the release bearing is packed with grease prior to assembly and no additional lubrication is required, but where a heavy-duty clutch is fitted, an external screw-down, cup type greaser, suitably connected to a heavy-duty release bearing, is located on the right-hand side of the clutch housing.

It is recommended that the cap on the greaser be screwed down one turn every day.

Replenish the cup as necessary with a lithium based high melting point grease—do not use chassis grease.

Lubrication

SERVICING SCHEDULE

ITEMS FOR ATTENTION	Twice Daily	Daily	Every 50 Hrs.	Every 200 Hrs.	Every 600 Hrs.
Check engine oil level - - -					
Check radiator water level - - -					
Clutch bearing greaser (1 turn) - - -					
Check air cleaner oil level - - -					
Grease all steering linkage points - - -					
Change air cleaner oil - - -					
Check gearbox and rear axle oil level - - -					
Grease steering gear upper bearing - - -					
Check power steering oil level - - -					
Grease rear wheel bearings - - -					
Grease front wheel bearings - - -					
Grease clutch and brake cross-shaft - - -					
Check clutch and brake pedal free play - - -					
Check tyre pressures - - -					
Grease levelling box - - -					
Check battery electrolyte level - - -					
Check steering arm clamping bolts - - -					
Clean governor breather capsule - - -					
Change engine oil and renew filter element - - -					
Clean and refill crankcase breather - - -					
Oil generator rear bearing - - -					
Check steering box oil level - - -					
Remove and clean air cleaner - - -					
Change fuel filter element - - -					
Change injectors - - -					

	Every 3 months	Every 6 months	Every 12 months
Change inertia starter oil - - -			
Change gearbox oil - - -			
Change rear axle oil and clean filter - - -			

MECHANICAL MAINTENANCE AND ADJUSTMENTS

This section describes the mechanical adjustments which require periodic attention, and also gives details of precautions which should be taken, and procedures to be followed to obtain maximum efficiency from the Super Major. Maintaining the correct adjustment of controls and moving parts is important, as in addition to providing safe and efficient operation, wear on the parts will be reduced to a minimum.

In addition to routine checks and adjustments this section also gives full information on adjustments that may have to be carried out to suit the tractor for any particular operating conditions, such as altering front and rear track widths and adding liquid ballast.

THE ENGINE

VALVE TAPPET ADJUSTMENT

Tappet clearance is an important factor in the efficient operation of the engine and a check at regular intervals of not more than 600 working hours will indicate when adjustment is necessary to maintain optimum engine performance.

Before making adjustments the engine should be operated for a short while to allow it to reach its normal operating temperature, and then the following operations should be carried out.

1. Remove the rocker cover to air cleaner pipe after slipping off the rubber connectors at each end of the pipe.
 2. If a decompressor control is fitted at the front end of the cover, ensure that the lever is placed in the non-operational (downwards) position, extract the lever securing screw, remove the lever and withdraw the connecting flange (to the rocker shaft) through the rubber grommet in the cover.
 3. Remove the six screws securing the rocker cover to the cylinder head and lift away the cover and gasket.
 4. Inlet valves should be set with a clearance of .015 in. (.38 mm.) and exhaust valves with a clearance of .012 in. (.304 mm.). Rotate the engine until No. 1 valve (numbered from the front end of the engine) is fully closed and check the clearance between the valve rotator cap and the rocker arm with a feeler blade. (See Fig. 12).
- If the clearance is not correct the adjusting screw lock nut should be slackened and the adjusting screw turned clockwise to decrease, and anti-clockwise to increase, the clearance. Securely tighten the lock nut after adjustment.
5. Turn the engine and repeat the operation on the remaining valves.



Fig. 12.
Valve Tappet Adjustment

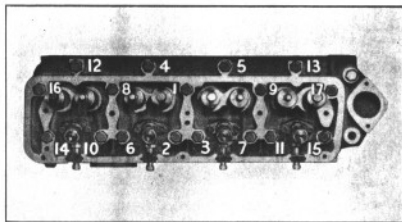


Fig. 13. Tightening Cylinder Head Bolts

6. After completing the adjustment run the engine and, when hot, check the cylinder head bolts for tightness. The cylinder head retaining bolts should be tightened uniformly and, if a torque wrench is available, to a torque of 85/90 lb. ft. Re-check the valve clearances whilst the engine is hot and adjust as required to the figures previously quoted.
7. Replace the rocker cover (using a new gasket), decompressor control (if fitted) and pipe (rocker cover to air cleaner), in the reverse order to which they were dismantled.

FUEL SYSTEM

It must always be remembered that the fuel injection equipment used on your tractor is made to very accurate limits, and therefore even the smallest particle of dirt that enters the fuel pump may destroy the accuracy of the equipment by causing scoring or premature wear on the highly finished parts.

HANDLING AND STORAGE OF DIESEL FUEL

It is essential that the diesel fuel used in your tractor is completely free from dirt or water. This can only be accomplished by always ensuring that care is taken in storing and handling, and that only reputable grades of fuel are used.

Mechanical Maintenance

The most satisfactory arrangement for storage is a bulk storage installation with a tank and pump (see Fig. 14), however, a gravity feed installation located high enough to enable the tractor tank to be filled, and set to slope downwards at the rear to allow sediment to settle, will serve nearly as well.

Never use a galvanised tank. The zinc from the coating will react with diesel fuel and form undesirable compounds which can adversely affect the operation of the fuel injection equipment.

If you have to keep your fuel in drums or barrels, it is preferable that you keep them in a clean, dry shed, with a concrete floor. If possible, use a 40-gallon barrel, fitted with a tap and mounted lengthwise on a trestle so that the barrel slopes downwards approximately half an inch per foot (5 cm. per metre) away from the tap. This will allow the sediment in the fuel to settle at the rear of the tank, and remain as the fuel is drawn from the barrel. Never tip the barrel so that you use the fuel below the level of the tap. After use replace the bung securely in the top, and clean up any fuel you have spilt, as fuel oil does not evaporate and will collect dust and dirt if allowed to remain.

When a new barrel of fuel is going to be used, mount it on the trestles and allow it to stand for at least 24 hours to allow any sediment that may be present to settle.

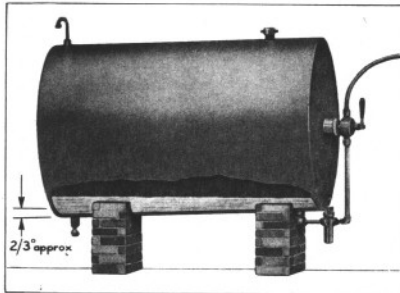


Fig. 14. Fuel Storage Installation

Mechanical Maintenance

REFUELLING THE TRACTOR

If it is not possible to refuel by hose from a storage tank a suitable can and a funnel with a fine gauze filter should be obtained, and used only when filling your tractor with fuel. Do not be tempted when in a hurry to use any can that may come to hand, as if there is water, dirt or rust in the can it will then go into the tank with the fuel.

Try and make a practice of refuelling in a sheltered position, and always wipe the fuel tank around the filler cap before filling, and immediately replace the cap after filling. The fuel tank has a capacity of 14 $\frac{1}{2}$ imperial gallons (65.8 litres) and at its base is fitted the fuel supply tap.

FUEL INJECTION EQUIPMENT

Fuel from the tank is fed to the fuel lift pump, which pumps it under low pressure through a renewable element filter into the injection pump. Here it is distributed to four pumping elements, one for each engine cylinder, which force the fuel under high pressure to the injectors. The injection pump is fitted with a pneumatic governor which provides a means for varying the quantity of fuel supplied to the injectors according to engine speed and load requirements.

FUEL INJECTION PUMP

The fuel injection pump should not require attention between engine overhaul periods, providing the fuel filter is serviced at the recommended intervals.

On no account should the injection pump be tampered with; any repairs necessary should be entrusted to your Authorised Dealer.

FUEL INJECTORS

The fuel injectors should be removed from the engine for testing and servicing at periods not exceeding 600 working hours.

Unless special equipment is available for testing and adjusting the injectors, this work should only be done by an Authorised Dealer. You will, however, doubtless find it advantageous to carry a spare set of reconditioned or new injectors, in which case the following procedure should be adopted for removal and replacement :—

1. Remove the rocker cover, disconnect the injector leak-off pipe connections and remove the pipe.
2. Disconnect the injection pump to injector pipes at the injectors and slacken the union nuts on the injection pump. Suitably cover the open ends of these pipes to prevent ingress of dirt.

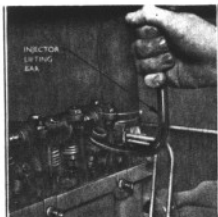


Fig. 15. Removing an Injector

3. Remove the two bolts securing each injector to the cylinder head and withdraw the injectors and copper seating washer which locates at the bottom of the injector locating bore in the cylinder head (see Fig. 15).

Do not keep the injectors loose in a box, but store them carefully until they are reconditioned.

4. Locate new copper washers in the injector bores and fit the new or reconditioned injectors, tightening the retaining bolts down evenly.
5. Replace the leak-off pipe and the injection pipes, tightening all connections securely.
6. Start the engine and check that no air leaks between the injector and the head.
7. Replace the rocker cover, renewing the gasket if necessary.

FUEL FILTRATION

The fuel is first filtered through a nylon filter fitted at the inlet to the fuel tap and again when it passes into the glass sediment bulb and gauze screen in the fuel lift pump (see Fig. 16). A regular check should be made on the sediment bulb and any accumulation of water or foreign matter should be removed and the gauze screen rinsed in clean fuel oil or paraffin.

Fig. 16. Fuel Lift Pump

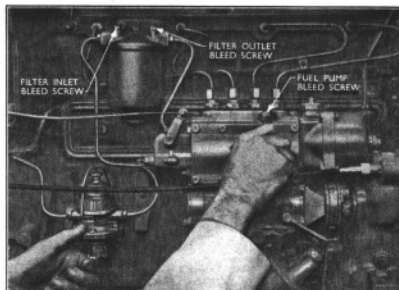
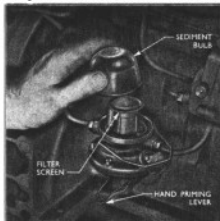


Fig. 17. Bleeding the Fuel System

When replacing the glass bulb ensure that the sealing gasket is in good condition and correctly located. An air leak at this point will give rise to starting troubles or erratic running of the engine.

The main filtration of the fuel occurs after the fuel leaves the fuel lift pump and before it enters the injection pump; i.e., it passes through the main fuel filter which incorporates a replaceable filter element. This element should be renewed after every 600 operating hours, using the following procedure:—

1. Detach the filter container by unscrewing the centre bolt retaining it to the filter head.
2. Remove the element and clean the interior of the container, using a brush and clean fuel oil. Do not use a rag to clean the filter container and do not touch it with dirty hands.
3. Fit the new element and a new rubber sealing ring between the filter body and the filter head. When retightening the centre bolt use a short spanner and apply moderate pressure only to ensure that the sealing ring is not damaged by over-tightening.

After renewing the fuel filter element, or cleaning the fuel lift pump sediment bulb, it will be necessary to bleed the fuel system to remove all traces of air which will have entered the system.

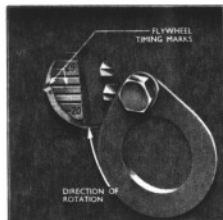


Fig. 18. Flywheel Timing Marks

BLEEDING AIR FROM THE FUEL SYSTEM

Ensure that all fuel pipe connections are tight and there is sufficient fuel in the tank. Turn the fuel tap to the "ON" position and remove the bleed screw on the outlet side of the fuel

filter (the one nearest the fuel injection pump), and operate the priming lever on the fuel lift pump. Continue pumping until a stream of fuel, free of air bubbles, issues from the filter. Replace and tighten the filter bleed screw. Next, release the bleed screw on the injection pump two to three turns approximately, operate the lift pump priming lever as before, tightening the bleed screw when all air bubbles cease and liquid fuel flows (see Fig. 17). Wipe all surplus fuel oil from the exterior of the filter and fuel injection pump.

TIMING THE FUEL INJECTION PUMP

The fuel injection pump is timed to commence injection at 23° B.T.D.C., and the engine flywheel is marked in degrees to facilitate timing the pump to the engine. To check the timing, set the engine with No. 1 piston on its compression stroke, move aside the inspection cover, situated on the rear right-hand side of the sump, and rotate the

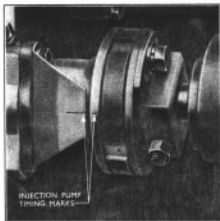


Fig. 19. Injection Pump Marks

crankshaft until the 23° B.T.D.C. mark on the flywheel is in line with the index notch on the side of the inspection aperture. (See Fig. 18.)

If correctly timed, the injection pump driven coupling timing mark should be in line with the timing plate fitted to the front of the pump, as illustrated in Fig. 19. If this is not so, slacken off the two claw bolts on the driving coupling and adjust the setting until the timing marks coincide. Tighten the claw bolts securely after adjustment.

GOVERNOR DAMPING VALVE ADJUSTMENT

To prevent "hunting" or irregular idling there is a damping valve fitted to the governor unit of the fuel injection pump which may be adjusted in conjunction with the idling screw on the inlet manifold. (See Fig. 20.)

1. Set the manifold idling screw to give a steady idling speed (approx. 600 r.p.m.).
2. Slacken the damping valve locknut and slowly turn the damping valve guide adjuster until the "hunting" is eliminated, and then tighten the lock nut.
3. Re-adjust the manifold idling screw if necessary.

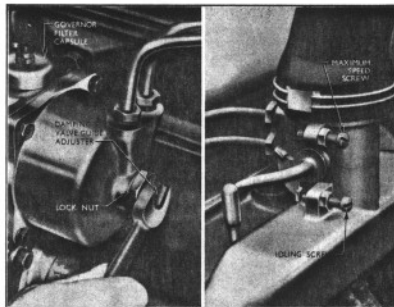


Fig. 20. Idling Adjustment

Mechanical Maintenance

GOVERNOR AIR FILTER

Every 200 hours, or sooner under dusty conditions, the governor air filter capsule should be removed, washed, lightly oiled and refitted after removing all surplus oil.

THE AIR CLEANER

The whole time the diesel engine is running a large volume of air is continuously being drawn at speed into the combustion chambers, where it is compressed to a high temperature. In most operating conditions the air initially contains a certain amount of dust, chaff and other impurities which, if allowed to enter the cylinders, could have a harmful effect. In addition to forming excessive deposits on the valves, combustion chambers and pistons, and fouling the lubricating oil, particles of dust have an abrasive effect on the working parts of the engine, and an excessive entry of such particles will inevitably cause excessive wear.

The function of the air cleaner is to remove such impurities from the air before it enters the engine, and it will fulfil this function efficiently, and protect the engine, only if it is itself cleaned at regular intervals and the oil in the base maintained at the correct level.

At the same time it must pass sufficient air to ensure complete combustion of the fuel, therefore if excessive fuel consumption is to be avoided and maximum power obtained from the engine, the cleaner must be regularly serviced.

As described on the Lubrication Chart, the oil level should be checked daily and the oil renewed after every 50 working hours. At the same time as the oil is changed, the filter gauze should be removed and cleaned thoroughly and the pre-cleaner inspected. It may be found that the vanes or slots in the domed top are partially blocked, and these should be cleared.

It must be stressed that although the above checks will be satisfactory in average working conditions, if the tractor is used in extremely dusty conditions, the air cleaner should be checked, if necessary, several times each day to prevent it becoming blocked.

In addition to the checks described on the Lubrication Chart, the air cleaner should be completely stripped down and all parts thoroughly cleaned every 600 working hours, although this interval also should be appreciably reduced if the tractor is operating under extremely dusty conditions.

Mechanical Maintenance

COOLING SYSTEM

The cooling system has a capacity of 3 imperial gallons (13.64 litres) and, except in winter conditions, should be kept filled with clean soft water. The water level should be checked at least twice daily, particularly if the tractor is operating under arduous conditions in hot climates.

For normal operating conditions the tractor is supplied with a non-pressurised cooling system. Where the tractor is to be operated in hot climates a radiator pressure cap incorporating a spring-loaded relief valve can be fitted, which has the effect of raising the boiling point of the coolant and minimising loss of coolant. Depending on the territory and conditions, the valve will be pre-set to either 4 lbs./sq. in. (0.281 kg./sq. cm.) or 7 lbs./sq. in. (0.492 kg./sq. cm.).

It is dangerous to remove a pressure cap until the radiator water has been allowed to cool down.

FROST PRECAUTIONS

In winter it is advisable to use an anti-freeze solution to protect the engine. This is important, as if the coolant freezes the resulting pressures could crack the cylinder block or radiator.

In an emergency the cooling system may be drained, but this should not be made a regular practice otherwise excessively large deposits from each change of water may block the system.

The following table gives the requisite quantity of anti-freeze required to give protection using the anti-freeze (ME-1163-B inhibited Ethylene Glycol) available through your Authorised Dealer.

If it is necessary to top up, pour in an anti-freeze solution when the engine is hot. This will prevent loss of the solution via the overflow as would occur if topped up when cold.

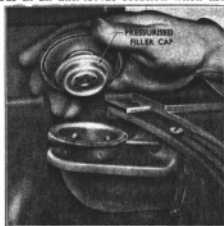


Fig. 21.
Pressurised Radiator Cap

Protection Down to	Volume of Anti-Freeze		Volume of Water	
	Pints	Litres	Pints	Litres
17° F or - 8° C	2.5	1.42	21.5	12.21
7° F or -14° C	3.5	1.99	20.5	11.65
- 3° F or -19° C	5	2.84	19	10.79
-20° F or -29° C	6	3.41	18	10.23

CLEANING THE SYSTEM

In the spring the system should be drained and flushed out thoroughly. The rust inhibitor in the anti-freeze will not remain effective indefinitely and it is therefore advisable to drain the cooling system in the spring and refill with clean soft water.

Drain off and flush the system thoroughly, using a hose pipe.

The radiator core should also be hosed down to wash out accumulated dirt and chaff and the system finally filled with soft clean water.

Always fill the radiator slowly to avoid an air lock, and **take the water to the tractor, not the tractor to the water.**

MAINTENANCE

Apart from ensuring that there is sufficient water in the cooling system, the following points should be observed.

The water pump, fan and also the generator are belt driven from the crankshaft pulley. A slipping fan belt will give rise to overheating, therefore every 200 hours the fan belt free play should be checked and if it exceeds $\frac{1}{2}$ in. (1.27 cm.) total movement, adjust by slackening the generator mounting bolts and moving the generator away from the cylinder block. Tighten the mounting bolts securely after adjustment.

Likewise make a regular check on the chaff screens as any blockage will restrict air circulation through the radiator and also result in overheating.

CLUTCH

Standard Super Major tractors are fitted with an 11 in. (27.94 cm.) single dry-plate clutch, but a 13 in. (33.02 cm.) heavy-duty single dry-plate clutch is available for use where operating conditions are particularly arduous.

Where a "Live" P.T.O. is fitted the clutch incorporates two 12 in. (30.48 cm.) dry plates, one operating on the main transmission and the other on the P.T.O.

It is most important that the tractor driver keeps his foot away from the clutch pedal except when releasing the clutch. "Riding" the pedal is bad practice and will result in excessive wear of the release bearing and clutch plate lining, with consequential loss of power due to clutch slip, and necessitating frequent adjustment of the linkage. In extreme cases the heat developed by the slipping clutch may cause distortion and subsequent linkage adjustment may not then correct the condition.

It is therefore important that a clutch pedal free travel of $1\frac{1}{2}$ to 2 ins. (38 to 51 mm.) is maintained at all times.

To change gear when a double clutch is fitted the clutch pedal need only be depressed through approximately half its total travel and depressing the pedal through the whole of its travel will disconnect the drive to both the gearbox and the P.T.O. shaft.

CLUTCH PEDAL ADJUSTMENT

Clutch pedal free play is the same whichever clutch is fitted, but additional checks should be made as detailed below when the tractor is fitted with a double clutch.

1. Loosen the clutch operating rod clevis lock nut and then remove the pin securing the clevis to the balance lever.
2. Adjust the length of the operating rod by moving the clevis on the rod until the pedal free travel is between $1\frac{1}{2}$ and 2 ins. (38 to 51 mm.). Tighten the lock nut after adjustment.

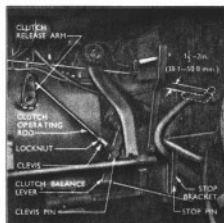


Fig. 22 Clutch Pedal Adjustment

Mechanical Maintenance

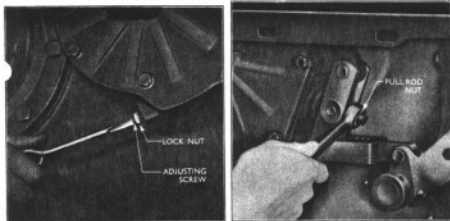
3. If a double clutch is fitted ensure that the stop pin (see Fig. 22) is removed from the stop bracket, start the engine, engage the P.T.O. and check that the P.T.O. ceases to rotate when the clutch pedal is fully depressed. Shorten the effective length of the operating rod if it fails to do so.
4. Fit the stop pin to the stop bracket, depress the pedal on to the stop pin and check that gear changing can be effectively carried out without excessive clutch spin. Further shortening of the operating rod may be necessary if excessive spin is evidenced.

BRAKES

AGRICULTURAL TRACTORS (Disc Brakes)

The only brake adjustment necessary between overhauls is that for normal lining wear indicated when pedal travel becomes excessive. The adjustment should be made with the brake housings cold.

1. Slacken the adjusting screw lock nut on the underside of either one of the brake housings (see Fig. 23a), and tighten the adjusting screw until the brake is fully locked.
2. Slacken off the screw one and a half turns and tighten the lock nut.
3. Disconnect the pedal return spring, adjust the pull rod nut (see Fig. 23b) until the pedal just touches its upper stop. Slacken the nut one and a half turns, which will give a pedal free travel of 1½ ins. (38.1 mm.) at the pedal pad.
4. Re-connect the pedal return spring and repeat these operations on the other brake.
5. Operate the brakes, to check for even operation, and re-check the pedal free travel, re-adjusting if necessary.



(a) Fig. 23. Disc Brake Adjustment

(b)

Mechanical Maintenance

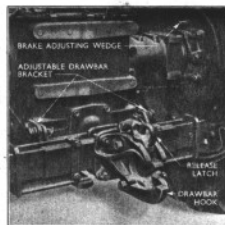


Fig. 24. Brake Adjustment (Industrial Tractor)

INDUSTRIAL TRACTORS (Rear Wheel Brakes)

To compensate for wear of the brake shoe linings, there is a simple external adjuster (Fig. 24) which permits the shoes to be expanded within each brake drum.

Turn the adjusting wedge on the rear of one brake plate in a clockwise direction until the shoes touch the brake drum. Back off the adjuster carefully, at the same time tapping the drum with a small spanner. Immediately the shoes are clear of the drum a clear ringing sound will be emitted when the drum is tapped.

Set the shoes in the other brake drum in a similar manner, testing the pedal to ensure that the free movement is not excessive.

The footbrake pedal linkage should be periodically checked for easy action and oil lightly applied to the moving parts.

WHEEL AND TRACK ADJUSTMENT

FRONT WHEELS

The wheels are of the well-base type, two types being available, depending on the size of tyre to be fitted.

The standard wheel, taking 6.00 x 19 tyres, is of cast construction, the wheel and hub being integral and the wheel being directly located on its spindle by means of its bearings.

The heavy-duty wheel, taking 7.50 x 16 tyres, is of pressed steel construction, being secured to a cast hub by means of six studs and nuts.

TESTING AND ADJUSTING FRONT WHEEL BEARINGS

To determine if there is excessive play in the bearings, jack up the front of the tractor, grasp the wheel (see Lubrication Chart) and rock. Do not mistake worn steering spindle pins or bushes for end play in the wheel bearings.

Excessive play in the bearings can be adjusted as follows:—
Remove the hub cap, jack up the front of the tractor, remove the split pin from the bearing adjusting nut, remove the clamp bolt from the adjusting nut to ensure the nut is free on the threads of the wheel spindle.

Rotate the wheel whilst tightening up the bearing adjusting nut until a heavy drag can just be felt, then turn back the nut one castellation at a time until the wheel rotates freely, but with no end play. Insert a split pin then refit and tighten the adjusting nut clamp bolt and nut.

Finally, replace the hub cap filled with grease and lower the tractor to the ground.

FRONT TRACK ADJUSTMENT

The three-piece front axle enables track adjustments to be made by positioning the two extension beams in relation to the fixed centre beam.

Front track settings may be obtained in 4 in. (10.2 cm.) steps between the following limits:—

- 48 to 72 ins. (122 to 183 cm.) with cast-iron wheels.
- 54 to 78 ins. (137 to 198 cm.) with 7.50 x 16 tyres.
- 50.5 to 74.5 ins. (128 to 189 cm.) with 6.00 x 19 tyres, except when power-assisted steering is fitted, when the minimum front track setting should not be less than 54.5 ins. otherwise the tyre may foul the power cylinder on full lock.

To adjust the front track proceed as follows:—

Raise the front of the tractor, unscrew and remove the clamp bolt and nut from each end of the track rod.

Remove the three nuts, washers and bolts from one extending axle beam and move the beam to the desired setting, replace the three bolts, nuts and washers and securely tighten.

Repeat this with the other extending axle beam and finally set the length of the track rod. Ensure that each extending axle beam and track rod spindle is an equal distance from the centre.

When replacing the three extending axle beam bolts on either side, ensure that one bolt is at the extreme outer end of the axle beam with the other two bolts each side of the radius rod yoke.

The track rod ends have slots machined at appropriate intervals to correspond with track widths. These slots, together with the clamp bolts and split-pinned nut, provide a positive locking according to the particular wheel track adjustment.

Make sure the bolts are kept tight, re-check if the adjustment is altered.

The rear wheels may also be set for row-crop work, details concerning these settings being given below.

REAR WHEELS

A choice of rear wheels enabling the fitting of 11 x 36, 12 x 36, 14 x 30, and, for certain export territories, 12 x 38 and 13 x 30 tyres, are available. In addition, 11 x 36 dual rear wheels may be fitted on request.

REAR TRACK ADJUSTMENT

By suitably combining the position of the wheel disc in relation to the fixing lugs on the wheel with the position of the disc in relation to the axle shaft, standard wheels may be adjusted (14 x 30 are non-adjustable) in 4 in. (10.2 cm.) stages between the limits of 52 in. (132 cm.) and 72 in. (182.9 cm.).

Fig. 25 illustrates the various combinations, and it will be seen that there are four methods of changing the track width, e.g.

- (a) By repositioning the wheel rim on the disc; i.e., re-locating the fixing lugs on the opposite side of the disc.
- (b) By repositioning the wheel rim on the opposite wheel disc.
- (c) By reversing the disc.
- (d) By interchanging the wheel assemblies.

It should be borne in mind that when making changes to track width that the wheel must always finish up with the "V" in the tyre tread pointing forward.

DUAL REAR WHEEL REMOVAL

When operating tractors equipped with dual rear wheels under heavy soil conditions the space between the dual tyres may become clogged with soil which will become packed quite solid.

To avoid the possibility of personal injury, wheels in this condition must not be detached unless the soil is removed or the tyres deflated.

This is most important as, if the soil is left packed solid between the tyres when the wheels are removed, the force is sufficient to strip the last few threads of the wheel studs.

TYRE PRESSURES

On new tractors, tyre pressures may be above normal. This is to avoid undesirable deflation in storage, and pressures should be corrected before the tractor is put into use. See "Specification."

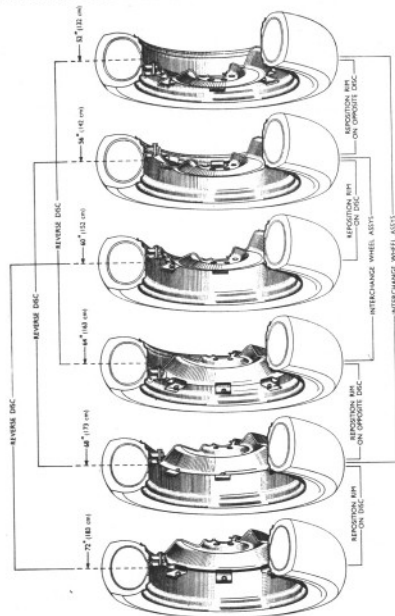


Fig. 25. Rear Wheel Settings

WATER BALLASTING

Where extra drawbar pull is required and it is found necessary to increase adhesion on the rear wheels, water may be pumped into the inner tubes to provide additional weight.

To provide protection against frost, a suitable anti-freeze solution must be used, otherwise ice may form inside the tube, become broken up when the tractor is used and so cut the tyre or tube, rendering them unfit for further use.

A suitable anti-freeze solution, which will not affect the valve core, inner tube or outer casing, is water mixed with calcium chloride (CaCl_2).

2 lbs. (.907 kg.) of commercial calcium chloride should be dissolved in each gallon (4.5 litres) of water, increasing the quantity of calcium chloride proportionately if considerable frost is anticipated. It is also recommended that 1 lb. of lime is added to every 100 lb. (1 gram to every 100 gram) of calcium chloride to prevent acidity.

This quantity will provide protection against freezing down to a temperature of 18°F. (−8°C.). 4 lb. of calcium chloride per gallon (0.4 kg. per litre) of water will protect down to −8°F. (−22°C.) and 6 lb. per gallon (0.6 kg. per litre) down to −44°F. (−42°C.).

Mix the solution, adding calcium chloride to the water first, in a wooden barrel or container for preference. Allow to cool before pumping the solution into the tyre.

Common salt may be used as a substitute for calcium chloride and should be used in the proportion of 2 lbs. per gallon (.2 kg. per litre) of water.

Radiator anti-freeze solutions must not be used in tyres, or calcium chloride solution used in the radiator.

The solution may be put into the tyre either by gravitational methods with a tank 6 to 8 feet (1.8 to 2.5 m.) above the tyre, or by means of an ordinary hand pump in conjunction with the special adaptor obtainable from your Authorised Dealer.

Proceed as follows:—

1. Jack up the rear of the tractor, turn the wheel to bring the valve to the bottom and block it in this position.
2. Unscrew and remove the valve core, so releasing all pressure in the tube.
3. Connect up the adaptor to the valve, passing the plastic tube through into the crown of the tyre. When secure, connect up the solution line from the pump or other container used.
4. Pump in the solution or allow it to enter from the gravitational tank if this method is used. Gradually turn the wheel round

Mechanical Maintenance

while the liquid is flowing into the inner tube until the valve is at the top, so that the air can escape. When the liquid issues from the small pipe in the side of the adaptor with the valve in the top position, the tyre is full.

5. Remove the adaptor quickly, replace the valve core and inflate the tyre to about 30 lbs. per sq. in. (2.11 kg. per sq. cm.) to seat the cover beads correctly. Then reduce the pressure to 2 lbs. per sq. in. (.14 kg. per sq. cm.) above the normal working pressure to allow for the added weight.

REAR WHEEL WEIGHTS

As a further means of increasing rear wheel adhesion, wheel weights may be fitted and used either in conjunction with water ballast or not, as required. Each weight is of cast-iron and weighs approximately 100 lbs. (45.36 kg.), and normally 300 lbs. (136 kg.) on each rear wheel will be found suitable for most conditions.

They should be equally distributed on each wheel and may be obtained in sets, comprising weights, bolts, nuts, etc., through your Authorised Dealer.

Note that the weight which is to be bolted directly to the wheel disc differs slightly from the auxiliary weight, as the former has five mounting holes drilled in the periphery of the weight, and the latter five recesses at this point.

Fit the weights as follows:—

Assemble the five reinforcement discs onto the bolts and insert the bolts from the inside of the wheel disc. If the wheel weight only is to be used, secure it to the wheel disc by the five bolts, nuts and washers.

Should, however, auxiliary weights be required, it will be necessary to fit the three mounting bolts with the head in the recessed hole provided before securing the weight to the rear wheel disc. Assemble the auxiliary weight to these three bolts, using the nuts and washers provided, and if further additional weight is required adopt the same procedure, making certain that the three bolts are assembled to the preceding weight before securing it to the wheel disc or auxiliary weight.

FRONT WHEEL WEIGHTS

Cast-iron weights may be fitted to the inside of 7.50 x 16 wheels to provide an additional 70 lb. (31.8 kg.) on each side of the tractor. To fit a front wheel weight it is necessary to remove the wheel from the hub and attach the weight to the inside of the front wheel disc with four nuts, bolts and washers supplied with each weight.

In addition water ballast may be added to the front tyres if extra weight is required. (See also "Weight Transference"—page 22.)

Mechanical Maintenance

ELECTRICAL SYSTEM

BATTERY MAINTENANCE

Two six-volt batteries, having a total capacity of 144 ampere hours at the 20-hour rate, are used to give 12 volt electrics on tractors equipped with electric starting. Tractors fitted with the optional inertia starter either use a smaller single 12-volt battery, with a 40 ampere hour capacity at the 20-hour rate, for generator charging warning light, oil pressure warning light and electric lighting, or are supplied without any electrical equipment whatsoever.

Check the level of the battery electrolyte every week and, if necessary, add distilled water to maintain the correct level. This level should be $\frac{1}{8}$ in. (16 mm.) above the top of the separators for the large twin batteries, but only $\frac{1}{4}$ to $\frac{1}{2}$ in. (6 to 10 mm.) for the small single battery fitted with the inertia starter.

Water for battery use should be kept in clean, covered vessels of glass, china, rubber or lead. A fully charged battery freezes less easily than a discharged one, therefore in cold weather add distilled water immediately before running the engine, so that the charging will mix the water and electrolyte.

The batteries should not be allowed to become unduly discharged, or to stand in a run-down condition, as this will materially affect their life.

Ensure that the battery is securely fixed at all times, keep the battery filling plugs and connections tight, the vent holes in the filler plugs clear and the top of the battery clean. Wiping the battery with a rag moistened with ammonia will counteract the effect of any of the solution which may be on the outside of the battery. A coating of good grade petroleum jelly will protect the terminals from corrosion.

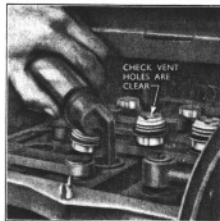


Fig. 26. Battery Maintenance

Mechanical Maintenance

When repairs are necessary, or if the tractor is to be laid up for the winter, take the battery to an Authorised Dealer for proper attention and storage. Do not entrust your battery to inexperienced or unskilled hands.

To remove the batteries from the tractor, remove terminal leads and connecting strap (when fitted), undo the securing nuts, and lift off the batteries. When replacing the batteries be sure to install them with the POSITIVE TERMINAL EARTHED.

GENERATOR MAINTENANCE

A generator, belt-driven from the engine crankshaft, provides charging current to the battery and a constant voltage control regulator automatically limits the rate of charge in accordance with battery requirements. The only maintenance necessary on the generator is to add two drops of engine oil every 200 hours to the generator rear bearing, to check at regular intervals that all wiring connections are clean and tight and to maintain the belt tension at $\frac{1}{4}$ in. (1.27 cm.) free movement between the generator and fan pulleys. It should be noted that an excessively slack fan belt will result in belt slip and adversely affect the generator charging rate. No attempt should be made to interfere with the regulator settings; the unit is sealed on assembly and is non-adjustable.

STARTER MOTOR

If the starter motor fails to rotate the engine at a reasonable speed to ensure starting, a check should be made that all connections are clean and tight, that the commutator is clean and that the brushes are not excessively worn so as to prevent proper contact on the commutator.

Operation of the starter motor is controlled by a solenoid switch which is mounted adjacent to the battery on the left-hand side of the tractor. Never attempt to start the engine without using the controls provided, pushing the solenoid plunger by hand can result in damage to the solenoid contacts.

THE LIGHTING SYSTEM

TO RENEW A REAR LAMP BULB

1. Remove the two cover retaining screws, remove cover and gasket.
2. The bulb may now be removed from its bayonet socket.
3. Fit the new bulb in the holder and replace the cover, ensuring that the rubber sealing gasket is correctly located.

TO RENEW A SIDE LAMP BULB

1. Remove the screw retaining the rim to the body and detach the rim and glass assembly.

Mechanical Maintenance

2. Turn the bulb holder anti-clockwise and withdraw it from the reflector.
3. Remove the bulb from its bayonet holder.
4. Fit a new bulb and re-assemble in the reverse order.

TO RENEW A HEADLAMP BULB

1. Loosen the rim clamp locking screw and push it downwards clear of the rim.
2. Pull the rim forwards at the bottom edge and detach the tongue from the slot in the lamp body.
3. Push the bulb holder in, and turn anti-clockwise to free the retaining lugs. The bulb may now be removed.
4. Fit a new bulb, ensuring that it is correctly located. When replacing the bulb holder note that it can only locate in one position.

TO RENEW A HEADLAMP LENS OR REFLECTOR

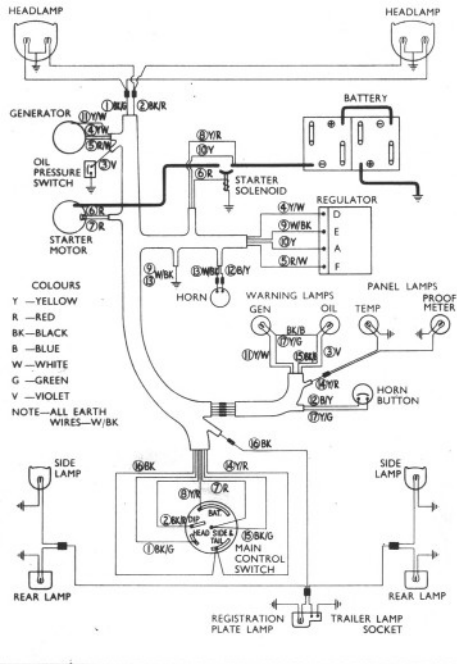
1. Remove headlamp rim assembly, bulb holder and bulb as described above.
2. Detach the six spring clips securing the reflector to the rim and remove the reflector assembly.
3. When re-assembling use new cork gaskets between rim and lens and lens and reflector. Ensure that the reflector is located in the notch cast in the lens, and the lens is replaced with the manufacturer's name adjacent to the small rivet head at the top of the rim.

TO ALIGN THE HEADLAMPS

The headlamps may be re-aligned by slackening the respective securing nuts on the "U" lamp adjustment bracket and moving the lamp as required.

TO REPLACE A WARNING LIGHT BULB

1. Remove the steering wheel and throttle control lever and extract the grease nipple from the top end of the steering column.
2. Remove the three instrument panel retaining screws.
3. Lift the panel assembly and release the two thumb screws retaining the temperature and warning light gauge to the panel.
4. Draw the gauge upwards away from the panel and extract the warning lights and holders from the rear of the gauge.
5. Remove bulbs and renew as necessary.
6. Reverse the dismantling procedure to effect replacement, ensuring that the bulb holders are replaced in their correct locations.



FAULT FINDING

Regular servicing will go a long way to eliminate irksome time-wasting troubles. If, however, there comes a time when you have difficulty in starting the engine, or if the engine does start but does not run correctly, then the following charts will enable you to approach the problem systematically.

Where possible any repair work should be entrusted to your Fordson Tractor Dealer and, above all, do not interfere with the fuel injection equipment, except to carry out the routine maintenance described in Section 3.

Engine Fault Finding Chart

(Diesel only)

ENGINE WILL NOT START

Battery run down;
Lead disconnected;
Faulty starter switch;
Faulty main control switch;
Faulty starter motor
or inertia starter.

Starter does not
crank engine.

Starter cranks
engine slowly.

Battery partly run down;
Terminals loose;
Connections dirty;
Wrong grade engine oil;
Faulty starter motor or
inertia starter.

MECHANICAL

FUEL SYSTEM

Injection timing incorrect;
Decompressor not released;
Poor cylinder compression.

Insufficient fuel in tank;
Fuel tank tap turned off;
Blocked fuel pipeline;
Faulty lift pump;
Restricted fuel filter;
Air leaks in pipeline.

Fuel Not Reaching
Injection Pump

Fuel Straching
Injection Pump

Air in Fuel System;
Control rod stuck in 'stop position'

Faulty injectors

Needle stuck;
Holes blocked;
Incorrect pressure;
Broken spring.

ENGINE OVERHEATS

MECHANICAL

FUEL

Insufficient water;
Insufficient lubricating oil;
Fan belt slack or broken;
Blocked radiator tubes or screens;
Thermostat sticking;
Injection timing incorrect;
Water pump needs attention;
Engine needs top overhaul;
"Blown" cylinder head gasket.

Faulty injectors.

ENGINE KNOCKS

Bearings worn;
Piston slap;
Sticking valve rocker(s);
Broken valve spring(s);
Injection timing incorrect.

Faulty injectors(s);
Air in system.

EXHAUST EMITS EXCESSIVE BLACK SMOKE

Maximum stop screw out of adjustment;
Excess fuel device in.

Faulty injectors(s);
Dirty air cleaner;
Worn delivery valve(s).

ENGINE MISFIRES

Sticking valve(s);
Sticking piston rings;
Engine needs top overhaul;
Broken injector pipe.

Faulty injectors(s);
Worn delivery valve(s) or broken
spring(s);
Broken pump plunger spring(s);
Air in system.

ENGINE STARTS AND STOPS

Valve(s) sticking;
Governor idling setting incorrect.

Air in system;
Faulty lift pump;
Fuel filter restricted;
Insufficient fuel in tank.

ENGINE DOES NOT GIVE FULL POWER

Sucking valve(s);
Worn piston rings and bores;
Incorrect valve clearance;
Sticking piston rings;
Injection timing incorrect;
Engine overheating.

Air in system;
Faulty lift pump;
Fuel filter restricted;
Faulty injectors(s);
Insufficient fuel in tank;
Broken delivery valve spring(s);
Dirty air cleaner;
Stuck control rod;
Stop control pulled out slightly;
Throttle butterfly movement restricted.

ENGINE IDLES IMPERFECTLY

Governor idling setting incorrect;
Injection timing incorrect;
Air leak in governor system;
Sticking valve(s);
Broken valve spring(s).

Air in system;
Fuel filter restricted;
Faulty injectors(s);
Faulty lift pump;
Insufficient fuel in tank;
Worn delivery valve(s) or broken
spring(s);
Worn fuel pump plunger(s) and
barrel(s).

Engine Fault Finding Chart

(Petrol only)

ENGINE WILL NOT START

Batteries run down;
Lead disconnected or corroded;
Faulty starter switch;
Starter drive dirty;
Faulty starter motor.

Starter does not
crank engine.

Starter cranks
engine slowly.

Battery partly run down;
Terminals loose;
Connections dirty;
Wrong grade engine oil;
Faulty starter motor.

IGNITION

No spark
at plug leads.

FUEL SYSTEM

No Petrol in Carburettor

Spark plugs oiled up;
Spark plug porcelain cracked.

Cracked rotor;
Loose low tension leads;
Faulty cap;
Dirty or worn distributor points;
Faulty condenser or connections;
Carbon brush not making contact;

Distributor
No spark at
plug leads.

Air leak in petrol line;
Blockage in carburettor
screw line;
Faulty petrol pump.

Petrol in Carburettor

Cool burns out;
High tension lead loose or broken;
Faulty ignition switch;
Points not opening or closing L.T.
circuit.

Cool
No spark
at H.T. lead.

Jets choked;
Choke control faulty;
Air leak in induction manifold;
Water in petrol;
Dirt in carburettor.

Battery

Battery run down;
Low tension lead loose or broken.

ENGINE MISFIRES

IGNITION

High tension leads to spark plugs
shorting;
Incorrect spacing of spark plug
points;
Cracked spark plug porcelain;
Battery connections loose (cool only);
Faulty or damp cap.

CARBURETTOR

Water in carburettor;
Fuel line partly choked;
Fuel pump pressure low;
Fuel pump filter choked;
Needle valve faulty or dirty.

MECHANICAL

Valves sticking;
Valves burnt;
Valve spring broken;
Incorrect valve clearance

ENGINE STARTS AND STOPS

IGNITION

Low tension connection loose;
Faulty switch contact;
Dirty contact points.

CARBURETTOR

Fuel line blocked;
Water in fuel;
Needle valve sticking;
Fuel pump faulty;
Fuel exhausted;
Air leaks.

ENGINE RUNS ON WIDE THROTTLE ONLY

CARBURETTOR

Slow running jet blocked;
Slow running adjusting screw incorrectly adjusted.

MECHANICAL

Valve sticking;
Valve burnt;
Valve spring broken.

ENGINE DOES NOT GIVE FULL POWER

CARBURETTOR

Fuel supply faulty;
Air leaks in induction pipe;
Jet partly choked or wrongly adjusted.

MECHANICAL AND IGNITION

Ignition retarded;
High tension lead shorting;
Valve burnt or bad seating;
Incorrect valve clearance;
Plug leads crossed;
Faulty cap.

ENGINE RUNS IMPERFECTLY

Weak mixture;
Fuel feed faulty;
Inlet valve(s) not closing;
Ignition timing incorrect;
Carburettor flooding.

ENGINE KNOCKS

Timing too far advanced;
Excessive carbon deposit;
Loose bearing or piston.

OPTIONS AND ACCESSORIES

This section gives brief descriptions of, and maintenance instructions for, some of the equipment which may be fitted at the factory when your tractor is produced, or which may be purchased from your Authorised Dealer as Accessories.

It by no means covers all the items which are available, but your Dealer will be pleased to give you full information on the very comprehensive range of equipment which is available.

VACUUM BRAKES

This equipment is particularly suitable for heavy trailers and may be fitted as a production option or supplied as an accessory through your Authorised Dealer.

It consists of a rotary exhauster which is driven from the rear of the fuel injection pump at half engine speed, a vacuum reservoir tank with a capacity of 1,570 cu.ins (25,748 c.c.), a reaction control valve which enables the operator to retain a "sense of feel" when applying the brakes, and a quick detachable coupling together with the necessary connecting pipes. The degree of vacuum applied to the trailer brakes is always in proportion to the effort applied to the operating lever, which must be pulled rearward to apply the brakes.

The quick detachable coupling ensures that no damage can be sustained by the trailer hose connection should the trailer accidentally break away. Always ensure that the dummy plug, provided with the detachable coupling, is inserted as the trailer is disconnected. This will prevent dirt entering the coupling.

PERIODIC ATTENTION

Every 200 hours remove the drain plug from the vacuum reservoir tank and allow any accumulation of water caused by condensation to drain off. At the same time check and tighten all pipe connections, ensure that the leather gaiter on the reaction control valve is

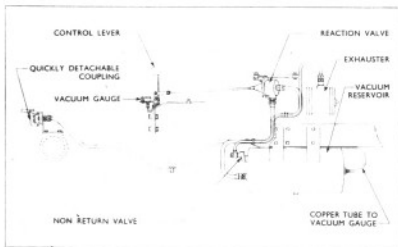


Fig. 28. Vacuum Braking Installation

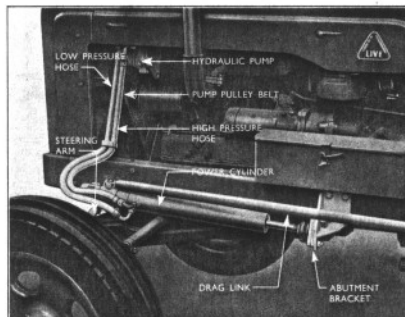


Fig. 29. Power Assisted Steering

in good condition, as this prevents dirt entering the valve when the brakes are released, and make sure that the rubber washer fitted to the coupling is not damaged or perished.

POWER ASSISTED STEERING

Power assisted steering not only provides an extremely light steering action, but also, due to the sensitive operation of the hydraulic shuttle valve, considerably reduces the tendency for the steering wheel to kick when the tractor is driven over uneven ground.

The equipment comprises an eccentric rotor type pump fitted to the front left-hand side of the engine, and a double acting ram connected to the steering drag link and mounted between an abutment bracket on the tractor side member and the left-hand steering arm (see Fig. 29). A special pulley, taking its drive from the standard crankshaft pulley, is mounted on the front of the crankshaft and drives the pump by means of a V-belt.

The pump has a delivery of approximately 2.75 imp. gallons per minute (12.6 litres per min.) at 400 lbs. per square inch pressure,

14.5 / 4 m PSI - 28 bar



Fig. 30.
Checking Pump Reservoir Oil Level

and the output is maintained within the correct limits by a control valve incorporated in the pump housing.

Power assisted steering is effective throughout the normal engine speed range, but a check valve in the power cylinder ensures that

if the power assistance becomes inoperative, or the engine stops, the tractor can be steered in the normal manner.

PERIODIC ATTENTION

After every 50 hours operation the following points should receive attention :—

1. Check the oil level in the reservoir mounted on top of the pump. A dipstick is attached to the filler cap, as shown in Fig. 30. Check the level when the tractor wheels are in the straight-ahead position and, if required, add sufficient good quality S.A.E. 10W oil to bring the level up to the "full" mark on the dipstick. Use S.A.E. 5W oil where temperatures are consistently below 10°F. (—12°C.). Oils such as brake fluid or shock absorber fluid must not be used.
2. Check that the belt free-play does not exceed 1 in. (25.4 mm.) total movement, measured between the pulleys. The pump body mounting bolts pass through slotted holes in the mounting bracket to provide belt adjustment.
3. Lubricate the steering arm and abutment bracket ball joints, using a grease gun.

Periodically inspect the system for any signs of leaks and check all nuts and bolts for tightness, particularly the ram cylinder abutment bracket bolts.

Providing care is taken to keep dirt out of the system the oil will only require replacing when a major overhaul is carried out.

NOTE.—The minimum front track setting when power assisted steering and 6.00 x 19 tyres are fitted must not be less than 54 ins. (137 cm.), otherwise the tyre may foul the power cylinder on full lock.

HYDRAULIC

AUTOMATIC CLUTCH RELEASE

To avoid damage to the tractor or implement during operations where obstructions are numerous, a hydraulic automatic clutch release may be incorporated with the normal three point linkage.

When a mounted implement encounters an obstruction, a shock load is transferred to the tractor through the top link. This factor is utilised to advantage when the hydraulic clutch release is fitted and a collapsible top link, operative only under shock load, is used to actuate the clutch release through a suitable linkage.

Following the clutch release sequence ; i.e., after an obstruction has been encountered and the tractor brought to rest, it will be necessary to free the temporarily depressed clutch and reset the mechanism for further operation.

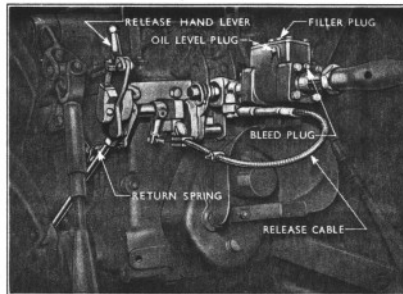


Fig. 31. Hydraulic Automatic Clutch Release

Proceed as follows :

1. Move the gear lever to the neutral position.
2. Fully depress the already disengaged clutch and move the spring-loaded hand release lever rearwards.
The clutch is now released and free for normal operation.
3. Select reverse gear and reverse away from the obstruction, simultaneously lifting the implement.

This third and last action will extend the collapsible top link and recuperate the unit, thus resetting it for further operation.

ADJUSTMENTS

A relief valve in the unit may be set to provide a suitable breaking load for a variety of soil conditions and cultivating operations. To carry out this adjustment remove the top link from the tractor. Line up the hole in the swivel ball with that in the tractor end of the link. Insert a screwdriver through these holes and turn the relief valve adjuster in or out, as required. Screwing the adjuster in increases the breaking load at which the unit operates, and *vice versa*.

Average settings from the fully tightened position are as follows :—

Light work	- 7 to 9 turns
Heavy work	- 5 to 7 turns

MAINTENANCE

The oil capacity of the unit is $\frac{1}{2}$ pint (.3 litre) of hydraulic fluid, Part No. M-100502-E, available from your Authorised Dealer. An oil level plug is provided on the left-hand side of the unit, and oil should be maintained at this level.

Should the unit be idle for some time it is suggested that before it is used the oil level is checked and the system "bled" to remove any traces of air which may have entered.

In the event of the unit operating, and so causing the clutch to be disengaged, without obstructions being encountered, it may be due either to the adjuster rod being incorrectly set, insufficient oil, or air in the system.

With the unit detached from the tractor and implement, it should not be possible to compress the link more than 1/16 in. (1.59 mm.) by hand. Any movement in excess of this indicates that the unit requires topping up and bleeding, as follows :—

- (a) Place the unit in a horizontal position and remove the oil filler plug.
- (b) Completely compress the unit, i.e., push the piston rod into the cylinder as far as possible.
- (c) Fill the unit with the correct hydraulic fluid, then loosely replace the filler plug and fibre washer.
- (d) Tilt the unit to approximately 30° with the air bleed plug uppermost.

- (e) Extend the unit so that the oil will be drawn from the reservoir into the space at the head of the piston.
- (f) Loosen the air bleed plug in the rear cover and gently tap the piston rod to expel any air which will be in the system, and then tighten the bleed plug.
- (g) With the link extended and placed in a horizontal position, and the filler plug still loose, remove the oil level plug from the left-hand side of the cylinder, when the surplus oil will drain away.
- (h) Tighten the oil level and filler plugs securely.
- (i) Check the unit for compression, by hand, when no more than 1/16 in. (1.59 mm.) movement of the rod should be possible.

If more than 1/16 in. (1.59 mm.) movement is observed, it will be necessary to again "bleed" the unit.

INERTIA STARTER

For export territories with ambient temperatures of 32°F. (0°C.) and above, an inertia starter, for manual starting, is available on diesel engine tractors in place of the normal electric starter motor (see Fig. 32).

TO START THE ENGINE

The main gear change lever must be in a neutral position before operating the inertia starter.

Set the tractor controls in the normal manner and without depressing the clutch pedal turn the inertia starter cranking handle in a clockwise direction. The first few turns will be "light" until the pinion engages with the flywheel ring gear on the engine, when the winding will feel "heavy" as the engine starts to turn. Apply steady but gentle pressure for the first heavy turn, then gradually increase the winding speed until a "buzzing" noise, distinct from the normal operating sound of the starter at speed, emits from the flywheel cover of the starter.

This is a signal to cease cranking immediately and firmly lift the clutch trip handle.

NOTE.—This procedure may have to be repeated a number of times if the injector pipes are not fully primed. **The starter is not intended for use when the ambient temperature is below 32°F. (0°C.).**

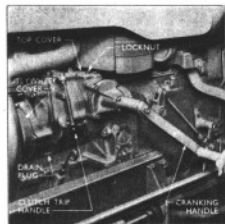


Fig. 32. Inertia Starter

PERIODIC ATTENTION

The oil in the starter should be drained and flushed after the first 50 hours and thereafter every three months, in the following manner :— Remove the top cover (do not loosen locknut on cover), then extract the drain plug. Thoroughly wash out the starter, using flushing or diesel fuel oil. Replace the drain plug (do not omit the sealing washer) and add 4 pint (.3 litre) of good quality oil of the same specification as is used in the engine. Replace and secure the top cover with the lock nut towards the outside of the starter, using a new gasket if necessary.

BELT PULLEY

This is available as optional equipment or as an accessory. It is driven by a bevel gear in the gearbox at a speed of either 1,400 r.p.m. or 779 r.p.m. at an engine speed of 1,400 r.p.m., depending on whether the primary lever of the gearbox is in the "High" or "Low" position. This gives a belt speed of 3,115 ft./min. (949.5 metres/min.) and 1,734 ft./min. (528.6 metres/min.), respectively.

The pulley diameter is 8½ ins. (21.6 cm.) and rotates clockwise when viewed on the outer face; the attachment is supplied with a dog clutch lever for engagement purposes.

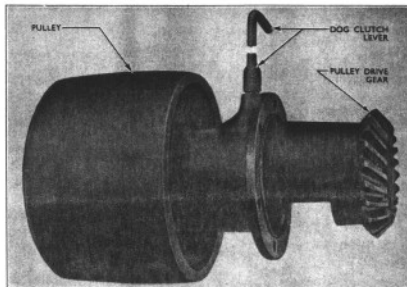


Fig. 33. Belt Pulley

Accessories

It is important to line up the tractor accurately so that the belt runs squarely, with full-width contact, on driving and driven pulleys. Do not permit the edge of the belt to contact any part of the tractor other than the pulley. No oil or grease must be allowed to reach the working surface of the belt, or slip may occur; any attempt to overcome such slipping by tensioning the belt will impose unnecessary loading on both the belt and the pulley bearings.

TRICYCLE CONVERSION

A tricycle tractor conversion is available for export territories and replaces the normal front axle fitted by the Ford Motor Company Limited on standard production.

Check the oil level at least once a month by removing the end cover on the right-hand side of the front cross-member (capacity $4\frac{1}{2}$ pints) (2.5 litres). Top up with any good quality S.A.E. 90 gear oil. The oil level is correct when the surface of the oil is flush with the bottom of the hole.

Lubricate each front wheel once a month with a good quality roller bearing grease, as follows:—

Remove the lubricator shroud on the inside of the wheel hub and apply the grease gun until the grease exudes from the seal housing. Wipe off all surplus grease and replace the lubricator shrouds.

Check tyre pressures weekly and maintain at 28 lbs. per sq. in. (1.969 kg./sq. cm.) and remove any stones, flints, etc., embedded in tyres.

To adjust the front wheel bearings place a jack under the rear end of each engine side channel and raise the front of the tractor. Remove the hub cap, slacken the hub nut clamping bolt and adjust the nut

until there is no perceptible end play at the hub, but with the wheel still revolving freely. Tighten the clamping bolt, again check the adjustment and if correct, replace the hub cap.

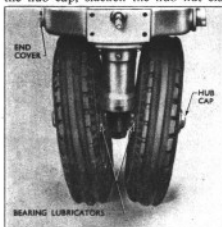


Fig. 34. Tricycle Conversion

PETROL ENGINE SUPER MAJOR

The preceding instructions have dealt specifically with the diesel-engined version of the Super Major, but a petrol-engined version is also available where required.

Naturally, when a petrol engine is fitted, a carbureted fuel system replaces the fuel injection system of the diesel engine, whilst either coil or magneto ignition is used to provide the necessary spark to initiate combustion.

The alternative operations necessary to start and stop the petrol engine, and the variations which occur in respect of lubrication and maintenance operations are detailed in this section.

A fault finding chart covering the petrol engine is included in Section 4.

Petrol Engine

TO START THE PETROL ENGINE (Cold Ignition)

1. Open the fuel tank tap.
2. Pull out the choke control (not necessary if the engine is warm) and ensure that the throttle control is in the fully-closed position. The choke control enables a rich fuel mixture to be supplied for starting purposes.
3. Check that the main gear lever is in the neutral position.
4. Depress the clutch pedal to reduce drag on the engine.
5. Turn the ignition key clockwise to the "on" position. It should be noted that on petrol tractors this switch controls the ignition circuit, not the starter circuit as on diesel tractors, and the engine can therefore be rotated by the starter motor but will not start unless the key is in the "on" position.
6. As soon as the engine is warmed up, push in the choke control. Continuous operation with the choke control pulled out not only wastes fuel, but is detrimental to the engine.

TO STOP THE PETROL ENGINE

1. Place the main gear lever in "neutral."
2. Switch off the engine by turning the ignition key anti-clockwise. If the halt is likely to be of some duration the fuel should be turned off at the fuel tank tap.

Do not allow the engine to remain stationary with the ignition "on," as this can cause damage to the ignition coil as well as discharging the battery.

Petrol Engine

MECHANICAL MAINTENANCE

Before making any adjustments, the engine should be warmed up to its normal operating temperature.

The adjustable throttle stop screw (see Fig. 35) determines the amount the throttle plate may be closed and when adjusted in conjunction with the idling screw sets the idling speed of the engine.

An approximate setting for the throttle stop screw is $1\frac{1}{4}$ turns in a clockwise direction after the screw touches the lever on the throttle shaft extension.

Having set the position of the throttle plate, the idling screw should now be adjusted to give an even "tick over." The setting will be approximately correct when the screw is turned $1\frac{1}{4}$ turns from the fully closed position.

Further adjustment may now be possible to the throttle stop screw to obtain an idling speed of approximately 500-550 r.p.m. followed by readjustment of the idling screw to maintain an even idling speed. Do not expect a new engine, which is stiff, to idle properly at very low speed or to "rock" on compression when stopped.

GOVERNOR ADJUSTMENT

If the governor linkage has been disturbed, or it is suspected that maximum "no load" engine speed is not being obtained the linkage adjustment may be checked in the following manner:—

1. To obtain an initial setting fully open the throttle control lever (clockwise), disconnect the vertical link (cross-shaft to carburettor) at the carburettor end and move the external throttle plate lever fully downwards, i.e., so that the internal throttle plate lever abuts the fixed stop at the rear of the carburettor, indicating that

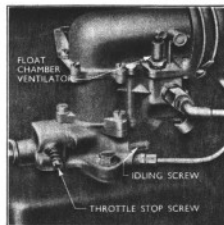


Fig. 35. Carburettor Adjustment

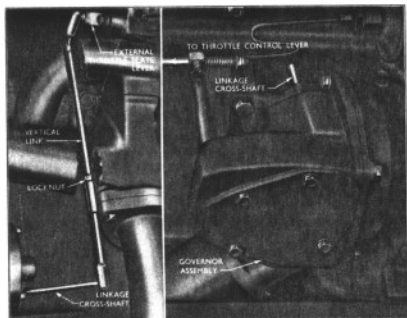


Fig. 36. Governor—Mechanical

the throttle plate is fully open. Loosen the lock-nut on the vertical link and adjust the length of the link so that it can be connected to the external throttle plate lever without strain.

2. Check that with the throttle control lever fully closed the internal throttle plate lever abuts the adjustable throttle stop screw.
3. From this initial setting further adjustment may be made to the vertical link to obtain the correct maximum "no load" engine speed of 1,800 r.p.m.

DISTRIBUTOR

Every 50 hours remove the rotor and add two drops of engine oil to the cam spindle, lightly smear the cam with petroleum jelly and lubricate the distributor governor weight mechanism with a few drops of engine oil through the contact breaker base plate. Where a magneto is fitted add engine oil to magneto base (through lubricator) to bring the level up to that of the lubricator.

CONTACT BREAKER POINTS

If the contact breaker points are dirty, pitted or incorrectly set, engine misfiring and loss of power may result. Badly-pitted or burnt points are often an indication of a faulty condenser or oil having reached the points.

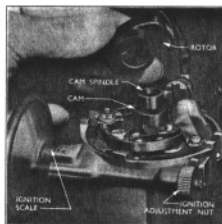


Fig. 37. Distributor Lubrication

The distributor contact breaker points should be set so that when the fibre arm of the moving contact is fully opened, there is a gap of 0.014 to 0.016 in. (0.356 to 0.406 mm.) The magneto breaker point gap should be set to 0.010 to 0.012 in. (0.254 to 0.305 mm.). This gap can be

adjusted by slackening off the locking screw on the fixed contact point and moving it until the gap setting is within the above limits (see Fig. 38).

IGNITION TIMING (Coil Ignition)

If for any reason the distributor has been removed from the engine it is essential that it be correctly timed when refitted.

Set the engine with No. 1 piston on compression stroke, move the inspection cover on the right-hand side of the sump to one side and rotate the crankshaft until the 1° B.T.D.C. mark on the flywheel is in line with the index notch on the side of the inspection aperture. The large "D" on the oil pump helical gear (Fig. 39) should now point to No. 2 cylinder.

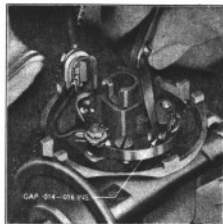


Fig. 38. Contact Breaker Setting

Petrol Engine

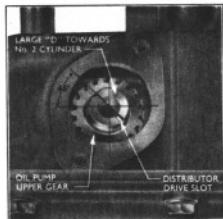


Fig. 39. Distributor Drive Slot

Fit the distributor to the top of the oil pump shaft, ensuring that the offset tongue enters the offset slot in the shaft correctly (see Fig. 39). Secure the distributor base to the block by means of the two screws and then loosen the clamp bolt.

Set the points to the correct gap and rotate the distributor body clockwise, with the long line on the ignition scale just visible, until the points are just opening with the vacuum control to the rear of the tractor. The rotor arm should now line up with No. 1 plug contact in the distributor cap. Then tighten the clamp bolt.

SPARKING PLUGS

Difficult starting or engine misfiring can be caused by dirty sparking plugs or incorrect plug gaps. Keep the plugs clean and the gaps set at 0.025 in. (0.635 mm.) (see Fig. 40). Adjust the gap by moving the side or earth electrode. Do not bend the centre electrode or its insulation may be damaged.

Ensure that the sparking plug insulators are kept free from dirt to prevent the possibility of high tension "tracking."

There is nothing to be gained by experimenting with different makes or types of sparking plugs, as those fitted on engines leaving the factory are best suited to the requirements of the engine.

Petrol Engine

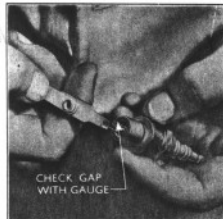


Fig. 40. Sparking Plug Adjustment

BATTERY

A single 12-volt battery having a capacity of 51 amp. hours at the 10-hour rate is fitted to petrol tractors. Maintenance instructions detailed in Section 3 should be followed, but it should be noted that the electrolyte level for this battery differs from that on the diesel-engined tractor in that it should be maintained at $\frac{1}{4}$ in. (6 mm.) above the top of the separators.

General Specification

ENGINE

Type	Diesel or Petrol 4 cyl. in line O.H.V.	
Bore	Diesel 3.937 in. (100 mm.)	Petrol 3.74 in. (95 mm.)
Stroke	4.524 in. (114.9 mm.)	4.524 in. (114.9 mm.)
Capacity	220 cu. in. (3610 c.c.)	199 cu. in. (3260 c.c.)
Compression Ratio	16:1	5.9:1
Lubricant	S.A.E. No. Above 90°F (32°C) 30 H.D.	S.A.E. No. 30
20° to 90°F (-7° to 32°C)	[20 H.D. or 20W H.D. or 20W/30 H.D.]	[20 or 20W or 20W/30 H.D.]
Below 20°F (-7°C)	[10 H.D. or 10W H.D.]	[10 or 10W]
Sump Capacity (dry filter)	12 imp. pints (6.816 litres)	12 imp. pints (6.816 litres)
Engine No. Location	Stamped on front off-side of cylinder block.	

COOLING SYSTEM

Capacity	3 imp. galls. (13.64 litres)
Fan	2 or 4 blade, 17 in. (43 cm.)
Thermostat—Opening Temperature	176°F (80°C)

FUEL SYSTEM (DIESEL)

Tank Capacity	14½ imp. galls. (65.8 litres)
Injection Pump	
Plunger Stroke and Diameter	7 x 7.5 mm.
Injectors—Nozzle Holes and Diameter	4—0.25 mm.
Firing Order	1-2-4-3
Timing	23° B.T.D.C.
No Load Speed	1900 r.p.m. (engine)

IGNITION SYSTEM (PETROL)

Sparkign Plugs	14 mm., Champion N8B
Distributor Point Gap	Point Gap, 0.025 in. (0.635 mm.)
Firing Order	0.014-0.016 in. (0.356-0.406 mm.)
Timing	1-2-4-3
	1° B.T.D.C.

CLUTCH

Type	Dry—Single (Standard) or Double Plate (with "Live" P.T.O.)	
Diameter	Single Standard: 12 in. (30.48 cm.) Heavy duty: 13 in. (33.02 cm.)	Double 12 in. (30.48 cm.) (both discs)

General Specification

Friction Area

Standard :	123.75 sq. ins. (791.9 sq. cm.)
Heavy Duty :	157.82 sq. ins. (1018 sq. cm.)
Double :	125.6 sq. ins. (810.3 sq. cm.) each disc.
Pedal Free Play	1½-2 in. (38.1-50.8 mm.)

GEARBOX

Type	6 forward and 2 reverse speeds.
Lubricant	
Above 20°F (-7°C)	30 H.D. or 20 W/30 H.D.
Below 20°F (-7°C)	20 H.D. or 20 W/30 H.D.
Capacity	4½ imp. galls. (20.43 litres)

REAR AXLE

Type	Semi-floating with 4-pinion differential and foot pedal operated differential lock.
Capacity	9 imp. galls. (41 litres)
Lubricant	As Gearbox (see above)

OVERALL GEAR RATIOS AND ROAD SPEEDS (Standard Tyres)

GEAR	FINAL RATIO	1,200 R.P.M.		1,400 R.P.M.		1,600 R.P.M.	
		M.P.H.	K.P.H.	M.P.H.	K.P.H.	M.P.H.	K.P.H.
1st	123:1	1.56	2.51	1.82	2.92	2.07	3.34
2nd	87.3:1	2.19	3.53	2.56	4.12	2.92	4.70
3rd	68.4:1	2.80	4.5	3.26	5.25	3.73	6.0
4th	48.6:1	3.94	6.34	4.59	7.39	5.25	8.45
5th	34.8:1	5.49	8.84	6.41	10.3	7.32	11.78
6th	19.3:1	9.87	15.90	11.52	18.54	13.16	21.17
H.R.	50.7:1	3.77	6.07	4.40	7.09	5.03	8.09
L.R.	91.1:1	2.10	3.38	2.45	3.94	2.80	4.51

BRAKES

Type	Mechanically operated disc brakes
Friction Discs	
Number	2 (4 friction faces)—each side
Lining Area	22.12 sq. in. (142.7 sq. cm.) each face
Pedal Free Play	0.81 in. (20.57 mm.) at pedal stop

STEERING

Type	Recirculatory Ball
Lubricant	As Gearbox
Power Assisted (Optional)	
Pump	Belt-driven from crankshaft
Belt Free Play	1 in. (25.4 mm.) measured between pulleys
Lubricant (P.A. Unit only)—	
Above 10°F (-12°C)	S.A.E. 10 W
Below 10°F (-12°C)	S.A.E. 5 W

General Specification

HYDRAULICS

Type	Qualitrol/Position Control with Auxiliary Service Control and Flow Control Device—suitable for Category 1 or 2 implements.
Pump	Gear type driven from P.T.O. shaft at 1135 r.p.m. at engine speed of 1,600 r.p.m.
Pump Output	4.93 galls./min. (21.39 litres/min.) at 1,600 engine r.p.m.
Pressure Relief Valve	Two-stage unloading type opening at 2,450-2,500 lb./sq. in. (172.24-175.77 kg./sq. cm.)

POWER TAKE-OFF ("Live" P.T.O. Optional)

Speed (Standard)	542 r.p.m. at 1,200 r.p.m. (engine)
Speed (Raised)	540 r.p.m. at 1,600 r.p.m. (engine)
Type	6 splines, 1 1/4 in. (34.92 mm.) diameter
P.T.O. Shaft Rotation	Clockwise

BELT PULLEY

Type	Side Mounted—2-speed
Pulley Diameter	8 1/2 in. (21.6 cm.)
Pulley Width	6 1/2 in. (16.5 cm.)
Belt Speed—High	3,115 ft./min. (949.5 m./min.) at 1,400 r.p.m. (engine)
Belt Speed—Low	1,734 ft./min. (528.6 m./min.) at 1,400 r.p.m. (engine)

TYRE PRESSURES

Front	6.00 x 19—25 lbs./sq. in. (1.758 kg./sq. cm.) 7.50 x 16—28 lbs./sq. in. (1.969 kg./sq. cm.)
Rear	12 lbs./sq. in. (0.84 kg./sq. cm.) minimum for land work. 14 lbs./sq. in. (0.984 kg./sq. cm.) for road work.

TYRE SIZES

Front	Standard 6.00 x 19. Optional 7.50 x 16.
Rear	Standard 11 x 36. Optional 12 x 36, 14 x 30. Export only, 12 x 38, 13 x 30.

DIMENSIONS

Wheelbase	80 ins. (2.02 m.)
Overall Length	130.5 ins. (3.3 m.)
Overall Width	Max. 85 ins. (2.1 m.) Min. 65 ins. (1.6 m.)
Height to top of radiator shell	57.35 ins. (145.6 cm.)
Height to top of steering wheel	64.57 ins. (164 cm.)
Ground Clearance under front axle	19.5 ins. (49.4 cm.)
Ground Clearance under sump	20.5 ins. (52.0 cm.)
Ground Clearance under rear axle housing	23.0 ins. (58.4 cm.)
Ground Clearance under drawbar	12.75 ins. (32.38 cm.)
Height to top of implement mounting channel	31.25 ins. (82.37 cm.)

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