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# FRAZIER



## Phantom

## TDI



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# **THE FRAZIER PHANTOM TDI LOW GROUND PRESSURE VEHICLE OPERATOR INSTRUCTION MANUAL**

MANUFACTURED BY:

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**THIS MANUAL SHOULD BE KEPT WITH THE MACHINE AT ALL TIMES AND  
SHOULD BE READ BY ALL OPERATORS BEFORE USING, MAINTAINING OR  
REPAIRING THE MACHINE**

After reading this manual and becoming acquainted with the PHANTOM it is recommended that you fill the sprayer with water only and have a trial run in a grass or stubble field. It is important that you get used to all aspects of operating the machine before applying chemicals.

The machine has been designed specifically for crop spraying and fertiliser spreading and therefore does not come within the scope of the Agriculture (Tractor Cabs) regulations. It should, therefore, not be used for any other purpose and should not be used for towing or be fitted with any other equipment unless approved by the manufacturer.

Issue 1 - 20/8/99 - Applicable to machines manufactured from June 1998 - Build No. 642 onwards.(Melo axle)

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*This manual is also available on floppy disc as a standalone programme with its own built-in browsing system - please contact T.J. Frazier if you would like a copy.*

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**EC Declaration of  
conformity**

T.J. Frazier Ltd.  
The Airfield,  
Seaton Ross,  
York. YO4 4NF

Type: FRAZIER LOW GROUND PRESSURE VEHICLE

Model: PHANTOM TDI

Build no.: .....

Serial no.: .....

Month/year of manufacture: .....

This is to certify that the above machine complies with the  
Supply of Machinery (Safety) Regulations 1992 (S.I. 1992/  
3073) as amended by (S.I. 1994/2063) and has been self-  
certified by the above named company.

Signed .....

Date .....

On behalf of T.J. Frazier Ltd.



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# Safety Precautions

**For your own and, more importantly, other peoples safety please read this section carefully and remember the points made.**

1. The machine should only be used, maintained and repaired by people familiar with it and in doing so they should comply with the operating, maintenance and safety instructions in this manual.
2. The machine should not be driven at speeds in excess of 30 m.p.h. (50kph)
3. Maximum laden weight should not exceed 6 tonnes
4. Keep all nuts & bolts tight.
5. Do not permit any person to ride on the machine other than the driver.
6. Stop engine, apply parking brake and ensure gearshift is in "Park" before leaving seat.
7. Great care should be exercised when operating on steep gradients to maintain proper stability.
8. Always keep machine in gear when going downhill. Ensure 1st gear is selected on steep hills.
9. Brakes should always be kept in proper operating condition.
10. Ensure speed is low enough for an emergency stop to be effective under all load conditions.
11. Ensure all guards, covers and access panels are fitted at all times.
12. Ensure engine is stopped and handbrake applied before carrying out adjustments or lubrication.
13. Engine must be stopped before connecting, disconnecting or making any adjustment to the hydraulic power take off.
14. Never start the engine other than from the driving position.
15. Select neutral or "Park" and depress foot brake before starting engine.
16. The machine should be regularly maintained as per the maintenance schedule in this manual.
17. Before carrying out any repairs or welding on the PHANTOM, the sprayer or the spreader, remove all chemical and fertiliser residues with a pressure washer or steam cleaner together with a suitable detergent and brushing if necessary - Burning chemical fumes are extremely toxic - Ammonium Nitrate (e.g. Nitram) can be explosive. Chemical residues are extremely hazardous to anyone working on the machine.
18. Hose machine down regularly - do not allow dirt / fertilisers to build up on the engine, particularly ammonium nitrate - this can create a fire hazard!

**NB If any factory or field repairs have to be carried out on a contaminated machine we reserve the right to either refuse to carry out the work or to charge for any necessary cleaning.**

Agricultural chemicals can be very dangerous. Improper selection or use can seriously injure people, animals, plants, the soil or other property. Be safe: select the right chemical for the job. Handle it with care. Follow the instructions on the container label and instructions for the spraying equipment.-

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## Operation - Driving controls

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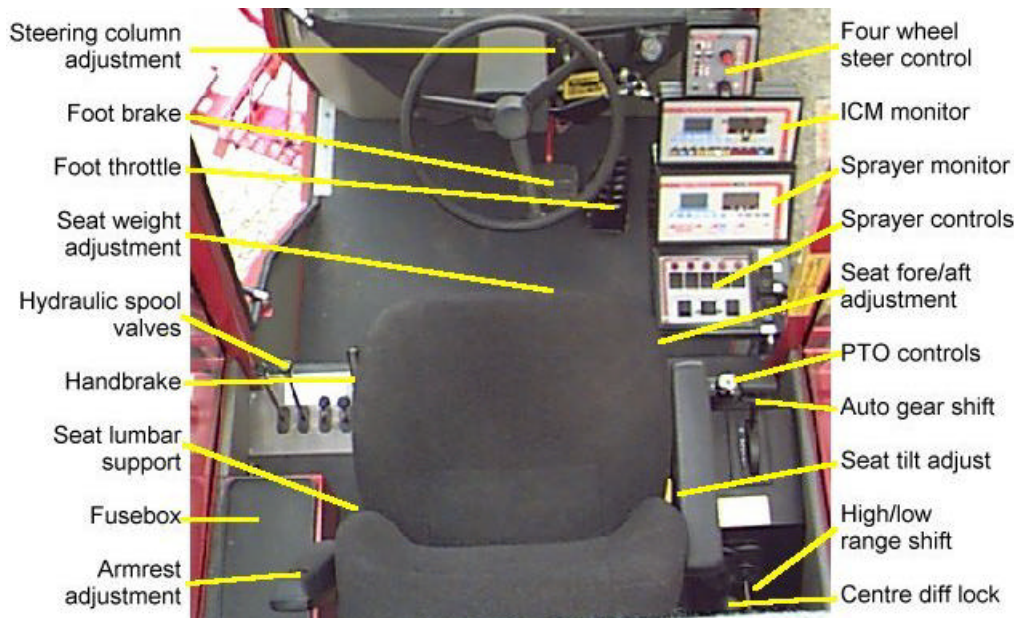
### Running in

There are no strict running in rules for the LandRover TDI diesel engine. However, do not treat it harshly during the first fifty hours running. Avoid consistently high speeds above 3000 rpm but do not let the engine labour. There should always be a positive response from the throttle. Select the right gear for the job. Be prepared to reduce your working speed if necessary. Check the instruments frequently and keep the coolant and oil filled to their recommended levels on a daily basis.

After the running in period speeds should be progressively increased up to maximum performance. The engine should not be run continually above 3500 rpm and should never exceed 4000 rpm (3500 rpm if fitted with high power PTO system - see appendices) or damage to the hydraulic system may result.

**After completing the first 50 hours running, carry out the maintenance instructions summarised in the maintenance section of this manual.**

### Main Driving controls



### Starting engine

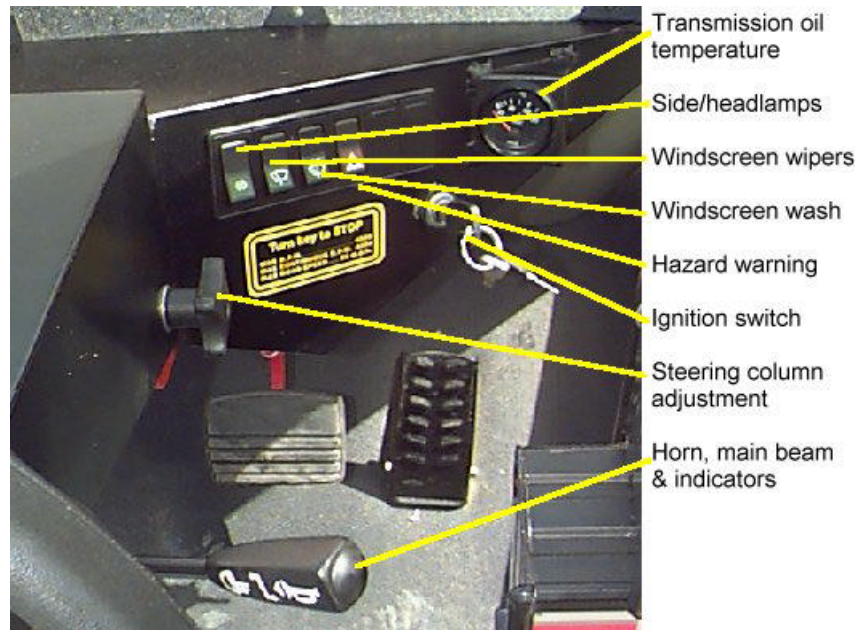
1. Ensure PTO is disengaged, handbrake applied and gearshift in Park or Neutral before starting.
2. Depress the brake and, turn the ignition switch to the centre position and wait until the 'glow plug' warning light on the ICM goes out (approx. 2-20 seconds depending on ambient temperature).
3. Crank the engine by turning the key fully clockwise. Release key when engine starts. If it does not start within 20 seconds or starts and then stops, return the key to the off position, wait a few seconds and then repeat the above procedure.
4. Allow engine to idle for a few seconds to allow oil to reach the turbo-charger. Avoid high engine revs until the engine and hydraulic system have warmed up.

After starting, ensure that the handbrake or footbrake are firmly applied and the accelerator pedal is not depressed while moving the gear selector lever from 'N' or 'P', other wise the vehicle may move immediately the selector lever is moved to one of the drive positions. This is particularly important whilst the engine is cold, because the engine will be idling at a faster speed than normal.

The first position on the ignition switch powers accessories only such as the Radio



### Dashboard controls



### Stopping engine

Before stopping engine ensure vehicle has completely stopped, apply handbrake and select 'Park'.

Allow engine to slow idle for at least 10 seconds before stopping particularly if you have been running at high engine revs to avoid damage to the turbo-charger bearings. If the engine stalls at any point, try to restart immediately.

To stop engine turn key anticlockwise.

### Handbrake

Situated at the left hand side of the operators seat. This should not be applied, other than in an emergency, whilst the vehicle is in motion or transmission damage may result.

A visual warning illuminates on the ICM monitor (see following pages) when the handbrake is applied and an audible alarm will sound if the machine is moved whilst it is still applied.

The brake operates on the rear drive shaft which may result in a slight movement of the vehicle after it is applied.

### Power steering

When turning do not hold the steering tight on full lock as this will cause the relief valve to blow off and the hydraulic system to overheat. Do not turn the steering whilst the PHANTOM is stationary particularly when on hard surfaces. This causes unnecessary, excessive pressures in the steering system especially when wide tyres are fitted.

For information on the optional four wheel steering system please see appendix 1 towards the rear of this manual.

To adjust the steering wheel position turn the knob on the side of the column anti-clockwise and move the wheel backwards and forwards until you find the most comfortable driving position and then re-lock by turning the knob clockwise. Do not adjust whilst driving!

## Operation - Auto transmission

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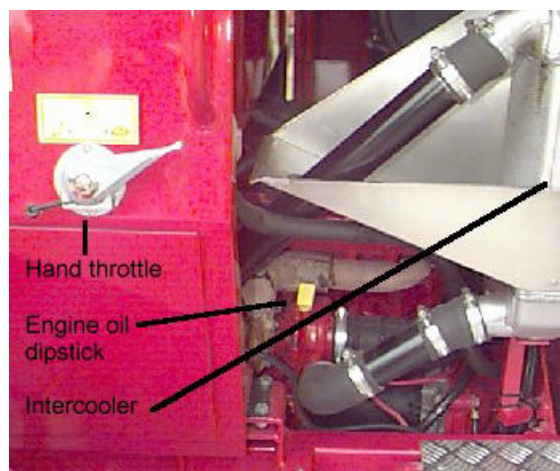
### Throttle

The PHANTOM is not normally fitted with a hand throttle in the cab. It is not possible to use a hand throttle for field use due to type of fuel pump fitted to the engine.

Due to the design of the fuel pump governing system and the automatic transmission you will find that you have to "drive" the PHANTOM with the foot throttle. Try to anticipate tough spots and be ready to respond with relatively large movements of the throttle to avoid the engine losing speed. With a little practice you will find a constant speed can quite easily be maintained.

A remote hand throttle is fitted onto the rear cab panel near the step. It is fitted to enable the PTO speed to be held at 540 rpm when stationary for self-filling the sprayer.

Ensure that the hand throttle is returned to the tick-over position immediately after use. Do not leave the machine unattended when the hand throttle is being used.



### Automatic transmission

The automatic transmission features a four speed main gearbox with a torque converter and a two speed transfer box. A central differential in the transfer gearbox distributes power to both front and rear axles, providing permanent four wheel drive. Using the main gearbox in conjunction with the transfer gearing produces eight forward and two reverse speeds

#### Main gearbox selector lever

A spring loaded catch restricts movement of the lever, thereby preventing inadvertent gear selection. Lift and hold the latch whilst moving to the required position.



**'P' Park** In this position the transmission is locked to prevent the vehicle from rolling away. Select ONLY with the vehicle stationary and the handbrake on.

**'R' Reverse** Select ONLY when the vehicle is stationary

**'N' Neutral** Use this position when the vehicle is stationary and the engine is to idle for a prolonged period (eg. at traffic lights)

**'D' Drive** Select 'Drive' for all normal driving on the road; fully automatic gear changing occurs on all four forward gears according to vehicle speed and accelerator position

**'3' 1st, 2nd & 3rd gears** Automatic gearchanging is limited to first, second and third gears only. Use for field work in good operating conditions with low pressure tyres fitted.

**'2' 1st and 2nd gears** Automatic gearchanging is limited to first and second gears only. Use for field work in more demanding conditions and when fitted with row crop wheels. In good conditions where your forward speed is relatively low or where you only have a light load you may need to use this position to stop the gearbox changing up to third gear. Although the engine/transmission may be perfectly happy in the higher gear you may find the engine speed is too low for you to attain the required PTO speed.

**'1' 1st gear only** Use at all times for steep hillside work where engine braking is required. If you are changing down from second to first it is most important that you slow down enough to ensure that first gear is correctly selected. ***The gearbox has its own built-in protection system so if your forward speed is too high it will not change down automatically until the speed has reduced.***

**Always leave the vehicle with the gear selector in 'P' (Park) position when parked.**

### Starting & driving

Drivers unfamiliar with the performance characteristics of an automatic gearbox should thoroughly familiarize themselves with the following instructions before driving:

- Before starting the engine, ensure that both foot brake and handbrake are applied.
- After starting the engine, keep both brakes applied before and whilst moving the selector lever to the required drive position.
- Keep the brakes applied until you are ready to move - remember, once a drive position is selected, an 'automatic' will tend to creep forwards (or backwards).
- Never 'rev' the engine while selecting a forward or reverse gear, or while the vehicle is stationary with a drive gear selected - remember, an 'automatic' will move immediately the accelerator pedal is pressed

### Gear change speeds

With 'D' selected, the speed at which gearchanges take place will vary according to the position of the accelerator: minimum acceleration will result in low speed gear changes, while larger throttle openings will cause the gearbox to delay gearchanges until faster speeds have been reached.

With practice, gear changes can be made to occur at a wide range of speeds depending on accelerator pedal pressure.

On long inclines and in some working conditions, the gearbox will change back and forth between gears. Under these conditions it is advisable to change down to the next lower gear to stop it 'hunting'.

### Kick-down

To provide extra power and acceleration through tough spots, push the accelerator pedal to the full extent of its travel in a single quick movement (known as kick-down). Up to a certain speed this will cause an immediate downshift into the lowest appropriate gear. Once the pedal is relaxed normal gearchanging will resume.

### Transmission oil temperature

A temperature gauge is fitted in the dashboard to monitor transmission oil temperature. The temperature should not continually exceed 120°C. Temperatures of up to an absolute maximum of 140°C are acceptable for very short periods of time - eg. ascending a very steep bank.

If the working temperature is consistently above 100°C check the transmission oil level and check that the oil cooler in front of the radiator is clear of dust and chaff.

## Operating - Transfer gearbox

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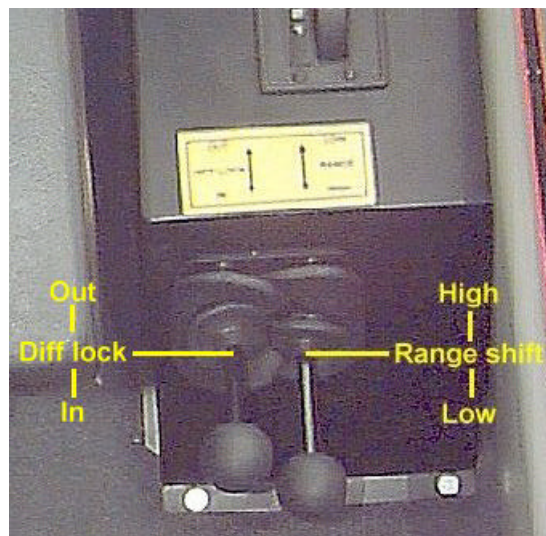
### Transfer gearbox

The second gearbox (known as the transfer gearbox) is used to select either the high or low gear range.

The low range should be used for all field work regardless of the wheels fitted.

High range should be used for road work only and allows a relatively high road speed to be used at relatively low engine revs.

**The maximum road speed of 30mph (50kph) should never be exceeded** - If you attempt to exceed this speed an audible warning buzzer will sound and the speed meter will flash. An engine cut-out will also come into effect just above the maximum permissible speed.



For some European countries the speed may be governed down to a lower speed and in some cases the transfer box may be locked into low range.

### Changing range

The easiest way to change range is whilst moving very slowly on the road or a hard track. Whilst slowing down to stop (**below 4mph**) release the accelerator, select 'N' and move the transfer lever quickly to the required high or low position. Reselect 'D' with the main gear selector and continue driving. *After a little practice, this operation can be carried out smoothly and quickly by using firm, positive moves.*

### Differential lock

The transfer gearbox is fitted with a lockable centre differential. With the differential locked, the drive shafts to the front and rear axles are (in effect) joined together, causing both to rotate at the same speed. This feature enhances traction when working in difficult and slippery conditions and when working on steep hillsides. With the differential unlocked for normal conditions and roadwork, the different running requirements of the two axles can be accommodated, thereby enabling the Phantom to operate permanently in four wheel drive for both road and field work.

### When to use the diff lock

As a general rule, the differential should only be locked on slippery or loose surfaces or on very steep hillsides. If any wheel slip is evident then it should, of course be used. However do not use it unnecessarily. **It must be disengaged for all road work.**

### Selecting diff lock

The diff lock can be engaged or disengaged either with the vehicle stationary, or when driving along. However, with the vehicle in motion it is essential to be travelling on firm ground, in a straight line and without wheel slip.

Do not engage the diff lock if one or more wheels are slipping - this could result in serious transmission damage. If wheels are slipping, ease off the accelerator before engaging the diff lock.

**Engaging diff lock** - Move the lever backwards - the warning lamp will illuminate when the differential engages. NB The lamp will only light up when the lock is actually engaged - rather than when it has been selected. Similarly it will only extinguish when the diff is actually disengaged.

**Dis-engaging diff lock** - Move the lever forwards. If the warning light is obviously reluctant to extinguish after the diff lock has disengaged, some transmission 'windup' may be present. Reversing the vehicle for a short distance and then going forward will usually 'unwind' the transmission.



### Foot brakes

As a safety precaution, the hydraulic braking system operates through dual circuits. If one circuit should fail, the other will continue to function, but increased pedal travel and longer stopping distances will be experienced.

### Servo assistance

The braking system is servo assisted, but ONLY when the engine is running. Without this assistance greater braking effort is necessary to safely control the vehicle, resulting in longer stopping distances. Always observe the following precautions:

- Never allow the vehicle to freewheel with the engine turned off (the steering will also be affected)
- Take particular care if the vehicle is being towed
- If the engine should stop for any reason whilst the vehicle is in motion, bring the vehicle to a halt as quickly as traffic conditions allow.

Remember! regular servicing is vital to ensure that the brake pads are examined for wear (especially when working in wet/muddy conditions) and changed periodically to ensure long term safety and optimum performance. When new brake pads have been fitted you should allow a period of time for them to "bed in" before optimum braking is achieved.

# FRAZIER ICM

## Introduction

The PHANTOM is fitted with a multi-function monitor which displays and monitors all the various functions relating to the engine, ground and PTO speeds, area covered etc. It has various audible and visual warnings built in and links to the sprayer controls, the four wheel steer system (if fitted) and to the air conditioning. It is relatively easy to operate and the majority of the calibration figures are factory preset.

In addition to the ICM you may have either an RDS Delta 3 or 4 sprayer controller fitted. The instructions later in this chapter for working out and setting the calibration factors for wheel circumference, can also be used for these units. The additional features of these units are explained in more detail in an accompanying booklet.

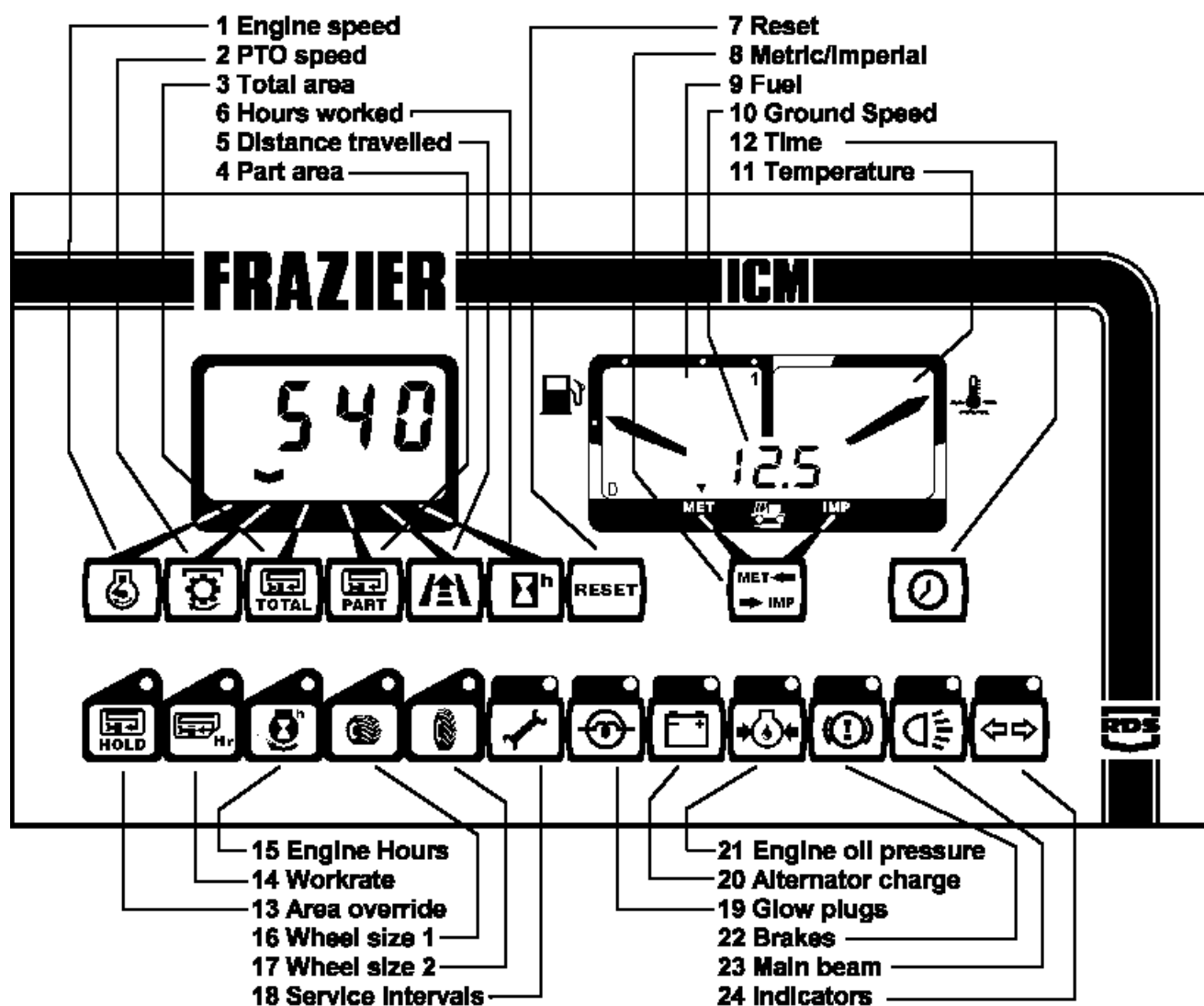
The calibration factors for all Deltas are normally factory preset, however, it is recommended that the wheel circumference be re-calibrated in field conditions, before using the machine, to ensure accuracy of applications.

## ICM Functions

The ICM will display any of the following information in one or other of the two display windows. Some functions are displayed permanently and some require a button press. The various warning systems are either simple warning lights or may be audible together with a flashing display. All the functions are described in more detail over the following pages. The numbered functions below are indicated on the facing page.

Function	Notes
1 Engine speed	Press to display engine speed in LH window
Engine speed warning	Visual and audible alarms for excessive engine speed
Engine speed warning	Automatic cut out for air conditioning compressor at low engine speeds
2 PTO speed	Press to display PTO speed in LH window
PTO speed warning	Visual and audible alarms for excessive PTO speed
3 Total area	Press to display total area covered in LH window
4 Part area	Press to display part area covered in LH window
Area cut out	Links to sprayer controls to stop acre meter when sprayer switched off
5 Distance travelled	Press to display distance travelled in LH window
6 Hours worked	Press to display hours worked in LH window
7 Reset	Press to reset either total area, part area, distance or hours worked
8 Metric / Imperial	Press to convert speed and information stored from metric to imperial
9 Fuel	Permanent display of fuel tank level
Low fuel	Audible and visual warning when fuel level drops to approx. 10 litres
10 Ground speed	Permanently displayed in either km/hr or mph
Ground speed alarm	Audible and visual alarm if 50 km/hr (30mph) exceeded
4WS alarm	Audible and visual warning to lock system for roadwork (over 19 km/hr)
11 Temperature gauge	Permanent display of engine temperature
Temperature warning	Audible and visual warning for engine overheating
12 Clock	Press to display time of day in LH window
13 Area override	Press to stop acremeter recording when in auto mode

14 Workrate	Press to display spot rate of work in LH window
15 Engine hours	Press to display total engine running hours in LH window
16 Wheel calibration 1	Press to select preprogrammed calibration for wheel size 1
17 Wheel calibration 2	Press to select preprogrammed calibration for wheel size 2
18 Service intervals	Press to display hours to and type of next service
Service reminder	Audible & visual warning to remind when service is due
19 Glow plugs	Glow plug warning light for engine starting
20 Alternator	Alternator charge warning light
21 Engine oil pressure	Engine oil pressure warning light
Oil pressure alarm	Visual and audible alarm if pressure low for 10secs with engine running
22 Handbrake	Visual warning light, audible alarm only when moving
Brake fluid	Warning light for low level, audible alarm if moving
23 Main beam	Warning light
24 Indicators	Warning light and audible beep with each flash



### ICM Operation

When the vehicle ignition is first switched on all segments of both displays will come on momentarily as it goes through its own test procedure. It will then display the same function that was selected last time it was switched off.

All internal accumulated data and programmed data is stored in the instrument memory whether it is connected to a power supply or not.

Please refer to the diagram on the previous page when reading the following instructions.



**1/ Engine speed** Press this button for the engine speed to be displayed in the LH window. The chevron in the bottom of the window will indicate that this function has been selected.

#### **Engine overspeed warning**

Should the maximum recommended engine speed be exceeded, (normally 4,000 rpm) the LH display will flash with the engine speed and an audible buzzer will sound.

#### **Air conditioning cut-out**

The ICM provides an output which is connected to the air conditioning system. This cuts the air conditioning out at engine speeds below 800 rpm.



**2/ PTO speed** Press this button for the PTO speed to be displayed in the LH window. The small chevron in the bottom of the display window will indicate that this function has been selected.

#### **PTO overspeed warning**

Should the maximum recommended PTO speed be exceeded, (normally 575 rpm) the LH display will flash with the PTO speed and an audible buzzer will sound.



**3/ Total area covered** Press this button for accumulated area to be displayed in the LH window. The small chevron in the bottom of the display window will indicate that this function has been selected. The instrument is normally connected to the sprayer or spreader master on/off control so that the area will only accumulate when is in work. When the sprayer/spreader is off the small chevron indicator in the bottom of the display will flash. When switched on it is steady to show the instrument is recording. The automatic cut-out can also be over-ridden manually (see below).



**4/ Part area** This operates the same as total area. The two area meters allow one to be used to check the area covered for each tank load or field whilst the other can be used to check the area covered over a day or any other period of time. Either area meter can be reset to zero at any time. (see below)



**5/ Distance travelled** This operates exactly the same as total & part area and will measure distance covered in miles or Km



**6/ Hours worked** Press this button to display the accumulated time (in hours) worked in the LH display window. It can be reset to zero whenever required (see below).





**7/ Reset** Area, distance and hours worked can be individually reset to zero at any time. To do so, firstly select the function that you wish to reset and then press and hold down the reset button. The display will flash for a few seconds and will then revert to zero.



**8/ Metric / Imperial** The ICM can convert any displayed or stored information between Metric and Imperial units at any time. A small chevron indicator at the bottom of the RH display indicates which units are currently selected. To convert from one to the other, simply press the Metric/Imperial button to move the chevron between the MET & IMP indices below the display window.



**9/ Fuel level** The LH side of the RH display operates like a conventional fuel gauge. Should the fuel level drop to around 10 litres the indicator bar will flash and an audible alarm will sound every 10 seconds.

**10/ Ground speed** The forward speed is permanently displayed in the RH window

**Ground speed alarm**

Should the maximum permissible forward speed (normally 30 mph) be exceeded the forward speed display will flash and the audible alarm will sound.

**Four wheel steer alarm (if fitted)**

The ICM provides an output for the electronic 4WS control. This activates at speeds above 12 mph. If the 4WS is not switched into "Road mode" when this speed is reached an audible alarm sounds in the 4WS control box and a visual warning illuminates.



**11/ Temperature gauge** The temperature display in the RH window works like a conventional gauge. There is also a two stage warning system built into the system to indicate engine overheating. At the first stage, when the indicator goes into the red sector, the indicator bar will flash and the audible alarm will sound. If the engine continues to get hotter the audible alarm volume will increase and "STOP" will flash in the LH display. The engine must be stopped when either of the alarms sound to avoid damage and the cause of overheating be investigated immediately.



**12/ Clock** Press this button to display the time of day in the LH window



**13/ Area override** Press this button to override the automatic cutout on the area meter. When you do so the area/distance meters will stop recording, the chevron in the LH display will flash and the L.E.D will illuminate on the override button. This can also be used if an automatic cut-out is not fitted to the sprayer/spreader controls.



**14/ Workrate** Press this button to show your spot rate of work in the LH display window. This will show your workrate in acres or hectares / hour as you are driving along.



**15/ Engine hours** Press this button to show the total accumulated engine hours worked by the machine. This function only records whilst the engine is running and cannot be reset.



**16/17 Wheel calibration** The ICM relies on an accurate wheel calibration factor being programmed in to enable it to display accurate information on ground speed and area covered etc. (Programming is covered later in this chapter). The instrument can be preprogrammed with two different calibration factors for different size wheels - e.g. Low pressure and row crop or, for extreme accuracy, different factors can be used for when working in soft/wet conditions and hard/dry conditions.

One of the L.E.D indicators on one of the wheel calibration buttons will be illuminated at all times to indicate which one is in current use. To change to the other, press and hold the button down for approximately 5 seconds (until it beeps).



**18/ Service intervals** When you press this button two pieces of information are shown in the LH display window - the number of hours remaining to the next service and the type of service due next (**F,A,B,C** etc).

#### **Service reminder**

When a service first becomes due the L.E.D indicator on the service interval button will illuminate and the alarm will sound once only. The LH display will also indicate that a service is due. After that a reminder will show on the LH display each time the engine is started and the L.E.D on the button will show continually.

When the appropriate service has been carried out it is then necessary to go into the instrument programming mode to reset the service interval reminder (see programming - later in this chapter). The L.E.D will then go out, the service hour counter reset and it will start counting down to the next service.

The different service types (**F,A,B** etc ) are indicated in the service schedule later in this manual.



**19/ Glow plug warning light** The L.E.D will illuminate when the ignition is first switched on and will go out when the engine is ready for starting. For more information on starting see the starting section earlier in this manual.



**20/ Alternator Warning light** If this warning light illuminates whilst the engine is running it indicates a fault with the charging system which should be investigated immediately.



**21/ Oil pressure warning light** This warning light should go out within a few seconds of start-up. If it is still on after 10 seconds the alarm will sound and the LH display will flash "**STOP**". The alarm will also be activated if the oil pressure becomes low at any other time when the engine is running. The engine should, of course, be stopped immediately should the alarm be activated and the cause investigated.



**22/ Handbrake / Low brake fluid warning light** This warning light will be illuminated at all times if the handbrake is on or if the brake fluid is low. An audible alarm will also sound if the machine is moving.



**23/ Main beam warning light** This warning light will be illuminated when the headlights are set to main beam.



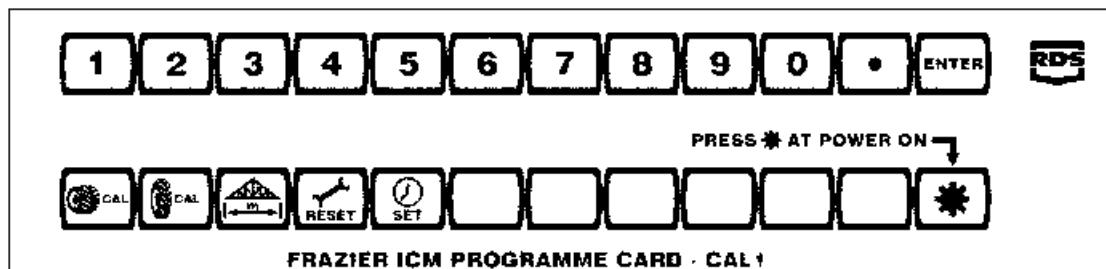
**24/ Indicator warning light** This warning light will flash and an audible beep will sound in conjunction with the direction indicators and hazard warning flashers.

### Programming

There are various inputs which must be programmed into the ICM relating to the machine and the sensors installed. The majority of these inputs are factory preset and cannot be altered by the operator.

The input data that can be altered by the operator can only be viewed or changed when the ICM is changed from its normal "Operating mode" to its "Programme mode"

A front panel overlay card is provided which indicates the new "programme mode" functions of each of the buttons along the bottom of the instrument.



**The ICM Overlay Card**

### Entry into programme mode

a/ Select either Metric or Imperial on the instrument according to which units you wish to use for programming and then switch the ignition off.

b/ Position the overlay card on the front panel of the instrument over the function buttons.

c/ Press and hold down the \* button whilst switching the ignition back on.

d/ The LH display will show "CAL1" to confirm that the ICM is in programme mode. The \* button should be released immediately that "CAL1" is displayed.

e/ The functions of all the lower buttons have all now changed to those indicated by the overlay card. The LH display will show the value of any of these factors currently set in the instrument simply by pressing the appropriate function button.

f/ The upper row of buttons (immediately below the displays) have also changed to become data entry keys having values of 1 to 9, 0, decimal point and ENTER.

## Operating - ICM data entry

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### Data entry procedure

All numerical data is entered by the same procedure as detailed below:

- a/ Select the programme function to be checked or altered by pressing the appropriate button on the overlay card. The LH display will show the numerical value currently stored for that function.
  - b/ If the value is correctly set then no further action is required. Simply select the next function to check or switch the ignition off to return to operating mode.
  - c/ To set a new value use the top row of buttons as numerical entry keys. Key in the number, as the first key is pressed the number will flash in the LH display and the RH display will flash "ENT". As the full number is keyed in, it will all appear in the LH display. Each key press is acknowledged with an audible beep.
  - d/ When the number is correctly set, press "Enter" to confirm the entry. The display will then stop flashing and the new data value is displayed in the LH window.
- If you enter your value incorrectly, simply press "Enter" at any time and then enter the value again.

### Data values

#### Wheel calibration 1 & 2

The data value to be set on these functions is the distance the vehicle travels forwards over 2 intervals between speed sensor pulses.

This data must be determined under practical operating conditions to allow for any wheel slip, sinkage or tyre deformation.

The PHANTOM is fitted with a propshaft speed sensor and the data programmed is the distance the machine travels forwards for two revolutions of the prop shaft. Determine this distance by driving the machine forwards for exactly 20 revolutions of the prop shaft, measure the distance travelled and divide this distance by 10 to determine the true "speed sensor factor" or distance travelled between 2 sensor pulses.

The following settings are the factory settings and are only approximate. The machine should be re-calibrated before use and the new settings recorded for future reference.

<b>Tyre size</b>	<b>Metric factor (metres)</b>
38x20x16 low pressure	0.453
500/60-22.5, 600/50-22.5	0.525
550/45 - 25.5	0.495
500/45 - 22.5	0.474
12.4x16 Intermediate	0.464
9.5x24 Intermediate	0.540
7.2x36 Row crop	0.617
8.3x36 Row crop	0.650
9.5x36 Row crop	0.688
7.2x40 Row crop	0.683

An alternative method of calculating the wheel factor, although not as accurate, is as follows:

Measure the distance from the ground to centre of the axle whilst in working conditions and approximately half loaded. Multiply this figure by 1.05 to get the wheel sensor factor.

### **Implement Width**

The data value to be set on this function is the full working width of the sprayer or spreader in either metres or inches.

### **Time set**

The data value to be set on this function is the time of day. Enter the hour followed by minutes e.g. 0915.

### **Service interval reset**

To reset the service interval counter press and hold down the function button for a minimum of 5 seconds. The LH display will then show the hours remaining to the next service and the next service type.

# Operating - Hydraulic PTO

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## Hydraulic PTO system.

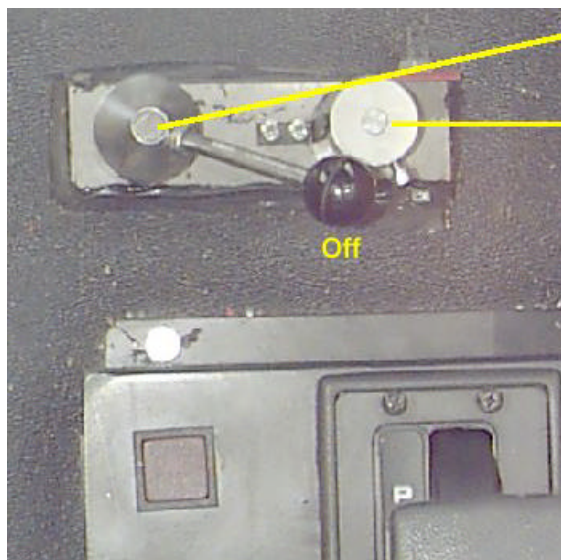
For information on the optional high power PTO system (Airtec) or non standard hydraulic systems please see appendices.

### Safety

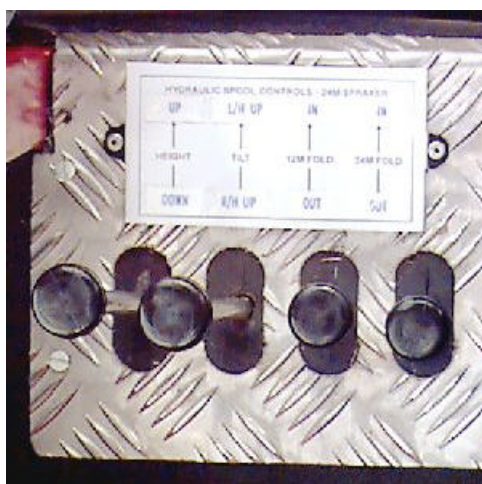
- Ensure PTO is disengaged before starting engine.
- The engine **MUST** be switched off before connecting the PTO or making any adjustments.

### Operation

The PTO is hydraulically driven, is fully independent and may therefore be engaged at any time providing the engine revs are not too high. The PTO controls are situated to the right of the seat and in front of the gear lever. To engage the PTO move the control lever to the left(as shown).



**PTO Control**



**The spool valve controls**

### Setting PTO speed

The hydraulic pump is geared so that 540 r.p.m. on the PTO is reached at a minimum engine speed of 1600 rpm. To set the PTO for 540, or indeed any other required speed, increase the engine speed to approx. 2000 rpm and adjust the speed with the knob adjacent to PTO control lever. The actual PTO speed can be read off the LH display of the ICM (see previous pages). Turning the knob anti-clockwise will increase the speed and clockwise will decrease the speed.

Once the speed is set, if the engine rpm is increased there will not be a significant increase in PTO speed. The PTO speed should never exceed 600 rpm. For most spraying operations you will find it is not necessary to always run the PTO at 540 rpm. Lower PTO speeds result in reduced wear and tear in the spray pump and hydraulic system, a lower engine power requirement and can help to prevent foaming in the spray tank.

If the sprayer is fitted with a high capacity spray pump e.g. 4, 5 or 6 cyl. the PTO speed should be set as low as possible whilst spraying. Speeds in the order of 350 rpm for a 6 cyl. pump and 450 rpm for a 4 cyl. pump are normally more than adequate to achieve working pressure with excess flow left for agitation. Higher speeds may result in overheating of the hydraulic system. The PTO speed can then be increased to 540 after each load for quick-filling if required.

It is important to ensure that sprayer filters are kept clean and that self-cleaning filters are working correctly at all times. Failure to do so will result in loss of PTO speed and overheating of the hydraulic system.

### Spool valves

The Hydraulic spool valves are operated by the levers to the left of the seat. The decal in front of the levers indicates the normal control functions for spray boom folding. There may be up to 6 valves fitted (4 normally fitted as standard) which can be any combination of single and double acting spools. A double acting spool can be safely used to operate a single acting service if required.

The hydraulic system/spool valve(s) fitted are only designed for intermittent operation of hydraulic cylinders and should not be used to power motors or other hydraulic circuits. Maximum pressure at the spools is approx. 2000 psi (124bar). Please consult the manufacturer if you require higher pressures or if wish to use them for any other purpose.

Please ensure that all couplings are clean before connecting hoses and that any couplings that are not in use are protected with plugs / caps. Ingress of dirt into the hydraulic system can lead to premature wear and possible failure of major components.

### Air Conditioning / ventilation

The air conditioning unit is integrated into the ventilation system within the cab roof. The unit will cool or heat the air which is partly drawn in to the cab through a carbon filter and partly re-circulated. This ensures the cab is kept positively pressurised to keep dust and vapours out of the cab.

### Operation

To operate the fan, turn the centre switch in the roof panel clockwise until you find the most preferred of the three speeds. The adjustable vents in the roof console can be directed to wherever you require the air.

## Operating - Cab ventilation

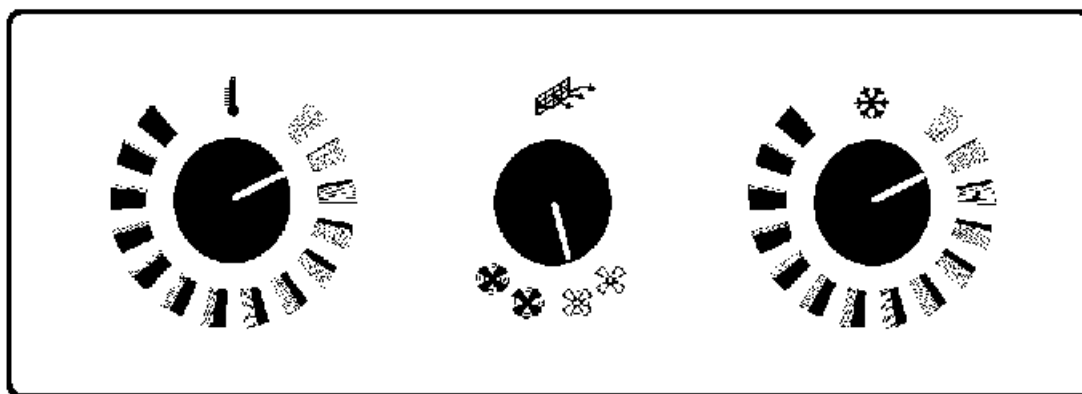
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To reduce the temperature of the air, turn the RH switch clockwise until the cab temperature is reduced as required. For maximum efficiency the LH control for the heater should be turned fully anti-clockwise. Remember the chiller will only work when the engine is running at over 800 rpm. Always keep the cab door closed to keep the cab cool.

To increase the temperature of the air turn the LH heater control clockwise and the chiller control anti-clockwise.

### Demisting

In damp conditions the heater control can be used in conjunction with the chiller to dehumidify the air entering the cab - to demist quickly turn both controls fully clockwise. For demisting on cool damp days turn the chiller control to the minimum setting, the heater to maximum and the fan to the second speed.



Heater control

Fan Speed

Chiller control

### Row crop work.

Only row crop wheels recommended by the manufacturer should be fitted to the PHANTOM. Fitting any other wheels will invalidate the warranty. Wheel track should not exceed 72" without consulting the manufacturer. (Unless Wide-track axles are fitted which allow up to 80" track with a maximum of a 1600litre sprayer). The top road speed is increased significantly when row-crops are fitted, however, a top speed of 30 m.p.h. (50 kph) should still NOT be exceeded. Speeds over 20 mph (32 kph) should only be used if the tyres fitted are suitable.

Please read notes on steering stop adjustment if you are fitting row crops on a PHANTOM with a wheel track of less than 68". The stops may have to be altered to maintain adequate wheel/cab clearances. It is also advisable to service the brakes as a matter of course before fitting row crop wheels in the Spring.

It is recommended that the front crop deflector and underbelly crop sheet be fitted when working in tall crops particularly as harvest approaches. This not only reduces crop damage but also protects the underside of the machine and stops the crop being pulled into the drive belts, shafts and alternator etc.

The front mounted crop deflector also helps to prevent the radiator from blocking. It may have to be extended for use in oil seed rape and some other tall crops. If so please ensure that the extension does not restrict the air flow into the radiator, especially when being used on the road.



### Field Operation

The optimum working speed of the PHANTOM in reasonable conditions is 6-9 mph. (10-14 kph) This speed is normally achieved in second gear for 7.5 mph (12 kph). If conditions are good, you may be able to travel in third gear as long as the engine is not labouring.

Try to keep between 1700 and 2800 rpm. Slow down and select a lower gear if necessary.

High engine revs will result in higher engine temperatures and fuel consumption.

The suspension of the PHANTOM gives it a relatively smooth ride compared with a tractor, however, it should still be driven with care and respect especially over rough ground.

Should you get badly "bogged down" when working in wet conditions, ensure that mud has not been forced up into the crankshaft pulley / drive belt area. If it has, then thoroughly clean the area and check that the camshaft drive belt cover has not been damaged and that mud has not got inside the cover. Please seek advice immediately, from T.J. Frazier Ltd., if it has.

### Field planning.

Try to plan your field before you start work. You will soon find out what the PHANTOM is capable of. If a field has any particularly wet areas or steep banks, plan the field so that your load is reduced before you reach them. If it has a very steep hill in it, it is advisable to reduce your working speed to 6 mph to do the whole field. 1st and 2nd gear can then be used. When spraying at relatively high speeds, it is very important that your working speed is maintained to avoid over or under dosing. For this reason it is important that two 12 metre bouts are sprayed around the headland before spraying the rest of the field. When spraying the rest of the field maintain your speed as you travel onto the headland and do not start to turn until the sprayer is switched off. After turning, straighten up, and try to get up to your target speed before switching back on.

When spraying with a wide boom do not change direction suddenly particularly when in 4WS mode or severe under/over dosing will occur as well as passing high shock loads on to the spray boom. Use 2WS mode whilst spraying down the field and try to turn as smoothly as possible at the ends.

### Potatoes.

When spraying potatoes with row crop wheels fitted it is most important that care is taken when turning. If a dummy headland is left between the field rows and the headland rows you may find it necessary to shunt when turning to avoid crossing over the headland rows. Go as slow as possible (bottom gear) if turning over the rows is unavoidable to ensure unnecessary strain on the machine is kept to a minimum.

### Sugar Beet.

When spraying sugar beet you will find it best to look forwards and drive by the centre of the machine rather than trying to look down at the wheels. Fit a centre marker on the bonnet if necessary. For low-dose/high pressure spraying forward speed should not exceed 6 mph (10 kph). We recommend the use of a jet which will apply 7+-10 gals (75-110 l/ha) at 5 mph (8 kph) at 45-50 psi (3.25-3.5 bar). E.G. Lurmark 015-F110 (light brown).

### Choice of jets.

We recommend the use of 110 degree fan nozzles for general high speed spraying. These will give better coverage than 80 degree jets with a more appropriate droplet size. Twin outlet or twin jet caps will give even better coverage. However, you should always check on your chemical container for recommendations regarding forward speed, pressure, spray quality and water rates before choosing which nozzles to use.

## Operating - Speed / fertiliser spreading

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### Forward speed

Most spraying operations can be carried out at 7.5 mph (12 kph), however the following points should be taken into consideration: The spray boom should ride evenly and should not bounce and yaw about. An unstable boom is one of the main causes of uneven application and is probably the main reason why chemical manufacturers and suppliers often recommend a slower working speed. If the crop is particularly dense or tall and good penetration is essential reduce your speed to 6 mph (10 kph). Also remember that, contrary to popular belief, increasing pressure does not increase penetration. It simply increases the number of smaller droplets which will settle on the upper leaves or blow away. e.g. for pre-harvest Round-Up a max speed of 6 mph (10 kph) and a pressure of 30 psi (2 bar) is recommended. If conditions are particularly rough, even if the boom is stable, it may pay to reduce speed for the sake of the machine.

### Fertiliser spreading.

#### Vicon spreaders. (Oscillating spout type)

When using Vicon spreaders the following points should be noted: When first fitted, the height of the spout on the spreader is higher than that specified by the manufacturer. However, once loaded and in the field you will find it will be a lot nearer the correct height above the crop. It is far better to be too high than too low and this should have no significant effect on the spread pattern. As a guide, the last bit of fertiliser should be hitting the previous wheeling. When spreading Nitram, or similar prilled material, the rear mudguards should be removed to avoid any effect on the spread pattern.

The spreader has a built-in shock absorber in its spreading mechanism to avoid shock loads being passed down the PTO shaft. It is very prone to seizing up. It should therefore be checked each time it is used to avoid possible damage to the shaft and hydraulic motor. Check as follows: Wedge the flywheel so it can't move in either direction. Push a screwdriver or bar through the PTO shaft yoke and try to turn the shaft. It should move approx. 20 degrees against the force of the shock absorber and then spring back to the central position. If it does not it should not be used until it has been repaired. If in doubt please consult T.J. Frazier.

#### Lely Centreliner spreaders.

Ensure there is a sheet fitted across the front of the spreader to avoid fertiliser being thrown forwards onto the machine. This is most important and a better sheet than the one supplied with the spreader should be fitted if necessary. Please remember the warranty does not cover faults caused by corrosion!

Due to the relatively low pressure that the PHANTOM hydraulics work at, the hydraulic control on the spreader may be too slow. If it is, remove the restrictors in the end of the actuating rams. However take care if it is also used on a tractor - it may then work too fast and damage may result.

A purpose made mounting frame is now available from T.J. Frazier which carries the later Centreliners on a 3 point linkage. This allows the tilt angle to be altered with a special top link and allows use of the headland tilt facility on the spreader.

#### Amazone spreaders.

Mounting frames are available for both Amazone ZAU and Amazone ZAM spreaders. A guide is available from T.J. Frazier for setting the spreaders up, however, as with all spreaders, it is advisable to have them tray tested before use.

### Seed Drilling

Only seed drill conversions supplied or recommended by T.J. Frazier Ltd. should be fitted to the PHANTOM. Incorrectly fitted drill units will invalidate the manufacturer's warranty, may be hazardous to the operator and may seriously reduce the life of the machine or some of its major components.

The only drills currently suitable for fitting to the PHANTOM are those of the pneumatic type with lightweight, Suffolk coulter toolbars up to a maximum width of 4 metres.

Make sure you follow the safety, operating and maintenance instructions given by the respective drill manufacturer.

### Operation

When drilling with the PHANTOM, a PTO speed of 520 rpm is normally more than adequate to operate this type of airseeder.

Whilst drilling the engine speed should not exceed 3000 rpm and ideally should be kept below 2600 rpm.

Wheel track eradicators should be set as shallow as possible to keep the draft load on the PHANTOM to a minimum and following harrows should only be fitted to 3m units.

### Service & Warranty.

The PHANTOM carries a 12 month / 500 hour warranty on defective parts and workmanship. It does not cover faults caused by incorrect use and servicing or faults caused by fertiliser or chemical corrosion.

All servicing should be carried out as per this instruction manual during the warranty period. The first service is normally carried out by the customer after the first fifty hours running. If any faults are apparent on delivery, at this first service or during the warranty period we would be grateful if you would notify us as soon as possible even if the fault is rectified by yourselves. We have found many people repair straight-forward faults themselves without telling us, however our policy is one of continual improvement and with your co-operation together with any suggestions and ideas we shall continue to improve the machine to our mutual advantage.

If any problems occur with the machine please contact your supplier, without delay, with whom you can discuss the best way to deal with the problem to avoid unnecessary delays. If a repair is carried out by yourselves or by an outside engineer to save time, and you wish to claim costs under warranty, we must be notified first or the claim will not be accepted under any circumstances. Unauthorised repairs may affect or even invalidate any remaining warranty. Any parts replaced must be returned to us for assessment.

If our service engineers are called out at any time, to work on the machine or if the machine has to be returned to our works for repair, it must be thoroughly cleaned to remove all chemical and fertiliser residues to enable the work to be carried out safely and effectively. If the machine is not clean, we reserve the right to either refuse to carry out the work or to charge for cleaning.



### Maintenance and technical information.

The life of the PHANTOM will depend on the care it receives throughout its life. It is the operator's responsibility to ensure that the machine is correctly operated and that the maintenance operations outlined in this manual are carried out regularly after the specified hours of operation are reached. If you are unsure of how to carry out any of the maintenance operations please do not hesitate to enlist the help of either your dealer or T.J. Frazier Ltd.

Please remember that the PHANTOM is unlike a tractor in many ways and the standard of maintenance needs to be much higher. It is designed primarily as a light weight machine and so consequently the components used in its construction have to be lightweight and are often of automotive origin. These parts will generally last just as long as heavy duty components providing they are inspected, serviced and maintained regularly. The PHANTOM is fitted with suspension and a rubber mounted engine so consequently not only are the drive line components more open to the elements but there are more moving parts which are also more subject to wear and tear. Engine hoses, cables and wiring looms are also more susceptible to wear and tear and also need regular inspection. Finally the machine is much more susceptible to general corrosion, seizure of components and electrical problems than a tractor due to the mounting position of the sprayer and fertiliser spreaders - right on top of it!

When carrying out your weekly service it is well worth spending a little time looking over (and under!) the machine and checking the condition of hoses, wear on drive shafts and for any signs of chafing or things coming loose. Also take the opportunity to go round with the oil can and lubricate anything that moves - particularly when working with fertilisers. An hour a week can save expensive down-time later on.

All nuts and bolts should be checked for tightness after the first days operation, especially axle u-bolts, wheel nuts, steering joints and track rod ends and propeller shaft bolts. Check engine and hoses for fluid leaks regularly during the first few days of operation.

Please refer to the condensed maintenance guide for service intervals.

### Engine oil

#### Checking oil

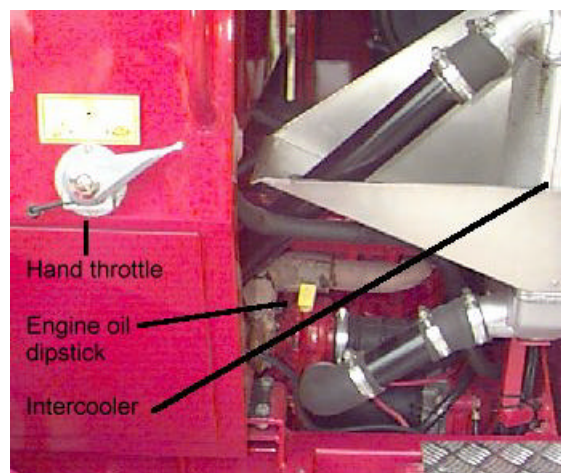
Check oil level daily ensuring that the PHANTOM is stood on level ground. Use SAE 10W/30 or a high quality 15W/40 oil meeting one of the following specifications:

Res 22.0L.PD2,

ACEA B2:96,

API-CE.

The use of a universal tractor oil is generally not recommended.



Check the oil when the engine is hot and with the vehicle on level ground.

Allow the engine to stand for 5 minutes to allow the oil to drain back into the sump.

Withdraw dipstick and wipe clean.

Fully reinsert dipstick and withdraw to check level.

The level should NEVER be allowed to fall below the bottom level mark on the dipstick.

**Do not fill above 'Max' mark on dipstick**

## Maintenance - Changing engine Oil

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**NB** If it is necessary to check the oil whilst the engine is cold, DO NOT start the engine. Follow the procedure as above and re-check the oil level once the engine has reached working temperature.

As a general guide if the level is nearer to the upper mark than the lower one then add no oil

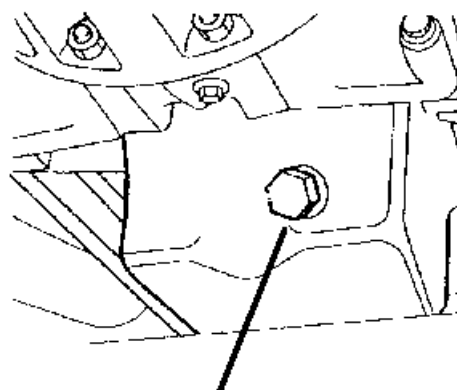
If it is nearer the bottom mark than the top one add half a litre.

If it is on the bottom mark or below it add one litre of oil.

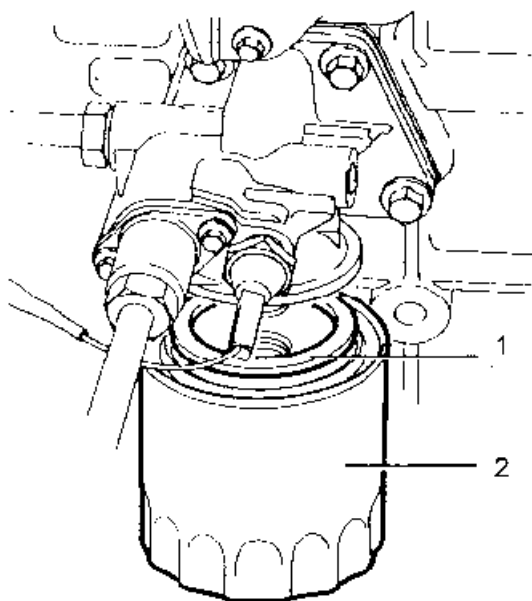
### Changing oil and filter

1. Warm engine to normal operating temperature.
  2. Make sure machine is stood on level ground, stop engine and turn battery isolator off.
  3. Remove oil filler cap from rocker cover, place suitable draining tray under engine and remove drain plug from oil pan.
  4. Using a suitable strap wrench, unscrew the oil filter canister one complete turn.
  5. Position a suitable draining tray underneath the filter and remove the filter from the engine casting by hand. Discard the old filter canister.
  6. Thoroughly clean the oil filter housing face.
  7. Partly pre-fill the new filter with clean oil of the correct type. Apply a thin film of clean oil to the filter sealing ring.
  8. Screw on new filter until sealing ring abuts the filter head and tighten a further 1/2 turn.  
**DO NOT OVERTIGHTEN.**
  9. Replace sump drain plug and fill engine via filler neck in rocker cover. Total oil capacity (inc. filter) is 6.5 litres.
- NB** either a cranked or flexible ended funnel will be required for filling oil through the rocker cover filler neck.
10. Replace oil filler cap, run engine and check for any leaks from the oil filter.
  11. Stop engine, allow oil to settle and top up as necessary.

**DO NOT OVERFILL**



Sump oil drain plug



1. Rubber sealing ring  
2 Oil filter

### Drive belts

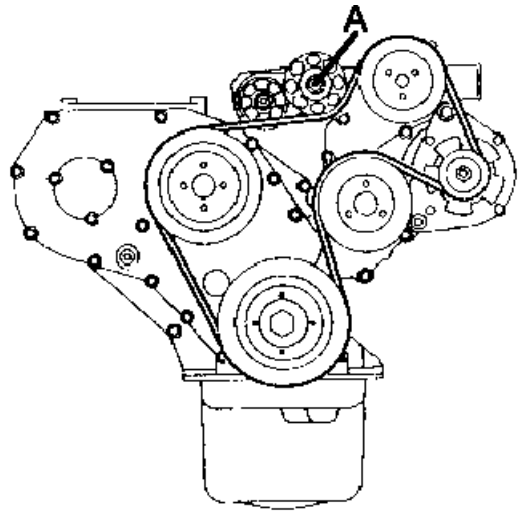
The 300 TDI engine uses a 'serpentine' type drive belt, which drives all the ancillaries except for the air conditioning compressor.

An automatic belt tensioner keeps the belt at the correct tension, thereby eliminating the need to manually check the belt tension.

The belt and all pulleys should be examined regularly for any damage, deterioration or fouling with mud, grit or chaff etc.

Under normal use the belt should be changed every 1,200 hrs or every 2yrs but in adverse conditions it may need changing at 600hrs or less.

***Before checking or adjusting any drive belt, turn off the battery isolator switch to prevent the engine from being started***



### Replacing drive belt

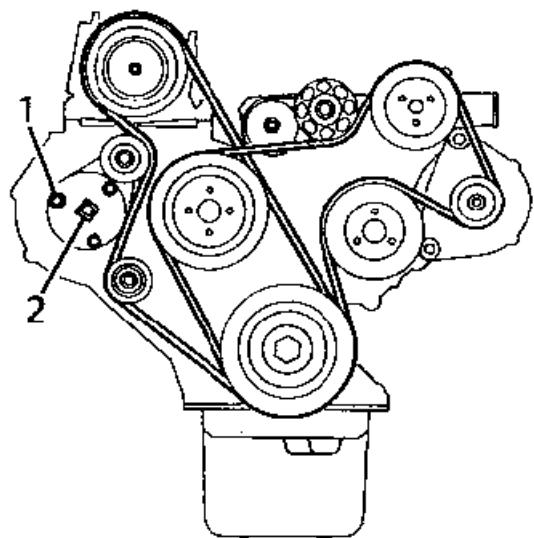
1. Disconnect both hydraulic and fan drive shafts.
2. Fit a 15mm ring spanner on to the tensioning pulley centre bolt (A above right) and turn anti-clockwise to release tension.
3. Remove belt and release tension gently.
4. Check all pulley grooves for wear and cleanliness.
5. Turn tensioner anti-clockwise again and fit new belt.
6. Re-fit drive shafts (see notes on page 32)

### Air conditioning compressor belt

To tension the belt correctly an accurate torque wrench will be required.

Slacken the 3 bolts (1) securing the tensioner

Apply a clockwise torque of 35Nm to the square drive (2) of the tensioner and tighten the bolts to 25Nm





## Maintenance - Pump drive

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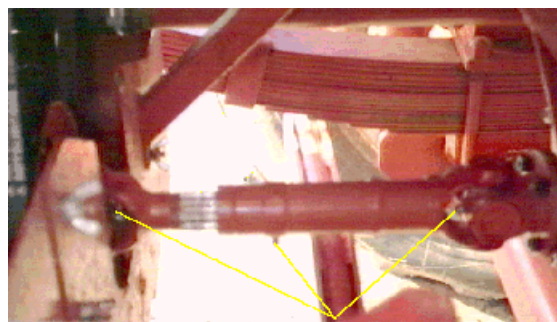
### Hydraulic pump drive

The hydraulic pump is driven by a propeller shaft connected to the front engine crankshaft pulley.

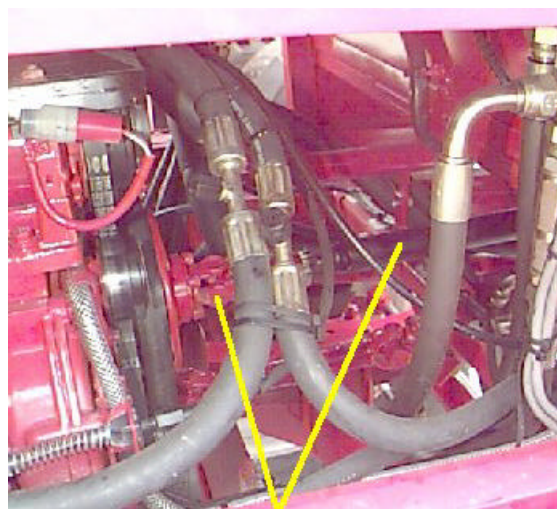
This shaft should be greased weekly or every 50 operating hours. There are 3 grease nipples on the shaft - one on each universal joint and one on the centre sliding section.

One end of this shaft will have to be removed to replace any of the drive belts. It is recommended, and is in fact easier, to disconnect this from the hydraulic pump end.

***Take care not to pull the two shaft halves apart - If you do so it must be put back together in exactly the same position to ensure it stays in balance. (Each half is marked with a series of centre punch marks to indicate correct position)***



Hydraulic pump drive grease points



Cooling fan drive shaft

### Cooling fan drive

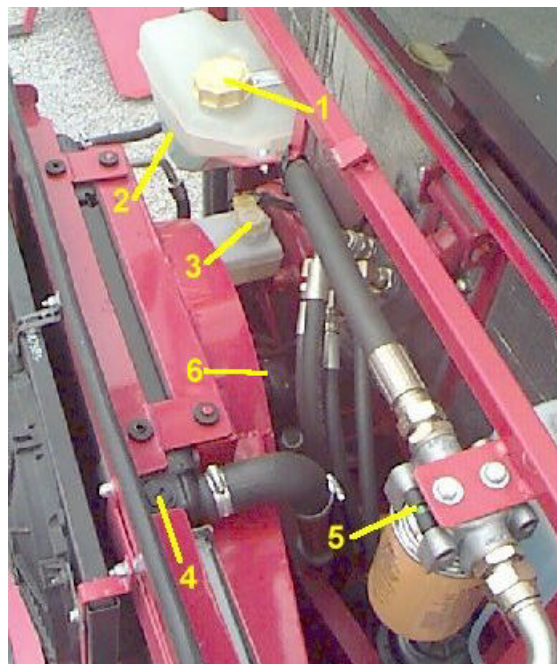
The radiator cooling fan is driven by a shaft going underneath the cab from the engine. There are two support bearings, two universal joints and 1 shaft slider which require greasing every 150 hrs (5 grease nipples in all)

The shaft will have to be removed from the engine end to enable fitting of belts etc

***Take care not to pull the two shaft halves apart - If you do so it must be put back together in exactly the same position to ensure it stays in balance. (Each half is marked with a series of centre punch marks to indicate correct position)***

### Cooling fan

The cooling fan has a viscous coupling which does not require any maintenance. It can be removed from the end of the drive shaft to facilitate removal of the fan cowling and radiator but **please note it is a left hand thread**



6 Fan shaft support bearing



### Cooling system

The coolant level is visible through the transparent walls of the degas tank. The coolant should be level with the 'Max' mark when the engine is cold. **DO NOT OVERFILL.** Allow engine to cool down until the back of the hand can be held against the cylinder head without discomfort before removing cap. Only turn the cap to the first stop so that pressure in the system is released then wait a few seconds before removing the cap completely.

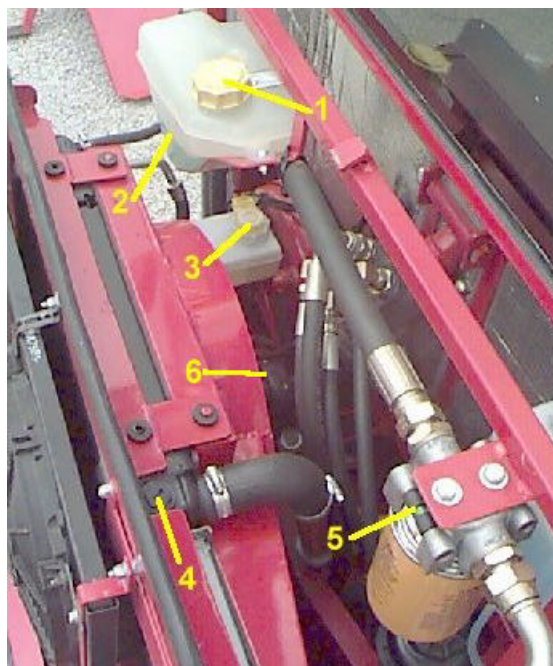
Never use cold water to top-up the cooling system of a hot engine, particularly if the coolant level is very low. This could cause serious damage to the engine.

The system should only be topped up with a water / anti-freeze mix as specified below.

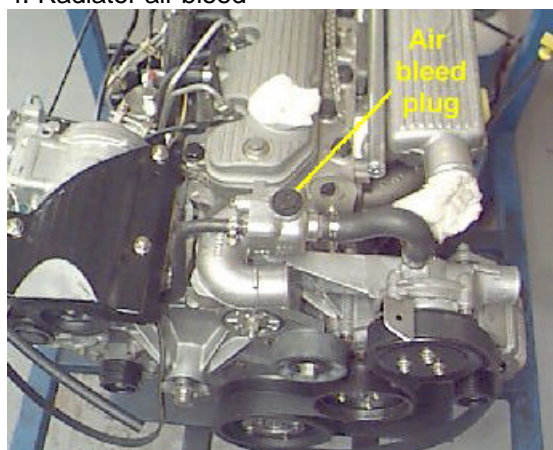
Ensure that the pressure cap is re-tightened correctly before running engine.

After two years the cooling system must be flushed out and coolant replaced. When the coolant is replaced or if a high quantity of coolant has to be used for topping up then care must be taken to ensure the system is free from air. To do this remove the radiator air bleed plug and add coolant through the degas tank until it can be seen that the top hose and radiator are completely full. Re-fit the plug and top up to the correct level. The engine should then be run (with the cab heater turned on) until it reaches normal working temperature and then switched off and allowed to cool and the water level re-checked.

If the system is completely drained it is also necessary to remove the engine air bleed plug in the thermostat housing. (see right)



- 1. Filler cap
- 2. Maximum level indicator
- 4. Radiator air bleed



Coolant capacity is approximately 2.75 gal (12.5l). It is recommended that you use LandRover pre-mixed antifreeze (particularly if you are in a hard water area) or a proprietary ethylene glycol based antifreeze (containing no methanol) with non-phosphate corrosion inhibitors suitable for use in aluminium engines. Use one part anti-freeze to one part water for protection down to -33°C Please check with your supplier that the antifreeze you use meets this specification to ensure full warranty cover.

A fine mesh screen is fitted in front of the radiator and should be kept clean at all times. It can be cleaned by brushing lightly or blowing out with an airline.

Ensure that the radiator core is also kept clean - inspect it regularly but take care if using a pressure washer to clean it - it is very easy to flatten the fins which will reduce air flow through it.

For late season spraying it is recommended that the optional crop deflector be fitted to the front of the PHANTOM to not only reduce crop damage but also to avoid blocking of the radiator grill/screen with pollen etc.

## Maintenance - Fuel system

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### Fuel system

It is particularly important to keep the fuel system well maintained - If even only slight traces of contamination or water are allowed to get past the filtration system and into the injection pump, the engine performance will be seriously affected and serious damage will be caused to the pump.

### Fuel tank

The fuel tank holds approx. 19 gals (86 litres). Use clean diesel fuel only. Always fill the tank at the end of the days work to avoid condensation. Drain the diesel tank periodically. (At least every 300 hrs) Take care to ensure the cap is correctly fitted after filling and when washing off do not direct a pressure washer directly at or under the filler/breather.

### Water/sediment trap

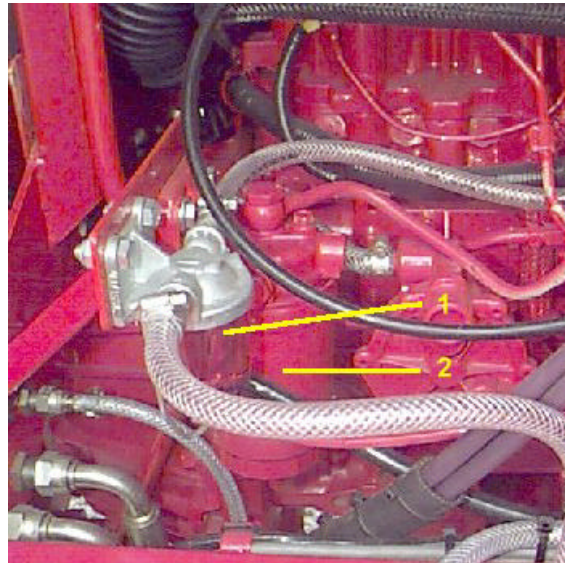
A water trap/sediment bowl is fitted in the suction line between the tank and fuel filter. The glass bowl should be checked weekly for any signs of water or sediments. The glass bowl should be removed, emptied and cleaned before it gets half full of water. When the bowl is removed you will also find a gauze mesh filter under the head unit which should also be removed and thoroughly cleaned. Failure to keep this mesh clean will result in loss of engine power. When replacing the bowl take care not to overtighten the thumbscrew.

### Draining fuel filter

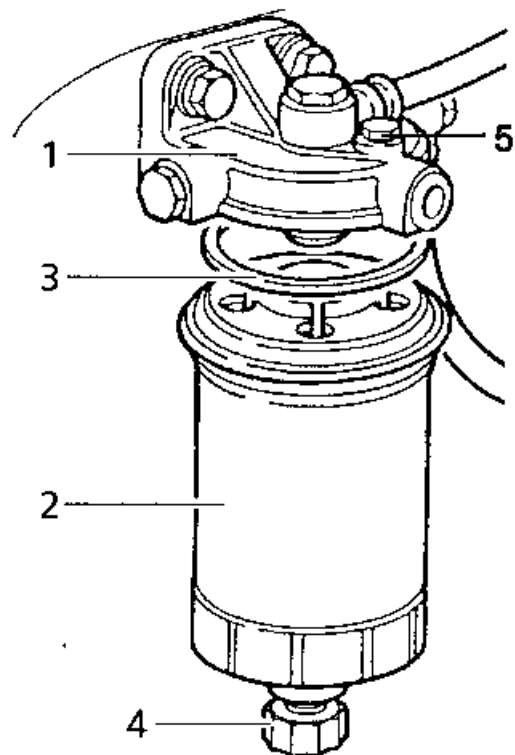
The fuel filter unit should also be drained regularly (every 50 hrs). To do so slacken the valve underneath the filter assembly to allow any accumulated water to drain from the filter.

### Replacing fuel filter element

1. Ensure filter head (1) area is clean.
2. Drain fuel from fuel filter.
3. Using a strap wrench, unscrew the filter(2) and catch the fuel released in the container.
4. Wet the seal of the new filter (3) with diesel fuel and screw the filter into position and tighten.
5. Ensure the drain tap (4) at the base of the filter is closed.



1. Water / sediment trap
2. Fuel filter



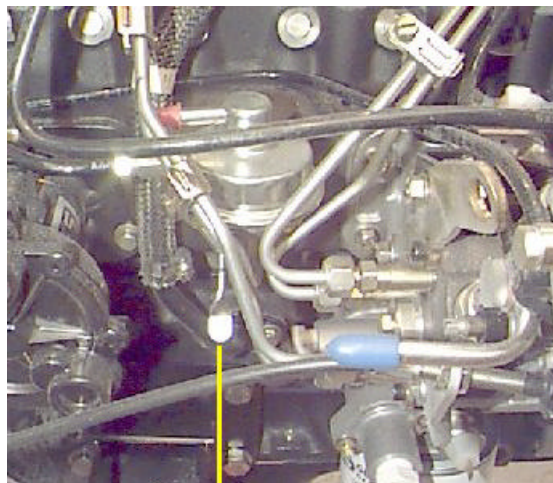
Fuel filter assembly:

1. Filter head
2. Filter element
3. Sealing ring
4. Water drain
5. Air bleed screw

### Bleeding the fuel system

The injection pump on the TDI engine is self priming, however, should you change the filter or run out of fuel, the system may need bleeding as far as the fuel filter. A hand pump is fitted to the engine for this purpose.(see below).

1. Slacken off the bleed screw on top of the fuel filter.
2. Operate the lever on the lift pump repeatedly until air-free fuel flows from the filter outlet.
3. Tighten the bleed screw on top of the fuel filter.
4. Start the engine as normal but avoid turning the engine over continually for above 20 secs to avoid damage to the starter motor - it may take several attempts.



Fuel lift pump lever

### Valve clearances.

The valve clearances on the TDI engine require adjustment every 600hrs. The clearance for both inlet and outlet valves is 0.2mm

### Camshaft / injection pump drive belt.

The camshaft drive belt should be replaced as a matter of course every 1200 hours. This routine work can be carried out by either ourselves, by some of our main dealers or by your nearest LandRover dealer.

Special tools are required and the job should not be attempted without these tools and the appropriate service manual.

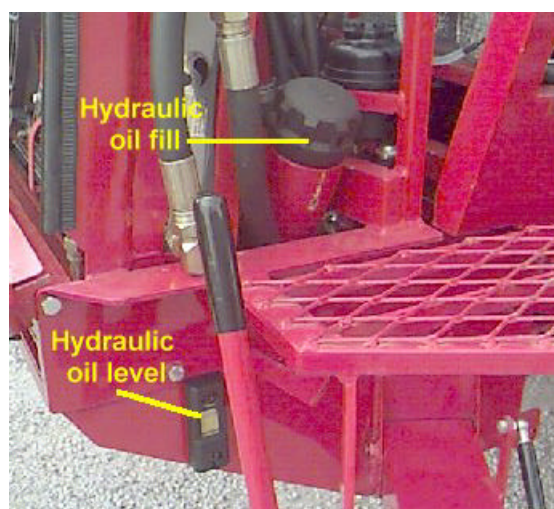
***Failure to replace the cam belt at the recommended intervals or failure to follow the correct fitting procedure can lead to belt failure which will result in serious and costly engine damage.***

### Hydraulic system.

The standard hydraulic system develops a maximum of 6hp (at the PTO) Please consult the manufacturer if you wish to drive anything other than a conventional diaphragm sprayer pump or Vicon, Lely Centreliner or Amazone twin disc fertiliser spreaders.

**Do not alter the relief valve settings** on either the spool valve or flow divider without consulting the manufacturer. They are preset at: PTO flow control (main relief) 2000 PSI, Spool valve relief valve 1200 PSI, front steering 1250 PSI and rear steering 1450 PSI.

See appendices for information on uprated and non-standard hydraulic systems.





## Maintenance - Air cleaning

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### Hydraulic oil

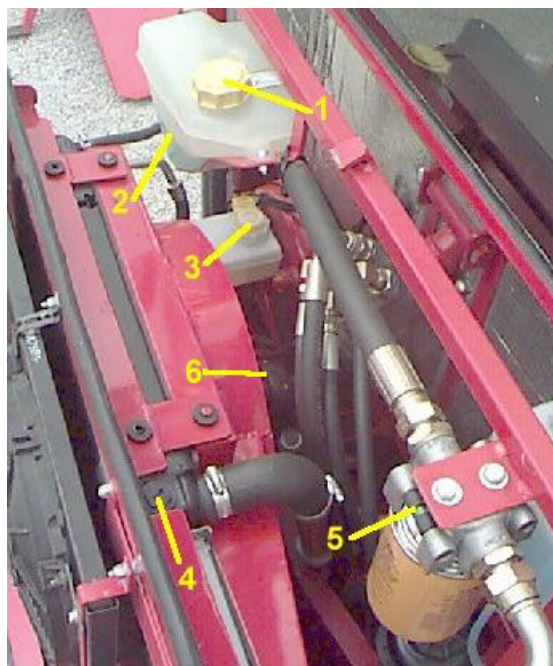
Ensure the hydraulic system is kept clean. Be careful when refilling tank. Do not direct high pressure hose at filler/breather cap. Oil level should be kept to top of level/temperature gauge. Use good quality, clean hydraulic oil for topping up only ( I.S.O VG 68 ). Do not use universal oils. The oil should always look clear and clean - If there are any signs at all of cloudiness or "milky" the oil should be changed.

### Oil filter

Change return line filter when indicator on filter unit turns red or at least every 12 months. If excessive oil contamination is evident the oil should also be changed and the suction filter (inside tank) should be removed and washed out. If this filter is removed ensure that no contamination gets inside the suction pipe or into the inside of the filter.

### Oil cooler

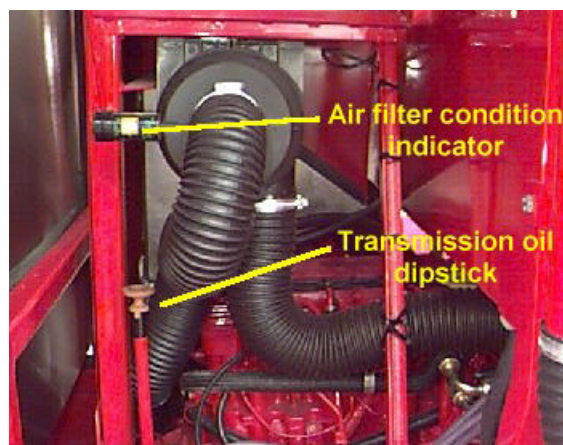
If an oil-to-air cooler is fitted in front of the engine radiator, ensure that it is kept perfectly clean along with the radiator behind it at all times. Failure to do so will lead to overheating of the hydraulic and/or engine cooling systems.



5. Hydraulic filter condition indicator

### Air Cleaning System

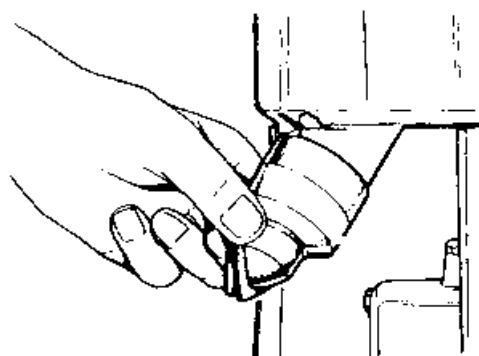
The PHANTOM is fitted with a Filter Minder air restriction indicator. This has a scale which shows when the air cleaner is getting dirty. It is fitted on the side of the air filter assembly. It is reset by pressing the rubber button on the end of the indicator. Avoid opening the air filter assembly until the gauge indicates 18" air restriction. Service BEFORE the yellow indicator reaches the red line.



When the air filter element does need servicing, replace it with a new one. Do not attempt to clean it. The condition of the air intake hoses should be checked regularly for signs of wear or damage and should be replaced if necessary.

### Dump Valve

The dump valve is situated on the end of the filter housing (see right). Squeeze the valve open to release any accumulated particles every 50 hrs.



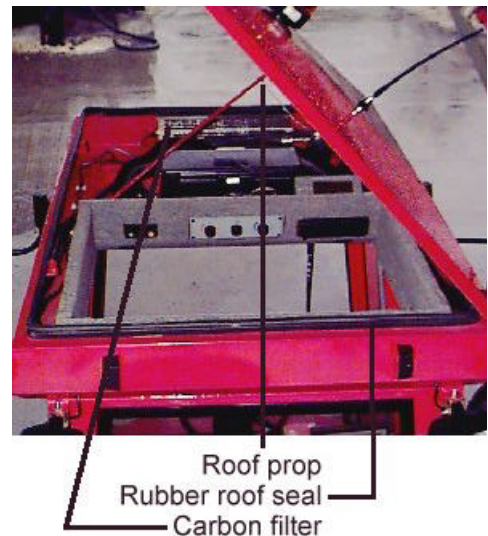
### Intercooler

The intercooler cools the air between the turbocharger and the air inlet of the engine. This is to increase the density of the air so the engine has more oxygen for combustion. It is therefore important that both the air inlet grill on the side of the engine cover and the intercooler radiator behind the engine are kept clear of dust and debris to maximise the airflow from the electric fan. The fine mesh grill on the outside of the engine cover can be removed for cleaning by removing two self tapping screws.

The intercooler can be removed for cleaning and to ease access to the engine compartment by slackening the two hose clips at the engine end and then lifting the top intercooler support bar off the locating pegs. The whole assembly can then be lifted clear. **Take care not to get any dust or dirt into the open ends of the hoses, air intake or turbocharger.**

### Cab Filtration Unit

The PHANTOM cab is fitted with an integrated air conditioning and carbon filtration system. The air inlet filter will filter out dust and small particles and the carbon element of the filter will filter out chemical particles and vapours. The carbon in the filter will only remain effective for up to a maximum of 6 months, whether the machine is being used or not, as the carbon degenerates when in contact with the air. If the machine is being used continuously it is recommended that the filter be changed every 300 hrs. If the machine is not being used for a long period of time, its life can be extended by removing the filter and storing it in a plastic bag.



### Lifting / lowering the roof

1. Remove the two studs to the left of the cab roof.
2. Stand on the cab entry step and lift the roof.
3. Swing the roof prop upwards and locate in its support bracket.
4. When lowering the roof ensure that the rubber seal around the roof is in good condition and that it seals correctly - Failure to do so will cause unfiltered air to be pulled into the ventilation system.
5. Replace the two studs in the cab roof.

### Filter replacement

Remove the rubber strap from over the top of the carbon filter and remove it from its frame. Place it in a plastic bag and dispose of properly. When fitting the replacement filter ensure that the rubber seal around the filter is located correctly to avoid contaminated air being pulled in past the filter.

### Air conditioning

There are no user serviceable parts in the air conditioning system, the only regular maintenance being the servicing of the compressor drive belt - as described earlier in this manual.

It is recommended that the system is serviced annually by a qualified refrigeration engineer.

The refrigerant gas currently being used is a hydrocarbon gas - HR30. NB this gas is highly flammable and for this reason the system must not be interfered with. However It is perfectly safe under normal operating conditions with the system charge being relatively small at only 14 ozs.

## Maintenance - Gearbox, Electrical

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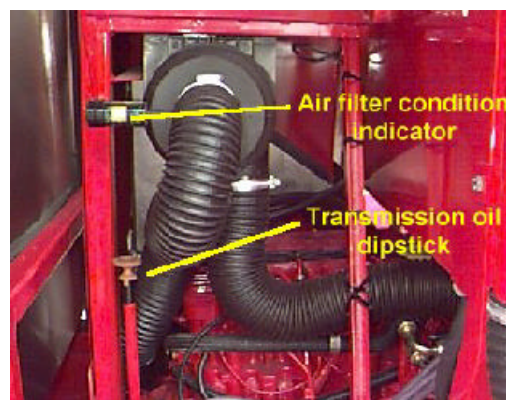
### Automatic transmission oil

The transmission fluid level should be checked at least every 50 hrs. It should be checked when the fluid is cold and with the engine **idling in neutral**.

Ensure the level is kept between the two small punched holes on the dipstick. **NB approx 0.25l will raise the level from the lower mark to the upper one - Do not overfill**

Use ATF Dexron IID for topping up - top up through the dipstick tube.

The oil and the oil filter screen in the bottom of the gearbox should be changed either by Frazier, your dealer or by a suitably qualified engineer every 600 hrs



### Transfer gearbox oil

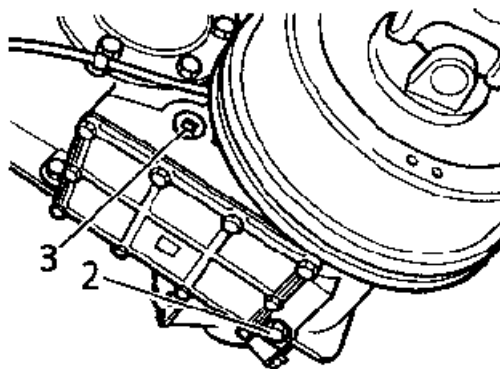
The transfer gearbox oil level should be checked every 300 hours.

The level can be checked by removing the level plug (3). It should be topped up through the same hole until it begins to run out.

The oil should be drained (2) and changed every 1200 hours. Use one of the following oils.

MIL-L-2105 90W EP

MIL-L-2105B, C & D 80W EP



### Battery

The battery fitted is 'maintenance free' and topping up is not normally required throughout the normal life of the battery. However, the level should still be checked when periodic services are carried out. Ensure terminals are kept clean and protected with petroleum jelly.

An isolator switch is fitted to the outside of the battery box near the step for use in emergencies or when any welding or repairs are being carried out to the machine.

### Wiring system

A main feed is taken from the battery to a power distribution "bobbin" on the main electrical panel inside the main fuse box. The same panel is fitted with all the main fuses and relays.

The ICM, 4WS, wipers and fuel pump solenoid are all powered through the ignition switch. However the lights, roof fan and auxiliary controls are powered directly from the fuse box so make sure everything is switched off when leaving the machine stood or you may return to find a flat battery.

NB. It is most important that all wiring connections in the engine compartment and under the bonnet are protected from the corrosive effects of fertilisers and chemicals. All connections should be frequently checked, cleaned if necessary and coated with oil, grease, or any other suitable anti-corrosive lubricant.



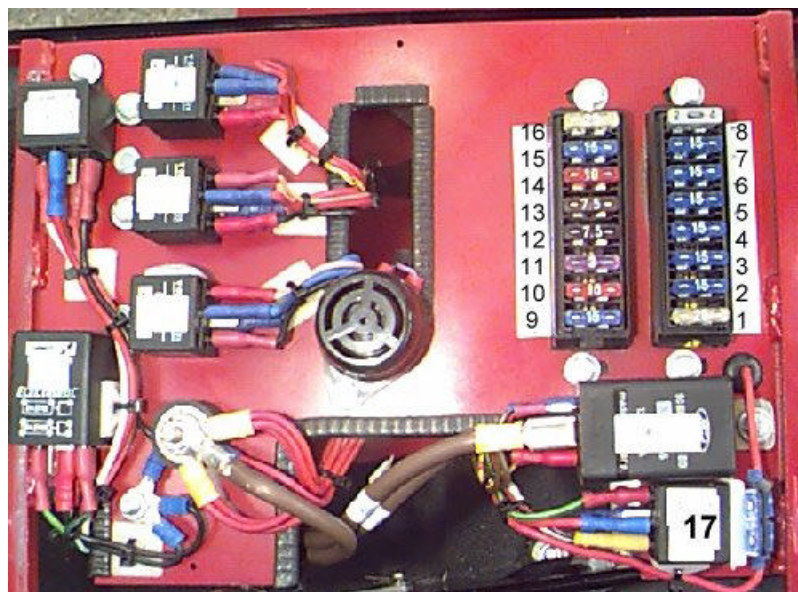
### Fuses

The fuse panel can be accessed by lifting the storage shelf lid on the left hand side of the cab. The complete panel can be lifted out of the box. **Ensure the battery isolator is turned off before removing the fuse panel.**

Should any fuses require replacement please ensure they are replaced with the correct size or serious damage to the wiring system and particularly the electronic components can occur.

The large Ford relay on the electric panel controls the glow plug timing. This is protected by a fuse link wire where the feed connects onto the power distribution bobbin. This link will melt in the event of a direct short.

### Fuse panel layout



1 Intercooler fan	25A
2 Auxiliary controls / boutmarker	15A
3 Cigarette / power socket / condenser fan	15A
4 Rear work lamps / beacon	15A
5 Front work lamps / interior lamp	15A
6 Headlights /flash / horn	15A
7 Air con compressor / Hazard warning	15A
8 Four wheel steering	2A
9 Ventilation fan / wiper park / radio	15A
10 Wipers / screen wash	10A
11 ICM warning buzzer, diff lock lamp	3A
12 RDS Delta / ICM / 4WS activation	5A
13 Indicators / relay feeds	7.5A
14 Engine fuel solenoid / Brake lights	10A
15 Spray controls (motorised valves only)	15A
16 Ignition switch feed	25A
17 Starter activate	15A

## Maintenance - Brakes

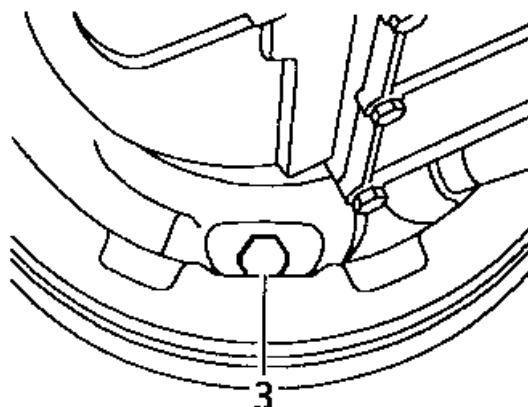
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### Handbrake

#### Adjustment

1. Chock the wheels and ensure the brake lever is off.
2. Raise one of the rear wheels clear of the ground and support the axle with an axle stand.
3. Tighten the adjusting bolt (3 right) until brake drum will not rotate by hand.
4. Slacken the adjuster by turning it 1.5 turns anti-clockwise and ensure the drum rotates freely.

If the actuating cable becomes slack, the free play can be taken up by adjusting the cable fitting in the cab (see right).



#### Lubrication

A grease nipple is also fitted into the operating cable approx 300mm up from the brake calliper. This should be greased every 50 hours.

#### Shoe replacement

If the adjuster reaches the end of its travel, the brake shoes will need replacing.

To do so the rear prop shaft will need to be removed and the drum will then slide off after slackening off the adjuster.

The drum should be removed every 600 hours to clean the brake. If you are working in very wet and muddy conditions or if you are spreading a lot of fertiliser then it may require cleaning every 300 hours.

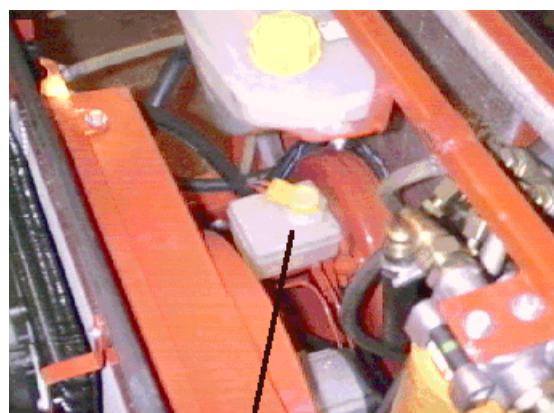
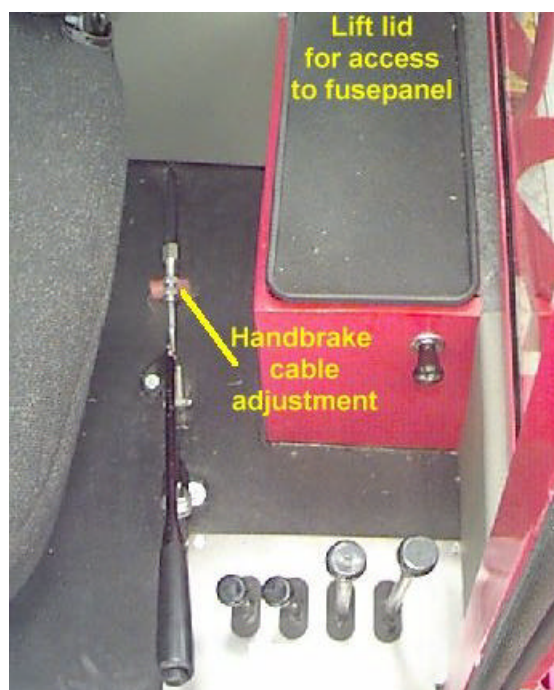
### Foot brakes

The brake master cylinder is situated in front of the cab and behind the radiator. Top up with 'Universal' brake fluid to between the 'max' and 'min' marks on the reservoir.

The linkage from the brake pedal to the master cylinder should be lubricated regularly. There is also a grease nipple on the lower brake linkage pivot shaft under the cab floor.

The brakes are all self adjusting discs and only need to be checked for wear periodically. Have the pads replaced before they get right down to "bare metal".

If you use your PHANTOM to spread a lot of fertiliser, inspect the metal brake pipes regularly for signs of corrosion and replace if necessary.



Brake fluid resevoir



### Steering

#### Fluid level

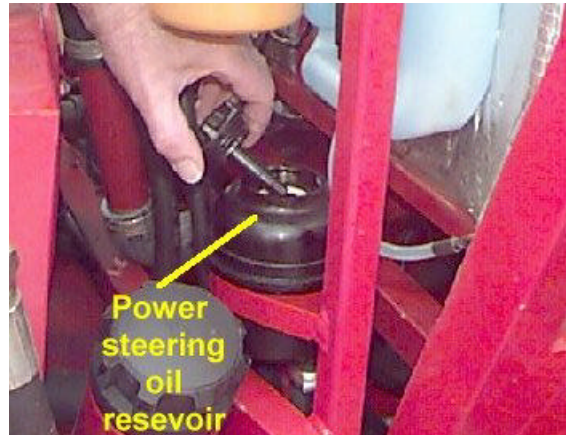
The steering on the Phantom is hydrostatic with the oil supply for the steering unit being taken from a belt driven pump on the engine. The fluid reservoir is situated under the bonnet (see right).

The fluid level should be checked at least every 50 hours.

***The fluid level should be checked only when the system is cold, with the engine switched off and the front wheels facing straight ahead.***

Ensure the filler cap area is clean to prevent dirt from entering the reservoir.

Remove the filler cap and, using a lint free cloth wipe the dipstick clean. Refit the cap, screw right down and then remove it again to check the level. If necessary top up with **Dexron II D** automatic transmission fluid. **DO NOT overfill**



#### Lubrication

There are grease nipples on the steering king pins which require greasing periodically (see illustration).

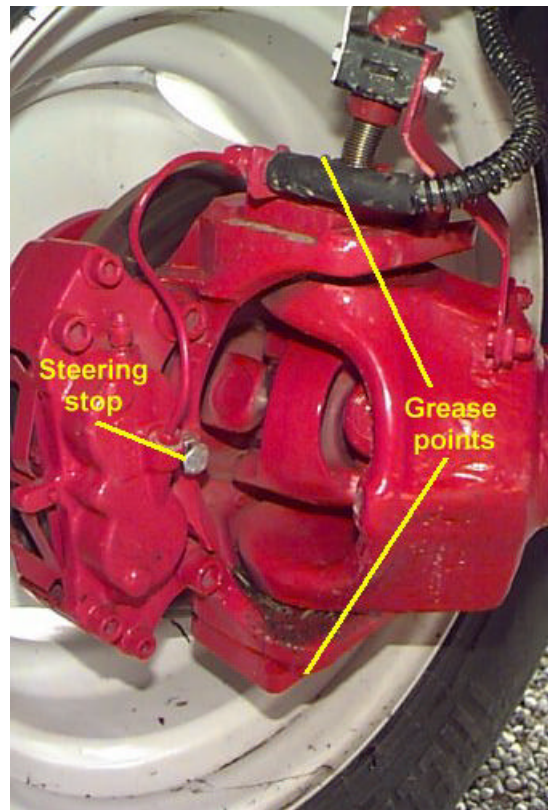
**Please note on four wheel steer machines the front and rear steering systems are not connected in any way - either mechanically or hydraulically. See appendix 1 for further information on the four wheel steering system.**

#### Steering stop Adjustment

When fitting row crop wheels for late season work you may find it necessary to adjust the steering stops to stop the wheels fouling the cab. This will almost certainly be the case if you are working on track widths of less than 68".

To adjust the stops, firstly turn the steering until the wheels are just clearing the cab on LH lock and then simply slacken off the lock-nut and screw out the stop until it touches the swivel housing. Repeat for RH lock.

**When screwing the stops in, it is important that they are not screwed in further than the original factory settings.** This will cause the swivels to over-rotate causing damage to the seals and may also result in damage to the axle drive shafts.



## Maintenance -Axles

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### Axle drive shafts

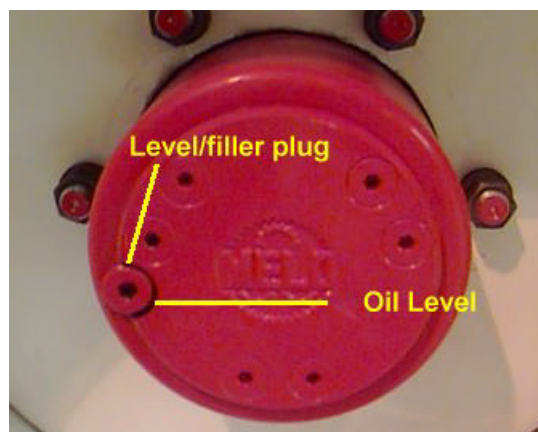
The axle drive shafts are fitted with sealed universal joints and therefore require no maintenance. However **it is essential that swivel housing area is kept clean**. When working in adverse conditions any mud or crop debris that accumulates around the drive shaft must be washed out daily. If it is left to accumulate it will wear the hub and axle oil seals which will eventually cause oil leaks and premature wear to the wheel and drive shaft bearings.

### Wheel hubs

The wheel hub/epicyclic units on the Phantom axles are filled with oil. The level should be checked every 300hrs. The hub should be rotated until the oil level/filler plug is in the position as shown on the right.

Use EP80/90 for topping up.

The oil should be changed every 1200 hrs. To drain the oil rotate the hub until the level/filler hole is at its lowest position.



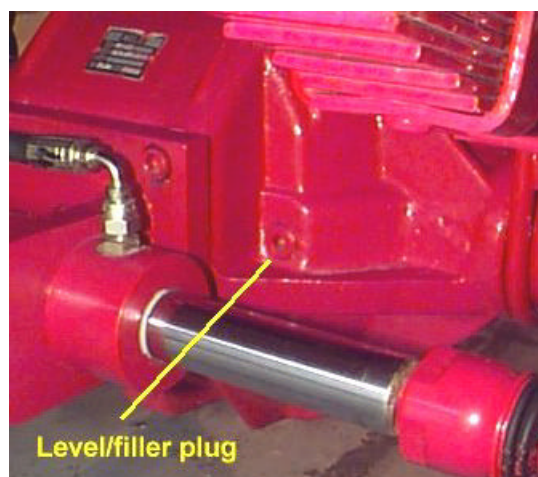
### Wheel Bearings

The wheel bearings should be checked regularly for signs of play. Should any play become evident they can be adjusted by either T.J. Frazier, your dealer or by a suitably qualified engineer.

### Axle Oil levels

Use SAE 90/140 gear oil for topping up the axle oil levels. The filler/level plugs are shown on the diagrams on the right

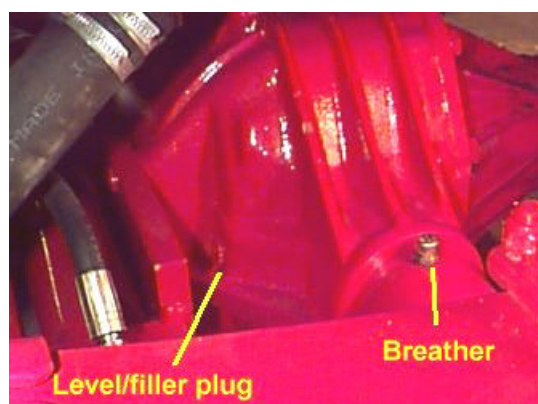
The axle oil should be changed every 1200hrs.



Rear axle (4ws version shown)

### Axle breathers

Should any axle oil leaks develop, the axle breather should be removed first and checked to make sure it is not blocked. Some breathers have a small ball fitted inside which is prone to seizure, particularly when spreading fertiliser.



Front axle

### Wheel alignment

The front axle should have a toe-in of 1-2mm and the rear steer axle (4ws machines only) should toe-out 1-2mm.

### Greasing.

Grease nipples are located as follows and all nipples should be greased every 50 hrs.

Prop shafts - 2 on each universal joint and 1 on the centre sliding section

Hydraulic pump drive shaft - 1 on each joint and 1 on the centre sliding section

Fan drive shaft - 1 on each joint, 1 on sliding section, 1 on each support bearing

Handbrake cable - 1

Footbrake linkage - Underneath RH front corner of cab

Axle king pins - 4 on front axle (4 also on four wheel steer rear axle)

### Tyres

The low pressure tyres are normally preset at 11 psi (0.7 bar). The pressure may be reduced in adverse conditions to as low as 6 psi (0.6 bar) depending on the load being carried. However the main thing to watch is that the tyre side walls do not crease when loaded. If the machine is being used for long periods on the road the pressure should be increased to 14 psi (1 bar). Row crop tyres should be inflated to 35 psi (2.4 bar).

### Cleaning

Mud and crop debris should be cleaned away from the steering swivel and brake calipers on a daily basis to avoid damage to axle oil seals and bearings.

Do not allow crop debris to build up on the engine, exhaust or in any of the cooling system radiators - this should be checked on a daily basis when working in tall or dusty crops.

Great care should be taken in cleaning the machine, particularly after spreading fertiliser. Some types of fertiliser are very corrosive and if not cleaned daily, problems will soon be encountered.

The wiring system is most vulnerable and connections should be checked regularly. The radiator is also susceptible to corrosion and every effort should be made to keep fertiliser out of the radiator core.

**After washing off, leave engine running for a while so that the engine compartment dries out.**

Some types of fertiliser spreaders are prone to throwing fertiliser forwards or making a lot of dust. If this is the case with your spreader it is advisable to fit a sheet or screen in front of the spreader to stop it getting into the engine compartment.

Coating the chassis with a mixture of oil and diesel, or a proprietary anti-corrosive coating agent, after cleaning, pays dividends if you spread large amounts of fertiliser.

It also pays to go round the machine with the grease gun and an oil can on a daily basis when the machine is being used intensively for spreading fertiliser in damp conditions.

***Please remember the warranty does not cover problems caused by corrosion and mud/debris build up!***



# Maintenance Schedule

Service Operation	Daily 10 Hours	First 50 Hours	Every 50 Hours	150 Hours	300 Hours 6 mth	600 Hours 1 yr	1200 Hours 2 yrs
1 Check engine oil level and top up if necessary	*	*	*	*	*	*	*
2 Check coolant level and top up if necessary	*	*	*	*	*	*	*
3 Check air filter restriction indicator	*	*	*	*	*	*	*
4 Check cooling radiators/steering swivels for cleanliness	*	*	*	*	*	*	*
5 Check wheel nuts for tightness	*	*	*	*	*	*	*
6 Grease hydraulic pump and fan drive shaft	-	*	-	*	*	*	*
7 Grease prop shafts & check for wear	-	*	*	*	*	*	*
8 Grease king pins & check for wear	-	*	*	*	*	*	*
9 Lubricate electrical connections	-	*	*	*	*	*	*
10 Check brake fluid level	-	*	*	*	*	*	*
11 Check power steering fluid level	-	*	*	*	*	*	*
12 Check automatic transmission fluid level	-	*	*	*	*	*	*
13 Check hydraulic filter pressure	-	*	*	*	*	*	*
14 Check fuel water trap and clean if necessary	-	*	*	*	*	*	*
15 Drain water from fuel filter	-	*	*	*	*	*	*
16 Check/clean radiator & intercooler screens	-	*	*	*	*	*	*
17 Check condition of drive belts & pulleys	-	*	-	*	*	*	*
18 Change engine oil and filter	-	*	-	*	*	*	*
19 Check for oil, fuel & coolant leaks	-	*	-	*	*	*	*
20 Check battery water level	-	*	-	*	*	*	*
21 Tighten leaf spring U bolts	-	*	-	*	*	*	*
22 Grease hand brake cable & foot brake pedal linkage	-	-	-	-	*	*	*
23 Clean & adjust transmission brake	-	-	-	-	*	*	*
24 Clean & lubricate battery terminals	-	-	-	-	*	*	*
25 Clean engine breather filter	-	-	-	-	*	*	*
26 Check transfer gearbox oil level	-	-	-	-	*	*	*
27 Check condition & security of wiring looms	-	-	-	-	*	*	*
28 Check all engine, prop-shaft bolts, steering joints etc for tightness.	-	-	-	-	*	*	*
29 Renew fuel filter element	-	-	-	-	*	*	*
30 Check engine idling speed & adjust if necessary	-	-	-	-	*	*	*
31 Visually check for exhaust smoke & system leaks	-	-	-	-	*	*	*
32 Check all air, oil and water hoses for leakage, damage or deterioration	-	-	-	-	*	*	*
33 Remove wheels, check brakes for wear and replace pads if necessary	-	-	-	-	*	*	*
34 Check axle/wheel hub oil levels	-	-	-	-	*	*	*
35 Drain fuel tank	-	-	-	-	*	*	*
36 Replace cab carbon filter	-	-	-	-	*	*	*
37 Check wheel alignment on steering axles	-	-	-	-	*	*	*
38 Check valve clearances	-	-	-	-	-	*	*
39 Check & adjust wheel bearings if necessary	-	-	-	-	-	*	*
40 Change air filter element	-	-	-	-	-	*	*
41 Change auto transmission oil and filter	-	-	-	-	-	*	*
42 Replace main drive belts	-	-	-	-	-	-	*
43 Replace cam shaft drive belt	-	-	-	-	-	-	*
44 Flush out cooling system & renew coolant	-	-	-	-	-	-	*
45 Replace hydraulic oil and filter, clean suction element	-	-	-	-	-	-	*
46 Drain brake fluid, replace & re-bleed	-	-	-	-	-	-	*
47 Remove injectors & fit exchange units	-	-	-	-	-	-	*
48 Change all axle oils	-	-	-	-	-	-	*

## Parts

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### Parts.

All replacement parts are available from T.J. Frazier or your dealer. Some parts may also be available from other local sources. Only genuine replacement parts should be used during the warranty period and we strongly recommend that you do the same after the warranty has expired. If you require any parts information please do not hesitate to contact us.

An electronic parts book system will soon be available on floppy disc, CD and on the internet. Please contact T.J. Frazier Ltd. for further details.

When ordering parts please quote the PHANTOM model/build no. which can be found on a plate on the front right hand corner of the PHANTOM chassis. E.G. 355.

If you are in any doubt about operating or maintaining the machine or fitting any of your own equipment please do not hesitate to contact us.

This instruction book covers all the most important points on operation and servicing of the PHANTOM but, by no means, does it cover everything in full detail. It is updated periodically and we would therefore welcome any suggestions of further information that you would like to see included. We hope to produce a more detailed workshop manual and parts book in the not too distant future.

***The manufacturer cannot be held responsible for any accident, injury, or any other occurrence resulting from the incorrect use of the machine or equipment fitted to it.***



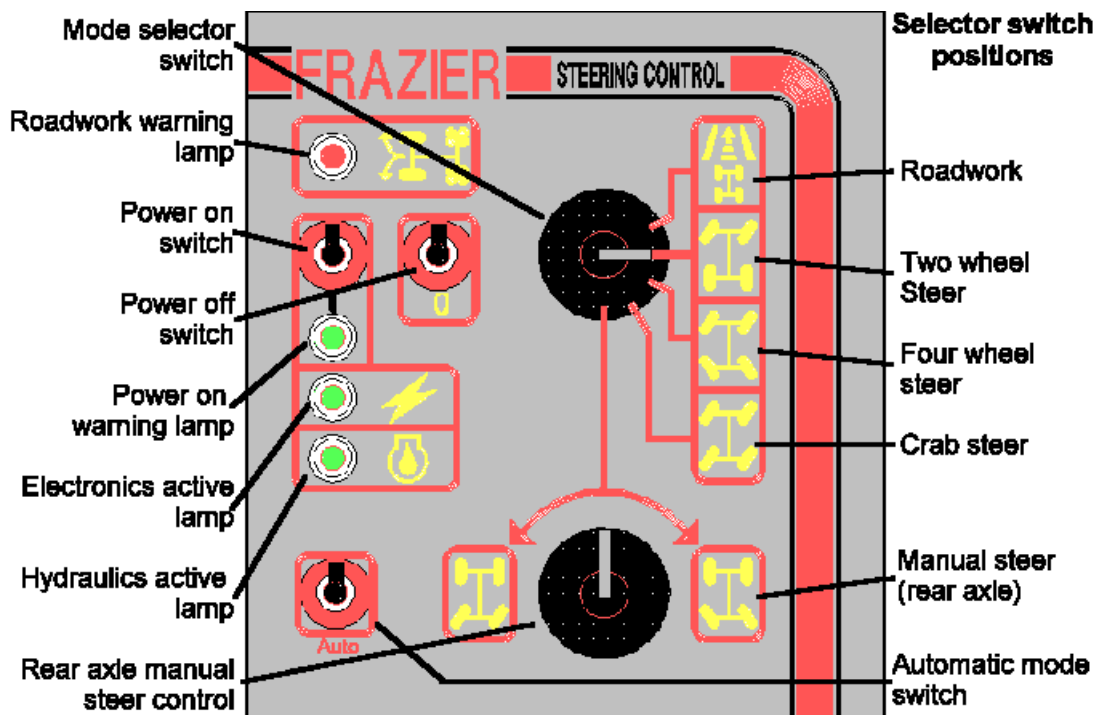
### FOUR WHEEL STEERING SYSTEM

The four wheel steer system on the PHANTOM is controlled electronically. Signals from sensors mounted on both axles are continually monitored by the electronic control box and a varying signal is sent from the control to an electro-hydraulic proportional valve which, in turn, directs oil to the steering ram on the rear axle to ensure the rear wheels are always kept in the correct position. The rear wheel position is also continually monitored when in two wheel, crab and manual modes, again, to ensure that the wheels do not "creep" and to keep them in the correct position.

#### Safety precautions

1. Always ensure the rear wheel area is clear before activating the four wheel steer system.
2. Always switch to the roadwork position for speeds above 12 m.p.h. (20 kph)
3. Do not switch modes when travelling at speed.
4. After using the manual steering mode always return the control to the centre position.

#### The control panel



#### Operating

The FWS system should be activated immediately after starting the engine. Ensure the rear wheel area is clear and then press the "Power On" switch on the control box. The Green lamp immediately below the power switch should then light up to show there is power to the box.

The "Electronics Active" and "Hydraulics Active" lamps will also light up as long as the mode selector switch is not in the "Roadwork" position.

***All three green lamps must be lit before the electronic control system will function correctly.***



# Four Wheel Steering

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## Operating modes



**Two wheel steer.** In Two Wheel Steer mode the rear axle position is monitored continually and fine adjustments will be made by the system to ensure the wheels keep straight. All three green lamps must be lit up for this to work correctly. You may switch to this position at any time in the field and the rear wheels will straighten up automatically.



**Four wheel steer.** In Four Wheel Steer mode the rear wheels will always follow the front ones and will give you the tightest turning circle. However, you may find the machine easier to steer down the field if you switch back to Two Wheel Steer after turning. You may switch to and from this position at any time in the field and the rear wheels will re-align automatically.



**Crab steer.** Crab steer may sometimes be useful when manoeuvring in buildings and in tight corners in fields. The rear wheels turn in the same direction as the front ones allowing the machine to move sideways.



**Manual steer** (rear wheels). In Manual Steer mode the rear wheels can be steered manually and independently of the front ones. When you have switched to Manual Steer lift the manual steer knob to unlock it and then rotate in the required direction to steer the rear wheels. This is also useful for manoeuvring in tight corners and may also be useful to offset the rear wheels slightly when working on steep side banks to stop the rear of the machine from slipping downhill. When you have set the rear wheel position the knob should be pushed back down to lock it in position. Before switching back to any other steering mode the rear wheels should be centralised with the manual control and the knob locked in position.



**Road work.** In the Roadwork position the electronics are deactivated for safety and the rear axle will lock. Before switching to this position, allow the rear wheels to straighten up in Two Wheel Steer. After a few miles on the road the wheels may tend to "creep". If this happens slow down, switch back to Two wheel Steer (which will quickly straighten the rear wheels) and then switch back to Roadwork again. An audible alarm and red warning lamp are fitted in the control box which will both activate at speeds above 12 m.p.h. when in any of the other steering modes.

**Auto mode (if fitted).** If the control box has the optional auto mode fitted the system can be made to switch from 2WS to 4WS automatically as the sprayer is switched on and off for ease of steering down the field and for optimum turning on the headlands.

To activate auto mode, turn the additional switch (in the bottom left hand corner of the control panel) to the on position and turn the main mode control knob to 2WS. The mode will then change automatically as the main sprayer control is switched on and off. If you wish to use 4WS whilst driving down the field, then simply turn the main mode control knob to the 4WS position to over-ride the auto function.

The auto mode function is activated by a single additional input into the 4WS control box. If you are fitting your own sprayer or spreader and wish to use this feature then the wire must be attached to your control circuit so that it is live (12V) when the implement is switched OFF. If you do not have a live connection when in the off position then a relay system must be used. For further information please contact T.J. Frazier.

### Safety systems

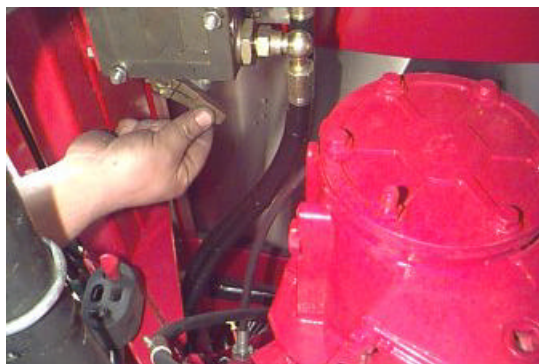
There are two safety systems built into the unit - one in the hydraulic control valve and one in the electronic control box. Should either of the systems detect a fault then one of the green lamps will go out on the control panel and the system will cease operating or "lock-out". To reset the system, deactivate it by pushing the "Power Off" switch and then switch back on with "Power On".

The valve safety system will often lock out if the unit is switched on when the engine is not running. This is normal and will reset itself when the engine is started. The control box safety system will lock out if it receives wildly varying signals from each axle - this can happen, for example, if the front steering is operated after engine start-up and before activating the FWS system. If this happens, realign the front wheels with the rear wheels and then reset the system as above. It will also lock out if sensor wires or sensors are damaged.

### Emergency operation

Should the system fail completely it can be operated manually to "get you home" as follows: Leave the control box switched off after starting the engine and attach the manual lever supplied to the hydraulic control valve. The valve is situated under the rearmost edge of the engine cowling. Operate the lever to centralise the rear wheels. The PHANTOM can then be driven and operated as normal.

You will find, however, that the rear steering will tend to creep out of position after a while and will need further periodic manual realignment until the fault can be rectified.



Operating the rear axle steering valve manually



## Row crop wheel settings

