



*For your safety:  
Always read this instruction manual  
before use.*

**Operator Instruction manual for**

**Bomford Turner**

**Raven**

**Vegetation control Arm mower**

**(Book number IM RAVEN-562 v1)**

## IMPORTANT

Note here the serial number of your machine and always quote it in any communication with us or your dealer. This is particularly important when ordering spares. Remember to include all numbers and letters.

Machine serial numbers \_\_\_\_\_

The information given throughout this manual is correct at the time of publication. However, in the course of constant development of Bomford Turner machines, changes in specification are inevitable. Should you find the information given in this book to be at variance with the machine in your possession, you are advised to contact the Bomford Turner Service department where up-to-date information will be provided.

The manual can contain standard and optional features and is not to be used as a machine specification. The machine has been tested and is considered safe if carefully used. Ensure your operator is properly trained in its use and maintenance.

## IMPORTANT

Notez ici les numeros de serie de votre machine et mentionnez les dans toute communication avec nos services ou votre revendeur. Ceci est important pour la commande de pieces detachees. Pensez a noter tous les numeros et toutes les letters.

Numeros de serie de la machine \_\_\_\_\_.

Les informations donnees dans ce manuel sont correctes cependant, du fait de developpement constant des machines Bomford Turner. Changements dans les caracteristiques sont inevitables. Si vous trouvez que les informations donnees ne correspondent pas a votre machine veuillez contacter le service des reparations ou des informations plus recentes vous seront donnees.

Ce manuel peut montrer des caracteristiques optionnelles et ne peut pas etre considere comme specification de la machine. Cette machine a ete testee, et elle est consideree comme fiable a condition d'une bonne utilisation. Assurez-vous que votre operateur est qualifie en ce qui concerne l'utilisation de la machine ainsi que son entretien.

## WICHTIG

Tragen sie hier die seriennummern ihrer maschine ein und geben sie diese immer an, wenn sie sich an uns oder ihren händler wenden. Das ist besonders bei ersatzteilbestellungen wichtig. Vergessen sie nicht, alle zahlen und buchstaben zu notieren.

Seriennummern der maschine \_\_\_\_\_

Die angaben indiesem handbuch sind bei veröffentliching korrekt. Aufgrund der konstanten weiterentwicklung von Bomford Turner maschinen sind jedochänderugden in der spezifikation unvermeidlich. Wenn die information in diesem handbuch nicht mit ihrer maschine übereinstimmen, nehmen sie bitte kontakt mit der Bomford Turner kundendienstabteilung auf, die ihnen gerne die aktuellen information zukommen lässt.

Das handbuch kann sowohl beschreibungen für die standard ausführung als auch für zubehör enthalten und ist nicht als maschinenspezifikation zu verwendet. Die maschine ist getestet und bei sachgemäßem betrieb als sicher befunden worden. Sorgen sie dafür, dass ihr bedienpersonal in anwendung und wartung richtig geschult wird.

**EC DECLARATION OF CONFORMITY**

Conforming to EEC Directive 2006/42/EC

We,

Of BOMFORD TURNER LIMITED, Station Road, Salford Priors, Evesham, Worcestershire, WR11 8SW

Declare that under our sole responsibility the product (type);

Reach arm base unit	Product code
<b>RAVEN</b>	<b>RV47</b>

A vegetation control arm mowing tractor attachment, to be fitted with one of the following flail mower cutting attachments;

Reach arm attachment	Product code
<b>950LW</b>	<b>9507</b>
<b>1100LW</b>	<b>1107</b>
<b>1257LW</b>	<b>1257</b>
<b>1007MW</b>	<b>1007</b>
<b>1100MW</b>	<b>1108</b>

Serial No(s). &amp; Date:.....

Manufactured by: ALAMO MANUFACTURING SERVICES (UK) Limited, Station Road, Salford priors, Evesham, Worcestershire, WR11 5SW.

Complies with the required provisions of;

- Directive 2006/42/EC
- Directive 2004/108/EC
- EN ISO 12100-1:2003+A1:2009
- EN ISO 12100-2:2003+A1:2009

And other national standards associated with its design and construction as listed in the technical file.

BOMFORD TURNER LIMITED operates an ISO 9001:2008 quality management system.

This system is accredited by;

BSI, Beech House, Linford Wood, Milton Keynes, UK, MK14 6ES

BSI identification number: UKAS 003

Bomford Turner certificate number: FM 34659

Signed.....  
On behalf of BOMFORD TURNER LIMITED Responsible person

Status Managing Director

Date 18/02/2011

## Raven

This manual covers the Raven series of Flail Mowing machines, which are two-arm linkage mounted machines. These light weight economy machines have integral mainframe and oil tank and fixed lateral arms. The raven has fully independent hydraulics powered by a PTO drive from the rear of a suitable tractor.

The Raven is designed for vegetation control, to cut and thin all types of hedges and verges within the scope of its reach and performance, provided the correct guards are fitted.

It is essential that the guards are fitted at all times during operation and that the machine is operated in line with the procedures and practices detailed in this manual

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### **IMPORTANT**

This machine is designed for vegetation control and must not be used for any other purpose.

It is potentially hazardous to fit or use any parts other than genuine **Bomford Turner** parts.

The company disclaims all liability for the consequences of such use  
which, in addition, voids the machine warranty.

## 1.0 Machine Description

### 1.1 Intended usage.

The Raven was developed to meet the demands of small scale agricultural markets having horticultural, landscape and amenity management needs. Equipped with lighter duty flail heads and a maximum reach up to 4.7m it can be mounted on large compact or small agricultural tractors in the 50 to 70 hp range.

The machine can be used for hedge or grass cutting.

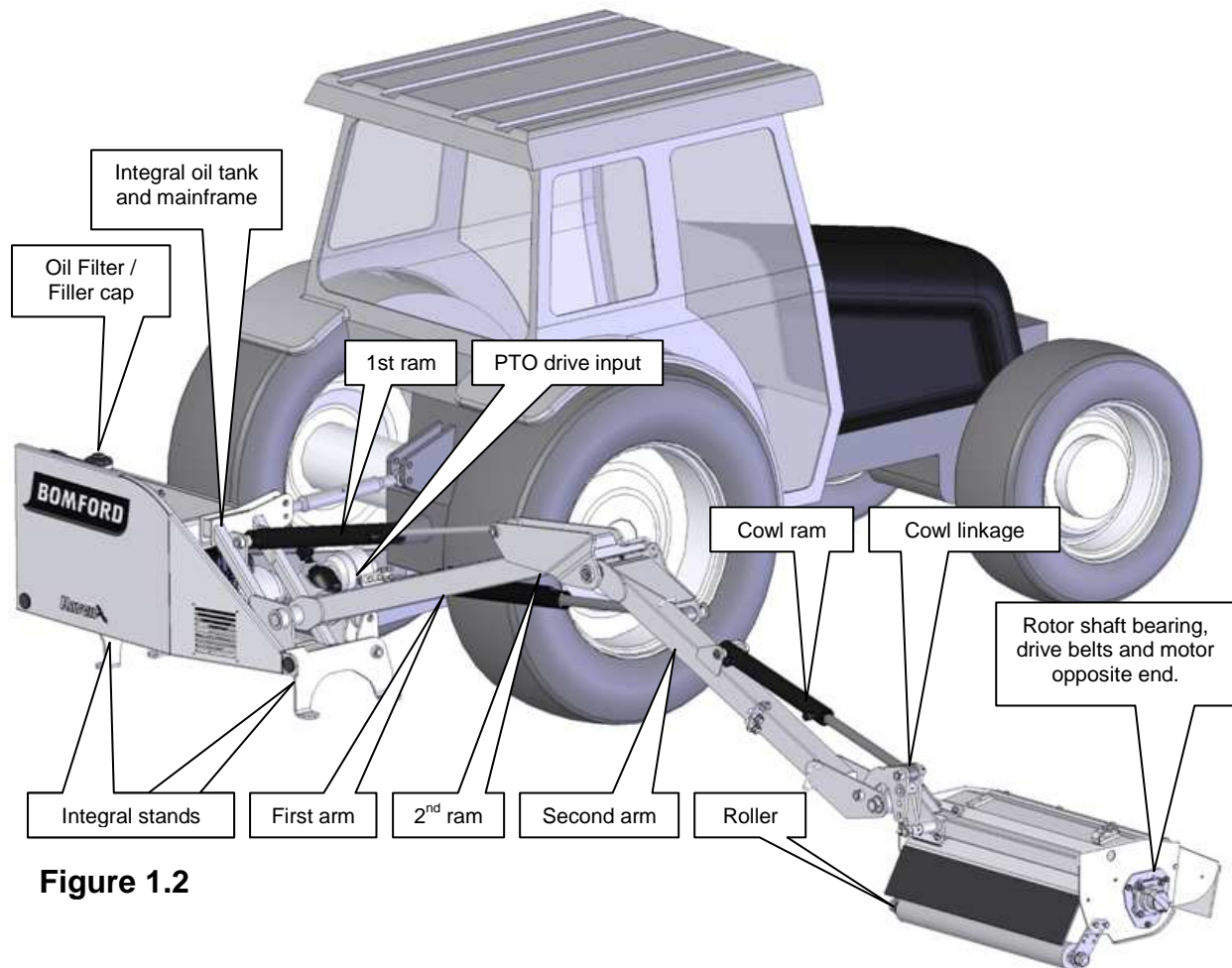
The Raven is designed to be rear mounted and for use on level, undulating or inclined ground. It can be articulated to access up-bank or down-bank vegetation and will cut up to 40mm thickness (depending on flail type fitted).



**Bomford Turner Raven**

## 1.2 General arrangement

The layout and naming convention used throughout this manual are shown in Figures 1.2 below



**Figure 1.2**

## 1.3 Machine rotation convention

Bomford Turner uses a convention to determine the correct rotation of the flail head cutting rotor with respect to specific types of cutting work. The convention relates the cutting rotor direction and the direction of rotation of the tractor wheels.

### Definition:

- '**Reverse rotation**', the cutting rotor direction is the **reverse of** the tractor drive wheel rotation
- '**Forward rotation**', the cutting rotor direction is the **same as** the tractor drive wheel rotation

- 1.3.1 The standard Bomford Turner cutting head construction for both **hedge** and **grass** cutting is '**Reverse rotation**' with a front steel guard and a flexible flap together with a rear flexible guard.
- 1.3.2 In all cases for '**Reverse rotation**', '**Forward rotation**' and both hedge and grass cutting conditions the roller is an integral and essential part of the safety guarding.
- 1.3.3 If the machine is to be used for cutting in '**Forward rotation**' then a rear metal guard must also be fitted.
- 1.3.4 See section 2.6 and 2.7 for detailed guarding instructions.

## 1.4 Machine general specification.

<b>RAVEN: Technical specification (1)</b>		
<b>PTO</b>	Type	Live
	Speed	540rpm
	Size	1.3/8" (34.9mm), 6 spline
<b>Minimum Tractor weight</b>	(With ballast)	50hp (@1800kg)
<b>Arm Mower weight</b>	Base unit with no oil	407kg
	Base unit with oil	510kg
<b>Reach arm dimensions (2) (3) (4) (9)</b>	Max lateral on-ground grass cut	4700mm (See item 1 in figure 1.4)
	Max lateral off-ground grass cut	4705mm (See item 2 in figure 1.4)
	Max lateral off-ground side cut	4219mm (See item 3 in figure 1.4)
	Max down-bank grass cut	3169mm (See item 4 in figure 1.4)
	Max up-bank grass cut	4240mm (See item 5 in figure 1.4)
	Max vertical flat cut	3375mm (See item 6 in figure 1.4)
	Max vertical side cut <b>(5)</b>	4810mm (See item 7 in figure 1.4)
	Max transport width to centreline <b>(6)</b>	1230mm (See item 8 in figure 1.4)
<b>Oil tank capacity</b>	130 litres	1503mm (See item 9 in figure 1.4)

<b>RAVEN: Flail head data (1)</b>					
<b>Cutting unit</b>	950LW	1100LW	1257LW	1007MW	1100MW
<b>Weight (Kg)</b>	130	140	170	150	160
<b>Drive</b>	Direct	Direct	Direct	V Belt	V Belt
<b>Nominal shaft speed (rpm) (8)</b>	2948	2948	2948	2480/3237	2480/3237
<b>Twin flail (Quantity)</b>	56	64	72	56	64
<b>Forward facing flail (Quantity)</b>	28	32	36	28	32
<b>HS40 flail (Quantity)</b>	28	32	36	28	32
<b>MP44 Flail (Quantity)</b>	28	32	36	28	32
<b>Bushmaster flail (Quantity)</b>	16	N/A	N/A	18	20

### Notes:

- (1) All specification information is correct for this version of the instruction manual. Bomford Turner constantly review and improve product designs and reserve the right to change this information. As a consequence actual machines may vary from specification. Contact your Bomford Turner Sales representative if you have any queries.
- (2) All dimensions are taken with a 950LW flail head fitted.
- (3) All heights assume a notional arm mower mounting height of 550mm. This is measured from the ground to the centre of the main first arm to mainframe pivot. This will vary from tractor to tractor.
- (4) All lateral reach dimensions are taken from the centreline of a notional tractor with a 2030mm overall width. Consequently down bank dimensions are measured assuming this notional tractor has the outside of its rear wheel on the edge of an embankment.
- (5) This specified geometric maximum is stated for information purposes only. It does not imply that it is safe or appropriate to cut material in this position. The actual safe maximum side cut height will depend on the width of the tractor that the arm mower is mounted to.
- (6) The transport width quoted is a half width and is measured to the PTO centre which is notionally assumed to be on the tractor centreline. As a consequence the full on road width is the quoted transport width plus half the tractor width plus (or minus) any mounting offset from the tractor centreline.
- (7) The transport depth is indicative and will vary with the specified tractor. This figure assumes a direct mount to the tractor. There is an optional spacer frame which can be fitted for some tractor configurations to allow the head to tuck in behind the wheel where this presents a problem for some direct mount configurations.
- (8) The two figures quoted for shaft rpm are dependant on the pulley configuration.
- (9) All dimensions are determined from computer models. As a result actual measurements may vary as a result of deflections due to weight. Tractor tyres will naturally compress on the working side of the tractor as the arm is deployed and the centre of gravity shifts. The amount is affected by tyre construction, age, inflation pressures and the use of local ballast weight. For example a 20mm compression of the cutting side rear tyre will be magnified by the arm reach which will have an affect on the actual cut height.



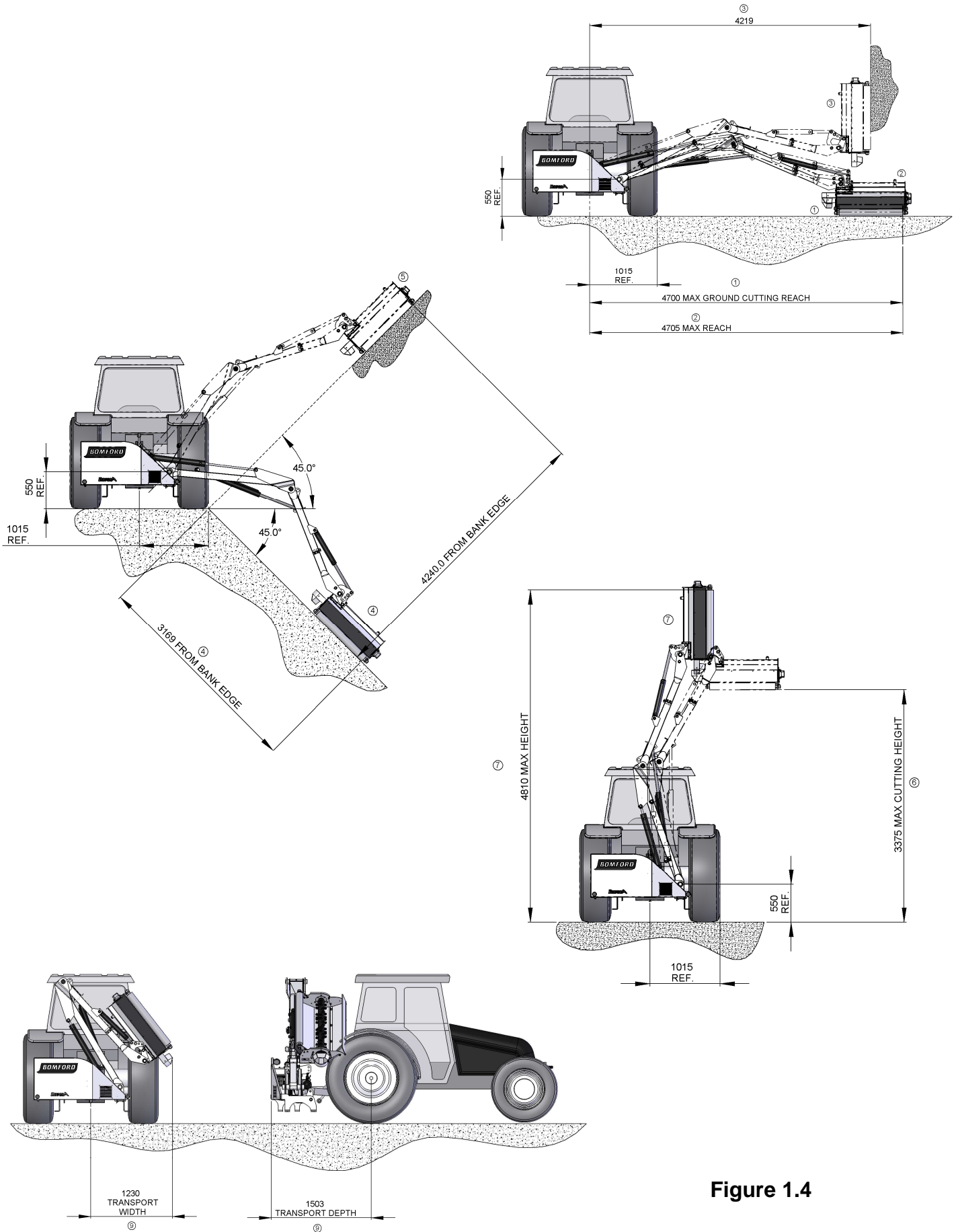


Figure 1.4

## 2.0 Safety:

### 2.1 Safety warnings;

The operator must read, understand and follow all of the Safety instructions. Serious injury or death may occur unless care is taken to follow the warnings and instructions provided. The level of safety is indicated in three levels and the following notation is used throughout this operator instruction book;

**DANGER!**      **Level 1; alerts for imminent death or critical injury.**

**WARNING!**      **Level 2; warns of serious injury or possible death.**

**CAUTION!**      **Level 3; indicates possible injury.**

Never operate the tractor or machinery until you have read and completely understand this manual and the tractor operators manual and each of the safety messages found in the manuals and those displayed on the tractor and implement.

**DANGER!**      **DO NOT** attempt any maintenance of or adjustment to the machine while it is running. Before carrying out any work on the machine follow the three safety instructions below:

- Lower the cutting head on to the ground
- Put the PTO out of gear
- Stop the tractor engine

**DANGER!**      At all times ensure that the PTO shaft guard is in position, securely fitted and in good condition and that the tractor PTO shaft shield is fitted.

**DANGER!**      Keep a careful watch for passers by who may inadvertently get in the way of cut material being thrown from the cutting unit. Flail mowers are capable under adverse conditions of throwing objects great distances at high velocity. Stop the rotor shaft until all people are well clear.

**DANGER!**      **AVOID WIRE.** It can be extremely dangerous if wire catches in the rotor, and every care must be taken to ensure this will not happen. Inspect the working area before commencing. Remove all loose wire and obstructions and clearly mark those that are fixed so that you can avoid them. Any unusual noise from the cutting unit area indicates that the rotor shaft may have been fouled by an obstruction. A visual indication that wire is in contact with the flails may be a sudden movement of the vegetation ahead of the cutting unit. In any such event STOP the tractor engine INSTANTLY. On no account move the cutting unit until the rotor has completely stopped. NEVER UNDER ANY CIRCUMSTANCES run the rotor in reverse to 'clear itself'. When the rotor has stopped, inspect it and remove any obstruction that may be present. If working under a raised machine ensure that it is safely supported. Before working on the rotor always stop the tractor engine and remove the ignition key.

**DANGER!**      Flail mowers are capable under adverse conditions of throwing objects great distances at high velocity. CHECK the flails for wear and the attachment bolts for tightness every day during work .A few moments whenever the machine is stopped, e.g. whenever removing obstructions, will help reduce flail wear or loss.

**DANGER!**      Keep your forward speed to a level appropriate to the operating conditions. High-speed manoeuvres with the arms stretched out are very dangerous, particularly on uneven ground where there is risk of overturning.

**DANGER!**      Do not operate or transport with the arms extended rearwards as instability will result with the possibility of overturning

**DANGER!**      A wire mesh cab guard must be fitted on the outside of the cab window, between the operator and the cutting head, in such a position as to give the operator maximum protection.

**DANGER!**      Where a hedge trimmer is used in conjunction with tractors not fitted with a glazed safety cab, a clear polycarbonate safety screen together with a mesh guard must be fitted to the tractor between the operator and the cutting head. A polycarbonate safety screen must be used on cabs where

windows are likely to be left open for ventilation purposes. It is essential that cab windows on the operating side; through which the cutting head is observed; are be intact, clean and closed, **or** a clear polycarbonate safety screen must be fitted where hedge cutting and grass trimming operations are carried out. When hedge cutting a mesh guard must also be fitted.

- WARNING!** Do not operate machinery with guards missing. Ensure that the correct guards are properly fitted to the machine and tractor at all times and that they are in good condition. Refer to section on Guards and Rotation in this manual to ensure you have the correct guards fitted for the type of operation being performed.
- WARNING!** While the tractor is running all personnel should keep well clear of the area around the machine as there are numerous crushing, shearing, impact dangers caused by the machine operation.
- WARNING!** Direct the cut material away from the tractor. It is important that while operating the cut material is not directed towards the operator. Avoid positioning the cutting head so that the underside is angled towards the cab.
- WARNING!** Extreme care should be taken when operating near loose objects such as gravel, rocks, wire, and other debris. Inspect the area before mowing. Foreign objects should be removed from the site to prevent machine damage and/or bodily injury or even death. Any objects that cannot be removed must be clearly marked and carefully avoided by the operator. Stop mowing immediately if flails strike a foreign object. Repair all damage and make certain the rotor shaft is still balanced before resuming cutting operations.
- WARNING!** Transport the machine only at safe speeds. Serious accidents and injuries can result from operating this equipment at unsafe speeds.
- WARNING!** Do not operate or transport with the arms extended rearwards as instability will result.
- CAUTION!** Replace the PTO shaft guard if any of the following are evident; guard cracked or damaged, any part of the PTO shaft exposed. Ensure the PTO shaft guard is free to rotate and the anti-rotation chains are securely fitted and effective.
- CAUTION!** Keep the roller in position at all times. It is an essential part of the machines guarding. The machine must not be operated with the roller missing.

## THINK SAFETY - WORK SAFELY

### 2.2 Noise

The equivalent daily personal noise exposure from this machine, measured at the operator's ear, is within the range of 80-85dB when used in conditions where the load fluctuates between zero and maximum. This applies when the machine is attached to a tractor fitted with a quiet cab and used in accordance with the operating instructions in a generally open environment. At equivalent daily noise exposure levels of between 85 and 90dB, suitable ear protectors are recommended.

### 2.3 Emergency Stop

In an emergency bringing the cutting head to a stop requires familiarity with the controls fitted to the machine.

The Raven is equipped with two types of control; Cable and Low Pressure Hydraulic (LPH). For Cable controls see section 7.2 to stop quickly. For LPH controls see section 8.2 for emergency stop.

### 2.4 Guards

**DANGER:** For safe operation it is essential that that all guards and the roller must be kept in position on the machine whenever the machine is running. Bomford Turner Ltd disclaim all responsibility for any damage or injury arising as a result of guards or roller being removed, or of guards other than of Bomford Turner manufacture having been fitted, or of operation of the machine other than in accordance with these instructions.

**DANGER:** When hedge cutting or trimming or any operation where the cutting head is not in contact with the ground, the welded mesh guard; supplied with the machine; must be fitted to the side window of the tractor cab. Cabs without laminated or toughened glass must also be fitted with a laminated glass or polycarbonate shield in addition to the welded mesh guard.

**WARNING:** Inspect guards twice daily or immediately damage is suspected.

Always replace guards that have damage or wear which could impair their performance. Typical damage to inspect for is;

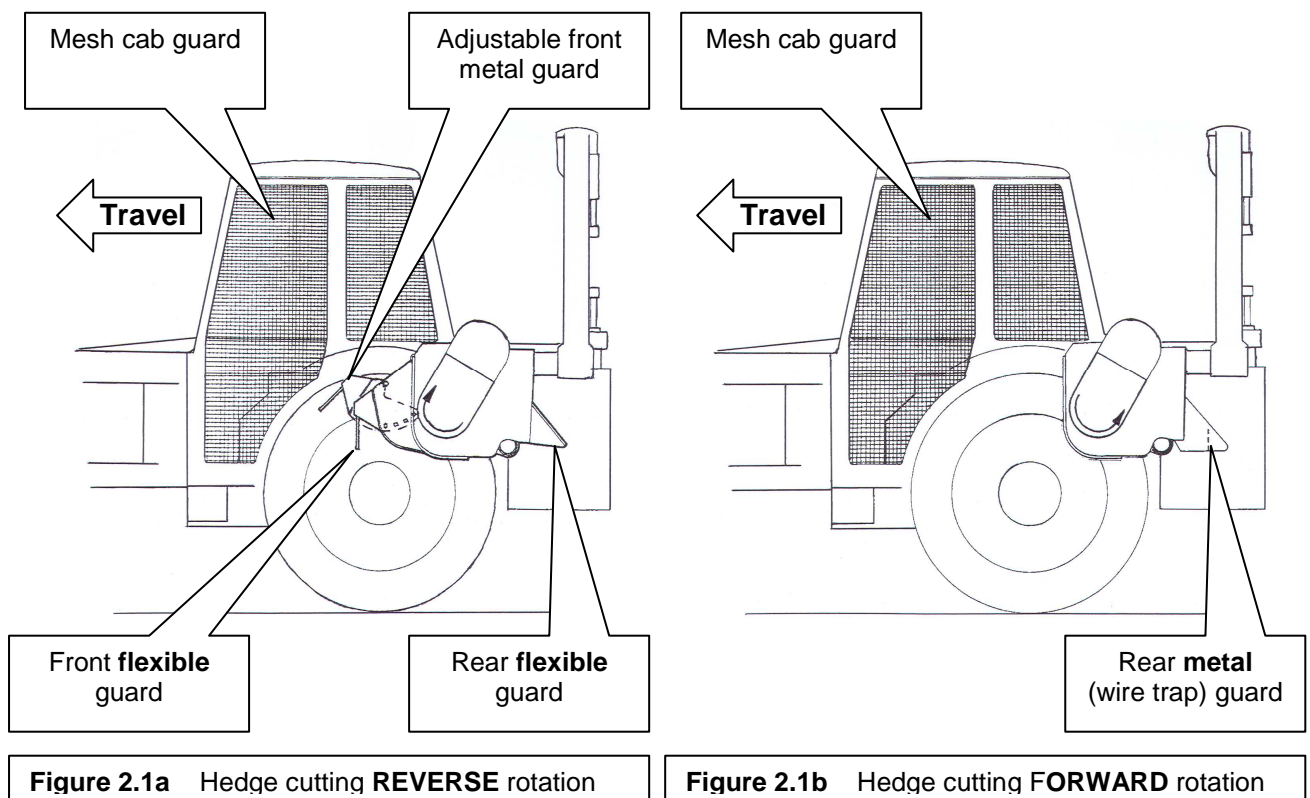
- **Adjustable front metal guard** - distorted or with sharp outer edges.
- **Rear metal guard (when fitted)** - bent, missing or blunt cutting edge.
- **Flexible front or rear guards** - missing portions, damaged, or worn sufficiently to permit stones or similar objects to be ejected beneath it in normal conditions.

## 2.5 Guarding related to shaft rotation

It is very important to fit the correct combination of guarding for the method of cutting being employed. This is also dependant on the drive option selected for the flail head. Flail heads fall into two broad types, single and dual rotation.

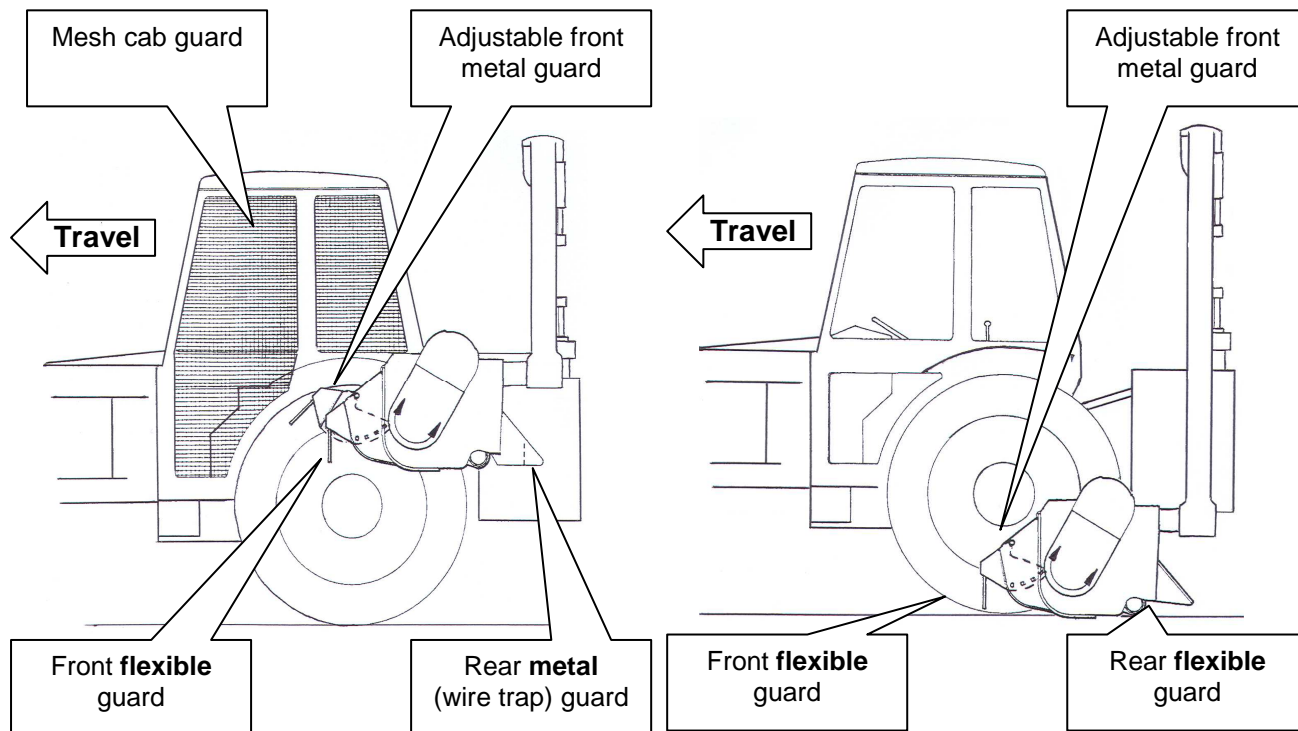
### 2.5.1 Single rotation Flail heads

The direction of the shaft rotation may be changed by reversing the hose connection on the motor. Ensure the correct guards are fitted for the direction of rotation being used, see figure 2.1a and 2.1b.



### 2.5.2 Dual rotation Flail heads:

On machines fitted with a Cable Dual Sense Rotation (CDSR) or Electric Dual Sense Rotation (EDSR) rotor control valves, the shaft rotation can be reversed by the operation of a lever or a switch. Ensure the correct guards are fitted for the direction of rotation being used at any time, see figure 2.2a and 2.2b.



**Figure 2.2a** Hedge cutting in **DUAL** rotation

**Figure 2.2b** Grass cutting in **DUAL** rotation

## 2.6 Tractor stability

Due to the design of mowers and the work they undertake, it is essential to ensure that the tractor is stable during work and transport in order to eliminate any risk of loss of directional control, imbalance or overturning.

Before work, extend the arms to full reach slowly and ensure that at full reach the rear wheel on the opposite side to the extended arms is still on the ground. It is advisable to have a helper to check this. Check that the tyre shows evidence of bearing some load.

If the tyre lifts then add ballast in the form of wheel weights to the rear wheel of the tractor opposite to the extended arms until the tyre shows evidence of bearing some load.

Before driving in transport, place the arm mower in the transport position and again check that the front wheels of the tractor are both on the ground. Again, it is advisable to have a helper to check this. Check that the tyre shows evidence of bearing load. This is especially important to ensure forward directional control at speed on an undulating terrain.

If the front tyres lift add ballast weights to the front of the tractor.

**WARNING:** Failure to have sufficient load over the front axle or to drive at inappropriate speeds on undulating terrain may result in a loss of directional control.

If ballast weights have been added to the tractor, check that the plated tractor axle loads have not been exceeded.

**IMPORTANT:** When transporting on the highway, it is the responsibility of the operator to obey all relevant local highway laws.

## 2.7 Safety Decals

Safety decals are located on various points of the machine see figure 2.3a for the mower and figure 2.3b for the cutting unit. They can be identified by the yellow upper panel depicting the hazard, and the lower white panel indicating means of avoidance or precautions to be taken. These decals have no text. It is essential that all operators and personnel associated with the machine fully understand their meanings, which are shown in figure 2.4.

Any safety decals which are found missing should be replaced.

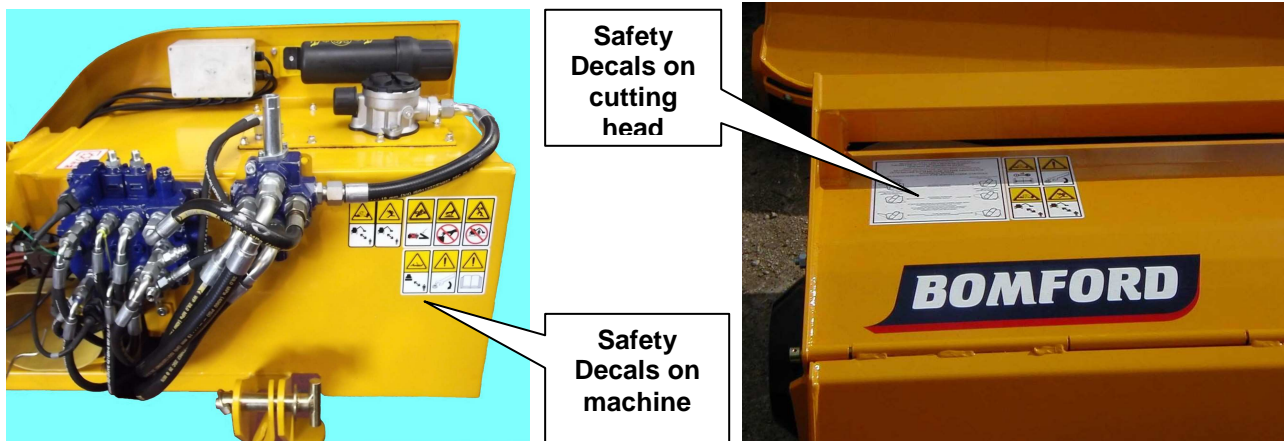


Figure 2.3a

Figure 2.3b

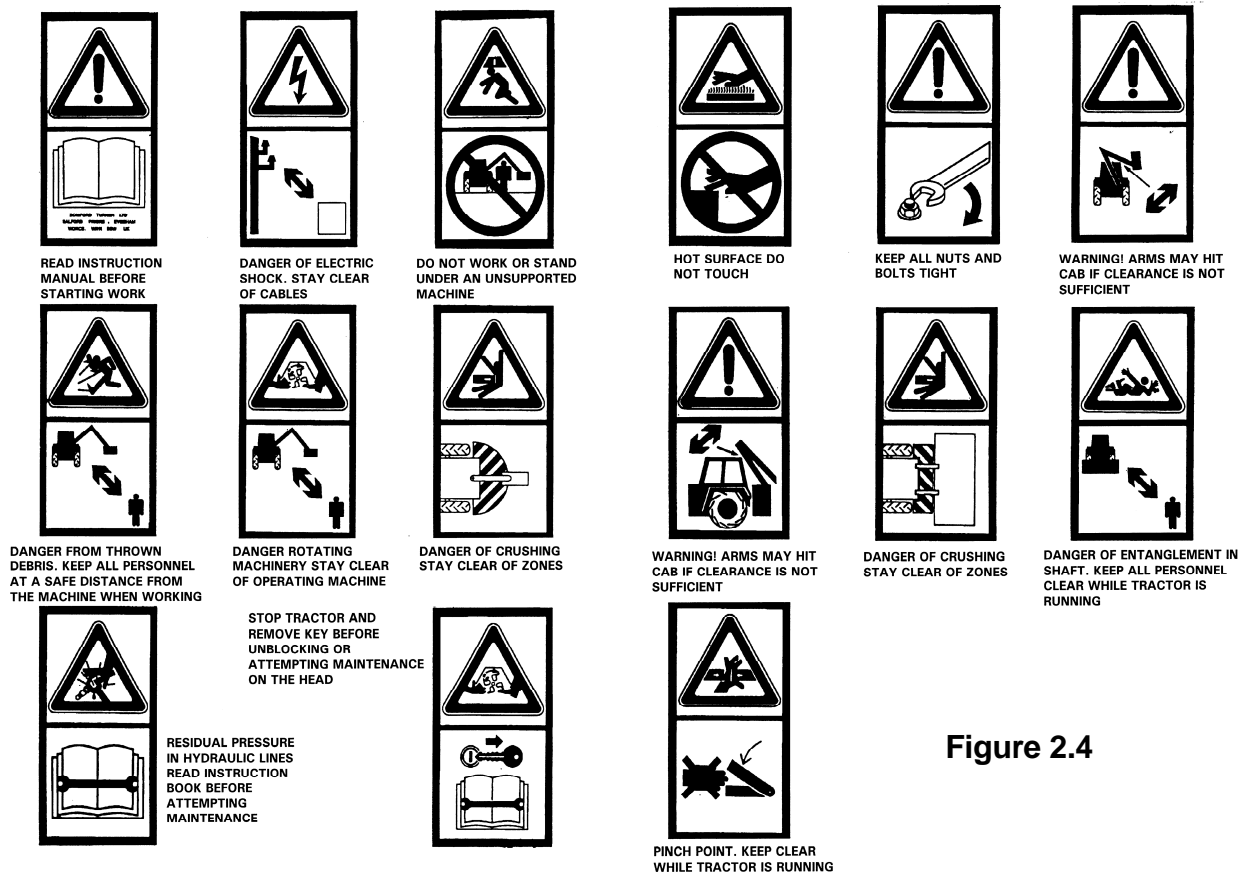


Figure 2.4

## 2.8 Electromagnetic Compatibility (EMC) - Radio Telephones

Machines fitted with electric controls are subject to EU directives. The use of radiotelephone equipment should not affect their performance. Ensure that any telephones are installed correctly. Check that no unexpected movements of the machine occur when a telephone is in use.

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## 3.0 Machine preparation

### 3.1 Tractor requirements;

Before fitting the machine to the tractor ensure that specification of the tractor meets the requirements listed below.

- 3.1.1 A six spline 1 3/8 inch diameter PTO output shaft, is available.
- 3.1.2 A PTO output speed of 540rev/min is available.
- 3.1.3 A tractor top link is available if required.
- 3.1.4 To ensure fore aft stability ballast should be added to the tractor front weight tray. The amount will vary depending on type of tractor used and prevailing conditions.
- 3.1.5 To ensure lateral stability ballast should be added to the rear wheel opposite to the arms. The amount will vary depending on type of tractor used and prevailing conditions. NOTE: Some Bomford Turner machines are capable of being deployed on both sides of the tractor, in such a case lateral ballast may be required on both rear wheels.
- 3.1.6 Once the machine is mounted to the tractor and the tractor is correctly ballasted ensure that the maximum axle loads for the tractor have not been exceeded. Failure to meet this requirement may render the operator liable for infringement of public highway regulations.
- 3.1.7 Ensure that the tyres fitted to the tractor are correctly rated for the total working weight. NOTE: When the cutting head is deployed in work at the furthest reach the load on the rear tyre on the cutting side increases significantly.
- 3.1.8 Bomford Turner does not endorse the use of water ballast within tyres as this can have adverse effects on fore aft stability at speed.

### 3.2 Lifting the machine

The machine will normally be delivered with the arms fully assembled to the mainframe, but with the cutting unit detached. If this is not the case then specific re-assembly instructions will be provided with the machine.

**WARNING!** Only personnel experienced in lift and hoist operation should be involved in lifting machines.

The lifting points (indicated with arrows) are for machines without the cutting unit attached. Due to the fact that machine may be supplied with or without a tank full of oil there are several lifting points. Ensure the correct points are used to suit the machine's condition, as the centre of gravity changes with or without oil - Exercise caution!

Figure 3.2 illustrates the lifting points and a typical transport stay.

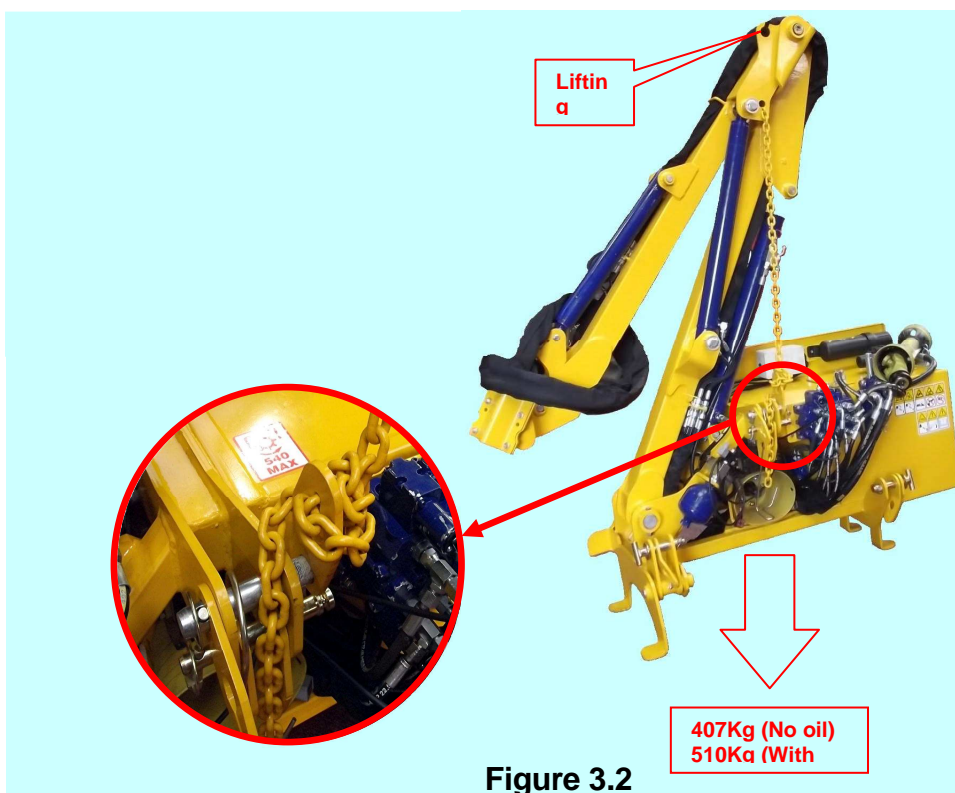


Figure 3.2



### 3.3 Tractor preparation for chain supports:

The machine is supported on the three point linkage of the tractor and its height is set by chain tension.

**IMPORTANT:** When fitting to some models of tractor a top link support kit is required. Please consult your local dealer for details.

**IMPORTANT:** Due to variations in the strength of different tractor manufacturer's drop links, it is recommended that support tubes are fitted around the exposed section of drop links that are less than 30mm in diameter.

To fit the machine to the tractor, follow the instructions below and refer to figure 3.3;

- 3.3.1 Position the machine on a flat, hard surface.
- 3.3.2 Remove the pins (A) from the support lugs or clevis's or in the Mainframe.
- 3.3.3 Carefully reverse the tractor so that the ball joint on the linkage (B) lines up with the clevis (C) in the mainframe. Note: the Raven has a breakout link fitted to the mainframe clevis nearest to the arms. This breakout link also has a clevis and it is this which must receive the tractor linkage ball joint on this side.
- 3.3.4 Adjust the height hydraulically until the link arm can be positioned in the clevis (C). When correctly aligned and before fitting the retention pin ensure that one of the bent keyhole plates (D) are introduced into the clevis on the inboard side of the lift arm. The plain hole should be used leaving keyhole bent towards the PTO. Secure the assembly with the retention pin (A).
- 3.3.5 Similarly, adjust the remaining lift arm levelling screw until this arm can also be secured to the clevis together with the remaining bent keyhole plate (D). Again secure with the retention pin (A).
- 3.3.6 Attach the top link bracket (E) between the machine and tractor top link clevis.
- 3.3.7 Two pairs of top link chain bracket are supplied. One pair with category 1 holes and the other pair with category 2 holes. Only one pair is required to fit either side of the tractor top link on the same pin (G). Fit whichever type is most suitable and thread the chain through the keyhole shaped hole(s), so that two equal lengths of chain are suspended from the bracket(s).
- 3.3.8 Lift the machine until the tractor and machine PTO are in line.
- 3.3.9 Adjust the right arm and the top link until the machine is square with the tractor.
- 3.3.10 Thread each end of the chain through the bent keyholes (H) in the lower link stabilizer bracket.
- 3.3.11 Lock the chain in the slot of the stabilizer bracket, taking up the slack in the chain between the top link and the bracket, and ensuring the lengths of the chain on each side are the same.
- 3.3.12 Lower the machine carefully, ensuring that the tension on each chain is taken up evenly. The chain attachment brackets are designed to flex and to take up minor irregularities.
- 3.3.13 Clip the 'loose' ends of the chain to the taut chain as far as possible, to lock it positively in the bracket keyholes.
- 3.3.14 Fit the tractor external check chains to the lift arms and adjust them until there is no sideways movement.

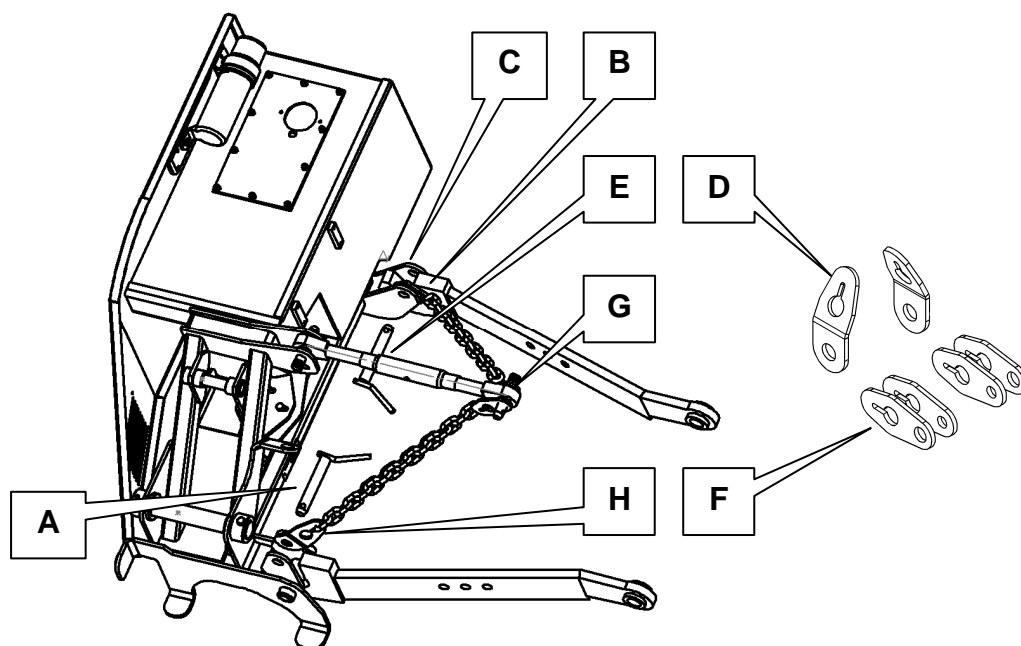


Figure 3.3

### 3.4 Tractor preparation for tubular three point linkage:

The machine is attached to the tractor by the tractor lift arms, top link and telescopic tubular linkages.

**IMPORTANT:** When fitting to some models of tractor a top link support kit is required. Please consult your local dealer for details.

**IMPORTANT:** Due to variations in the strength of different tractor manufacturer's drop links, it is recommended that support tubes are fitted around the exposed section of drop links that are less than 30mm in diameter.

- 3.4.1 Position the machine on a flat, hard surface.
- 3.4.2 Prepare the mower by using the top link to join the mower's mainframe's upper hitch point to the clevis on the linkage delta bracket – (See Figure 3.4). Select an appropriate top link mounting plate to fit the tractor. In the top link kit, Category 2 fittings are standard (Two optional plates are supplied for cat 3 and 28mm diameter pins and a category 1 bush is also included)
- 3.4.3 Using the lower pins, fix the linkage delta bracket ball ends into the inner clevis of each mower mainframe lower hitch point.
- 3.4.4 Carefully reverse the tractor so the ball joints on the tractor linkage line up with the clevis on the mower mainframe. Connect the mower by pushing the hitch pins through the lift arm ball ends in the outer clevises and fit the lynch pins.

**WARNING:** Do not allow personnel between tractor and mower.

- 3.4.5 Connect the upper hitch point of the A frame to the tractor upper hitch point, adjusting the top link as necessary. It is recommended a second top link pin is fitted to act as a stop against top link mounting plate.
- 3.4.6 Lift machine to its working height ensuring that the machine is level by adjusting the tractor linkage to suit.
- 3.4.7 Adjust the outer part of each A frame arm by turning it until one of the 12mm holes in the outer tube lines up with one of the holes in the inner rod, then insert pin and R clip.
- 3.4.8 The A frame is now a rigid unit and the tractor lift arms can be lowered, removing the weight from the tractor hydraulics.

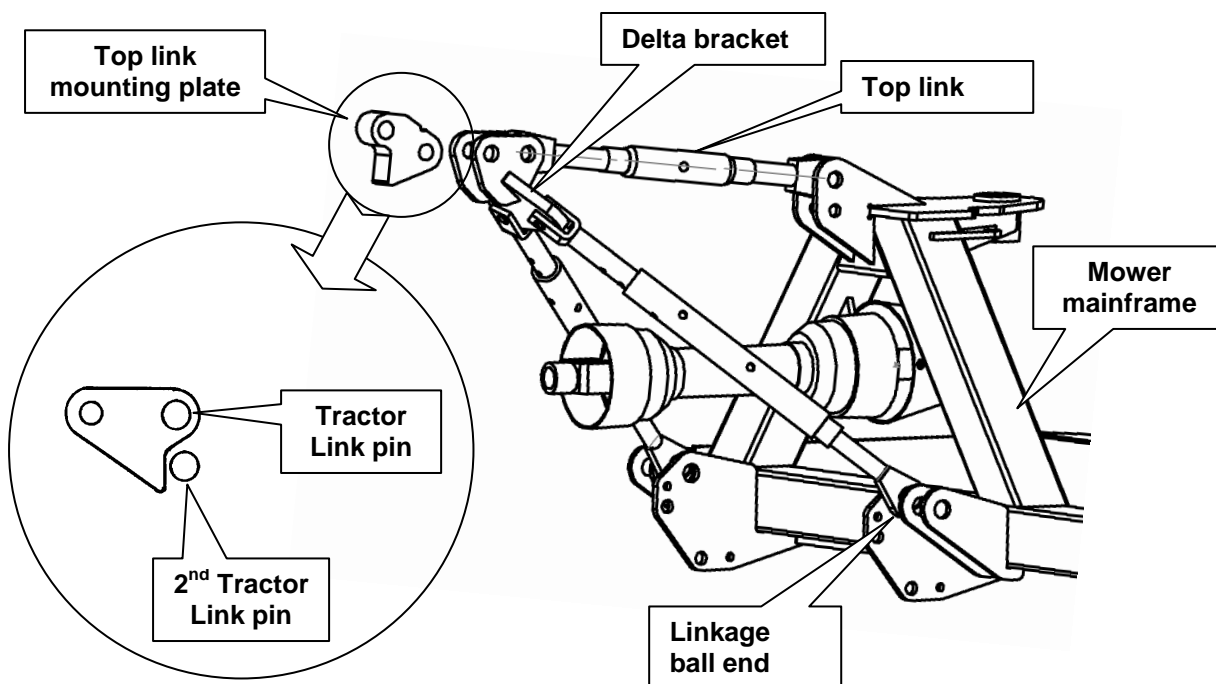


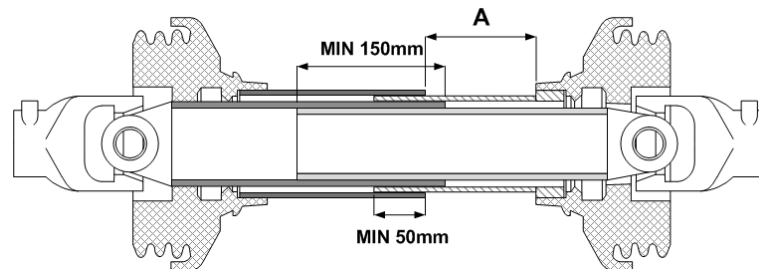
Figure 3.4

### 3.5 Fitting the PTO

Due to many different makes and sizes of tractor to which mowers may be fitted, a nominal length PTO shaft is supplied with the machine. In some cases the nominal PTO shaft supplied will be too long and will have to be shortened, see below.

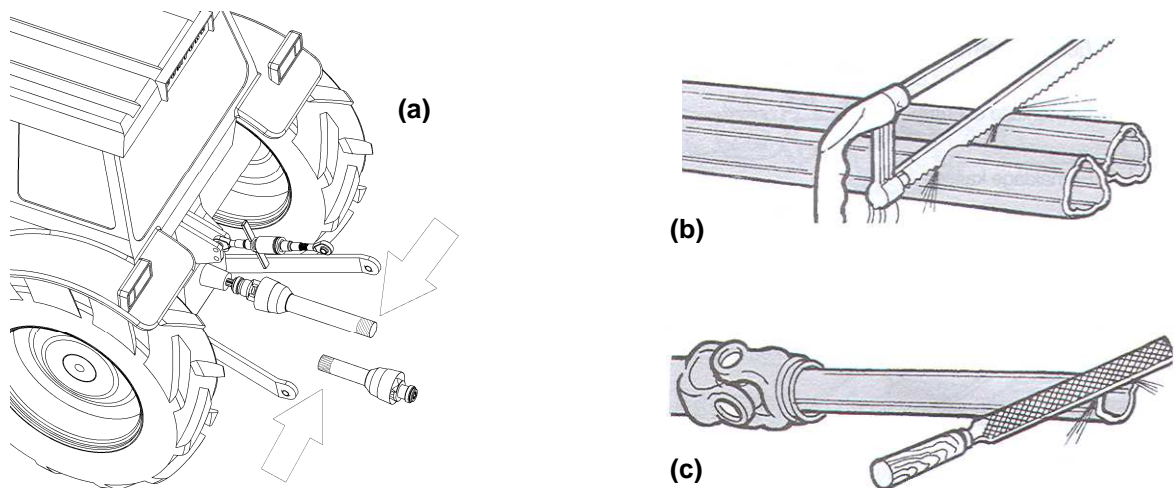
**IMPORTANT:** The PTO shaft, which drives the hydraulic system, must not be operated until the tank is filled with the correct brand/grade of oil. (See section 5.0)

**IMPORTANT:** The recommended minimum engagement of the PTO is 150mm in the working position. This measurement must be taken into account when shortening the PTO shaft. (See Figure 3.5.1)



**Figure 3.5.1**

- 3.5.1 Both machinery and tractor must be parallel to one another.
- 3.5.2 Pre-assemble the PTO shaft and check that the drive tube overlap is not less than 150mm, see figure 3.5.1, and 3.5.2a
- 3.5.3 Check that the minimum overlap of the shaft guards is not less than 50mm, see figure 3.5.1.
- 3.5.4 If the overall PTO length is likely to reduce during operation then ensure that at its minimum there is at least 40mm movement left between the guards, see dimension 'A' in figure 3.5.1.
- 3.5.5 If the PTO needs to be shortened, cut both tubes as both halves must be shortened equally, see figure 3.5.2b.
- 3.5.6 Remove burrs with a file and clean any residual cutting debris from the tubes.
- 3.5.7 Before fitting the PTO shaft to the tractor, grease the sliding drive shafts and bearing units.
- 3.5.8 Fit the PTO to the tractor ensuring that the locking peg and collar on the spline-coupling is fully engaged.
- 3.5.9 Attach the PTO guard check chains to the tractor and to the machine to prevent guard rotation.



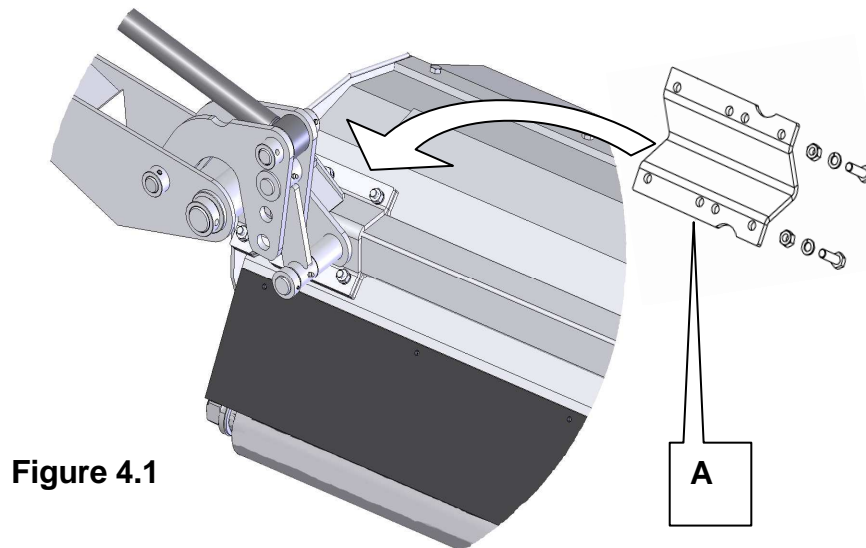
**Figure 3.5.2**

## 4.0 Mounting the cutting unit to the arm;

With the machine assembled, the cutting unit can now be fitted to the end of the arms, see figure 4.1.

To do this;

- 4.0.1 Start tractor engine and raise the arms so that the cutting unit clamp on the end of the arm is approximately 500mm clear of the ground.
- 4.0.2 Place the cutting unit directly in front of the clamp, ensuring that the roller is behind the cutting rotor for the intended direction of travel. (Level up cutting unit with wood packing if necessary.)
- 4.0.3 Remove clamp bracket (A) from the end of the arm.
- 4.0.4 Adjust the position of the arms until the cutting unit clamp is lined up with the clamping bar on top of the cutting unit in the desired position along the bar.
- 4.0.5 Replace and re-tighten clamp bracket (A).



**Figure 4.1**

Bomford Turner flail heads can be centre mounted or end mounted according to user preference.

**IMPORTANT:** Head float is most effective when the flail head is centre mounted.

The hydraulic hose length for the motor hoses supplied makes allowance for different user mounting preferences. The hoses must run down the back of the second arm from the bulkhead connection plate to the head motor in a smooth unrestricted loop, see typical right hand configuration in figure 4.2. (Typically, on left hand configurations the loop is not necessary.) Hose clamps on the arm and the flail head cowl are provided to guide the hose routing. The bend radius of this loop must not be less than ten times the diameter of the hose. If possible ensure the hoses are clamped to the cowl to allow for full articulation of the cowl ram without snagging the hoses.



**Figure 4.2**

(Note: Typical RH set up illustrated)

## 4.1 Connecting the cutting unit motor

Connection of the drive hoses to the flail head motor will determine the direction of rotation of the cutting rotor shaft. For safe cutting of both grass and hedge the Bomford Turner standard factory build supports '**Reverse rotation**' (for definition see section 1.3).

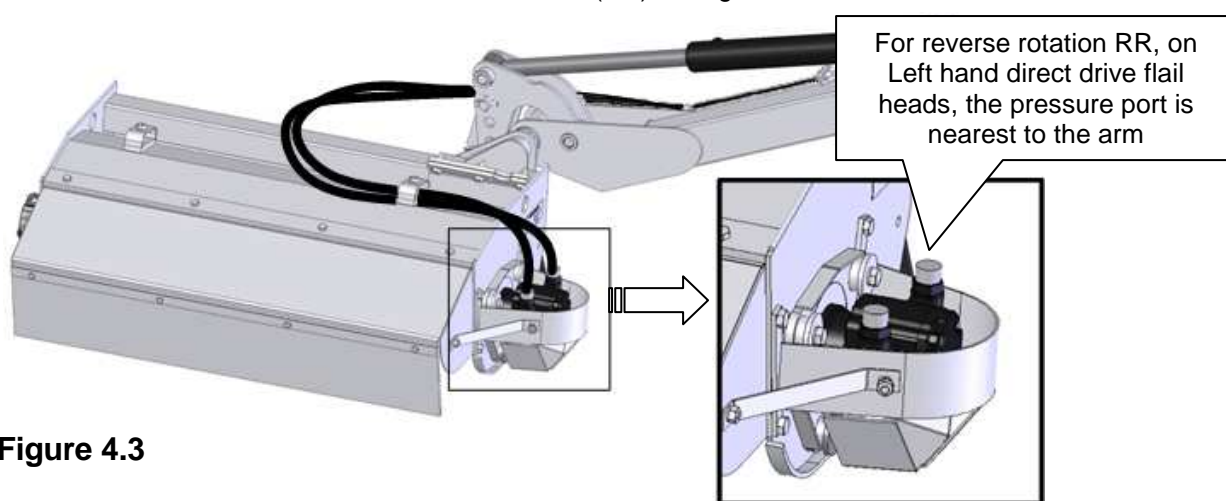
There are two types of flail head configuration available. These are; 'Direct drive' and 'Belt drive'. Direct drive allows for one rotor speed dictated by the PTO input. Belt drive allows for two operating speeds depending on the pulley configuration used.

On a left hand arm mower the drive motor will be on the end of the flail head furthest from the tractor. On a right hand arm mower the drive motor will be on the end of the flail head nearest the tractor.

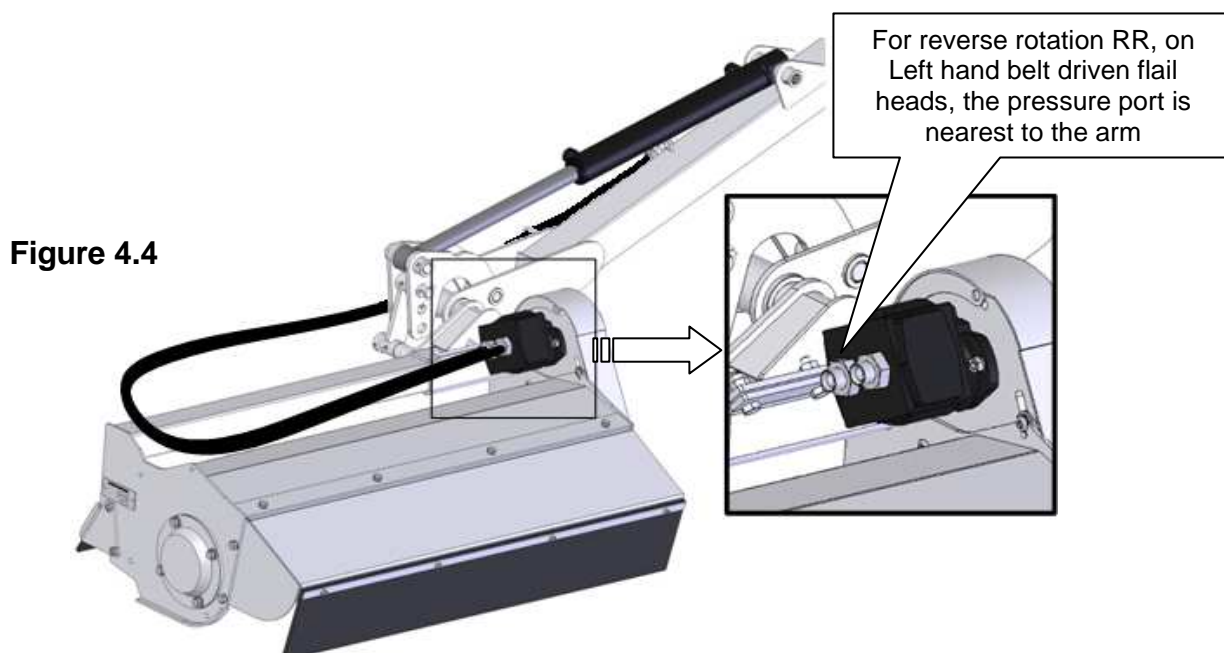
This convention ensures that shaft rotation is common between left hand and right hand machines and that the pressure hose is always connected to the motor port closest to the arm mounting point to achieve reverse rotation (RR).

To connect a direct drive flail head in reverse rotation (RR) see figure 4.3.

To connect a belt drive flail head in reverse rotation (RR) see figure 4.4.



**Figure 4.3**



**Figure 4.4**

Having connected the hoses to the motor supplied, then;

- 4.1.1 Start the tractor and engage the PTO with engine on low revs.
- 4.1.2 Switch on the rotor control in reserve rotation as shown on the decal.
- 4.1.3 Check the direction of rotation of the rotor.
- 4.1.4 Stop the rotor and the tractor.
- 4.1.5 If the rotor has run in the wrong direction, reverse the large hoses on the motor.

## 5.0 Hydraulic oils:

The list of oils in figure 5.2 has been approved for use with hydraulically driven flail mowers.

**IMPORTANT:** The warranty on hydraulic equipment is invalidated if oils other than those recommended here are used.

### 5.1 Filter replacement;

The filter element in the filter unit situated on the top of the tank **must** be replaced after the first 50 hours of work and thereafter after every 500 hours of work or after 'two seasons' work whichever is the sooner. See figure 5.1.

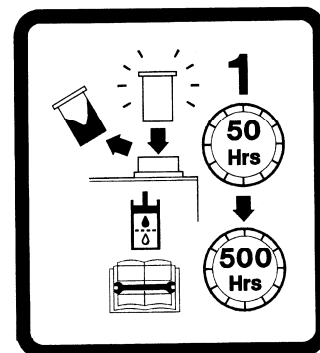


Figure 5.1

### 5.2 Filling the tank;

**IMPORTANT:** Before filling the tank with oil connect the drive hoses together using one of the adapters from the motor fitted to the cutting head.

Unless the tank is already full, the correct procedure for filling the oil tank is as follows:

- 5.2.1 Remove breather cap and strainer assembly and place at side of tank.
- 5.2.2 Check unions on suction hose from tank to pumps for tightness and freedom from kinks and restrictions.
- 5.2.3 Fill tank to half way up the sight glass with the correct grade of oil from the recommended list, see figure 5.2.

**WARNING!** Only use oil on the approved list, see figure 5.2.

- 5.2.4 Replace breather cap and strainer assembly.
- 5.2.5 Avoid contamination at all times particularly when the breather cap and strainer assembly is removed.

Figure 5.2: Approved oils

ANTAR	-	Agria FM 10W/30
B.P.	-	Energol SHF 32 (ISO)
	-	Energol SHF 46 (ISO)
	-	Energol HLP 32 (ISO)
BRASWAY	-	HO.32V
CALTEX	-	Rando HD 46
	-	Five Star Motor Oil 10W
	-	RPM Delo 200 10W
CASTROL	-	Hyspin AWH 46 (not AWS 46)
	-	Hyspin AWH 68 (not AWS 68)
	-	Agricastrol Multi-use 10W/30 (not 20/30)
	-	Agricastrol Hydraulic Oil
CENTURY OILS	-	Nevis 10
COMMA OIL	-	Comma LIC 10 Hydraulic Oil
DALTON	-	Silkolene - Grade 219
DUCKHAMS	-	Fleetol MultiLite 10W/30
	-	ZirconQ32
	-	Zircon 68
ELF	-	Multiperformance 2B 10W/30
	-	Olna 46
	-	Hydelf 32
	-	Hydelf 68
ESSO	-	Univis N46
FILTRATE	-	Hydraulic Oil 10W/30
FORD	-	M2C-48-C Multi-purpose Hydraulic Oil
GULF	-	Gulfube Motor Oil XHD 10W/30
	-	Gulf Hydrasil 32
	-	Multi G 10W/30
J.O. BUCHANAN	-	Alpha 'O' 10W/30
	-	Hydroil 68
LORCO	-	FVT 46 Fourfold Treated Hydraulic Oil
MOBIL	-	DTE 15
DTE 24	-	Delvac Special 10W/30
PETROFINA	-	Fina Delta Multigrade 10W/30
	-	Fina Hydran 32
	-	Fina Hydran 68
SHELL	-	Tellus T46
	-	Tellus T37
TEXACO	-	Randis A2 32
	-	Rando CZ 68
TOTAL	-	Equivis ZS32
	-	Equivis ZS46

### 5.3 Filling the Gearbox

The gearbox capacity is 0.5 litres. Always check the oil level before use and top up if necessary. Recommended gearbox oils are listed in Figure 5.3.

### 5.4 Greasing pivot points

Any lithium-based grease can be used for lubricated pivot points.

Recommended Gearbox oils	
Mobil	Mobiland Universal multi-purpose tractor
Exelube	Super universal tractor oil

Figure 5.3

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## 6.0 Controls overview:

Your Bomford Turner machine will be fitted with one of four available control systems detailed in the following standard sections;

- 7.0 Cable control:** which is a mechanical system where the control valve is operated by cables and is actuated by mechanical levers.
- 8.0 LPH control:** which is a hydraulic system where two hydraulic services on the control valve are operated by low pressure hydraulic flow; actuated by a single joystick; and other services are operated by electronic switches.  
There are two joystick configurations depending on machine type.
- 9.0 EPP III control:** which is an electrical system where the control valve is operated by electronic signals and is actuated by joystick or electronic switches mounted in a control box. Two services; first and second rams; are proportionally controlled.
- 10.0 ICS control:** which is an electrical system where the control valve is operated by electronic signals and is actuated by joystick or electronic switches mounted in a control box. Three hydraulic services are proportionally controlled, with all remaining services having ramped control. This control also benefits from a setup and diagnostics screen and a three user settings memory. Up to three operators can store preferred personal speed settings for each direction of every ram service.

Raven machines can be fitted with either Cable or LPH controls, thus sections 9.0 and 10.0 are deliberately left blank in this instruction manual.

### 6.1 Definitions:

The text in this instruction by necessity needs to refer to relative rotational directions. The terms clockwise and anti-clockwise are themselves relative definitions and depend on the operator's viewpoint. To eliminate confusion the following definition will be used throughout this text;

Under normal cutting conditions flail rotation in the flail head should be the reverse of the tractor drive wheel rotation, this will be defined as '**Reverse rotation**' (RR).

When the direction of flail rotation in the flail head is the same as the tractor drive wheel rotation, this will be defined as '**Forward rotation**' (FR).

Additionally, other references to 'clockwise' and 'anti-clockwise' actions by the operator conform to international right hand thread conventions for 'screw down' and 'un-screw' respectively.



## 7.0 Cable controls

The Bomford cable control system is fitted and comprises a curved metal armrest surmounted by an operation decal. Up to five hydraulic service control levers can be added to the armrest. The hydraulic service control levers are normally identified with black knobs.

Additionally there is an On/Off lever identified by a red knob. This basic cable ON/Off control can be optionally replaced with a cable rotor reverse control lever also identified with a red knob. To avoid confusion there will only be one red knob lever fitted on a set of controls.

The entire assembly is connected to the machine control valve by cables. There is one cable per lever.

The entire assembly can be mounted within the tractor cab using a universal cab mounting kit.

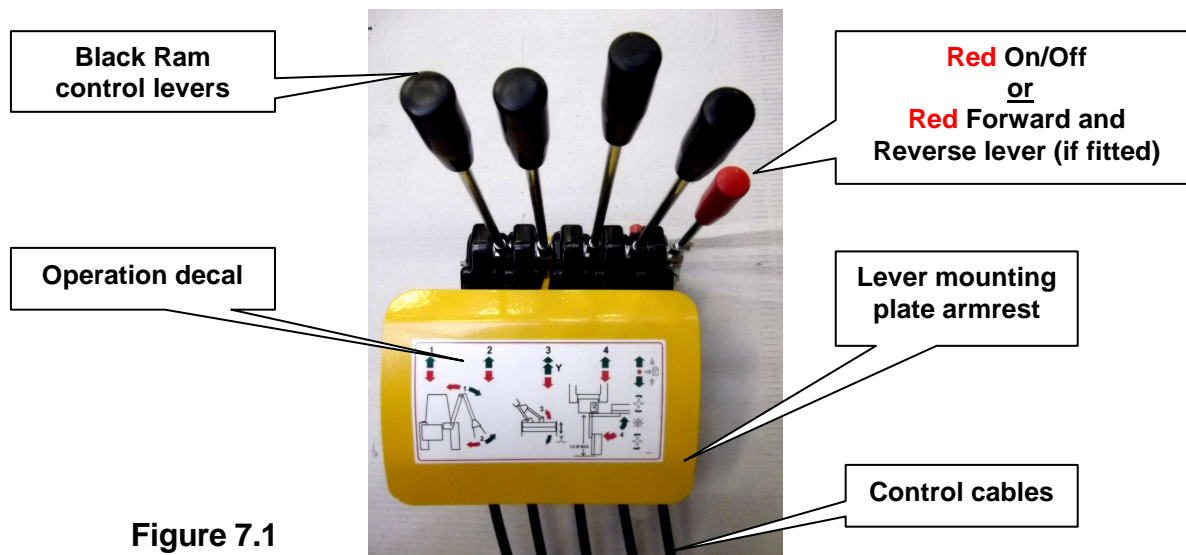


Figure 7.1

### 7.1 Fitting the control lever unit

The position of the lever unit inside the tractor cab depends largely upon the route of the cables between unit and control valve. The cable normally can be routed through the rear cab window and should be as free of bends as possible.

**IMPORTANT:** Do not pinch any cables in a closed window.

If the tractor cab has special apertures for cables, then the lever unit should be fed through them before they are attached to the tractor cab.

**IMPORTANT:** The remote control cables must not have a bend of less than 150mm (6in) radius.

Follow instructions below for fitting lever unit:

- 7.1.1 Pass lever unit and cable through the window or suitable aperture in rear of tractor cab.

**IMPORTANT:** See separate cab fitting kit instruction sheet supplied with the machine. It is essential not to drill mounting holes through any structural member of the safety cab.

- 7.1.2 Mount the unit securely on to the mounting bracket with bolts provided.
- 7.1.3 Check motor control lever for smooth operation in both directions. If any stiffness is detected check the cable for sharp bends.

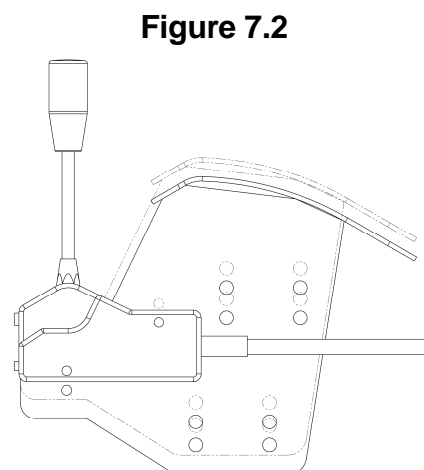


Figure 7.2

- 7.1.4 Adjust arm support to suit operator handling preferences. The lever body can be raised or lowered relative to the armrest, see figure 7.2.

**IMPORTANT:** Whenever the machine is removed and the tractor is operated without the control valve unit in place, fit rubber beading (contained in cab fitting kit) to the edge of the console mounting bracket to prevent risk of injury.

## 7.2 Stopping quickly

In an emergency bringing the cutting head to a stop requires familiarity with the lever controls fitted to the machine.

If the machine is fitted with a **red** On/Off lever pull the lever to stop, disengage the PTO drive and switch off the engine. Wait until the rotor has audibly stopped turning before approaching the flail head. When leaving the cab always pocket the ignition keys.

If the machine is fitted with a **red** cable rotor reverse control (CDSR) move the lever to the stop position, disengage the PTO drive and switch off the engine. Wait until the rotor has audibly stopped turning before approaching the flail head. When leaving the cab always pocket the ignition keys.

**IMPORTANT:** The tractor PTO control should not be used to engage or disengage the drive to the rotor.

## 7.3 Movement of cable control levers

An instruction decal for control valve operation is provided just behind the levers on the lever mounting plate arm rest. The decal is illustrated in Figure 7.3. **IMPORTANT:** If this decal is damaged in any way it must be replaced.

**Black** Lever 1 controls the first arm ram.

Push forwards to lower the arm and pull back to raise the arm.

**Black** Lever 2 controls the second arm ram.

Push forwards to lower the arm and pull back to raise the arm.

**Black** Lever 3 controls a telescopic ram (If fitted).

Push forwards to extend the ram and pull back to retract the ram.

**Black** Lever 4 controls the cowl angling ram.

Push forwards to lower the angle of the head and pull back to lift the angle of the head.

This lever also has a detent position on push forward.

Overcoming the detent position and pushing the lever fully forward to position 'Y', engages head float, see section 7.4.

**Black** Lever 5 controls the slew ram (If fitted).

Push forwards to slew the arm into work and pull back slew the arm into transport position.

**CAUTION:** Do not slew to the rear of the machine with the arms extended more than 2m beyond the kingpost pivot or a tipping instability may result.

The **Red** Lever controls rotor on off (If fitted).

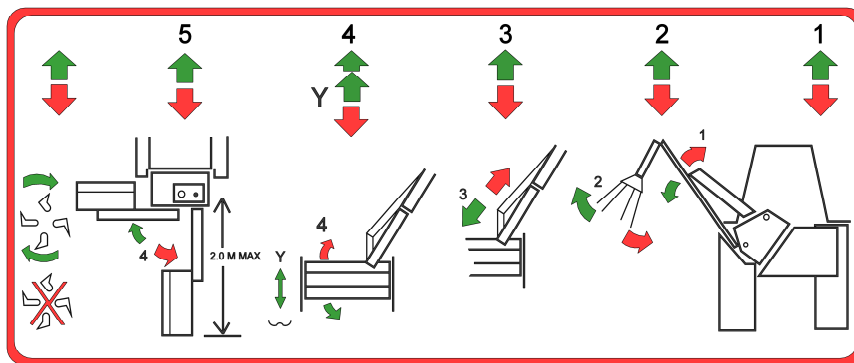
Push forwards to start the rotor and pull back to stop the rotor  
The resulting rotation direction is determined by the hose connections used when mounting the flail head to the base unit, see section 4.0.

**OR...**

The **Red** Lever controls rotor reverse (If fitted).

Push forwards to start the rotor in '**Forward rotation**' (**FR**). Pull back to the mid lever position to stop forward rotation. There is a pawl which prevents instant shifts between rotation directions. Lift the pawl to allow the lever to move beyond the mid position from any direction. **WARNING:** Always wait for the rotor to stop rotating completely before raising the pawl. Pull the lever fully back to start in '**Reverse rotation**' (**RR**). **NOTE:** The rotation direction is determined by the hose connections used when mounting the flail head to the base unit, see section 4.0

A typical decal (for a five service machine with on off controls) is illustrated in Figure 7.3. The operator must be familiar with the operation of these levers before commencing work.



**Figure 7.3**

#### 7.4 Head float

All Bomford Turner machines have head float fitted as standard. When the machine is to be used for cutting verges, the head float may be turned on. Head float has the benefit of letting the flail head pitch side to side around the cowl movement axis, smoothing out lumps and bumps in the ground being worked upon. This will create a more level cut, reduce “scalping” of the ground, and will prolong the life of the arm mower by reducing shock loads in the arms. This works most efficiently when the arm is centrally mounted on the cowl rail.

To engage the head float push fully forward the cowl angling lever, overcoming the intermediate spring detent until it engages in the valve detent position ‘Y’.

#### 7.5 Manual arm float (If fitted)

There are no lever controls for this. Instead there is a manual hydraulic tap fitted on the first arm. If the machine is to be used on rough or undulating ground, then the manual arm float must be engaged. In order to do this the hydraulic tap on the first arm ram need to be opened. As a result, when the spool valve is closed and the arm is pushed up by the undulating ground the displaced oil is diverted into an accumulator bottle. When the machine is to be moved into transport position, the valve will need to be closed again before manoeuvring the arms.

## 8.0 LPH controls

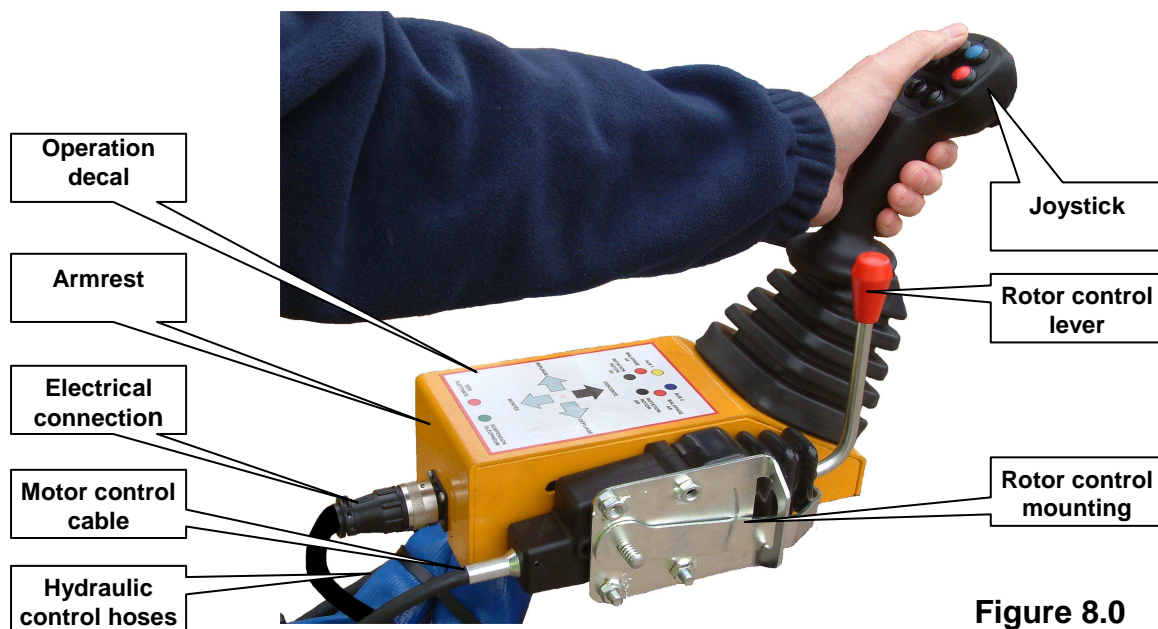
The Bomford LPH (Low Pressure Hydraulic) control system is fitted and comprises a joystick and armrest for mounting in the tractor cab connected to the machine via low pressure hydraulic control hoses and an electrical loom connected to a control box positioned either on the top or the side of the oil tank. If your machine is fitted with a cover or cooler lid it is likely to be fitted under it. Under normal circumstances the system will already be connected to the machine it is controlling and only requires electrical connection to the tractor (see section 8.1.1) and also fitting into the tractor cab, see section 8.5.

Optionally, rotor on and off and reverse controls can be fitted to the armrest. There is a choice of both, cable or electric diverter; to simply start or stop the rotor; and cable and electric rotor reverse controls. In figure 8.0 a cable rotor control lever (CDSR - Cable Dual Sense Reverse) is illustrated. The electric controls are operated by push button switches and additional rocker switches which are either set into the armrest or added to the side.

The joystick provides proportional control to the first ram and second ram, with non-proportional control through push button switches to slew ram, cowl ram, (and if fitted) the telescopic ram and forward arm ram. On machines which support a turntable option, the turntable ram is accommodated through the use of an additional rocker switch on the electric rotor control box.

Push buttons are also provided for head float, arm float.

A typical LPH control setup is illustrated in figure 8.0 below;



**Figure 8.0**

## 8.1 Connecting the LPH control unit

Under normal circumstances the LPH control system will already be connected to the machine it is controlling and only requires to be connected electrically and fitted into the tractor cab. The position of the unit inside the cab depends largely upon the preference of the operator. An armrest mounting kit is provided which attaches the unit to the cab, see section 8.5.

The LPH control hoses are 3.5 meters long and may be fed through an open cab window or suitable aperture in the rear of the cab. Take care to avoid sharp edges which may damage the hoses. Do not trap the hoses when closing cab windows

### 8.1.1 Electrical Connections

Power is supplied through a pre-wired loom with a 7 pin trailer socket and is powered from the tractor side light circuit. Connect the power lead with the 7 pin connector into the tractor 7 pin socket and switch on the tractor sidelights.

The power lead from the control box to the LPH joystick is 4.8 metres long may be fed through an open cab window or suitable aperture in the rear of the cab. Take care to avoid sharp edges which may damage the cable. Do not trap the cable when closing cab windows. It is recommended that the power to the LPH control box is disconnected at the end of each working day.

**WARNING:** Once the machine is fitted to the tractor and the power connected, it may be possible to slew the arms to hit the cab. Serious injury or damage could occur. The slewing operation must be practised with care to ensure safe operation.

## 8.2 Emergency cut-off

In an emergency bringing the cutting head to a stop requires familiarity with the lever controls fitted to the machine.

### 8.2.1 For machines fitted with Cable controls then;

If the machine is fitted with a red On/Off lever (COFF) pull the lever to stop, disengage the PTO drive and switch off the engine. Wait until the rotor has audibly stopped turning before approaching the flail head. Stop the engine when leaving the cab and always pocket the ignition keys.

If the machine is fitted with a red cable rotor reverse control (CDSR) move the lever to the stop position, disengage the PTO drive and switch off the engine. DO NOT lift the pawl. Wait until the rotor has audibly stopped turning before approaching the flail head. Stop the engine when leaving the cab and always pocket the ignition keys.

**IMPORTANT:** The tractor PTO control should not be used to engage or disengage the drive to the rotor.

### 8.2.1 For LPH machines fitted with Electric controls then;

In both Electric on/off (EOFF) and electric rotor reverse (EDSR) the red mushroom button disables power to the rotor control rocker switch. Push down to latch in OFF position. This stops the cutter rotation only. It is reactivated by twisting the button clockwise and allowing it to release upwards. When reactivated any previously active rotor functions are de-activated.

**WARNING:** The rotor has considerable inertia and will not stop instantly on pressing the stop button.

## 8.3 Joystick Movement (See figure 8.3 below)

When operating any of the joystick controls take care. The cutting head must at all times be lowered gently into the cutting position. Never 'drop' a flail head into a hedge at speed.

Similarly, when cutting at ground level (grass etc.) the head must be lowered gently to give a slight contact pressure of the roller to the ground.

**DANGER!** Before attempting to remove any items that foul the flail head ALWAYS stop the machine, disengage the PTO, switch off the engine and pocket the key.

**WARNING!** Ensure the flail head does not come into contact with obstacles such as rocks, stones, stumps etc. Keep the rotor away and free from wire, because wire entangled in a rotor is both dangerous and costly. Should large obstacles be encountered or wire becomes entangled in the rotor STOP IMMEDIATELY and reset or clear obstacles before continuing.

Normal obstacles and level variations should be overcome by the operator slowing 'forward motion' and raising/lowering the arms of the machine to suit.

### 8.3.1 Movement of the joystick in a 'Forward' and 'Backward' direction operates the first arm:

- Forwards (away from the operator) – lowers the first arm
- Backwards (towards the operator) – raises the first arm

### 8.3.2 Movement of the joystick in a 'Sideways' direction operates the second arm:

- Left – Moves second arm away from the operator (for left hand machine)
- Right – Moves second arm towards the operator (for left hand machine)
- **These are REVERSED if a right handed machine is being operated.**



**Figure 8.3** – Arm rest decal

## 8.4 The Joystick button functions

The control decal in figure 8.3 above is illustrated as viewed from the driving position. **NOTE:** the arm float button is only operative if the machine is fitted with the electrical arm float option.

The remaining cowl ram is controlled by the thumb rocker switch at the top of the joystick, see figure 8.3 and as follows for left hand machine. **These are REVERSED if a right handed machine is being operated.**

- 8.4.1 Head ACW** rocker switch – when the rocker switch is thumbed to the left the flail head is rotated in an anti-clockwise direction when viewed from behind the tractor.
- 8.4.2 Head CW** rocker switch – when the rocker switch is thumbed to the right the flail head is rotated in a clockwise direction when viewed from behind the tractor.

Float function controls are located on the upper face of the armrest behind the joystick, see figure 8.3 and as follows;

- 8.4.3 Head float** button – Engages the electric head float. Press once to engage – press again to disengage. When the machine is to be used for cutting verges, the head float may be turned on. Head float has the benefit of letting the flail head pitch side to side around the cowl movement axis, smoothing out lumps and bumps in the ground being worked upon. This will create a more level cut, reduce “scalping” of the ground, and will prolong the life of the arm mower by reducing shock loads in the arms, cowl, roller bearings etc. This works most efficiently when the arm is centrally mounted on the cowl rail.
- 8.4.4 Arm float** button – Engages electric arm float. Press once to engage – press again to disengage. **NOTE:** the arm float button is only operative if the machine is fitted with the electrical arm float option. If fitted, turning on the arm float will allow the arm mower to ride undulating ground without

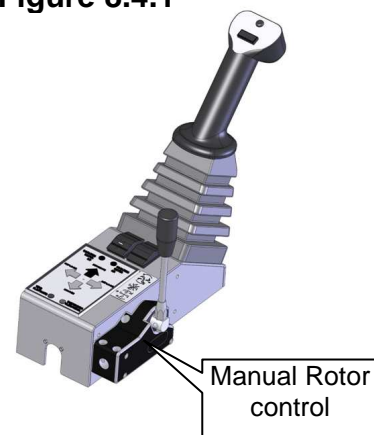
transferring these displacements to the tractor, and will also prolong the life of the arm mower and flail head. When the machine is to be moved into transport position, or the arms are to be moved from their work position, then the arm float will need to be disabled by pressing the same button on the joystick again.

**8.4.5 Manual arm float operation** – There are no joystick controls for this. Instead there is a manual hydraulic tap fitted on the first arm. If the machine is to be used on rough or undulating ground, then the manual arm float must be engaged. In order to do this the hydraulic tap on the first arm ram need to be opened. As a result, when the spool valve is closed and the arm is pushed up by the undulating ground the displaced oil is diverted into an accumulator bottle. When the machine is to be moved into transport position, the valve will need to be closed again before manoeuvring the arms.

#### 8.4.6 Cable operated rotor on/off (COFF – if fitted)

- 8.4.6.1 The cable rotor on/off lever is easily identified by a red coloured knob. It is attached to the side of the armrest as illustrated in figure 8.4.1.
- 8.4.6.2 To operate, push forwards to start the rotor and pull back to stop the rotor.
- 8.4.6.3 The rotation direction is determined by the hose connections used when mounting the flail head to the base unit, see section 4.0.

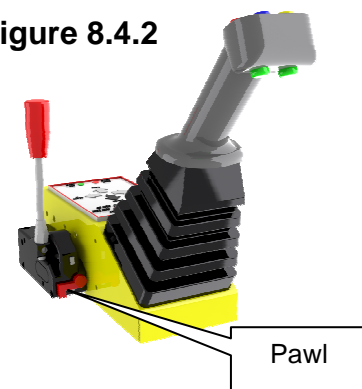
Figure 8.4.1



#### 8.4.7 Cable operated rotor reverse (CDSR – if fitted)

- 8.4.7.1 The Cable Operated Dual Sense (CDSR) rotor reverse control is mounted in the same way as for the Cable on off control Figure 8.4.1.
- 8.4.7.2 To operate, push forwards to start the rotor in 'Forward rotation' (FR) and pull back to the mid lever position to stop forward rotation.
- 8.4.7.3 There is a pawl which prevents instant shifts between rotation directions, see Figure 8.4.2. Lift the pawl to allow the lever to move beyond the mid position from any direction.

Figure 8.4.2



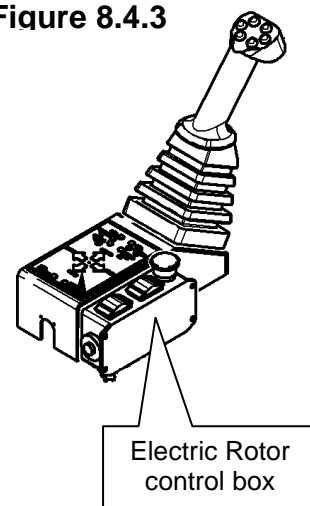
**WARNING:** Always wait for the rotor to stop rotating completely before raising the pawl.

- 8.4.7.4 Pull the lever fully back to start in 'Reverse rotation' (RR).
- 8.4.7.5 NOTE: The rotation direction is determined by the hose connections used when mounting the flail head to the base unit, see section 4.0.

#### 8.4.8 Electric rotor on/off (EOFF)

- 8.4.8.1 The electric rotor on/off control consists of a switch box containing a red mushroom stop button and a rocker switch. (An optional and additional service switch can also be mounted within the same box.) The box is attached to the side of the LPH armrest in the same way as the illustration in Figure 8.4.3
- 8.4.8.2 To operate, press the rocker switch once and to stop press the opposite end of the rocker switch again. The switch contains an indicator lamp which illuminates when the switch is on.

Figure 8.4.3



**WARNING:** The rotor has considerable inertia and will not stop instantly on pressing the stop button.

- 8.4.8.3 The rotation direction is determined by the hose connections used when mounting the flail head to the base unit, see section 4.0. The red mushroom button disables power to the rotor control rocker switch. Push down to latch in OFF position. This stops the cutter rotation only.

**WARNING:** The rotor has considerable inertia and will not stop instantly on pressing the stop button.

8.4.8.4 It is reactivated by twisting the button clockwise and allowing it to release upwards. When reactivated any previously active rotor functions are de-activated. The Tractor PTO emergency stop control must be used to disable the rotor control during road transit and whenever the operator stops the tractor or leaves the cab.

#### 8.4.9 Electric operated rotor reverse (EDSR)

The Electric Operated Dual Sense (EDSR) rotor reverse control consists of a switch box containing a red mushroom stop button and at least one two way rocker switch. (An optional and additional service switch can also be mounted within the same box).

The box is attached to the side of the LPH armrest in the same way as the illustration in Figure 8.4.3.

**IMPORTANT:** The correct rotation direction is determined by the hose connections used when mounting the flail head to the base unit, see section 4.0.

To operate the EDSR rocker switch see figure 8.4.4.

8.4.9.1 The rocker switch is a two way latching rocker switch with indicator lamps (8.4.4a).

8.4.9.2 For reverse rotation press the end of the rocker switch identified with a solid arrow. The switch will latch on and illuminate to show that reverse rotation is engaged but the switch itself will return to the neutral position (8.4.4b). The rotor will start in reverse rotation.

8.4.9.3 To stop normally, press the end with the solid arrow again, at which point the illumination lamps will flash for a short time.

8.4.9.4 Whilst the lights are flashing the switch is inoperative to allow the rotor to come to a stop. This prevents instantaneous selection of opposite rotation.

**WARNING:** The rotor has considerable inertia and will not stop instantly on pressing the stop button.

8.4.9.5 When the lights have stopped flashing reverse or forward rotation may be selected.

8.4.9.6 For forward rotation, press the end of the rocker switch with the outline arrow symbol. The switch will again latch on and illuminate to show that forward rotation is engaged but the switch itself will return to the neutral position (8.4.4c). The rotor will start in forward rotation.

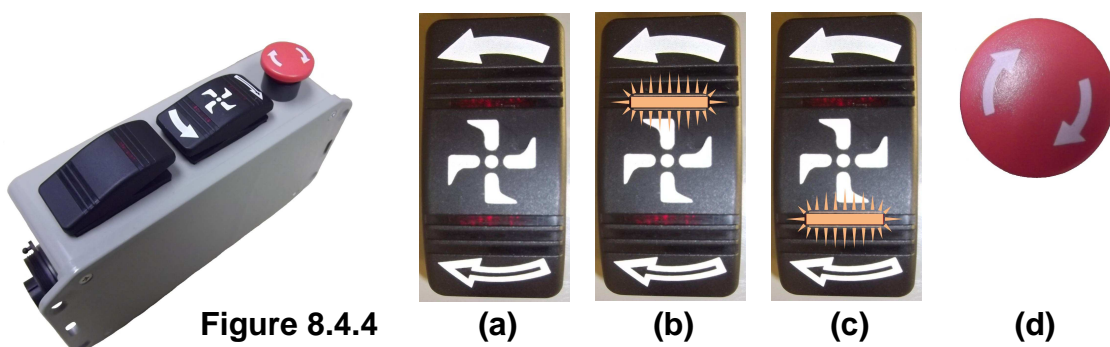
8.4.9.7 The red mushroom button disables power to the rotor control rocker switch, see (8.4.4d). Push down to latch in OFF position. This stops the rotor only.

**WARNING:** The rotor has considerable inertia and will not stop instantly on pressing the stop button.

8.4.9.8 It is reactivated by twisting the button clockwise and allowing it to release upwards.

8.4.9.9 When reactivated any previously active rotor functions are de-activated (8.4.4a).

8.4.9.10 The Tractor PTO emergency stop control must be used to disable the rotor control during road transit and whenever the operator stops the tractor or leaves the cab.





## 8.5 Armrest mounting

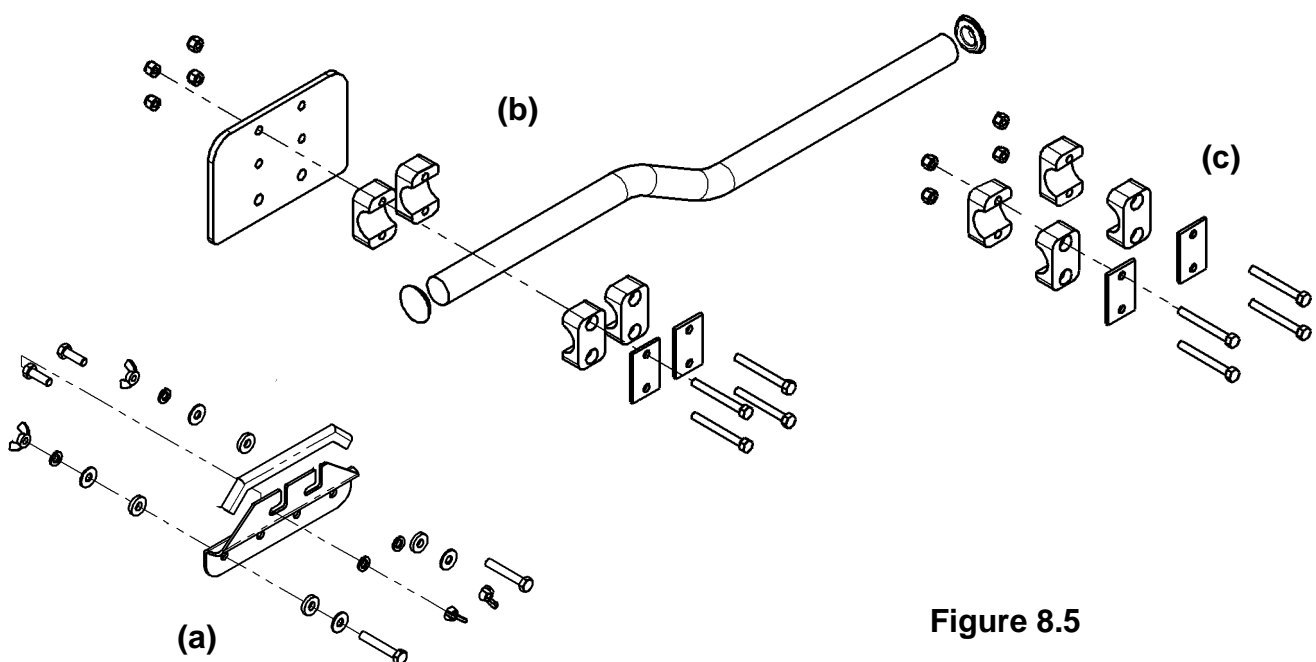
Cable and low pressure hydraulic control armrests can be fitted into the cab using a remote cab control kit, see figure 8.5.

A universal cab mounting bracket is supplied, see figure 8.5a. Depending on the cab construction this bracket can be mounted on the steel body of the cab as follows;

**IMPORTANT:** Do not drill through any structural cab supports.

- 8.5.1 Two 50mm long by 8mm setscrews, two M8 wing nuts, 4off rubber washers, 2off flat washers and 2off spring washers are supplied for the purpose of fastening the cab mounting bracket to the cab, see figure 8.5a Use the cab mounting bracket for marking out, and then drill 2off 9mm diameter holes in the preferred location. Use the fasteners to mount the bracket. If the armrest is subsequently removed and the bracket is left in place then for safety a small piece of protective edging strip is provided to cover the upper edge of the bracket and this should be either fitted or retained.
- 8.5.2 The cable or LPH armrest control can be fitted directly to this bracket if space and ergonomics permit. Otherwise there is a mounting extension bar which can be fitted to the cab mounting bracket, see figure 8.5b.
- 8.5.3 Assemble the mounting plate, clamps and extension beam with the fasteners as illustrated in figure 8.5b. Remove the protective edging strip from the cab mounting bracket and retain it for future use. Bolt the extension beam mounting plate to the cab mounting bracket. If necessary slacken the clamps on the extension tube and turn the offset extension bar to present the most favourable ergonomics for a seated operator.
- 8.5.4 Finally, assemble the armrest mounting clamps onto the armrest but do not tighten, see figure 8.5c. Leave sufficient play to allow the armrest and clamp assembly to be slid easily onto the end of the now rigid extension beam. Once the armrest is positioned and rotated favourably tighten the bolts fully.
- 8.5.5 When temporarily removing the arm mower controls from the cab the armrest and extension beam should be removed as one piece. This preserves the setup for when the arm mower controls are re-fitted.

**IMPORTANT:** Always refit the protective edging strip to the cab mounting bracket when the controls are removed.



**Figure 8.5**

## 9.0 EPP III controls

**This function is not available in the RAVEN arm mower range.**

(This section is intentionally blank)

## 10.0 ICS controls

**This function is not available in the RAVEN arm mower range.**

(This section is intentionally blank)

## 11.0 Installation checks:

With the machine fully assembled, familiarize yourself with all the controls, start the tractor and check for leaks.

### 11.1 Checking Head float

All Bomford Turner machines have head float fitted as standard. Head float allows the flail head to pitch side to side around the cowl movement axis, smoothing out lumps and bumps in the ground being worked upon. It works most effectively when the flail head is mid-mounted. To check the head float operation;

- 11.1.1 Start the tractor engine and move the arms into a normal work position with the flail head raised about 1m (39") off the ground.
- 11.1.2 Switch the head float on. The flail head should slowly rotate as the heavier drive end sinks under gravity. In specific circumstances the head may also be in complete balance, in which case apply pressure by hand to lift or lower one end of the flail head.
- 11.1.3 If the system is operating there should be some movement in one or other direction. No movement can indicate a fault with the accumulator isolation valve or a defective accumulator.
- 11.1.4 To determine which, replace the cutting head back on ground. Stop the tractor engine and operate the cowl ram control to remove pressure from the hydraulic system.
- 11.1.5 Remove the isolator valve. Reconnect the hose and repeat the test from item 11.1.1.
- 11.1.6 If there is again no movement in the flail head this indicates an accumulator defect. However, if there is movement in the flail head then this indicates a faulty isolator valve.
- 11.1.7 Repeat instruction 11.1.4, replace the defective part and repeat the test procedure to confirm the correct operation.

### 11.2 Checking Arm float (If fitted)

Arm float is an optional feature. It allows the first arm to rise or fall under the action of ground pressure or gravity in order to follow undulating ground. The range of movement is controlled by an accumulator on the lift end of the first ram. Under correct operating conditions the accumulator will be partially charged for level cutting. The accumulator will fill further when the flail head encounters a depression in the ground, and, it will empty when the ground rises.

When the mower is first installed on the tractor, or, when transferring from hedge cutting to verge cutting it is advisable to check that the arm float is operational. The following test procedure should be used;

- 11.2.1 Start the tractor engine and move the arms into a normal work position, with the flail head roller resting on the ground.
- 11.2.2 Open the accumulator isolator valve, i.e. switch arm float on.
- 11.2.3 Operate the first ram and lift the rotor unit about 1 metre (39") off the ground.

**CAUTION:** The rotor should be switched off for this test.

- 11.2.4 Test the accumulator by pushing the rotor unit downwards by hand. This should compress the first ram slightly.
- 11.2.5 If there is no movement in the first ram then a fault is indicated. This could result from a faulty isolation valve or a defective accumulator.
- 11.2.6 To determine which, replace cutting head back on ground. Stop the tractor engine and operate the first ram control to remove pressure from the hydraulic system.
- 11.2.7 Remove the isolator valve. Reconnect the hose and repeat the test from item 1.
- 11.2.8 If there is again no movement in the first ram this indicates an accumulator defect. However, if there is movement in the first ram then this indicates a faulty isolator valve.
- 11.2.9 Repeat instruction 11.2.6, replace the defective part and repeat test procedure to confirm correct operation.

## 11.3 Breakout

All breakout systems are designed for the purpose of providing initial protection to the mower and its cutting attachment. This protection is to be afforded in the relatively rare circumstance that an obstruction; unseen by the operator; is encountered during work.

Breakout systems are not designed as a complete protection system to remove operator responsibility. The operator must always be in control. By breaking back the arm signals to the operator that an obstruction has been encountered and it is then the responsibility of the operator to take appropriate action to prevent any further damage to the arm mower. Damage resulting from continuing to work with the arm 'broken back' will invalidate warranty claims.

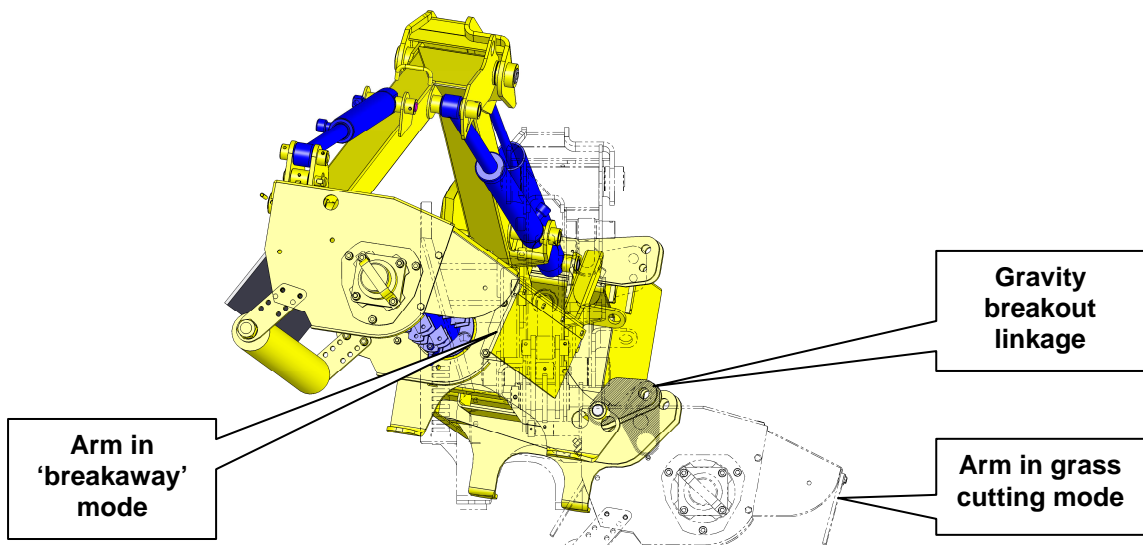
In most cases the speed of response required by the operator is proportional to the cutting speed. Operators must therefore work responsibly within their own individual capability. To monitor ongoing capability Bomford Turner endorses the maintenance of operator training records.

There are several types of breakout employed on Bomford Turner machines depending on the duty cycle envisaged for the machine. These are;

- 11.3.1 Gravity breakout
- 11.3.2 Spring breakout
- 11.3.4 Hydraulic breakout.

### 11.3.1 Gravity breakout:

On the Raven, a gravity breakout vertical-link is fitted between the mainframe and the tractor lift arm attachment point on the cutting side. See the gravity breakout linkage in figure 11.3.1. It will reduce the risk of damage if an obstruction is encountered during work.



**FIGURE 11.3.1**

When an obstruction is encountered the arm is pushed back by the obstacle and as it is pushed back the gravity breakout linkage ensures that the cutting head is also raised slightly. The force to 'breakout' of the work position is the force to overcome the weight of the arm mower. This force increases linearly as the arm is pushed back and the breakout linkage rotates. When the linkage is horizontal the arm cannot breakout any more. At this point, if the obstacle has not been overcome or if forward progress is not stopped by the operator; the arms are no longer protected and will begin to bend. Beyond this point and depending on the power of the tractor the arms may become permanently damaged. Mounting the Raven on a tractor larger than 70hp allows the operator to drive faster and also de-sensitises the operator to feedback from the gravity breakout system. This allows less time to respond and will not only stress the arm mower structure but also the drive system.

Always use on an appropriately sized tractor and drive within the operator capability.

## 11.4 Hydraulic Hoses

It is important that hoses are fitted correctly. Always check all hoses to ensure that there are no kinks or sharp bends, and that the hoses do not chafe against sharp edges. The following guidelines should be used when checking the hosing of the machine prior to work;

### 11.4.1 Twists;

Hoses should never be twisted or kinked. On most hoses there is a line which runs the full length of the hose acting as a useful guide. If a visual check reveals that no guideline is present along a hose, refer to figure 11.4.1 and conduct the following check;

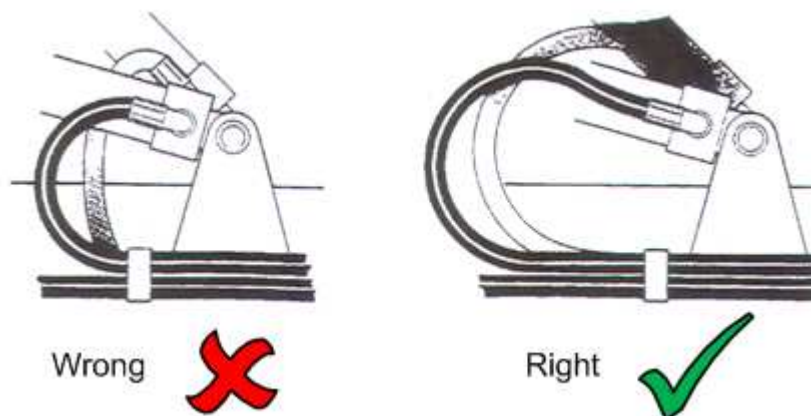
- 11.4.1.1 Loosen any clamps.
- 11.4.1.2 Attach one end of the hose to its coupling, but do not tighten.
- 11.4.1.3 Place the hose in its required position.
- 11.4.1.4 Connect the other end loosely to its union.
- 11.4.1.5 Tighten the and with any angled fittings first ensuring it is in the right position for its intended run.
- 11.4.1.6 Now tighten the straight end. It is possible that as the nut is tightened the hose may twist slightly.
- 11.4.1.7 If this happens, slacken off the nut and turn the hose in the opposite direction to that caused by tightening. Then, re-tighten the nut bringing the hose back to the central position.
- 11.4.1.8 Otherwise tighten the fitting fully. Torque settings for BSP hose fittings are shown in table 11.4 below.
- 11.4.1.9 Tighten any clamps.
- 11.4.1.10 Finally re-bleed the rams and operate the arms in all positions whilst carefully checking for any twists and obstructions.



**Figure 11.4.1**

### 11.4.2 Sharp bends

Hoses should always be fitted to allow enough hose radius for free movement, see figure 11.4.2. It is also important to avoid sharp bends in hoses. As a general guideline hoses should not be bent round a radius smaller than ten times the hose diameter. This will vary with hose construction and any queries about specific hoses should be addressed to the Bomford Turner service department.



**Figure 11.4.2**

**11.4.3 Chafing hoses**

It is important that hoses are fitted and clamped so that hose chafing is avoided. Always give plenty of clearance around sharp edges see figure 11.4.3



**Figure 11.4.3**

<b>BSP SWIVEL FEMALE TORQUE VALUES</b>				
Thread	Metric (Nm)		Imperial (lbf.ft)	
Diameter (inch)	nominal	Min - max	nominal	Min - max
1/4	20	15 -25	14.75	11.06 - 18.44
3/8	34	27 – 41	25.07	19.91 - 30.24
1/2	60	42 – 76	44.25	30.97 - 56.05
5/8	69	44 – 94	50.88	32.45 - 69.32
3/4	115	95 – 135	84.81	70.06 - 99.56
1	140	115 – 165	103.24	84.81 - 121.68
1 1/4	210	140 – 280	154.87	103.24 - 206.49
1 1/2	290	215 - 365	213.86	158.55 - 269.17

**Table 11.4**

## 12.0 General operation

### 12.1 Operator training

These notes are produced for guidance and are intended to help the operator obtain the best results from the machine, with the minimum of trouble and downtime. The operator should read the following pages carefully and be familiar with the contents before commencing work. A familiar knowledge of the operator instruction manual forms an essential part of the training record for a competent user.

Make a note of the serial numbers inside the front cover of this manual. The serial number is stamped on the mainframe of the arm mower and on the cowl of the cutting unit. Always quote these numbers in any correspondence with a dealer.

The parts manual supplied with the machine is specific to the construction of the machine. It will already contain the machine serial number on each page. Upon delivery always confirm that the parts book serial number matches the machine serial number.

### 12.2 Initial checks

Check that the tractor is equipped to deliver 540 rpm at the PTO shaft. The machine is designed to run at this speed. Check also that the machine is firmly and safely mounted.

**WARNING:** Under no circumstances must the PTO exceed 600 rpm.

### 12.3 Machine pre-start check

At every opportunity and before getting into the cab and starting the engine perform the following inspections;

- 12.3.1 Check that the rotor is free from obstructions especially pieces of wire.
- 12.3.2 Check that all flails are in good condition and securely attached to the rotor.
- 12.3.3 Check that all guards are in their correct place (see Section 2.6 and 2.7) and in good condition.
- 12.3.4 Check the oil level in the tank. The level is correct when up to the indicator mark in the sight glass or visible in the bottom of the filler assembly strainer.

**IMPORTANT:** DO NOT OVERFILL. Most oils increase in volume as they warm up and aerate and can then spill out through the breather. (Refer to Approved Oils Section.)

### 12.4 Starting up procedure

#### 12.4.1 Cold start up

When starting the machine for the first time; when the hydraulic oil is cold; and prior to commencing work, it is essential that the pumps must **not** be run at working speeds initially. To avoid cavitation the pumps should be allowed to warm up gradually. Therefore, the tractor PTO speed should not exceed 360rpm, and this initial speed should only be achieved gradually.

**IMPORTANT:** The cold start up instructions given below should be strictly adhered to.

- 12.4.1.1 Ensure that the tractor PTO drive is in neutral.
- 12.4.1.2 For twin pump independent machines, ensure that the rotor control lever is in the rotor-stopped position. (This is the lever with the red knob which operates the diverter valve [CDIV] or the rotor reverse valve [CDSR]. It will be located adjacent to the ram operation levers.
- 12.4.1.3 Start the tractor engine, run it at idle speed and engage the PTO drive.
- 12.4.1.4 Slowly move the rotor control lever to start the rotor.
- 12.4.1.5 Gradually increase the engine speed.
- 12.4.1.6 Continue to increase the engine speed until the rotor is running smoothly and the PTO speed is approximately 360rpm.
- 12.4.1.7 Run the rotor at this speed for a minimum of 5 minutes to allow the oil in the system to warm up.
- 12.4.1.8 On completion the machine is ready for work.



## 12.4.1 Normal start up

**CAUTION:** Never attempt to start the rotor while it is under load. Always free the rotor from any obstructions first.

**IMPORTANT:** Never increase or decrease PTO speed rapidly as this can lead to pump and motor damage.

## 12.5 Transportation to work site

Normally the machine will need to be driven to the work site before commencing work. To keep the tractor and machine width to a minimum it is necessary to fold the arms to the transport position see figure 12.5.1. On models with a slew breakout ram the arms may also be slewed back at an angle to provide a narrower transport position.

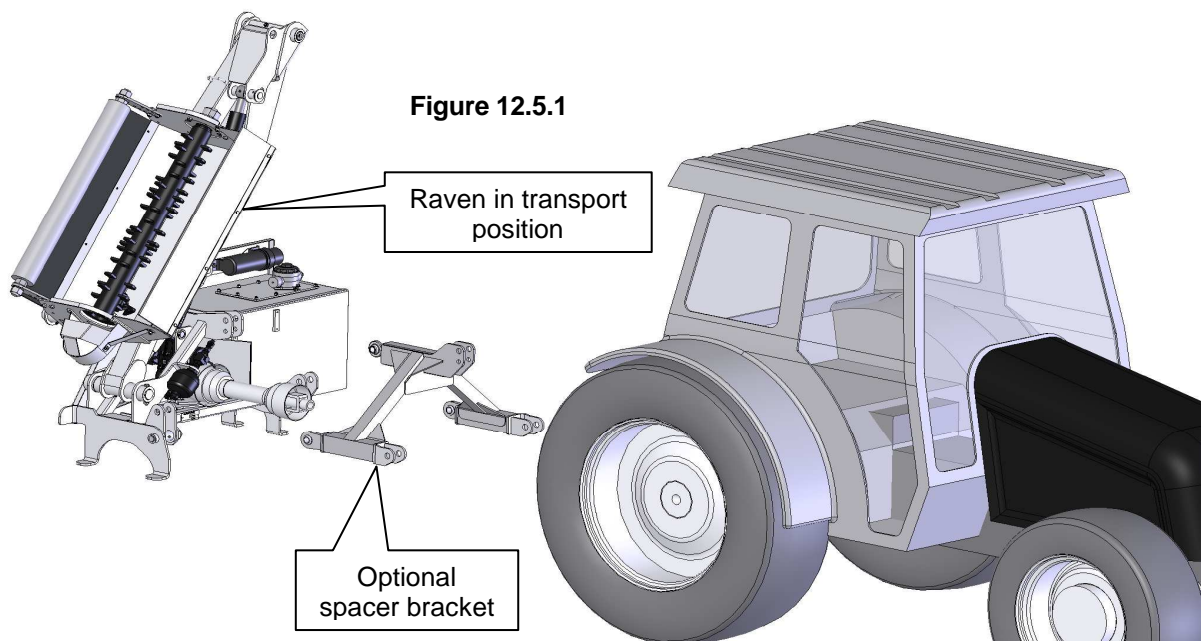
Before driving on the public highway check the following;

- 12.5.1 All hoses are sufficiently clear of the tyres to prevent contact during bounce and sway on braking, turning and undulating ground.
- 12.5.2 It is an essential requirement that when the machine is in the transport position all the isolator valves are closed.
- 12.5.3 When transporting with the arms slewed back, keep the first arm vertical as the arms can bounce forward and damage the tractor cab.
- 12.5.4 Ensure sufficient ballast is added to the front of the tractor to maintain steering under bounce conditions.
- 12.5.5 Ensure that the rear axle load does not exceed the plated axle limit for the tractor
- 12.5.6 Ensure the rear tyres are correctly inflated and rated for the axle load.
- 12.5.7 Ensure all stop, tail and indicator lights (if fitted) are in working order.
- 12.5.8 Ensure all stop, tail and indicator lights are visible to road users at the rear and fit a trailer bar if appropriate.

**IMPORTANT:** When transporting on the highway, it is the responsibility of the operator to obey all relevant local highway laws.

**IMPORTANT:** Pay due care and attention to the driving conditions and drive accordingly. DO NOT travel too quickly over undulating ground. In transport the arms and head represent heavy masses on long lever arms thus braking, turning, sway and bounce can magnify forces and induce significant and damaging loads into the arm mower which is rigidly attached to the tractor. Bomford Turner will not warrant damage bought about by abuse of the machines proper purpose or neglectful handling.

On non-slew machines there is an optional spacer bracket which displaces the whole machine 460mm rearward. For some tractor mounting configurations this may be required to allow the flail head to be tucked in behind the rear wheels. For further details contact a Bomford Turner sales representative.



## 12.6 Cutting control

**CAUTION:** Do not swing the cutting unit inboard beyond the vertical cut when arms are raised above tractor cab height. In this position a loss of control can occur.

The roller on the cutting unit is set in its middle position before the machine leaves the factory. It should be reset to suit the operating conditions and cut length required. This is best achieved by rotating the cowl bracket until the roller is standing upright.

**WARNING:** Ensure the tractor is switched off and the keys are removed before making adjustments.

Undo the roller height location bolts on the roller brackets at each end and push or pull the roller to the required position. Always check to ensure the same hole is used on either side of the roller. Re-tighten the location bolts, ensuring that the spring washers are in place

- For Grass Cutting; adjust the height of the roller to give the required cut length. The higher the roller is raised the shorter the grass. Note: The higher the roller is set the greater the flail wear.
- For Hedge Trimming; raise the roller to its maximum height to give the lowest cut possible.

**IMPORTANT:** The roller must be kept in position at all times as it is an essential part of the cutting unit guarding.

## 12.7 Stopping the cutting unit

The rotor must only be engaged or disengaged by means of the rotor on/off control lever (with red knob) or switch depending on the method of control (e.g. cable or electric), see section 7.0 and 8.0. Stopping the rotor by use of the tractor engine stop or PTO control risks damage to the cutting unit's hydraulic system, and should only be used in an emergency.

**WARNING:** If the rotor is stopped by use of the tractor engine stop or the PTO control, care must be taken to ensure the rotor control lever is returned to the OFF position before restarting the tractor.

## 12.8 Arm float (if fitted)

The machine may be fitted with an accumulator to allow the arms to float for grass cutting application.

The purpose of the arm float is to permit the cutting unit to follow uneven ground without operator intervention as far as possible and to allow most of the weight of the cutting unit to be carried by the tractor, thus minimising the tendency to slew. This also reduces wear on the rotor and in the bearings of the roller.

The arm float is not used when hedge trimming, as the cutting unit would be very difficult to control and uneven (castellated) results would be obtained.

To shut off the arm float close the isolator valve. When opening the isolator valve ensure all head weight is on the ground, otherwise the first arm may move unexpectedly.

**WARNING:** This valve must be closed when the machine is being transported whether the arm mower is in the transport position or not.

## 12.9 Operating hints

- 12.9.1 Keep the tractor PTO speed at 540-550 rpm to maintain the correct rotor speed for the job. Depending on the build of the fitted cutting unit this may be either 2948 to 3237 rpm advised for **hedge** cutting, or 2480 rpm advised for **grass** cutting see sections 12.10 & 12.11. Slower speeds may reduce the quality of cut obtained by the rotor, but satisfactory performance can be maintained down to a rotor speed of 2100 rpm. This can be an advantage with tractors with a high bottom gear.
- 12.9.2 Examine the piece of work to be cut. It is very important that the work site is inspected before cutting and all hidden obstructions removed or their position clearly marked so that they may be avoided.
- 12.9.3 Check hedges for wire and fencing stakes, and ditches for tree stumps, drain pipes, large stones, etc.
- 12.9.4 Stalling the rotor in heavy growth is likely to cause damage to the rotor.

- 12.9.5 Do not operate the machine with the cutting head slewed more than 40° backwards and ensure sufficient stability ballast is used when cutting in a slewed position.

**WARNING:** Do not allow personnel near the machine while it is operating.

- 12.9.6 DO NOT angle the cutting unit in such a way as to throw cut material towards the tractor.  
 12.9.7 Avoid rushing into the work. Remember that the unit has to chop up material as well as cut it to the required height.  
 12.9.8 When hedge cutting, close the isolator valve on the arm float accumulator, (if fitted).  
 12.9.9 Always give the rotor shaft enough material to 'bite' into, particularly when a hedge has a lot of leaf and very flexible thin stems.

## 12.10 Grass cutting (Rotor Shaft Speed 2400 - 2600rpm.)

- 12.10.1 Run the rotor at normal speed, i.e. 540rpm PTO speed  
 12.10.2 Avoid taking in too much grass by regulating the forward speed of the tractor.  
 12.10.3 If the rotor shaft slows down or begins to choke up in grass, raise the cutting unit a little and allow grass to fall clear.  
 12.10.4 Before continuing with the cut let the rotor speed recover again.  
 12.10.5 Advantage may be gained in exceptional conditions by taking a narrow cut with part of the cutting unit clear of the work.  
 12.10.6 When working alongside or clearing ditches, take a first cut along the edge of the ditch so that the ditch limits can be seen.  
 12.10.7 When working over a hedge or into a ditch, keep the highest point of the mower arms directly over the obstacle.  
 12.10.8 Do not run the machine for prolonged periods when the head is not at 90° to the direction of travel.

## 12.11 Hedge cutting (Rotor Shaft Speed 3000-3200rpm).

Consider how the job should be done before commencing work, as every hedge has a different height, width, thickness and density of growth. Hedges that have previously been cut by machine tend to have denser growth, and although they can be cut to any desired shape, it is advisable to trim to the same shape and height as before.

The flails cause the new growth to 'tiller' (spread out) and thicken up the hedge. Therefore it is advisable to cut the hedge side at a slight angle rather than straight, otherwise the hedge may eventually die at the bottom due to lack of light. The following information gives a few hints on how to tackle a hedge.

- 12.11.1 First trim the top down to the height of the previous year's trim in one cut, but do not cut into it as the old growth will be very thick and strong and can cause premature wear to the flail cutting edges.  
 12.11.2 Next trim the sides to the previous trim but not into it.

**WARNING:** Do not angle the cutting unit so that debris is thrown through the hedge when trimming the far side of the hedge. Always ensure that cut material is directed away from you or on to the ground.

- 12.11.3 Finally, lower the roller and trim along the bottom of the hedge to clear debris and undergrowth.

## 12.12 Stalling the rotor

If the rotor does become choked the tractor will stall, the belts may slip and/or the relief valve will operate. If this occurs follow the instructions below:

- 12.12.1 Stop forwards motion and disengage drive to cutting unit immediately by placing the lever controlling the rotor in the stop position.  
 12.12.2 Ensure that the rotor has stopped and lift the cutting unit.  
 12.12.3 Stop tractor engine.  
 12.12.4 Remove any obstruction that may be present on the rotor. If working under the raised machine ensure that it is safely supported.

**WARNING:** NEVER IN ANY CIRCUMSTANCES run or reverse the rotor to "clear itself".

## 13.0 Removal, Storage and Disposal

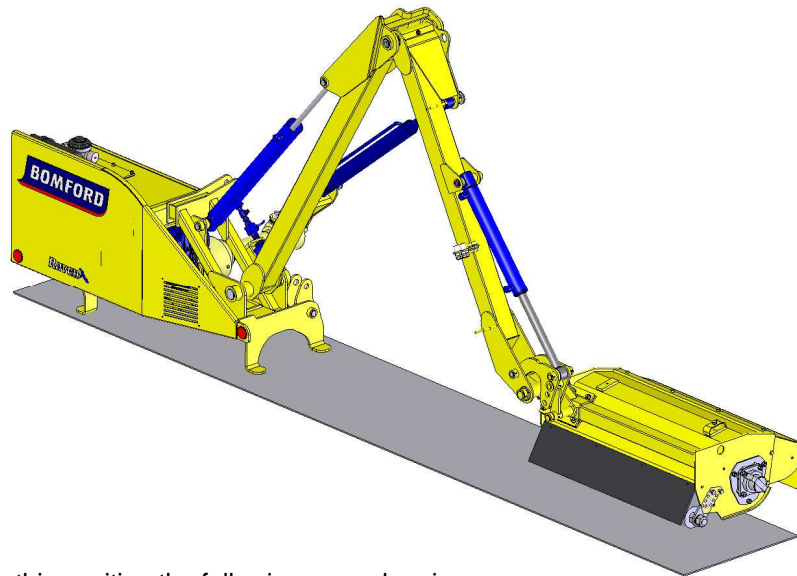
### 13.1 Preparation for storage

Before removing the machine from the tractor a thorough check of the machine should be made as follows;

- 13.1.1 Thoroughly clean all moving parts, particularly the cutting unit.
- 13.1.2 Check that all flails are in place and that they are in good condition.
- 13.1.3 Check all hoses for damage such as cracks, evidence of chafing and leaks.
- 13.1.4 Smear all unpainted metal parts with grease and lubricate all grease nipples.
- 13.1.5 Make a note of any item that needs replacing so that parts can be ordered in good time.

### 13.2 Parking and removal

In the parked position the machine is supported by three stands on the mainframe and also the cutting head, see figure 13.1.



**Figure 13.1**

To put the machine into this position the following procedure is necessary;

**DANGER:** Do not allow personnel between tractor and machine when manoeuvring.

- 13.2.1 Find a flat, hard area on which to park.
- 13.2.2 Place the cutting unit on the ground about 1 metre from the tractor rear wheel.
- 13.2.3 Lift the mainframe on the tractor lift arms.
- 13.2.4 Stop the tractor engine and (if fitted) lower the stands on the arm mower from their stored position.
- 13.2.5 Restart the tractor and lower the 3-point linkage so that the weight of the machine is on the stands and cowl. In doing this, the tension will be removed from the chain linkage.
- 13.2.6 For mowers fitted with a **chain stabilised** three point linkage
  - 13.2.6.1 Raise the machine slightly on the lift arms to loosen the tension chains.
  - 13.2.6.2 Stop the tractor engine, unclip the chain and remove it from the keyholes in the lower link stabilizer brackets.
  - 13.2.6.3 Open the accumulator isolation valve (if fitted) and operate control levers to release pressure.
  - 13.2.6.4 (If fitted) Ensure that the isolator valves on first ram and accumulator are closed.
  - 13.2.6.5 Remove the control unit from inside the tractor and tie the unit on to the mainframe. Do not at any time during removal or storage bend any connection cables in a tight radius. Ensure that the control unit is protected from weather.
  - 13.2.6.6 Remove lower and top link pins. Store the chain and brackets in a safe place.
  - 13.2.6.7 Release the tractor end of the PTO shaft and pull back along the spline until the PTO shaft is free from the tractor. Place a cap over the tractor PTO.
  - 13.2.6.8 Start the tractor engine and drive carefully forward disengaging the machine from the tractor.
  - 13.2.6.9 Replace lower link pins and place cap over tractor PTO.

### 13.2.7 For mowers fitted with a **tubular stabilised** three point linkage

- 13.2.7.1 Raise the machine slightly on the lift arms and remove the 12mm locking pins.
- 13.2.7.2 Stop the tractor engine and open the accumulator isolation valve (if fitted) and operate the control levers to release any residual pressure.
- 13.2.7.3 (If fitted) Ensure that the isolator valves on first ram and accumulator are closed.
- 13.2.7.4 Remove the control unit from inside the tractor and tie the unit on to the mainframe. Do not at any time during removal and storage bend any connection cables in a tight radius. Ensure that the control unit is protected from weather.
- 13.2.7.5 Remove the lower pins connecting the tractor lift arms to the mainframe. To do this, partially withdraw the pin towards the PTO in order to clear the clevis which supports the tractor lift arms but do not withdraw the pin into the clevis which is supporting the linkage. At the same time remove the pin connecting the top link to the tractor.
- 13.2.7.6 Release the tractor end of the PTO shaft and pull back along the spline until the PTO shaft is free from the tractor. Place a cap over the tractor PTO.
- 13.2.7.7 Start the tractor engine and drive carefully forward disengaging the machine from the tractor.
- 13.2.7.8 Replace the top link pin into the linkage. .

13.2.8 Remove the mower PTO shaft and store in a safe place. Protect the mower PTO and spline from the effects of weather.

## 13.3 Disposal

When Bomford Turner equipment reaches the end of its economic working life it should be disposed of responsibly, either through an approved recycling centre or by compliance with all applicable regulations in force in its final destination territory.

In most instances Bomford Turner machines can be broken into the following constituent parts with the use of basic workshop equipment. Table 13.1 contains a typical list of constituent materials, together with disposal guidelines.

When undertaking a machine breakdown take care to ensure heavy parts are adequately supported at all times to avoid injury and take containment precautions to retain control of liquids to avoid environmental contamination.

It is the owner's responsibility to ensure the machine is disposed of in accordance with all applicable regulations.

<b>Material</b>	<b>Typically found in;</b>	<b>Disposal guideline</b>
Steel	Structural components, fixed guards, fasteners and driveline	Can be dismantled and recycled. Take care when handling heavy and/or sharp objects
Aluminium	Pump and gearbox housings, serial number plates	Can be dismantled and recycled. Take care when handling heavy and/or sharp objects. Take appropriate actions for oil contaminated products
Copper	Wiring, electrical components	Can be recycled using appropriate recovery procedures.
Hydraulic oil	Tank, hydraulic components	Dispose of in accordance with all applicable regulations
Rubber	Hoses, flexible guards, seals, 'O' rings	Dispose of in accordance with all applicable regulations
Plastics	Clips, caps, cable ties, decals, filter housings, document holders, bushes, electrical components, plugs, connectors, wire insulation	Dispose of in accordance with all applicable regulations
Filter element	Filter housings	Dispose of in accordance with all applicable regulations
Cork / paper	Gaskets	Dispose of in accordance with all applicable regulations

**Table 13.1**

## 14.0 Maintenance

### 14.1 Power Take-Off shaft (PTO)

The normal agricultural type of PTO shaft is used. Spares kits; comprising for example, the spider, needle bearings, circlips; are available from your dealer. For correct part numbers see the parts manual specific to the serial number plate on and supplied with your machine. The correct part numbers must be quoted when ordering spares.

Some routine maintenance is needed to ensure a trouble free life of the PTO shaft.

- 11.1.1 Grease both ends of the PTO shaft daily.
- 11.1.2 Grease the PTO shaft tubes regularly.
- 11.1.3 Ensure the guard check chains are securely attached and in good condition.
- 11.1.4 Check that PTO guard is in good condition and **replace it if cracked or damaged**.
- 11.1.5 Check the universal joint bearing journals for roughness or slackness. Replace if necessary.

### 14.2 Hoses

It is false economy to try and make a damaged hose last a bit longer, because a failure can spill a lot of oil on the road endangering traffic, the environment and costing money. To reduce the risk of this happening and ensure a long life from the hoses, follow the guidelines below. On a weekly basis:

- 14.2.1 Check that all hoses and their connections are in good condition and that there are no leaks or damage. Pay particular attention to the rotor drive circuit. Replace any hose that is leaking or damaged.
- 14.2.2 Check to see that hoses are not and have not been chafing against sharp edges. If evidence of chafing is found then inspect for damage and if found replace. Re-route any hose that has been chafing, see section 14.4.
- 14.2.3 Check to ensure that hoses are fitted without kinks or sharp bends, see section 14.4. Pay particular attention to the suction hose from the tank to the pump.
- 14.2.4 If in doubt about the condition of any hose **replace it**. When replacing hoses be sure to tighten to the correct torque setting, see table 14.1.

**WARNING:** Some hoses may contain residual pressure, take care when removing.

Table 14.1

BSP SWIVEL FEMALE TORQUE VALUES				
THread	Metric (Nm)		Imperial (lbf.ft)	
	nominal	Min - max	nominal	Min - max
1/4	20	15 -25	14.75	11.06 - 18.44
3/8	34	27 – 41	25.07	19.91 - 30.24
1/2	60	42 – 76	44.25	30.97 - 56.05
5/8	69	44 – 94	50.88	32.45 - 69.32
3/4	115	95 – 135	84.81	70.06 - 99.56
1	140	115 – 165	103.24	84.81 - 121.68
1 1/4	210	140 – 280	154.87	103.24 - 206.49
1 1/2	290	215 - 365	213.86	158.55 - 269.17

### 14.3 Pins

Periodically check all pins for damage and correct retention.

### 14.4 Rams

It is advisable to check all ram caps for tightness occasionally and if found to be loose tighten them immediately.

## 14.5 Gearbox

The gearbox is normally mounted to an adaptor plate mounted onto the mainframe. It transmits the available power of the tractor PTO into the rotor and ram circuits. Potentially most of the available power can go into either circuit. However, both circuits are protected by a main line relief at 207bar. The gearbox is rated for the following which should not be exceeded;

- Maximum power rating = 25kW (34hp)
- Maximum input speed = 600rpm
- Gearbox oil capacity = 0.5litres
- Gearbox fastening torque = 90-100Nm

**IMPORTANT:** Always check oil level before use and top up if necessary

Recommended oils are:

- MOBIL - Mobiland universal multi-purpose tractor oil
- EXELUBE - Super universal tractor oil

Drain and replace the oil after the first 50 hours' work and thereafter every 1000 hours or 12 months, whichever is the earlier.

## 14.6 Greasing

There are a number of greasing points on the machine that need regular attention;

- All pivot bushes on rams, arms and cowl linkage equipped with a grease nipple,
- The breakaway link on the mainframe,
- Flail head rotor bearings
- Flail head roller bearings
- PTO knuckles
- PTO engagement spline

These should all be greased after every 50hrs of work

**IMPORTANT:** Any good quality lithium based grease may be used for lubrication of pivot pins and bearings.

When greasing the flail head roller and its bearings do not over grease or the carriers may be forced apart and distorted by the pressure.

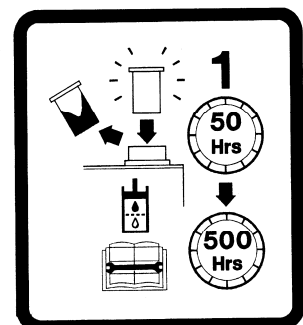
Grease the rotor shaft bearings as follows:

- 14.4.1 Place the flail head on the ground or support it safely.
- 14.4.2 Stop the tractor engine and disengage drive to the PTO shaft.
- 14.4.3 Rotor shaft bearing grease nipples are located through a cut out in the drive guards. Apply grease to the nipples but do not grease violently as damage to the seals may result. Do not over grease or it could cause overheating.

## 14.7 Filter

The element must be changed after the first 50 hours work and thereafter every 500 hours, see change filter decal in figure 14.1.

Figure 14.1



## 14.8 Rotor shaft

**WARNING:** Check flails **daily**. Check that flails are in good condition and securely attached to the rotor shaft. Replace any that are damaged. When replacing a flail always replace the retaining bolt and locknut at the same time.

**CAUTION:** Vibration of the rotor shaft will cause premature failure of the rotor shaft bearings, as well as hydraulic and structural failures. It is important not to operate the machine with the cutting unit vibrating.

As soon as any vibration is felt stop operating the machine and make the checks listed below:

- 14.6.1 Place the cutting head vertically on ground or support it safely.
- 14.6.2 Stop tractor engine and disengage PTO drive.
- 14.6.3 Check daily for missing or worn flails. Always replace missing or worn flails in pairs opposite each other to maintain shaft balance. A New flail must always have a new retaining bolt locknut and spring washer.
- 14.6.4 Check that the retaining bolts are in good condition. If any are found to be bent or in poor condition then even if the flail is still good replace the bolt locknut and spring washer together
- 14.6.5 Check that the securing locknuts are visibly tight. If any nuts are loose do not re-tighten the old locknut. Always replace with a new locknut and spring washer and re-tighten. Locknuts deform once on fitting to provide a torque off resistance which is an additional defence against vibrational unscrewing. If the nut is subsequently re-tightened this protection is lost leaving the spring washer only to preventing the nut from vibrating off.

**IMPORTANT:** Only fit genuine Bomford Turner spare parts.

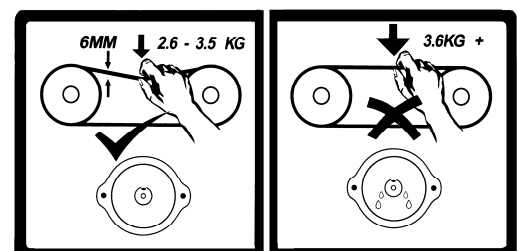
- 14.6.6 If any flails were missing or loose and have been replaced or tightened, run the rotor and retest for vibration. If vibration is still present check rotor shaft bearings as follows.
- 14.6.7 Stop tractor engine and disengage PTO drive.
- 14.6.8 Check rotor shaft bearings for roughness or signs of slackness.
- 14.6.9 Replace the bearings if either of the above symptoms are found. If vibration persists it is an indication that the rotor shaft is probably bent and must therefore be replaced.

**IMPORTANT:** When replacing bearings, ensure the centre bolt retaining the taper lock is fully tightened, before tightening the grub screws holding the taper lock to pulley. Failure to do this may result in the bearing rotating on the shaft journal

## 14.9 Tensioning drive belts

The rotor shaft is driven from the gear motor via 'V' belts, which are adjustable for tension. The procedure for tightening the belts is as follows:

- 14.7.1 Stop the tractor engine and disengage the PTO drive.
- 14.7.2 Remove the flail head drive guard.
- 14.7.3 Check the tension by applying a force of between 2.6kg and 3.5kg at right angles to the belts in the centre of the belt and between the two pulleys, see figure 14.2. If the deflection is greater than 6mm increase the belt tension as follows;
- 14.7.4 Release the motor mounting plate bolts (A) in figure 14.3.
- 14.7.5 For 1007MW flail head loosen the adjuster locknut and screw the adjuster (B) to tighten the belts, see figure 14.3a. Retighten locknut.
- 14.7.6 For 1100MW flail head loosen the adjuster locknut and rotate the adjuster (C) to tighten the belts, see figure 14.3b. Retighten locknut.
- 14.7.7 Tighten the locknut and motor mounting plate bolts.
- 14.7.8 Replace the flail head drive guard.



**Figure 14.2**

**ATTENTION:** DO NOT OVERTIGHTEN BELTS as this may cause premature failure of the rotor shaft, motor bearings and seals.



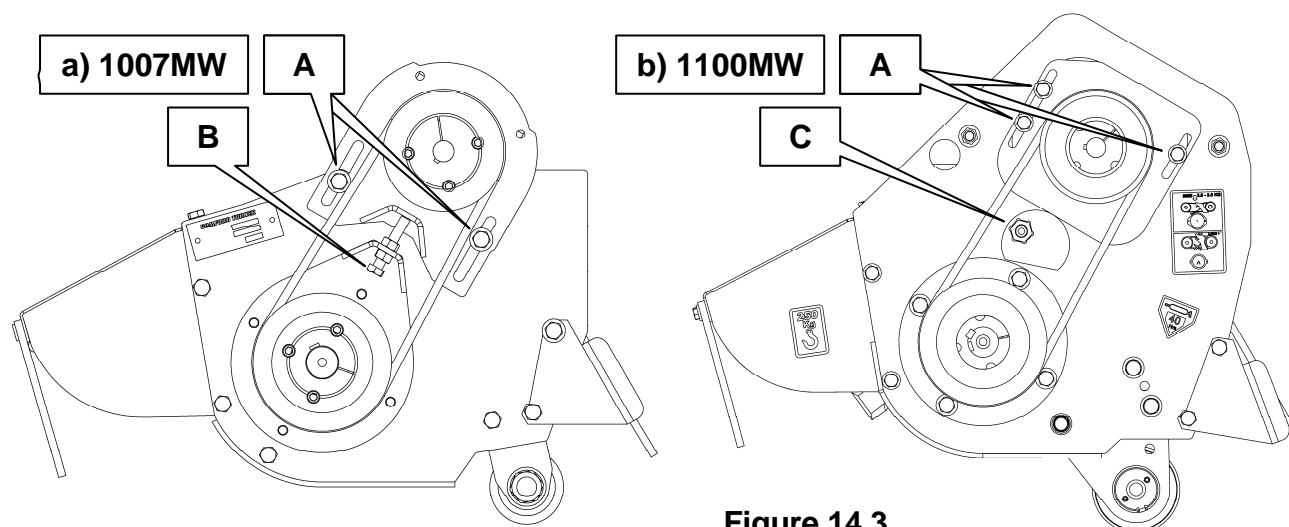


Figure 14.3

### 14.10 Changing the drive pulleys

Some cutting units have direct hydraulic drive where the rotor speed is governed by the PTO input speed. These are recommended for hedge cutting only. Others have belt drives driven by unequal pulleys which can be interchanged to give two rotor speeds. These are suitable for either hedge trimming or grass cutting, see sections 12.11 and 12.12. To change the rotor speed, refer to figure 14.4 a) or b); depending on flail head fitted; and reverse the pulleys as follows;

- 14.8.1 Stop the tractor engine and disengage the PTO drive.
- 14.8.2 Remove the flail head drive guard.
- 14.8.3 Slacken the motor mounting plate nuts (A).
- 14.8.4 Slacken the adjuster (B) or (C) enough to push the motor mounting plate fully down.
- 14.8.5 Remove the lower pulley centre bolt and washer (D).
- 14.8.6 Remove the top pulley by taking out the two grub screws (E) from the taper lock bush and using one of them to loosen the pulley by inserting into the third tapped hole, (F).
- 14.8.7 Remove the 'V' belts and remove the bottom pulley in the same manner as 14.8.6 above.
- 14.8.8 Exchange the pulleys on the taper lock bushes and loosely fit the two grub screws (E).
- 14.8.9 Replace the lower taper lock bush and pulley on to the rotor shaft, being careful not to displace the drive key.

**ATTENTION:** Replace and fully tighten the centre bolt before tightening the grub screws holding the taper lock. Failure to do this may result in the bearing rotating on the shaft journal.

- 14.8.10 Replace the 'V'-belts at the same time as replacing the top taper lock bush and pulley. With a straight edge line up the top and bottom pulleys and fully tighten the grub screws. Check the pulley alignment and repeat if they are not aligned correctly.
- 14.8.11 Re tension the drive belts as in section 14.7.

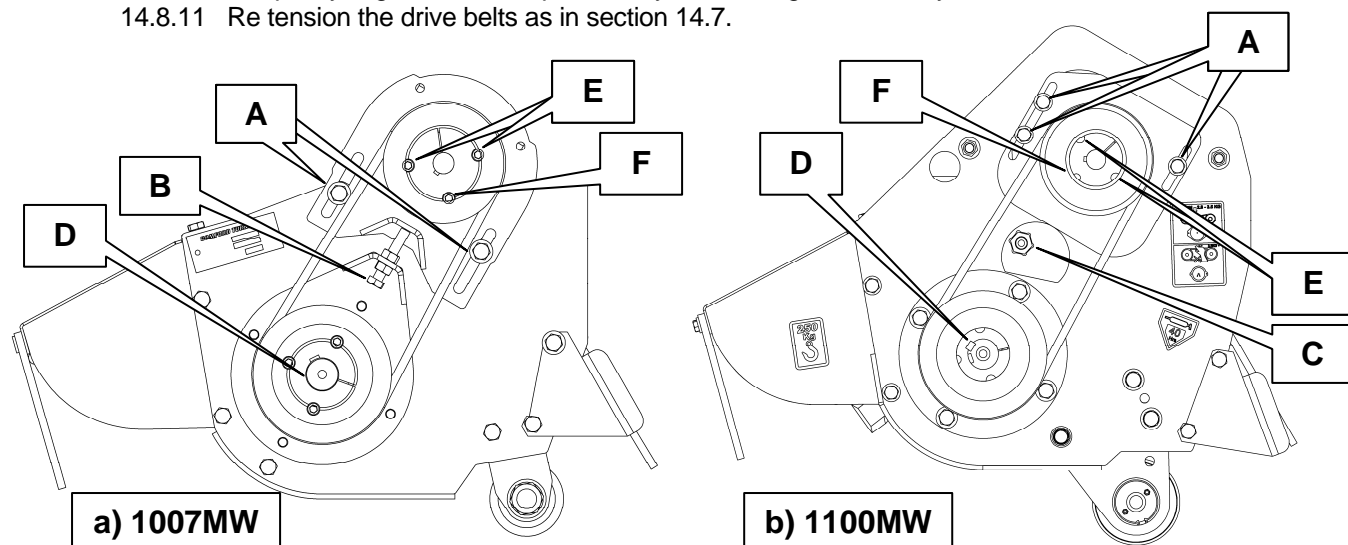


Figure 14.4

## 14.9 Cable Lever adjustment

The position of the cable levers can be adjusted. The adjustment is provided at the point of cable attachment to the control valve. Refer to figure 14.5 and adjust the lever position as follows

- 14.9.1 Loosen locknut on the cable/valve connection flange (A).
- 14.9.2 Loosen the two cap screws holding the valve connection flange (B).
- 14.9.3 Rotate valve connection body by its hexagonal form (C); whilst holding the cable to stop it rotating; until lever is in the required position.
- 14.9.4 Retighten the two cap screws (B).
- 14.9.5 Retighten the locknut (A).

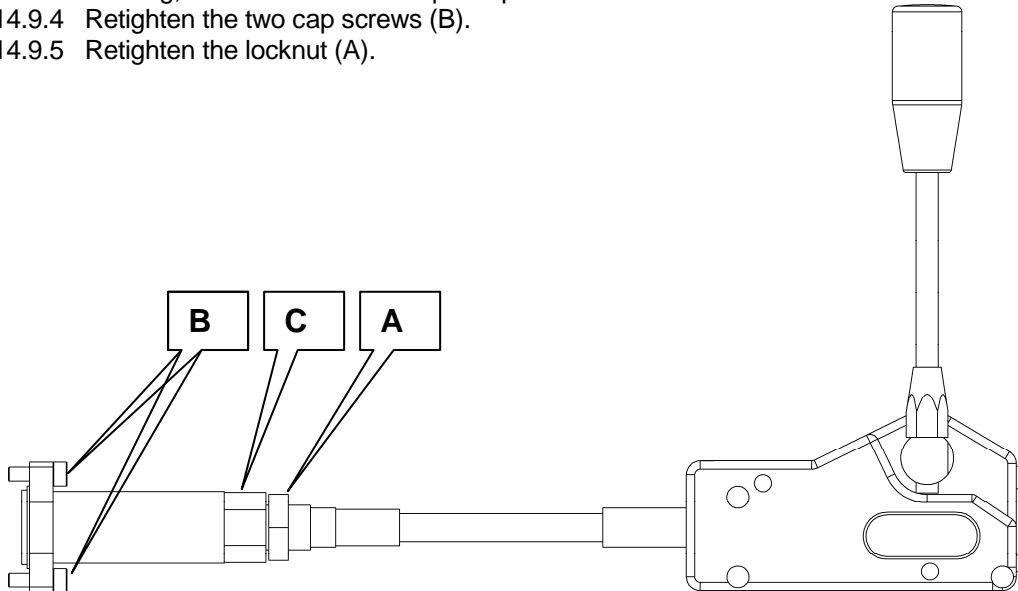


Figure 14.5