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McCONNEL

AGRICULTURAL SERIES HEDGE CUTTERS

PA5157 – PA5557 Range (50HP)

Models: Standard Arm & Fixed Midcut Arm

57 SERIES

Operator Manual



IMPORTANT

VERIFICATION OF WARRANTY REGISTRATION



Dealer Warranty Information & Registration Verification

It is imperative that the selling dealer registers this machine with McConnel Limited before delivery to the end user – failure to do so may affect the validity of the machine warranty.

To register machines; log onto <https://my.mcconnel.com> and select 'Machine Registration' which can be found in the 'Warranty' section of the site. **Confirm to the customer that the machine has been registered by completing the verification form below.**

Registration Verification	Serial No. <input type="text"/>
Dealer Name:	
Dealer Address:	
Customer Name:	
Date of Warranty Registration:/...../..... Dealer Signature:	

Note to Customer / Owner

Please ensure the section above has been completed and signed by the dealer to verify your machine has been registered with McConnel Limited.

IMPORTANT: During the initial 'bedding in' period of a new machine it is the customer's responsibility to regularly inspect all nuts, bolts and hose connections for tightness and re-tighten if required. New hydraulic connections occasionally weep small amounts of oil as the seals and joints settle in – where this occurs it can be cured by re-tightening the connection – *refer to torque settings chart below*. The tasks stated above should be performed on an hourly basis during the first day of work and at least daily thereafter as part of the machine's general maintenance procedure.

CAUTION: DO NOT OVER TORQUE HYDRAULIC FITTINGS AND HOSES

Torque Settings for Hydraulic Fittings

Hydraulic Hose Ends			Port Adaptors with Bonded Seals		
BSP	Setting	Metric	BSP	Setting	Metric
1/4"	18 Nm	19 mm	1/4"	34 Nm	19 mm
3/8"	31 Nm	22 mm	3/8"	47 Nm	22 mm
1/2"	49 Nm	27 mm	1/2"	102 Nm	27 mm
5/8"	60 Nm	30 mm	5/8"	122 Nm	30 mm
3/4"	80 Nm	32 mm	3/4"	149 Nm	32 mm
1"	125 Nm	41 mm	1"	203 Nm	41 mm
1.1/4"	190 Nm	50 mm	1.1/4"	305 Nm	50 mm
1.1/2"	250 Nm	55 mm	1.1/2"	305 Nm	55 mm
2"	420 Nm	70 mm	2"	400 Nm	70 mm

WARRANTY POLICY

WARRANTY REGISTRATION

All machines must be registered, by the selling dealer with McConnel Ltd, before delivery to the end user. On receipt of the goods it is the buyer's responsibility to check that the Verification of Warranty Registration in the Operator's Manual has been completed by the selling dealer.

1. LIMITED WARRANTIES

- 1.01. *All mounted machines supplied by McConnel Ltd are warranted to be free from defects in material and workmanship from the date of sale to the original purchaser for a period of 12 months, unless a different period is specified.*
All Self Propelled Machines supplied by McConnel Ltd are warranted to be free from defects in material and workmanship from the date of sale to the original purchaser for a period of 12 months or 1500 hours. Engine warranty will be specific to the Manufacturer of that unit.
- 1.02. *All spare parts supplied by McConnel Ltd and purchased by the end user are warranted to be free from defects in material and workmanship from the date of sale to the original purchaser for a period of 6 months. All parts warranty claims must be supported by a copy of the failed part invoice to the end user. We cannot consider claims for which sales invoices are not available.*
- 1.03. *The warranty offered by McConnel Ltd is limited to the making good by repair or replacement for the purchaser any part or parts found, upon examination at its factory, to be defective under normal use and service due to defects in material or workmanship. Returned parts must be complete and unexamined. Pack the component(s) carefully so that any transit damage is avoided. All ports on hydraulic items should be drained of oil and securely plugged to prevent seepage and foreign body ingress. Certain other components, electrical items for example, may require particular care when packing to avoid damage in transit.*
- 1.04. *This warranty does not extend to any product from which McConnel Ltd's serial number plate has been removed or altered.*
- 1.05. *The warranty policy is valid for machines registered in line with the terms and conditions detailed and on the basis that the machines do not extend a period of 24 months or greater since their original purchase date, that is the original invoice date from McConnel Limited.*
Machines that are held in stock for more than 24 months cannot be registered for warranty.
- 1.06. *This warranty does not apply to any part of the goods, which has been subjected to improper or abnormal use, negligence, alteration, modification, fitment of non-genuine parts, accident damage, or damage resulting from contact with overhead power lines, damage caused by foreign objects (e.g. stones, iron, material other than vegetation), failure due to lack of maintenance, use of incorrect oil or lubricants, contamination of the oil, or which has served its normal life. This warranty does not apply to any expendable items such as blades, belts, clutch linings, filter elements, flails, flap kits, skids, soil engaging parts, shields, guards, wear pads, pneumatic tyres or tracks.*
- 1.07. *Temporary repairs and consequential loss - i.e. oil, downtime and associated parts are specifically excluded from the warranty.*
- 1.08. *Warranty on hoses is limited to 12 months and does not include hoses which have suffered external damage. Only complete hoses may be returned under warranty, any which have been cut or repaired will be rejected.*
- 1.09. *Machines must be repaired immediately a problem arises. Continued use of the machine after a problem has occurred can result in further component failures, for which McConnel Ltd cannot be held liable, and may have safety implications.*
- 1.10. *If in exceptional circumstances a non McConnel Ltd part is used to effect a repair, warranty reimbursement will be at no more than McConnel Ltd's standard dealer cost for the genuine part.*

- 1.11. *Except as provided herein, no employee, agent, dealer or other person is authorised to give any warranties of any nature on behalf of McConnell Ltd.*
- 1.12. *For machine warranty periods in excess of 12 months the following additional exclusions shall apply:*
 - 1.12.1. *Hoses, exposed pipes and hydraulic tank breathers.*
 - 1.12.2. *Filters.*
 - 1.12.3. *Rubber mountings.*
 - 1.12.4. *External electric wiring.*
 - 1.12.5. *Bearings and seals*
 - 1.12.6. *External Cables, Linkages*
 - 1.12.7. *Loose/Corroded Connections, Light Units, LED's*
 - 1.12.8. *Comfort items such as Operator Seat, Ventilation, Audio Equipment*
- 1.13. *All service work, particularly filter changes, must be carried out in accordance with the manufacturer's service schedule. Failure to comply will invalidate the warranty. In the event of a claim, proof of the service work being carried out may be required.*
- 1.14. *Repeat or additional repairs resulting from incorrect diagnosis or poor quality previous repair work are excluded from warranty.*

NB Warranty cover will be invalid if any non-genuine parts have been fitted or used. Use of non-genuine parts may seriously affect the machine's performance and safety. McConnell Ltd cannot be held responsible for any failures or safety implications that arise due to the use of non-genuine parts.

2. REMEDIES AND PROCEDURES

- 2.01. *The warranty is not effective unless the Selling Dealer registers the machine, via the McConnell web site and confirms the registration to the purchaser by completing the confirmation form in the operator's manual.*
- 2.02. *Any fault must be reported to an authorised McConnell Ltd dealer as soon as it occurs. Continued use of a machine, after a fault has occurred, can result in further component failure for which McConnell Ltd cannot be held liable.*
- 2.03. *Repairs should be undertaken within two days of the failure. Claims submitted for repairs undertaken more than 2 weeks after a failure has occurred, or 2 days after the parts were supplied will be rejected, unless the delay has been authorised by McConnell Ltd. Please note that failure by the customer to release the machine for repair will not be accepted as a reason for delay in repair or submitting warranty claims.*
- 2.04. *All claims must be submitted, by an authorised McConnell Ltd Service Dealer, within 30 days of the date of repair.*
- 2.05. *Following examination of the claim and parts, McConnell Ltd will pay, at their discretion, for any valid claim the invoiced cost of any parts supplied by McConnell Ltd and appropriate labour and mileage allowances if applicable.*
- 2.06. *The submission of a claim is not a guarantee of payment.*
- 2.07. *Any decision reached by McConnell Ltd. is final.*

3. LIMITATION OF LIABILITY

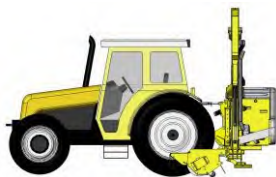
- 3.01. *McConnell Ltd disclaims any express (except as set forth herein) and implied warranties with respect to the goods including, but not limited to, merchantability and fitness for a particular purpose.*
- 3.02. *McConnell Ltd makes no warranty as to the design, capability, capacity or suitability for use of the goods.*
- 3.03. *Except as provided herein, McConnell Ltd shall have no liability or responsibility to the purchaser or any other person or entity with respect to any liability, loss, or damage caused or alleged to be caused directly or indirectly by the goods including, but not limited to, any indirect, special, consequential, or incidental damages resulting from the use or operation of the goods or any breach of this warranty. Notwithstanding the above limitations and warranties, the manufacturer's liability hereunder for damages incurred by the purchaser or others shall not exceed the price of the goods.*
- 3.04. *No action arising out of any claimed breach of this warranty or transactions under this warranty may be brought more than one (1) year after the cause of the action has occurred.*

4. MISCELLANEOUS

- 4.01. McConnel Ltd may waive compliance with any of the terms of this limited warranty, but no waiver of any terms shall be deemed to be a waiver of any other term.*
- 4.02. If any provision of this limited warranty shall violate any applicable law and is held to be unenforceable, then the invalidity of such provision shall not invalidate any other provisions herein.*
- 4.03. Applicable law may provide rights and benefits to the purchaser in addition to those provided herein.*

McConnel Limited

POWER ARM & TRACTOR PRE-OPERATION INSPECTION



A daily equipment inspection of machine and tractor should be conducted before the equipment is used.

Use the inspection sheets on the following pages to assist with these daily inspections. Damaged or missing guards should be repaired or replaced before operating the mower. Failure to repair or replace damaged guards can result in objects being thrown from the mower and possibly hitting the operator and/or bystanders.

Inspect the Mower for Safe Operating Condition

- Make sure the driveline guards and shielding are in place and in good repair.
- Inspect the flexible thrown object shielding to assure that they are in place on the front and rear of the mower head and in good repair. Repair or replace any damaged or missing thrown object shields.
- Ensure the mower cutting height is set high enough to reduce the possibility of the mower blades contacting the ground. Actual height will be dependent on the ground conditions. Increase the height when working in rough or undulating conditions.
- Inspect for broken, chipped, bent, missing, or severely worn blades. Replace damaged blades before operating the mower. Ensure the blade retaining bolts and fasteners are secure and tight.
- Ensure all head bolts and nuts are tight.
- Lubricate the driveline universal joints and telescoping members daily.
- Grease the rotor and roller bearings and inspect their condition.
- Inspect for any oil leaks or damaged hoses.
- Inspect for worn and/or damaged decals and safety instructions. Replace unreadable, damaged or missing safety decals.
- Follow the operator's manual(s) inspection and maintenance instructions for lubricating parts, and keeping thrown object shielding, driveline guards, rotating parts shields, mower blades, and decals in good repair.

Inspect the Tractor for Safe Operating Condition

- Inspect the controls, lights, SMV's (Slow Moving Vehicle sign), seat belts, and ROPS to ensure they are in place and in good working order.
- Ensure tyres, wheels, lug bolts/nuts are in good condition.
- Make sure the tractor brakes and steering are in proper operating condition.
- Follow the operator's manual(s) inspection and maintenance procedures for keeping the tractor in good and safe condition before operating.

Copies of the inspection sheets on the following pages should be retained in this manual for reference; two sets are included to allow removal of one set for photocopying purposes. Alternatively, these inspection sheets can be download from our website via the QR code or using the link below;
<https://my.mcconnel.com/service/pre-operation-inspection-documents/>





POWER ARM PRE-OPERATION INSPECTION



Power Arm ID Date: Shift:



WARNING: Before conducting the inspection, make sure the tractor engine is off, the key removed, all rotation has stopped and the tractor is in park with the parking brake engaged. Make sure the mower head is resting on the ground or is securely blocked up and supported and all hydraulic pressure has been relieved.

Item	Condition at start of shift	Specific Comments if not O.K.
The operator's manual is in the canister on the mower.		
All warning decals are in place, clean and legible.		
All lights are clean and working.		
The mounting frame bolts are in place and tight.		
The arm pivot pins are tight and correctly secured.		
There are no cracks in the arms.		
Hydraulic cylinder pins are tight and correctly secured.		
Hydraulic cylinder hose connections are tight.		
Hydraulic pump hose connections are tight.		
Hydraulic valve hose connections are tight.		
Hydraulic valve controls function properly.		
There are no damaged hoses.		
The oil level is to the green mark on the tank sight glass.		
There is no evidence of hydraulic oil leaks.		
Flails are not missing, chipped, broken or excessively worn.		
The flail bolts are tight.		
The front and rear flaps are fitted and in good condition.		
The front hood is in place and in good condition.		
The wire trap is in good condition.		
The skid shoes are in good condition and tight.		
There are no cracks or holes in flail casing.		
Hydraulic motor mounting bolts are tight.		
All flail head nuts and bolts are tight.		
The rotor bearings are in good condition and greased.		
The roller bearings are in good condition and greased.		
The drive line shaft guard is in good condition.		
The drive line shaft guard is correctly secured.		
Controls are securely mounted in the cab.		
With engine running check arm operation.		
Have a spare pack of flails, bushes, bolts and nuts.		

Operators Signature:

DO NOT OPERATE AN UNSAFE TRACTOR OR MACHINE



TRACTOR PRE-OPERATION INSPECTION



Power Arm ID Date: Shift:



WARNING: Before conducting the inspection, make sure the tractor engine is off, the key removed, all rotation has stopped and the tractor is in park with the parking brake engaged. Ensure any implement attached to the tractor is firmly on the ground.

Item	Condition at start of shift	Specific Comments if not O.K.
The flashing lights function properly.		
All lights are clean and working correctly.		
All cab windows are clean and wipers working correctly.		
The SMV sign, where required, is clean and visible.		
The tyres are in good condition with correct pressure.		
The wheel nuts are tight.		
The tractor brakes are in good condition.		
The steering linkage is in good condition.		
There are no visible oil leaks.		
The hydraulic controls function properly.		
The ROPS or ROPS cab is in good condition.		
The seatbelt is in place and in good condition.		
The 3-point hitch is in good condition.		
The drawbar/pick up hook is secure and in good condition.		
The PTO master shield is in place.		
The engine oil level is full.		
The brake fluid level is full.		
The power steering fluid level is full.		
The fuel level is adequate.		
The engine coolant fluid level is full.		
The radiator and oil cooler are free of debris.		
The air filter is in good condition.		

Operators Signature:

DO NOT OPERATE AN UNSAFE TRACTOR OR MACHINE



POWER ARM PRE-OPERATION INSPECTION



Power Arm ID Date: Shift:



WARNING: Before conducting the inspection, make sure the tractor engine is off, the key removed, all rotation has stopped and the tractor is in park with the parking brake engaged. Make sure the mower head is resting on the ground or is securely blocked up and supported and all hydraulic pressure has been relieved.

Item	Condition at start of shift	Specific Comments if not O.K.
The operator's manual is in the canister on the mower.		
All warning decals are in place, clean and legible.		
All lights are clean and working.		
The mounting frame bolts are in place and tight.		
The arm pivot pins are tight and correctly secured.		
There are no cracks in the arms.		
Hydraulic cylinder pins are tight and correctly secured.		
Hydraulic cylinder hose connections are tight.		
Hydraulic pump hose connections are tight.		
Hydraulic valve hose connections are tight.		
Hydraulic valve controls function properly.		
There are no damaged hoses.		
The oil level is to the green mark on the tank sight glass.		
There is no evidence of hydraulic oil leaks.		
Flails are not missing, chipped, broken or excessively worn.		
The flail bolts are tight.		
The front and rear flaps are fitted and in good condition.		
The front hood is in place and in good condition.		
The wire trap is in good condition.		
The skid shoes are in good condition and tight.		
There are no cracks or holes in flail casing.		
Hydraulic motor mounting bolts are tight.		
All flail head nuts and bolts are tight.		
The rotor bearings are in good condition and greased.		
The roller bearings are in good condition and greased.		
The drive line shaft guard is in good condition.		
The drive line shaft guard is correctly secured.		
Controls are securely mounted in the cab.		
With engine running check arm operation.		
Have a spare pack of flails, bushes, bolts and nuts.		

Operators Signature:

DO NOT OPERATE AN UNSAFE TRACTOR OR MACHINE



TRACTOR PRE-OPERATION INSPECTION



Power Arm ID Date: Shift:



WARNING: Before conducting the inspection, make sure the tractor engine is off, the key removed, all rotation has stopped and the tractor is in park with the parking brake engaged. Ensure any implement attached to the tractor is firmly on the ground.

Item	Condition at start of shift	Specific Comments if not O.K.
The flashing lights function properly.		
All lights are clean and working correctly.		
All cab windows are clean and wipers working correctly.		
The SMV sign, where required, is clean and visible.		
The tyres are in good condition with correct pressure.		
The wheel nuts are tight.		
The tractor brakes are in good condition.		
The steering linkage is in good condition.		
There are no visible oil leaks.		
The hydraulic controls function properly.		
The ROPS or ROPS cab is in good condition.		
The seatbelt is in place and in good condition.		
The 3-point hitch is in good condition.		
The drawbar/pick up hook is secure and in good condition.		
The PTO master shield is in place.		
The engine oil level is full.		
The brake fluid level is full.		
The power steering fluid level is full.		
The fuel level is adequate.		
The engine coolant fluid level is full.		
The radiator and oil cooler are free of debris.		
The air filter is in good condition.		

Operators Signature:

DO NOT OPERATE AN UNSAFE TRACTOR OR MACHINE



For Safety and Performance...

ALWAYS READ THE BOOK FIRST

McCONEL LIMITED

**Temeside Works
Ludlow
Shropshire
England**

**Telephone: 01584 873131
www.mcconnel.com**

For best performance...

USE ONLY GENUINE McCONNEL SERVICE PARTS

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'Genuine Replacements' from the 'Original Equipment Manufacturer'*

McCONEL LIMITED

Order through your local Dealer or Stockist

NOISE STATEMENT

The equivalent daily personal noise exposure from this machine measured at the operators' ear is within the range 78 – 85 dB, these figures apply to a normal distribution of use where the noise fluctuates between zero and maximum. The figures assume that the machine is fitted to a tractor with a 'quiet' cab with the windows closed in a generally open environment. We recommend that the windows are kept closed. With the cab rear window open the equivalent daily personal noise exposure will increase to a figure within the range 82 – 88 dB. At equivalent daily noise exposure levels of between 85 – 90 dB ear protection is recommended – it should be used if any window is left open.

SAFETY FIRST

**MACHINE SAFETY DECALS MUST BE KEPT IN CLEAN READABLE CONDITION AT ALL TIMES;
Any safety decals that are missing, damaged or illegible must always be replaced immediately.
McConnel have a policy of providing replacement safety decals and manuals free of charge.**

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GENERAL INFORMATION

Read this manual before fitting or operating the machine or accessory. Whenever any doubt exists contact your local dealer or the McConnel Service Department for assistance.

Only use 'Genuine McConnel Parts' on McConnel machinery and equipment.

DEFINITIONS: *The following definitions apply throughout this manual;*

DANGER

DANGER: Alerts to a hazardous situation which will result in death or serious injury if not observed carefully.

WARNING

WARNING: Alerts to a hazardous situation which could result in death or serious injury if not observed carefully.

CAUTION

CAUTION: Alerts to a hazardous situation which could result in damage to the machine and/or equipment if not observed carefully.

NOTICE

NOTICE: Specific or general information considered important or useful to emphasise.

LEFT HAND (LH) & RIGHT HAND (RH): *These terms are applicable to the machine when fitted to the tractor and viewed from the rear; these terms also apply to tractor references.*

SERIAL PLATE

All machines are equipped with a serial number plate containing important information relating to the machine including a unique serial number used for identification purposes.

Note: Images in this manual are provided for instruction and informational purposes only and may not show components in their entirety. In certain instances images may appear different to the actual machine; where this occurs the general procedure will be basically the same. E&OE.

MACHINE & DEALER INFORMATION

Record the serial number of your machine on this page and always quote it when ordering parts. Whenever information concerning the machine is requested remember to also state the make and model of tractor to which the machine is fitted.	
Machine Serial Number:	Installation Date:
Machine Model Details:	
Dealer Name & Branch:	
Dealer Address:	
Dealer Telephone No:	
Dealer Email Address:	

FEATURES & OPTIONS

PA5157-50, PA5157-50MC, PA5557-50, PA5557-50MC

- Linkage Mounted
- Choice of right-hand or left-hand cutting
- Rear mounted
- Cast iron gearbox
- Operator guard
- Hydraulic breakaway
- 120° powered slew
- 180 litre Hydraulic Reservoir
- 50HP hydraulic system
- Totally independent hydraulics powered by tandem PTO pump
- Built-in LED lighting kit
- Choice of controls

PA5157-50 Models

- Standard Arm
- 5.1m reach

PA5157-50MC Models

- Fixed Mid-Cut Arm
- 5.1m reach

PA5557-50 Models

- Standard Arm
- 5.5m reach

PA5557-50MC Models

- Fixed Mid-Cut Arm
- 5.5m reach

Machine Options

- Lift Float Kit
- Head Angle Float (standard on Cable Controlled machines)
- Cable or Electric Rotor Control Valve
- Choice of flail heads and attachments

SAFETY INFORMATION















Read the manual before using the machine

This machine has the potential to be extremely dangerous - in the wrong hands it can kill or maim; It is therefore imperative that both owner and operator of the machine reads and understands the following section to ensure they are fully aware of the dangers that do, or may exist, and their responsibilities surrounding the use and operation of the machine.

















The operator of this machine is responsible not only for their own safety but equally for the safety of others who may come into the close proximity of the machine, as the owner you are responsible for both.




When the machine is not in use the cutting head should be lowered to rest on the ground. In the event of any fault being detected with the machine's operation it must be stopped immediately and not used again until the fault has been corrected by a qualified technician.

POTENTIAL SIGNIFICANT DANGERS ASSOCIATED WITH THE USE OF THIS MACHINE:




















-  *Being hit by debris thrown by rotating components.*
-  *Being hit by machine parts ejected through damage during use.*
-  *Being caught on a rotating power take-off (PTO) shaft.*
-  *Being caught in other moving parts i.e.: belts, pulleys and cutting heads.*
-  *Electrocution from Overhead Power Lines (by contact with or 'flashover' from).*
-  *Being hit by cutting heads or machine arms as they move.*
-  *Becoming trapped between tractor and machine when hitching or unhitching.*
-  *Tractor overbalancing when machine arm is extended.*
-  *Injection of high-pressure oil from hydraulic hoses or couplings.*
-  *Machine overbalancing when freestanding (out of use).*
-  *Road traffic accidents due to collision or debris on the road.*
-  *Burn risk from hot components.*

BEFORE USING THIS MACHINE YOU MUST:

-  *Ensure you read all sections of the operator handbook.*
-  *Ensure the operator is, or has been, properly trained to use the machine.*
-  *Ensure the operator has been issued with and reads the operator handbook.*
-  *Ensure the operator understands and follows the instructions in operator handbook.*
-  *Ensure the tractor front, rear and sides are fitted with metal mesh or polycarbonate guards of suitable size and strength to protect the operator against thrown debris or parts.*
-  *Ensure tractor guards are fitted correctly, are undamaged and kept properly maintained.*
-  *Ensure that all machine guards are in position, are undamaged, and are kept maintained in accordance with the manufacturer's recommendations.*
-  *Ensure flails and their fixings are of a type recommended by the manufacturer, are securely attached and that none are missing or damaged.*
-  *Ensure hydraulic pipes are carefully and correctly routed to avoid damage by chaffing, stretching or pinching and that they are held in place with the correct fittings.*
-  *Always follow the manufacturer's instructions for attachment and removal of the machine from the tractor.*
-  *Check that the machine fittings and couplings are in good condition.*
-  *Ensure the tractor meets the minimum weight recommendations of the machine's manufacturer and that ballast is used as necessary.*
-  *Always inspect the work area thoroughly before starting to note obstacles and remove wire, bottles, cans and other debris.*
-  *Use clear suitably sized warning signs to alert others to the nature of the machine working within that area. Signs should be placed at both ends of the work site. (It is recommended that signs used are of a size and type specified by the Department of Transport and positioned in accordance with their, and the Local Highways Authority, guidelines).*
-  *Ensure the operator is protected from noise. Ear defenders should be worn and tractor cab doors and windows must be kept closed. Machine controls should be routed through proprietary openings in the cab to enable all windows to be shut fully.*
-  *Always work at a safe speed taking account of the conditions i.e.: terrain, highway proximity and obstacles around and above the machine. Extra special attention should be applied to Overhead Power Lines. Some of our machines are capable of reach in excess of 8 metres (26 feet) this means they have the potential to well exceed, by possibly 3 metres (9' 9"), the lowest legal minimum height of 5.2 metres from the ground for 11,000 and 33,000 volt power lines. It cannot be stressed enough the dangers that surround this capability, it is therefore vital that the operator is fully aware of the maximum height and reach of the machine, and that they are fully conversant with all aspects regarding the safe minimum distances that apply when working with machines in close proximity to Power Lines. (Further information on this subject can be obtained from the Health & Safety Executive or your Local Power Company).*

-  Always disengage the machine, kill the tractor engine, remove and pocket the key before dismounting for any reason.
-  Always clear up all debris left at the work area; it may cause hazard to others.
-  Always ensure when you remove your machine from the tractor that it is left in a safe and stable position using the stands and props provided and secured if necessary.

WHEN NOT TO USE THIS MACHINE:

-  Never attempt to use this machine if you have not been trained to do so.
-  Never use a machine until you have read and understood the operator handbook, are familiar with it, and practiced the controls.
-  Never use a machine that is poorly maintained.
-  Never use a machine if the guards are missing or damaged.
-  Never use a machine on which the hydraulic system shows signs of wear or damage.
-  Never fit, or use, a machine on a tractor that does not meet the manufacturer's minimum specification level.
-  Never use a machine fitted to a tractor that does not have suitable front, rear and side(s) cab guarding made of metal mesh or polycarbonate.
-  Never use the machine if the tractor cab guarding is damaged, deteriorating or badly fitted.
-  Never turn a machine cutting head to an angle that causes debris to be ejected towards the cab.
-  Never start or continue to work a machine if people are nearby or approaching - Stop and wait until they are at a safe distance before continuing. **WARNING:** Some cutting heads may continue to 'freewheel' for up to 40 seconds after being stopped.
-  Never attempt to use a machine on materials in excess of its capability.
-  Never use a machine to perform a task it has not been designed to do.
-  Never operate the tractor or machine controls from any position other than from the driving seat, especially whilst hitching or unhitching the machine.
-  Never carry out maintenance of a machine or a tractor whilst the engine is running – the engine should be switched off, the key removed and pocketed.
-  Never leave a machine unattended in a raised position – it should be lowered to the ground in a safe position on a level firm site.
-  Never leave a tractor with the key in or the engine running.
-  Never carry out maintenance on any part or component of a machine that is raised unless that part or component has been properly substantially braced or supported.
-  Never attempt to detect a hydraulic leak with your hand – use a piece of cardboard.
-  Never allow children near to, or play on, a tractor or machine under any circumstances.

ADDITIONAL SAFETY ADVICE

Training

Operators need to be competent and fully capable of operating this machine in a safe and efficient way prior to attempting to use it in any public place. We advise therefore that the prospective operator make use of relevant training courses available such as those run by the Agricultural Training Board, Agricultural Colleges, Dealers and McConnel.

Working in Public Places

When working in public places such as roadsides, consideration should be paid to others in the vicinity. Stop the machine immediately when pedestrians, cyclists and horse riders etc. pass. Restart only when they are at a distance that causes no risk to their safety.

Warning Signs

It is advisable that any working area be covered by suitable warning signs and statutory in public places. Signs should be highly visible and well placed in order to give clear advanced warning of the hazard. Contact the Department of Transport or your Local Highways Authority to obtain detailed information on this subject. The latter should be contacted prior to working on the public highway advising them of the time and location of the intended work asking what is required by way of signs and procedure. – ‘Non-authorized placement of road signs may create offences under the Highways Act’.

Suggested Warning Signs Required








‘Road works ahead’ warning sign with a supplementary **‘Hedge cutting’** plate. **‘For 1 mile’** or appropriate shorter distance may be added to the plate.

‘Road narrows’ warning signs with supplementary **‘Single file traffic’** plate.

White on blue **‘Keep right’** (*) arrow sign on rear of machine.

** Note – this applies to UK Market machines where traffic passes to the right of a machine working in the same direction as the traffic flow. The direction, use and colour of the arrow sign will depend on the country of use and the Local Highway Authorities regulations in the locality.*

Use of Warning Signs

-  On two-way roads one set of signs is needed facing traffic in each direction.
-  Work should be within 1 mile of the signs.
-  Work only when visibility is good and at times of low risk e.g.: NOT during ‘rush-hour’.
-  Vehicles should have an amber-flashing beacon.
-  Ideally, vehicles should be conspicuously coloured.
-  Debris should be removed from the road and path as soon as practicable, and at regular intervals, wearing high visibility clothing and before removing the hazard warning signs.
-  Collect all road signs promptly when the job is completed.

Although the information stated here covers a wide range of safety subjects it is impossible to predict every eventuality that can occur under differing circumstances whilst operating this machine. No advice given here can replace ‘good common sense’ and ‘total awareness’ at all times, but will go a long way towards the safe use of your McConnel machine.



Safe use of rotary flail hedge cutters

HSE information sheet

Agriculture Information Sheet No 21 (Revision 1)

Introduction

This information sheet outlines typical hazards when using most types of tractor-mounted rotary flail hedge cutter. It gives guidance on reducing risks to the operator and others during work with hedge cutters and will help employers, employees and the self-employed comply with their duties under health and safety law.

All users of rotary flail hedge cutters need to be aware of the particular features of their make/model of hedge cutter when considering the hazards, risks and precautions.

Hazards

The greatest risk of injury comes from contact with the machine's moving parts and in particular:

- entanglement on inadequately guarded power take-off shafts;
- contact with the cutter head parts, drive belts or pulleys;
- being struck by the cutting head or machine arm as it moves.

Other risks associated with tractor-mounted hedge cutters can include:

- being hit by material or other debris ejected by the cutters;
- being hit by component parts ejected from the machine;
- coming into contact with overhead electricity power lines (OHPLs);
- the tractor overbalancing when the machine arm is extended;
- injection of high-pressure oil from damaged hydraulic hoses or couplings;
- being struck by the machine overbalancing when un-hitched from the tractor;
- road traffic accidents due to collisions with other vehicles either directly or from debris on the road.

Control measures

It is extremely dangerous to carry out any work on a machine while it is under power. The most important safety measure is to follow the 'safe stop' procedure before dismounting, or carrying out any maintenance or adjustments, including dealing with a blockage or other problem:

- Handbrake on.
- Controls neutral.
- Stop engine.
- Remove key.

Guards and machine safety

Check that all guards and other protective devices are in place before starting work. Don't use the machine if the guards are missing or damaged. Make sure:

- the power take-off (PTO) shaft is fully enclosed in a guard along its entire length from the tractor power take-off to the power input connection on the hedge cutter;
- the tractor rear and side(s) are fitted with protective glazing, metal mesh or polycarbonate guards of a size/strength specified by the hedge cutter manufacturer to protect the operator against thrown debris or other projectiles;
- tractor mesh/polycarbonate guards are suitable for the job, undamaged and maintained in accordance with the manufacturer's instructions;
- all hedge cutter guards and safety devices are in position, correctly fitted and maintained in accordance with the manufacturer's recommendations;
- flails and their fixing heads are the right size for the task. Flails, and their fixings, should be of the type recommended by the manufacturer, securely attached, and should not be missing or damaged;
- hydraulic pipes are carefully routed to avoid damage;
- machine fittings and couplings are in good condition.

General guidance on safe working practice

- Operators should receive adequate instructions and training to enable them to use the machine safely. Take advantage of relevant training/courses provided by manufacturers/dealers. They will help ensure your safety and that of your staff, and help you get the best performance from your hedge cutter.
- Make sure the operator reads, understands and follows the instruction manual.
- Follow the manufacturer's instructions when hitching or unhitching the machine from the tractor. Do not stand in any position where you may be at risk of being crushed, eg in the area between the back of the tractor and the cutter.
- Make sure the machine is left in a stable position when it is removed from the tractor, using any stands or props provided, and securing it further if necessary.
- Do not carry out maintenance on the hedge cutter with the cutting arm/dipper arm raised, unless the arm is properly supported.
- Check the tractor is at least the minimum weight recommended by the hedge cutter manufacturer. Use ballast as necessary.
- Inspect the hedge before starting to cut and remove wire, bottles, cans and other debris. Check for any telegraph/electricity pole stays. Damaged stays should be reported to the relevant Telecoms Company/Distribution Network Operator.
- Use appropriate warning signs to alert others to the hedge-cutting operation where necessary.
- Work at a safe speed, taking account of the conditions (eg terrain, proximity to the highway, or obstacles).
- Use safe practices when work needs to be done near OHPLs. Flailhead units on some dipper arms can reach over 5.2 metres, the minimum height of OHPLs above ground level (see Further reading).
- Clear up debris after cutting if it could be a hazard to others.

Roadside hedges

Take extra care if you are hedge/verge cutting along a road. Consider what measures you will need to control the risks to other road users (eg vehicles, cyclists, pedestrians, or horse riders). For roadside work (on the public highway) there are other legal requirements. For example, there may be obligations to:

- display specific warning signs in defined locations where work is carried out;
- fit flashing beacons to tractors/machines;
- clear debris from paths and roads;
- restrict your working hours.

Consult your local authority highways department and the Department for Transport for advice (see Further reading).

Further reading

Traffic signs manual 2009. Chapter 8. Traffic safety measures and signs for road works and temporary situations. Part 2: Operations DfT ISBN 978 0 11 553052 4 <http://assets.dft.gov.uk/publications/traffic-signs-manual/traffic-signs-manual-chapter-08-part-02.pdf>

Working safely near overhead electricity power lines AIS8(rev3) HSE Books 2012 www.hse.gov.uk/pubns/ais8.htm

Further information

For information about health and safety, or to report inconsistencies or inaccuracies in this guidance, visit www.hse.gov.uk/. You can view HSE guidance online and order priced publications from the website. HSE priced publications are also available from bookshops.

This guidance is issued by the Health and Safety Executive. Following the guidance is not compulsory, unless specifically stated, and you are free to take other action. But if you do follow the guidance you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance.

This document is available at www.hse.gov.uk/pubns/ais21.htm.

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SAFETY & INFORMATION DECALS (Power Arms)

Power Arm machines are equipped with safety and information decals designed to warn of dangers, operational information and machine protection. Operators must understand the decals and heed all warnings. Keep decals in a good condition and replace immediately if they are damaged or missing.



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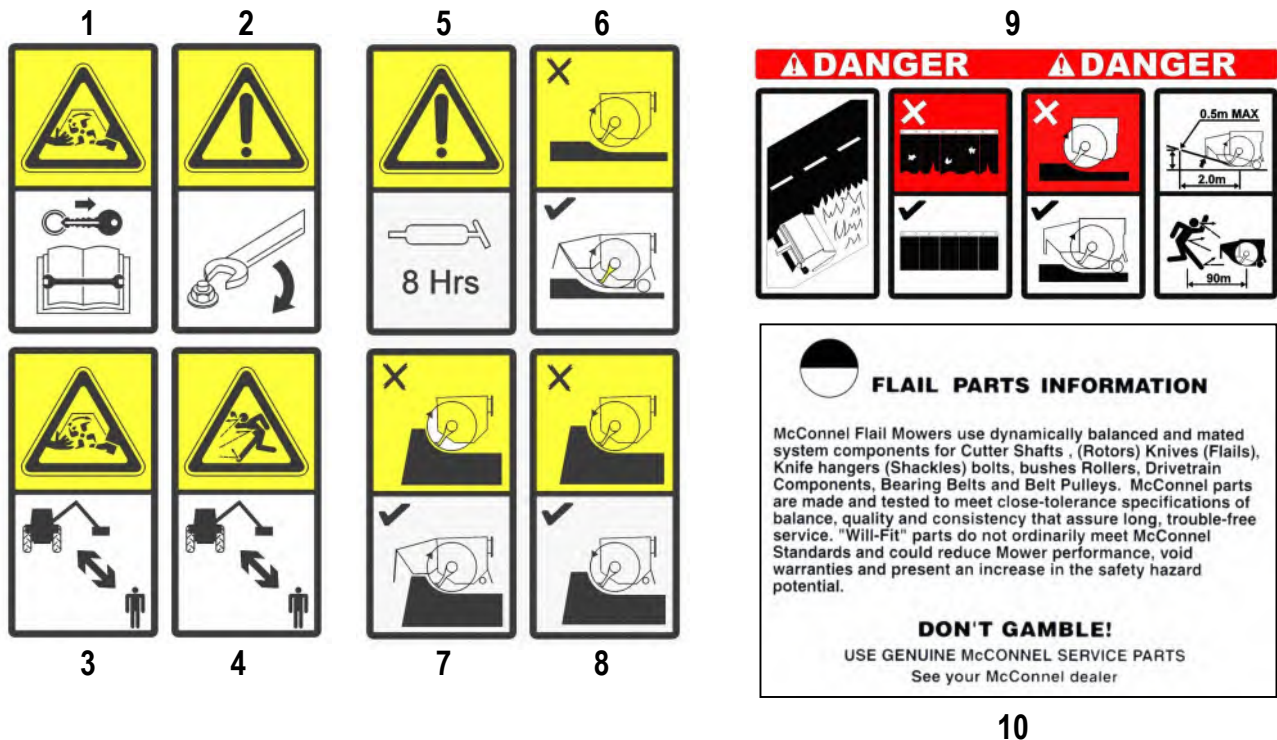
13.

14.

15.

1. General Safety Warnings.
2. Driveline Hazard Warning.
3. Tighten Check Chains Warning.
4. 'In vehicle' Safety Rules Decal.
5. Serial Number Plate.
6. Read the Book First.
7. Lift Point with SWL (Kg).
8. Specific Pinch Point Warning.
9. Maximum vehicle PTO Speed & Direction Warning.
10. Oil Filter Initial and subsequent change information.
11. Lift Point for shipping only; stow when machine installed on vehicle. (Models with stowable lift eyes only).
12. Auto-breakaway Return Warning; in 'Auto-Reset' arm will automatically return to the work position, when possible.
13. Vehicle Clearance Warning; leave 300mm+ between arm and vehicle.
14. Lift Stop Clearance Warning; leave 300mm+ between arm and vehicle, leave 5mm between arm and stop.
15. Lift Tap 'Lock' Warning; leave 300mm+ between arm and vehicle, lock lift taps for transport.

SAFETY & INFORMATION DECALS (Flail Heads)



1. **Caution!** Rotating blades; keep clear of machine, stop machine (wait for rotor to stop), remove vehicle key and read the book first before performing any service or maintenance.
2. **Caution!** Keep all nuts and bolts tight.
3. **Caution!** Rotating components; keep clear of the working machine.
4. **Caution!** Thrown objects risk; keep all persons at a safe distance from the working machine.
5. **Caution!** Lubricate greasing points every 8 working hours.
6. **Caution!** Grass/Verge Mowing; front hood, front flap, rear roller and rear flap must be fitted and correctly adjusted when using the machine for grass and verge mowing. Flaps must be in good condition.
7. **Caution!** Hedging (Uphill cutting); front hood, front flap and rear flap must always be fitted and correctly adjusted. Rear roller should be placed into the raised position. Flaps must be in good condition.
8. **Caution!** Hedging (Downhill cutting); front hood may be removed; rear flap must be fitted and rear roller placed into the raised position. Flap must be in good condition.
9. **Danger!** Road side mowing. Flaps must be in good condition. Do not work if front hood, front flaps, rear roller and rear flaps not fitted. Front hood, front flaps, rear roller and rear flaps must be fitted. Adjust front hood to the correct height position for verge mowing. A extended straight line from the bottom of the rotor and bottom of the front flap should not be higher than 0.5m at a horizontal distance of 2.0m from the rotor. Keep all persons at 90m from the working machine, stop machine if persons are closer. *Refer to front hood height setting section for details.*
10. **Important!** Parts information; for safety and performance only use 'Genuine McConnel Service Parts'.

TRACTOR REQUIREMENTS

Minimum Tractor Weight - *including ballast weight if necessary:*

PA5162-60 models **5000kg**

PA5162-60MC models **5000kg**

PA5562-60 models **5500kg**

PA5562-60MC models **5500kg**

PA5562-60VFR models **5500kg**

PA5762-60 models **6000kg**

Minimum HP Requirements

All models **60HP**

Linkage

Category 2

PTO Shaft

Tractor must be equipped with a live drive PTO to enable forward motion to be stopped while the flail head continues to operate.

Check Chains/Stabilizers

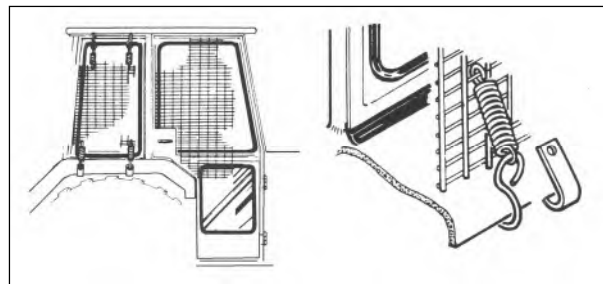
Check chains or stabilizers must be fitted and tightened.

VEHICLE/ TRACTOR PREPARATION

We recommend vehicles are fitted with cabs using safety glass windows and protective guarding when used with our machines.

Fit Operator Guard (Part No. 7313324) using the hooks provided. Shape mesh to cover all vulnerable areas.

Remember the driver must be looking through mesh and/or polycarbonate glazing when viewing the flail head in any working position - unless the vehicle/ cab manufacturer can demonstrate that the penetration resistance is equivalent to, or higher than, that provided by mesh/polycarbonate glazing. If the tractor has a roll bar only, a frame must be made to carry both mesh and polycarbonate glazing. The operator should also use personal protective equipment to reduce the risk of serious injury such as; eye protection (mesh visor to EN1731 or safety glasses to EN166), hearing protection to EN352, safety helmet to EN297, gloves, filter mask and high visibility clothing.



Vehicle Ballast: It is imperative when attaching 'third-party' equipment to a vehicle that the maximum possible stability of the machine and vehicle combination is achieved – this can be accomplished by the utilisation of 'ballast' in order to counter-balance the additional equipment added.

Front weights may be required for rear mounted machines to place 15% of total outfit weight on the front axle for stable transport on the road and to reduce 'crabbing' due to the drag of the cutting unit when working on the ground.

Rear weights may be required to maintain a reasonable amount of rear axle load on the opposite wheel from the arms when in work; for normal off-ground work i.e. hedge cutting this should be 20% of rear axle weight or more for adequate control, and for ground work i.e. verge mowing with experienced operators, this can be reduced to 10%.

All factors must be addressed in order to match the type and nature of the equipment added to the circumstances under which it will be used – in the instance of Power Arm hedgecutters it must be remembered that the machines centre of gravity during work will be constantly moving and will differ from that during transport mode, therefore balance becomes critical.

Factors that affect stability:

- *Centre of gravity of the tractor/machine combination.*
- *Geometric conditions, e.g. position of the cutting head and ballast.*
- *Weight, track width and wheelbase of the tractor.*
- *Acceleration, braking, turning and the relative position of the cutting head during these operations.*
- *Ground conditions, e.g. slope, grip, load capability of the soil/surface.*
- *Rigidity of implement mounting.*

Suggestions to increase stability:

- *Increasing rear wheel track; a vehicle with a wider wheel track is more stable.*
- *Ballasting the wheel; it is preferable to use external weights but liquid can be added to around 75% of the tyre volume – water with anti-freeze or the heavier Calcium Chloride alternative can be used.*
- *Addition of weights – care should be taken in selecting the location of the weights to ensure they are added to a position that offers the greatest advantage.*
- *Front axle locking, check with tractor manufacturer.*

The advice above is offered as a guide for stability only and is not a guide to vehicle strength. It is therefore recommended that you consult your vehicle manufacturer or local dealer to obtain specific advice on this subject, additionally advice should be sought from a tyre specialist with regard to tyre pressures and ratings suitable for the type and nature of the machine you intend to fit.

DELIVERY & PRE-ATTACHMENT (Dealer Reference)

Delivery

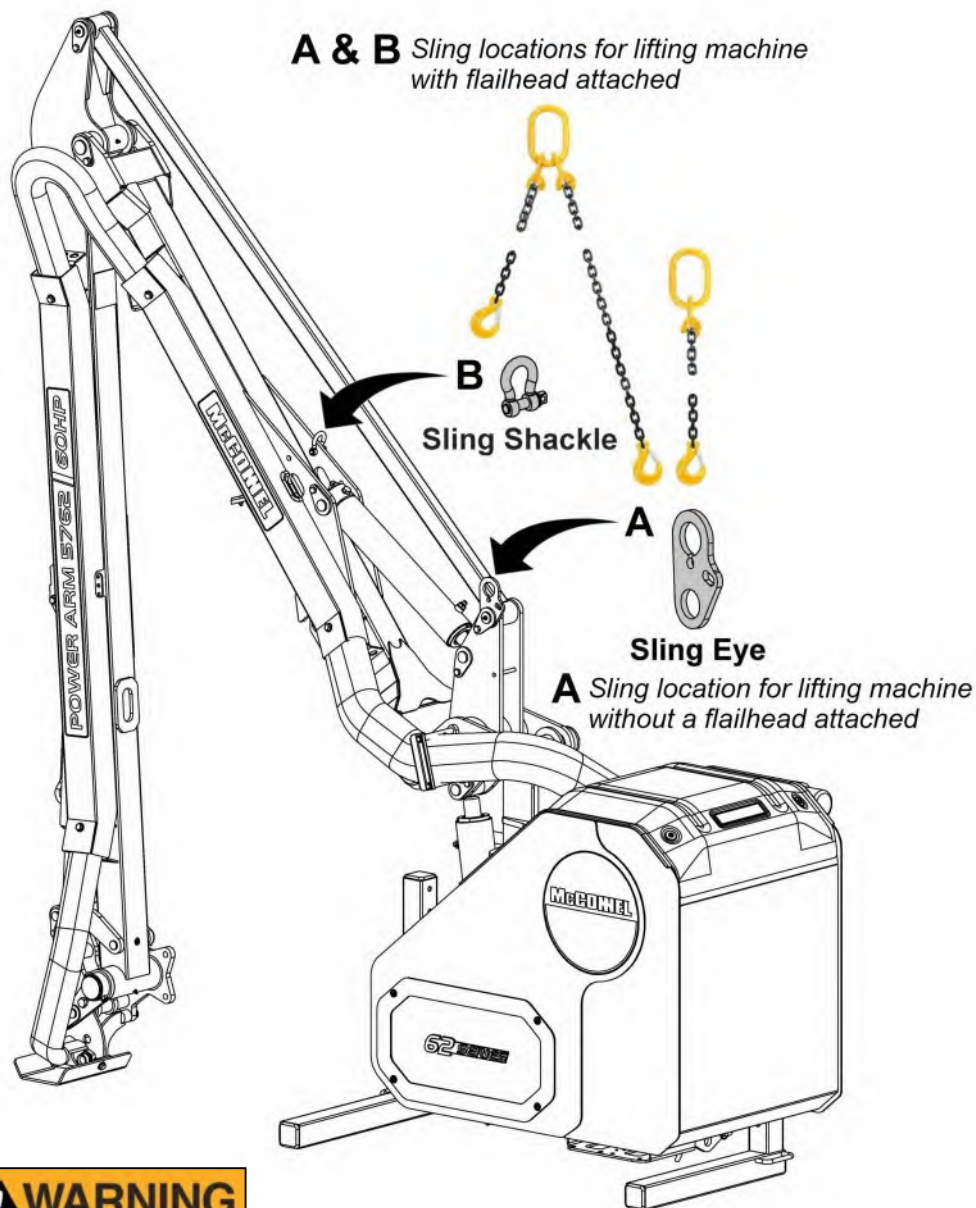
The machine will be delivered in a partially dismantled condition secured with transport straps and banding. Select a firm level site on which to place the machine before removing the straps, banding and other loose items.

Handling the Machine

Handling of the machine should always be performed using suitable overhead lifting equipment with a minimum safe lifting capacity over and above the maximum weight of the machine. Always ensure the machine is balanced during the lifting procedure and that all bystanders are kept well clear of the raised machine.

Lifting Points

To ensure even weight distribution when handling the machine it should be lifted using the Sling Eye located at position 'A'. If the machine has a flailhead attached it should be lifted using the Sling Eye located at position 'A' and a Sling Shackle installed at position 'B' – see below.



WARNING

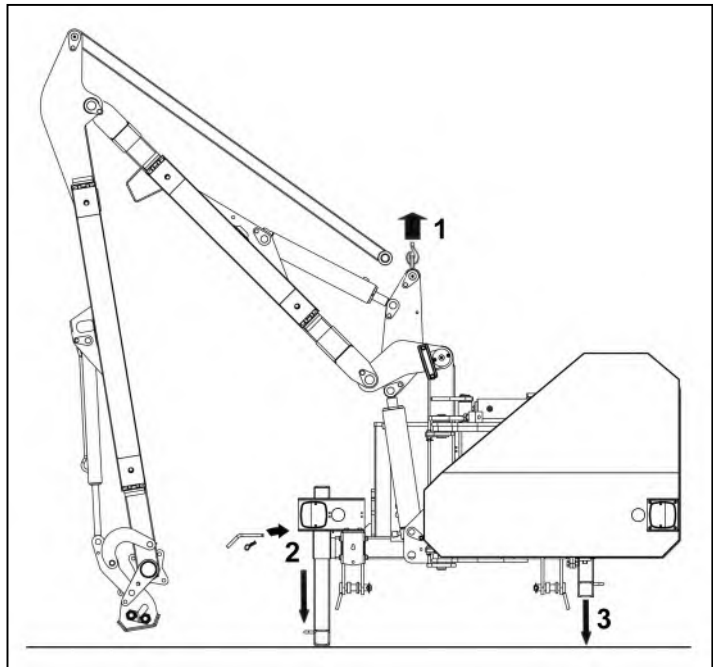
Always place and secure the lifting eye on the machines rocker into its stowed position when not in use. **Never** attempt to operate the machine with the lifting eye out of its stowed position – failure to observe this may result in damage to machine components.

Post Delivery Assembly

To allow for a compact shipping state the machine will be delivered with the tension link disconnected from the rocker and the stand legs retracted, these items will need to be correctly installed before initial attachment to a tractor; *the procedure is as follows:*

Stand Legs

Raise the machine using suitable overhead lifting equipment.
Lower stand legs and secure in position using pins and locking pins – the hole position selected should be at a height that places the gearbox stub axle approximately 75mm (3") below the height of the tractor's PTO shaft when the machine is at rest on the ground. Note the hole position used and ensure the equivalent one is used on both sides of the machine



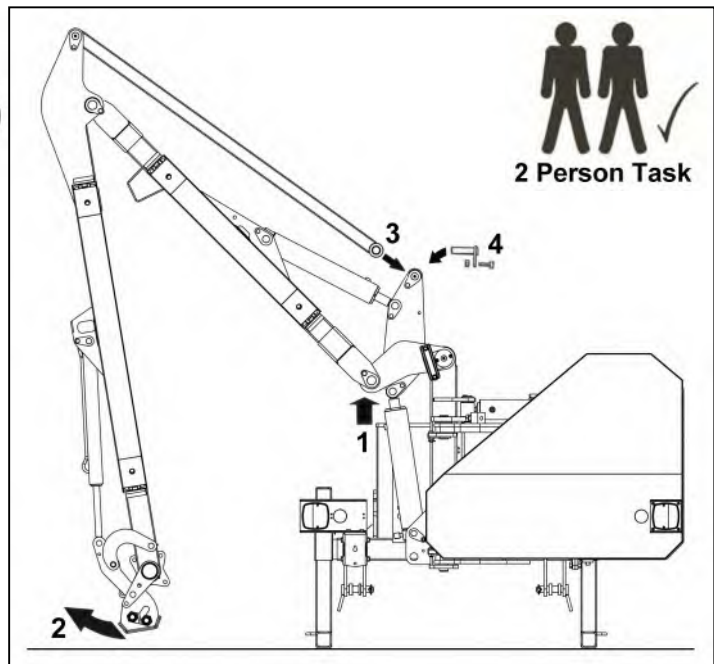
Hydraulic Oil

Fill tank with hydraulic oil.
Refer to hydraulic oil page for details of oil tank capacity and recommended oils.



Tension Link Attachment

Request assistance for this task.
Operate 'lift up' on machine controls sufficient only for dipper arm to clear the ground.
Pivot out the dipper arm until tension link can be connected and secure in position with pin and fixings supplied.

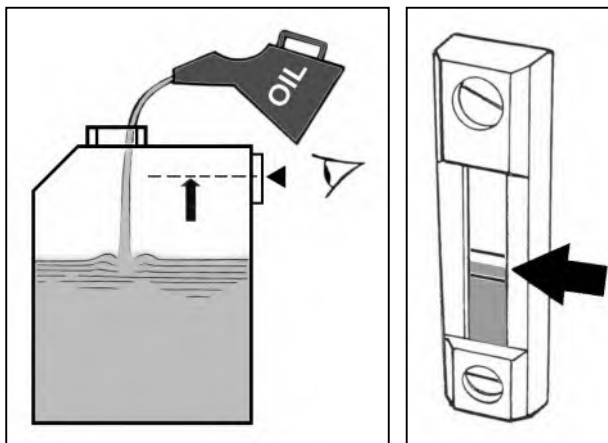


HYDRAULIC OIL

Hydraulic Oil Reservoir

Fill the tank with oil selected from the chart below or a good quality equivalent to a point where the level is between the minimum and maximum marks on the tank gauge. When the machine is initially run the level will drop as the oil is drawn into the circuit - *top back up as required to the correct level on the gauge.*

Always use clean receptacles when handling and transferring oil to avoid moisture or dirt contamination that can damage components and/or reduce machine performance.



Refer to the maintenance section for further information on the subject of hydraulic oil and system filtration.

Reservoir Capacity

The oil tank capacity of the machine is approximately **180 Litres**.

Recommended Hydraulic Oils

For initial filling of the oil reservoir, periodic oil changes and replenishment purposes the following hydraulic oils, or a good quality equivalent are recommended:

NOTICE

Only use oils that are ISO 18/16/13, NAS 7, or cleaner.

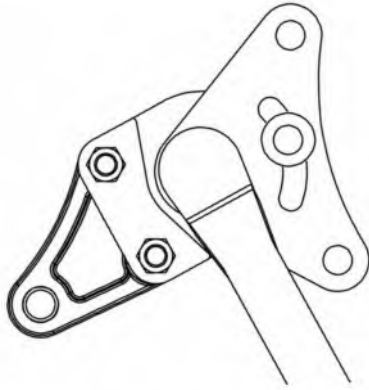
Manufacturer	Cold or Temperate Climate	Hot Climate
BP	Bartran 46 Energol HLP-HM 46	Bartran 68 Energol HLP-HM 68
CASTROL	Hyspin AWH-M 46	Hyspin AWH-M 68
COMMA	Hydraulic Oil LIC 15	Hydraulic Oil LIC 20
ELF	Hydrelf HV 46 Hydrelf XV 46	Hydrelf HV 68
ESSO	Univis N 46	Univis N 68
FUCHS (UK/Non UK markets*)	Renolin 46 Renolin HVZ 46 Renolin CL46/B15* Renolin AF46/ZAF46B*	Renolin 68 Renolin HVZ 68 Renolin CL68/B20* Renolin AF68/ZAF68B*
GREENWAY	Excelpower HY 68	Excelpower HY 68
MILLERS	Millmax 46 Millmax HV 46	Millmax 68 Millmax HV 68
MORRIS	Liquimatic 5 Liquimatic HV 46 Triad 46	Liquimatic 6 Liquimatic HV 68 Triad 68
SHELL	Tellus 46 Tellus T46	Tellus 68 Tellus T68
TEXACO	Rando HD 46 Rando HDZ 46	Rando HD 68 Rando HDZ 68
TOTAL	Equivis ZS 46	Equivis ZS 68

STABILIZERS

Standard Stabilizer Types Identification

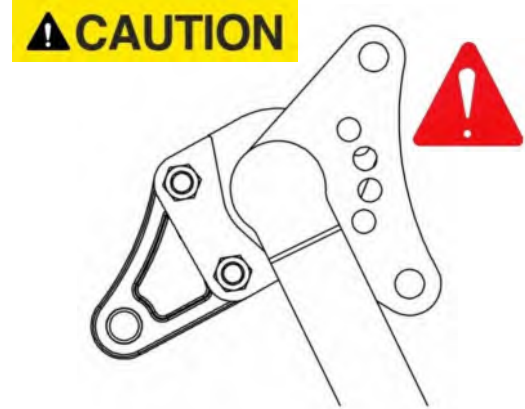
As standard, machines are fitted with either a 'slotted' type stabilizer or a 'multi-hole' type stabilizer; the particular one used is dependent on the specific machine build. Machines with Standard arm-sets use the 'slotted' type and machines with Midcut or VFR arm-sets use the 'multi-hole' type; *for identification refer to the illustrations below.*

Slotted Type Stabilizer



Machines with standard arm-sets.

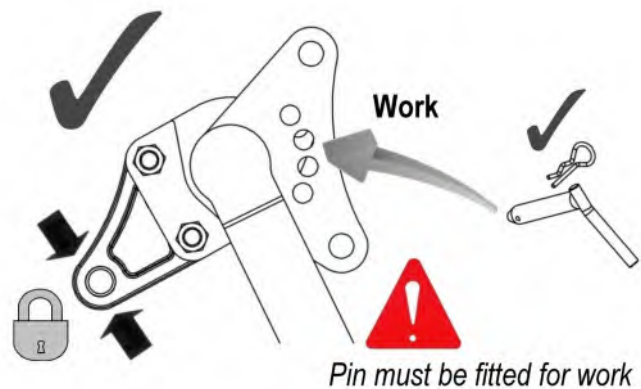
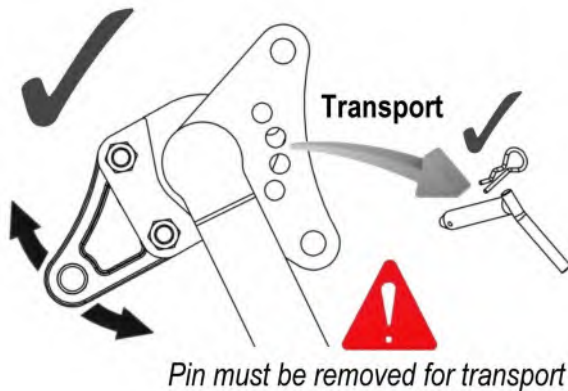
Multi-hole Type Stabilizer



Machines with Midcut or VFR arm-sets.

⚠ CAUTION

On machines equipped with multi-hole type stabilizers it is vital that the stabilizer position pin is always removed for machine transport and only fitted for work; failure to observe this can result in serious damage to machine and/or tractor components.



Position Pin Fitting & Removal (Multi-hole type stabilizers)

Insertion or removal of the position pin is best performed whilst the machine in its transport position as the forces acting on the stabilizer are greatly reduced; this will make the task of insertion or removal much easier. Always stow the position pin in a safe location when it is not in use.

Stabilizer Tongues

McConnel bolt on stabilizer tongues are available in a wide variety of versions to suit differing makes and models of tractors and are reversible to accommodate for greater variation in tractor linkage designs; *refer to following page for details.*

Stabilizer Tongue Options & Specifications



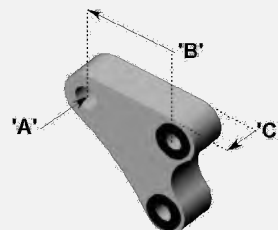
McConel Stabilizer Tongues

'A' – Hole diameter

'B' – Hole centre spacing

'C' – Stabilizer width

(Dimensions in mm)

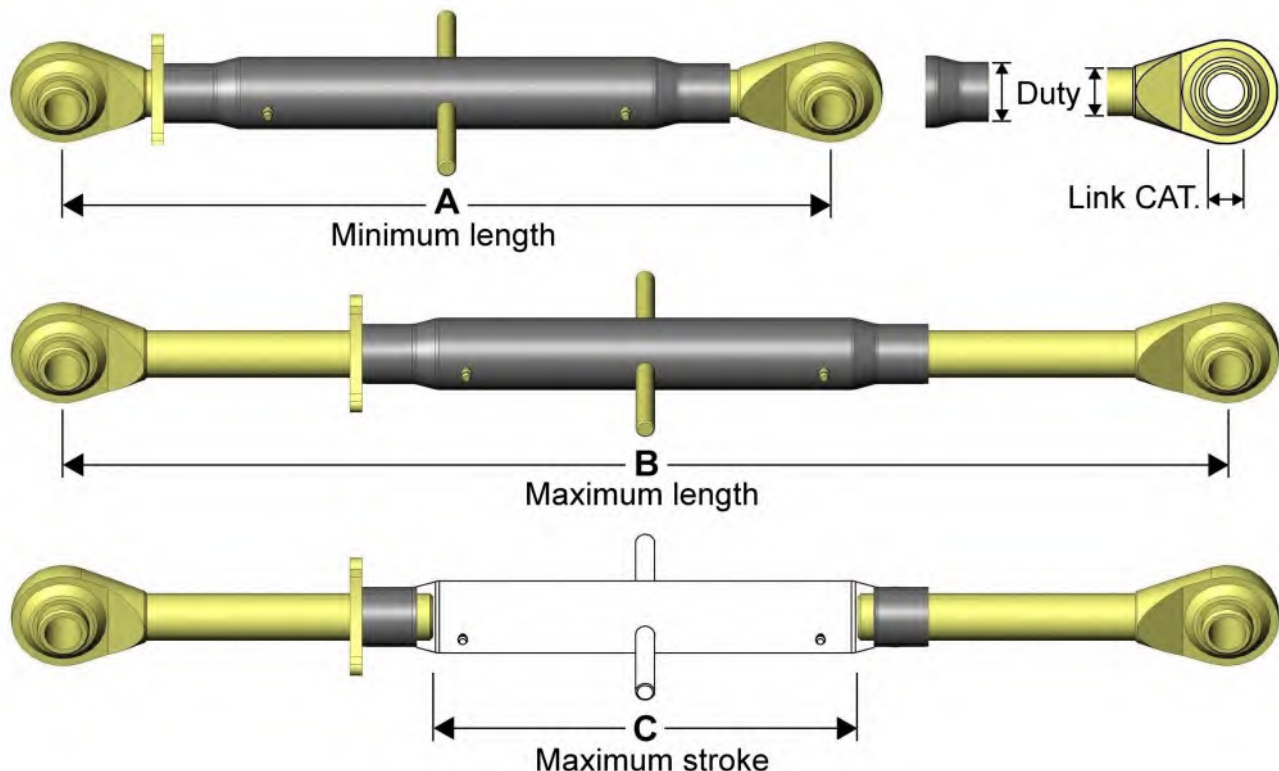


Ref.	Part No.	Description	'A'	'B'	'C'
1	7499501	Tongue: Standard CAT. 2/3	32.0	107.5	45.0
2	7499500	Tongue: Special CAT. 2/3 narrow	32.0	107.5	35.0
3	7499502	Tongue: Special CAT. 2 long	27.0	217.4	45.0
4	7499503	Tongue: Special CAT. 3 long	32.0	217.4	45.0
5	7499504	Tongue: Special CAT. 1	19.5	107.5	35.0
6	7499505	Tongue: Special CAT. 2 for Case TX tractors	25.0	120.0	50.0
7	7499506	Tongue: Special CAT. 3	32.0	107.5	45.0
8	7499507	Tongue: Special CAT. 3 narrow	32.0	107.5	30.0
9	7499508	Tongue: Special for some Ford tractors	28.6	107.5	45.0
10	7499510	Tongue: Special CAT. 2	27.0	107.5	40.0
11	7499511	Tongue: Special CAT. 1	19.5	217.4	45.0
12	7499512	Tongue: Special	35.0	217.4	45.0
13	7499513	Tongue: Special	28.6	217.4	45.0
14	7499514	Tongue: Special CAT. 4	45.2	107.5	63.5
15	7499515	Tongue: Special CAT. 4 long	45.2	217.4	63.5
16	7499262	Tongue: Special CAT. 2 extra long for Aebi	27.0	260.1	45.0

TOP LINK

Top Link Selection

The top link selected for connecting the machine's upper linkage point to the tractor must be of suitable length, link category and duty type for the particular application.



CAUTION Never install a top link that exceeds its maximum stroke.

McConnel offer the following range of top links suitable for Power Arm attachment.

Part No.	Description	Length (A)	Length (B)	Stroke (C)
21370.04	Top Link : CAT 0 - Standard Duty	280mm	393mm	113mm
4007280.01	Top Link : CAT 1 - Standard Duty	226mm	281mm	55mm
07.584.04	Top Link : CAT 2 - Standard Duty	307mm	382mm	75mm
07.584.03	Top Link : CAT 2 - Standard Duty	419mm	552mm	133mm
07.584.01	Top Link : CAT 2 - Standard Duty	460mm	680mm	220mm
199.213	Top Link : CAT 2 Sprung - Standard Duty	530mm	680mm	150mm
T6937	Top Link : CAT 2 - Standard Duty	660mm	920mm	260mm
23346.01	Top Link : CAT 2 - Standard Duty	770mm	975mm	205mm
7115275	Top Link : CAT 2 - Standard Duty	829mm	1019mm	190mm
21370.07	Top Link : CAT 2 - Heavy Duty	407mm	517mm	110mm
21370.07	* Shortened option minus 25mm each end	357mm	467mm	110mm
07.584.02	Top Link : CAT 2 - Heavy Duty	510mm	685mm	175mm
07.584.02	* Shortened option minus 50mm each end	410mm	585mm	175mm
07.584.06	Top Link : CAT 2 - Heavy Duty	420mm	585mm	165mm
21370.06	Top Link : CAT 2 - Heavy Duty	420mm	585mm	165mm
21370.01	Top Link : CAT 2 - Heavy Duty	515mm	781mm	266mm
1066258	Top Link : CAT 3 - Heavy Duty	540mm	800mm	260mm

* Can be supplied as a shortened version with the stated length of thread removed from each end.

MACHINE ATTACHMENT

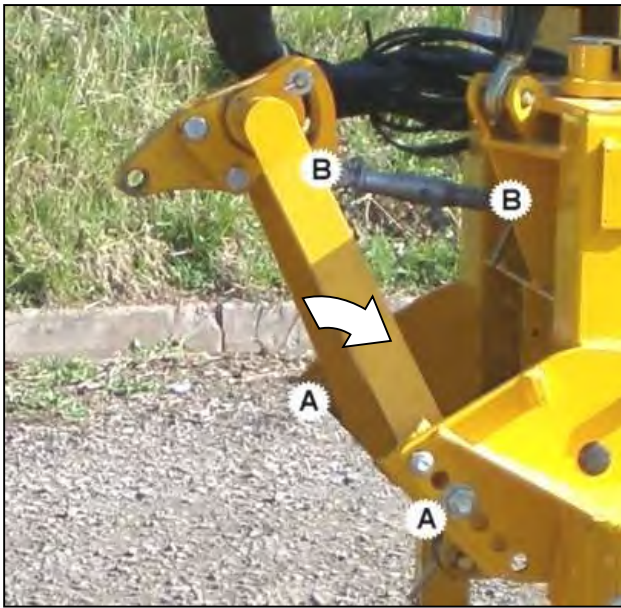
Attachment of the machine should always be performed on a firm level site.

⚠ CAUTION

During the attachment procedure bystanders must be kept at a safe distance from the machine at all times. Never operate the tractors linkage system or machine controls when persons are standing on, or working between, the tractor and machine.

PTO NOTE: Due to the close coupled design of the machine it is advisable to fit the PTO shaft to the machines gearbox stub axle prior to attaching the machine to the tractor. On initial installation the machine will need to be attached without the PTO fitted in order to measure for the required shaft length – In some cases the machine will then need to be removed from the tractor and subsequently refitted with the PTO pre-attached.

NOTE: The machine shown below may differ from the actual machine but the same general principals apply.



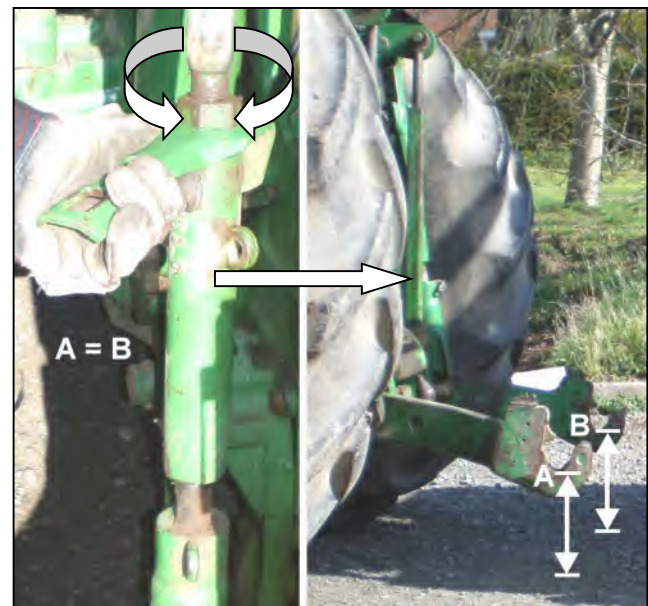
Attach stabiliser to machine frame at points 'A' - selecting a mid-point position initially – secure with nuts and bolts provided. Fit top link at points 'B' and secure with pins & lock pins.



Fit lower link balls and spacers into lower frame connection points and secure with linkage and lock pins – *place spacers to position lower link balls for best alignment with tractor lower links.*



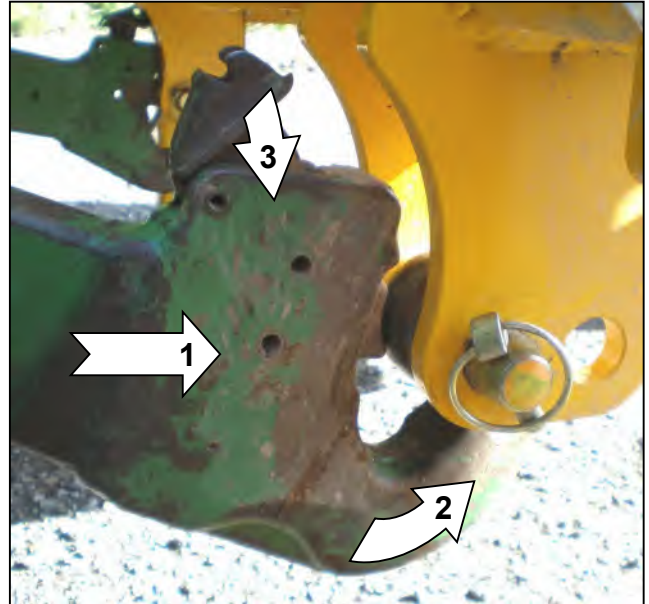
Fit PTO shaft to the stub axle of the machines gearbox. **NOTE:** for initial installation of a new machine or attachment to a different tractor refer to PTO note at top of page.



Adjust the drop arms so that lower links are level.



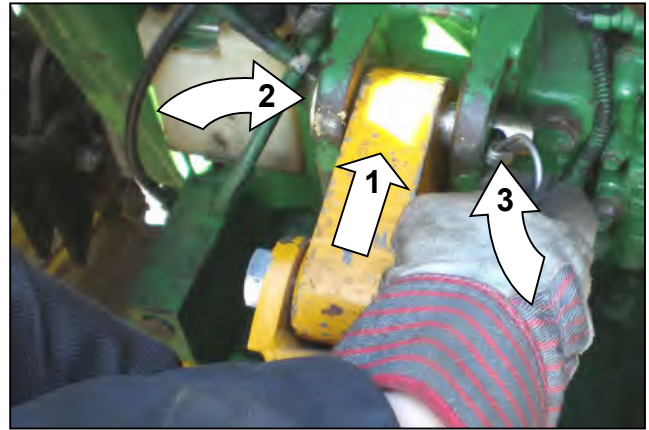
Reverse tractor squarely and centrally to the machine - set tractor lower links to a height that will permit attachment to lower frame attachment points.



Reverse fully in to attachment points then raise the tractor linkage until it locks onto the lower link balls on both sides of the machine.



Adjust top link to position the stabiliser tongue for attachment to the tractors top link clevis. NOTE: Alternative tongues for stabilisers are available for differing applications.



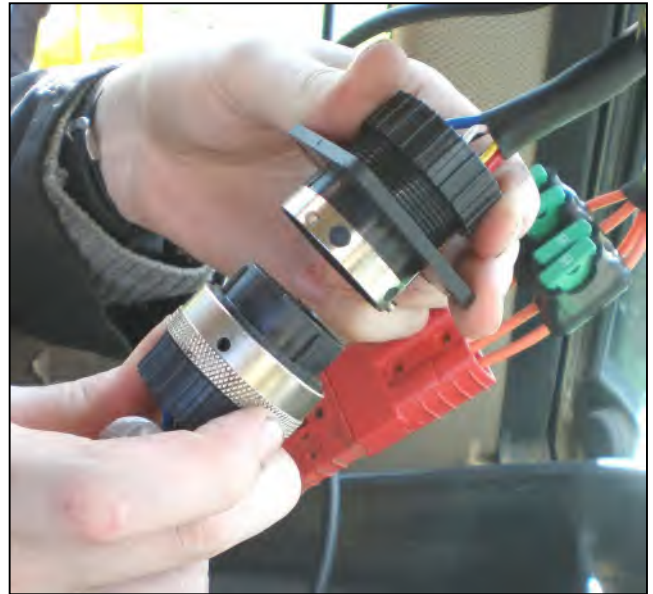
Attach stabiliser tongue to highest suitable clevis position that does not interfere with or foul tractor components - secure with pin and lock pin.



IMPORTANT: Rear of stabiliser tongue should be as close as possible to the bottom of the stabiliser slot with the machine at rest on the ground – if required change the stabiliser lower attachment points and/or clevis attachment position to achieve this setting. This is a vital requirement to ensure the tongue is located at the slots mid-point when the machine is raised to the work position thus allowing float in each direction.



Feed control lines into tractor cab – avoid sharp bends and keep lines well clear of all moving parts on the machine or tractor.



Connect control lines to the machines control unit in the tractor cab.



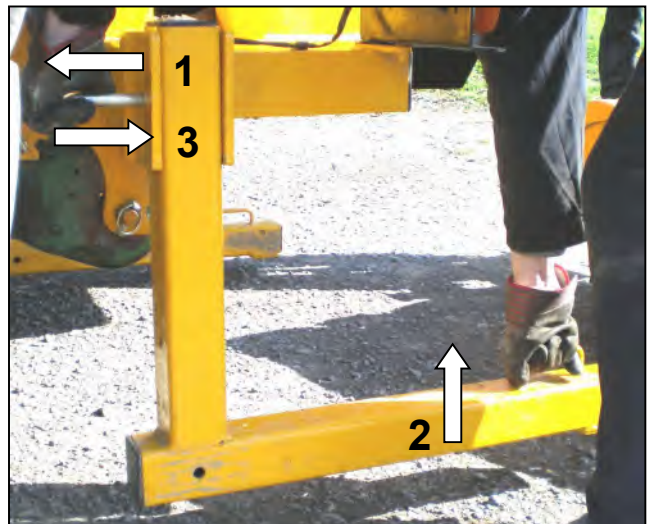
Tighten tractor stabilisers - raise tractor linkage to lift the machine to its working height.



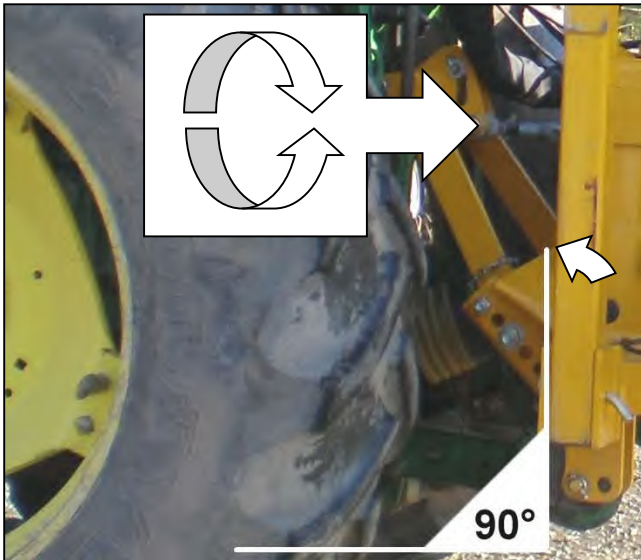
Attach PTO shaft to the output shaft of the tractor.



Attach torque chains to convenient locations to prevent rotation of PTO shaft guarding.



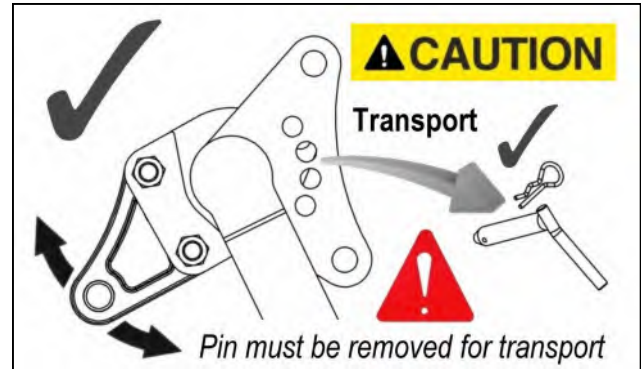
Remove stand legs from both sides of the machine.



With machine in work position adjust the top link to bring machine frame into the vertical position.

Finally, slew the machine into the transport position and close the slew ram and lift ram taps (*transport mode*).

Attachment is now complete and machine is ready for transportation to the work site.



NOTE: For initial installation refer to running up procedure.

VFR Models

Open VFR lock tap when the machine has been installed on the tractor.

PTO DRIVESHAFT INSTALLATION

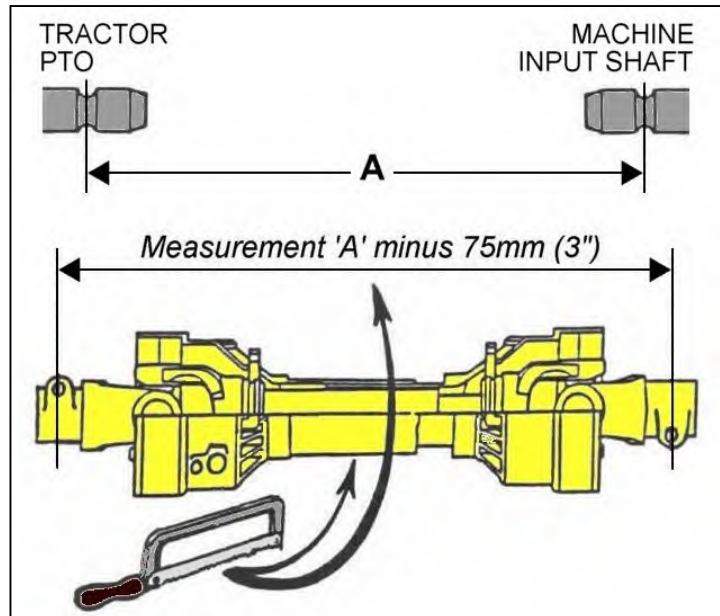
The PTO driveshaft attaches between the tractor and the machine gearbox to transfer the power required to run and operate the machine – it is important to achieve the correct shaft length to avoid risk of it ‘bottoming out’ when raising or lowering the machine. The procedure for measuring and cutting the shaft is as follows:

Measuring the PTO Shaft

With the machine attached to the tractor in the working position measure the horizontal distance ‘A’ from the tractor’s PTO to the input shaft on the machines gearbox and subtract 75mm (3”) – *this figure is the required shaft length.*

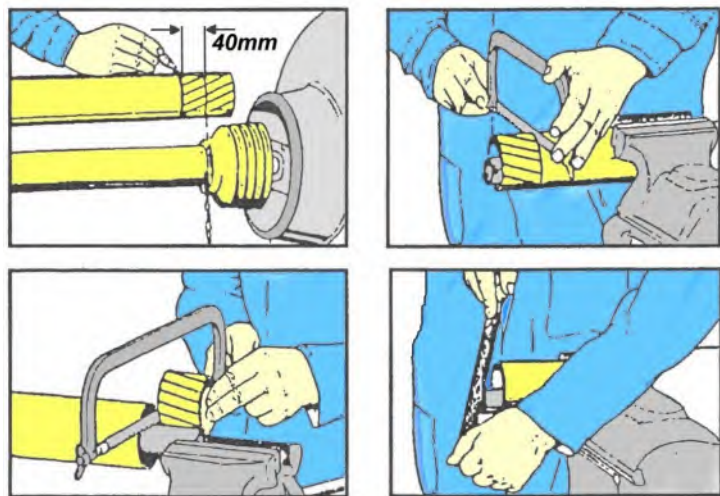
Place the fully closed PTO shaft on the ground and measure its overall length, if the shaft is shorter than the required length you can use it without the need to shorten - *providing it allows for a minimum 150mm (6”) overlap when fitted.*

If the shaft is longer subtract the required shaft length plus an additional 75mm (3”) - *the resulting figure is the excess length that will need to be removed from each half of the shaft.*



Cutting the PTO Shaft

Separate the two halves and using the measurement obtained above shorten both the plastic guarding and the inner steel profile tubes of each shaft by this same amount. De-burr the cut tubes with a file to remove rough or sharp edges and thoroughly clean to remove swarf before greasing, assembling and fitting the shaft.



NOTICE

For subsequent use with different tractors the shaft should be measured again to check suitability – *there must be a minimum shaft overlap of 150mm (6”).*

Maintenance

To increase the working life of the PTO shaft it should be periodically checked, cleaned and lubricated – *refer to the PTO maintenance section for further details on this subject.*

CONTROL UNIT INSTALLATION

The information below states installation methods for fitting control units in the tractor cab.

NOTE: Electric control units work within the range of **12v-16v DC** and require a minimum power supply of **12v DC**.

Cable Controls

Cable control units are provided with, and attached to, a mounting bracket – the bracket should be securely fixed to the internal mud wing or cab cladding in a suitable convenient location that offers ease of use without interfering with normal tractor operation.

In deciding the final position of the control unit bear in mind the location of the cable run – make sure the minimum acceptable cable bend radii of 8" (200mm) is not exceeded.

Ensure during fitting that no structural member of the tractor cab or roll bar is drilled or damaged.

The cable rotor control valve lever on cable controlled machines will be assembled as a component part of the main bank of controls and therefore shares the same mounting bracket.

On electric machines with cable operated rotor control valve the lever will be supplied as a 'standalone' unit with its own individual mounting bracket – this should be fitted in the same manner as above adopting the same precautions pertaining to attachment and cable runs.

Electric Controls

Electric control units feature an inbuilt mounting bracket for attaching the controls to the armrest of the tractor seat.

The power supply cable should be connected directly to the tractors battery; do not use cigarette lighter type connections as these prove to be sporadic and unreliable for control applications. Control units are **12 volt DC** operated. The **brown lead is positive (+)**, the **blue lead is negative (-)**.

Revolution Proportional Controls

Revolution proportional controls comprise of 2 units; the main control screen and the armrest control unit.

The control screen is supplied with a mounting bracket and suction cup assembly that allows the unit to be mounted on the window of the tractor cab; ensure the surface used is clean and dry and the unit mounted in a position where it does not obstruct operator vision.

The armrest unit is designed to slide over the armrest of the tractor seat and is held in place with the fixing straps provided. Alternately, the mounting bar of the controls can be used should a more permanent installation be required; when fitting the latter ensure that any holes drilled in the tractor cab are clear of any important components and/or electrical wiring and should not be located in any area where it could affect the safety structure of the cab or impede normal operation of machine or tractor.

The power supply cable should be connected directly to the tractors battery; do not use cigarette lighter type connections as these prove to be sporadic and unreliable for control applications. Control units are **12 volt DC** operated; the **red lead is positive (+)** and the **black lead is negative (-)**.

Operation of Electric Control Units

Refer to the specific control manual supplied with the machine for operating instructions; users should read the controls operation manual in conjunction with the operation manual for the machine.

CABLE CONTROLS

Cable controlled machines are supplied with a control unit of the type shown below, the particular version will be dependent on the specification and features of the machine. Versions differ primarily in the number of armhead control levers assembled within the control bank, some versions will have the rotor control lever assembled alongside the armhead control levers as shown below left and others will be supplied with the rotor control lever as a 'standalone' unit with its own individual mounting bracket.

The armhead control levers all move in a forwards and backwards direction each controlling a specific arm function with the exception of the auto reset lever which operates only in the backward direction (from central 'off' position to the backwards 'on' position).

Where applicable, if a machine is fitted with the optional lift float feature, operation of the lift float will be via an additional electrical switch which will need to be installed in a convenient location in the tractor cab.



Basic Cable Control Unit



Cable Control Unit with Auto Reset

Control Location & Function

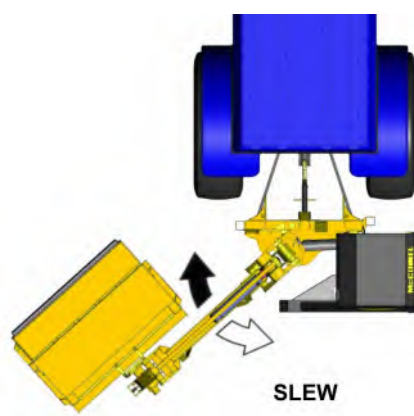
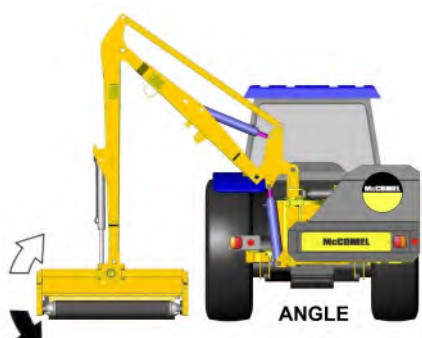
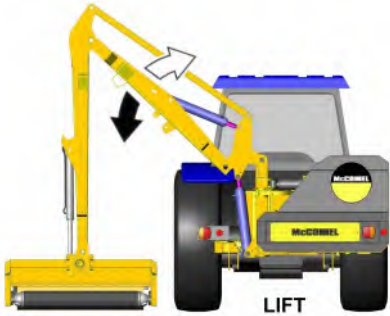
1. Arm Lift Control
2. Arm Reach Control
3. Head Angle Control / Angle Float Selection
4. Arm Slew Control
5. Rotor Control
6. Auto Reset (*where applicable*)
7. Midcut (*where applicable*)



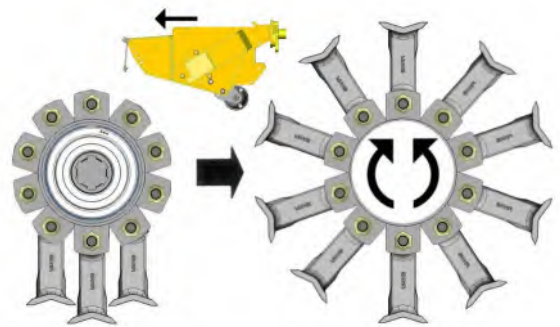
Cable Control Unit with Auto Reset & Midcut

NOTE: The illustrations on the following pages show the method of operating all possible functions; depending on individual specifications some features may not be present on your particular machine and therefore will not be applicable.

ARM OPERATION

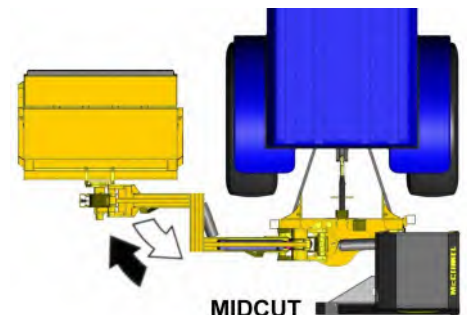


Rotor Control



Refer to specific cable rotor control section for additional information on rotor operation

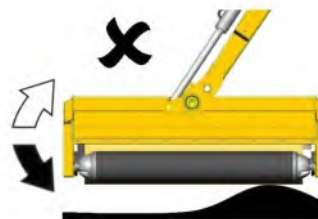
Midcut Models



FLOAT OPERATION (Angle Float standard / Lift Float optional)



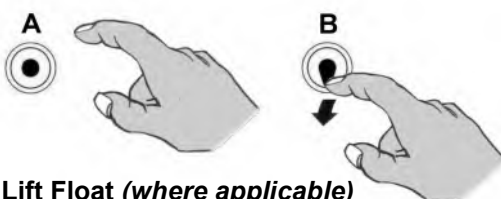
Head Angle Float -
Push angle lever fully forward into the detent position.



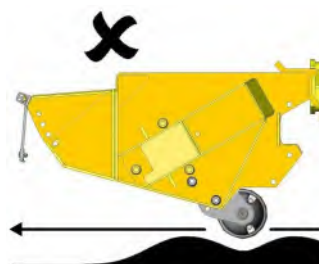
A) Angle Float OFF



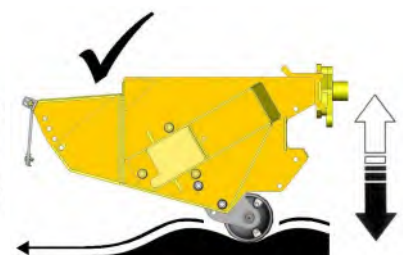
B) Angle Float ON



Lift Float (where applicable)



A) Lift Float OFF

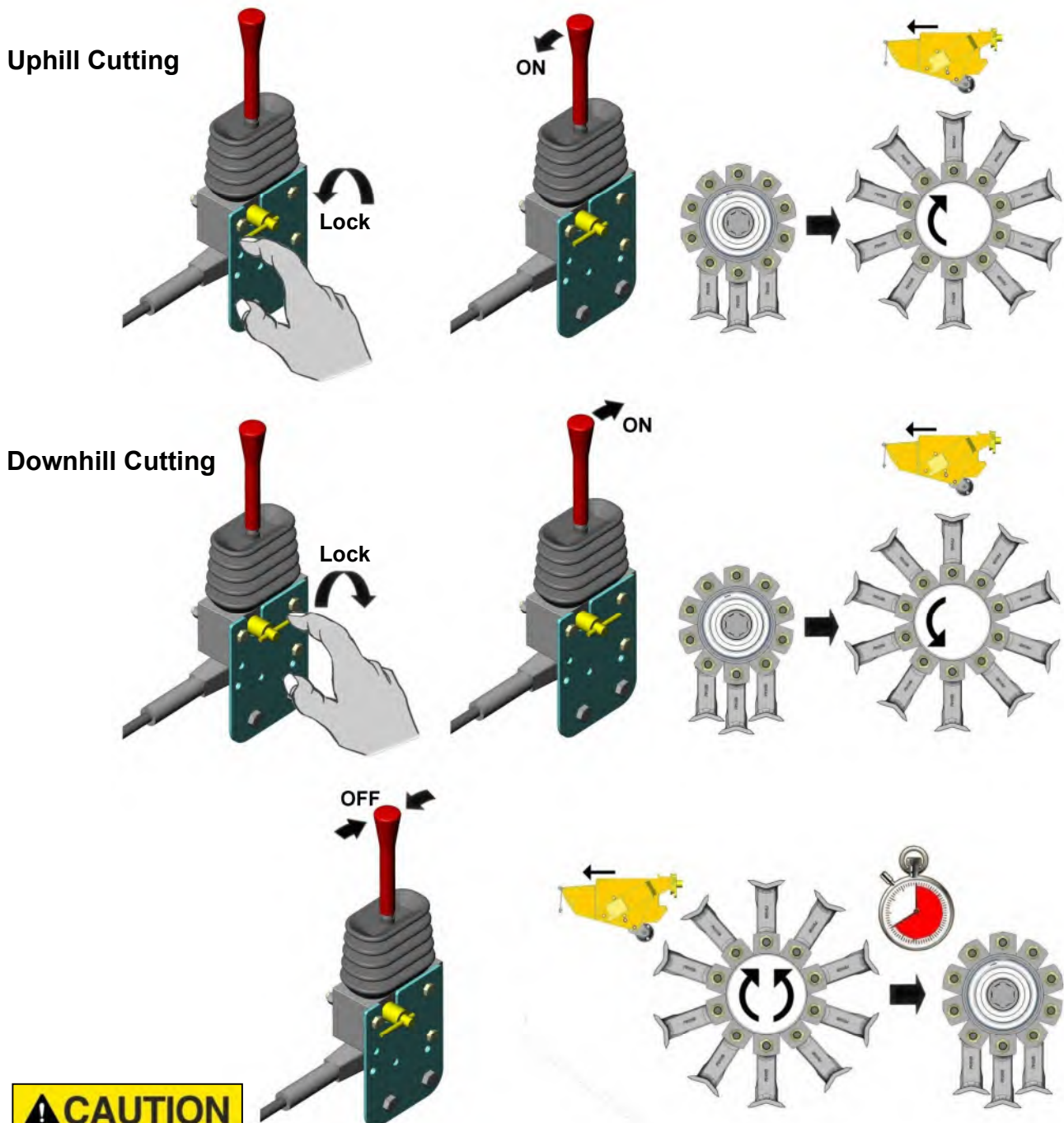


B) Lift Float ON

CABLE ROTOR CONTROL

On cable rotor control machines the rotor is operated by the lever shown below; from the upright 'OFF' position pushing the lever forward switches the rotor 'ON' for downhill cutting and pulling the lever backwards switches the rotor 'ON' for uphill cutting. The small pivot locking lever mounted on the side of the control assembly rotates through 180° to lock the rotor in a specific cutting direction; this is a safety feature to avoid changes of rotor direction without first stopping the rotor. To change the direction of cut the rotor lever must be placed in the upright 'OFF' position; when the rotor has stopped rotating completely the pivot locking lever can be turned to the opposing position allowing the control lever to be operated for opposite cutting direction.

On some cable operated machines the rotor control lever will be assembled as part of the main bank of controls, whereas on others and all electric models it will be supplied as a 'standalone' unit with its own mounting bracket.



CAUTION



Ensure rotor has stopped turning completely before attempting to change direction; when switched 'OFF' a rotor can continue to 'freewheel' under its own momentum for up to 40 seconds before stopping.

OPERATOR CONTROL SYSTEMS

Control System Operation Manual

For electrically controlled machines a dedicated operation manual for the specific control unit shipped with the machine is issued alongside this manual; **the control unit operation manual supplied must be read in conjunction with this manual** and should ideally be kept in the tractor cab for reference by the operator.

Control Unit Identification

Depending on specification the machine will be operated by one of the following controls;



Users of this machine must read the specific control unit operation manual supplied with the machine in conjunction with this manual.

Control unit operation manuals are also available on our website for reference or download at; <https://www.mcconnel.com/support/parts-and-operators-manual/> or via QR code below.

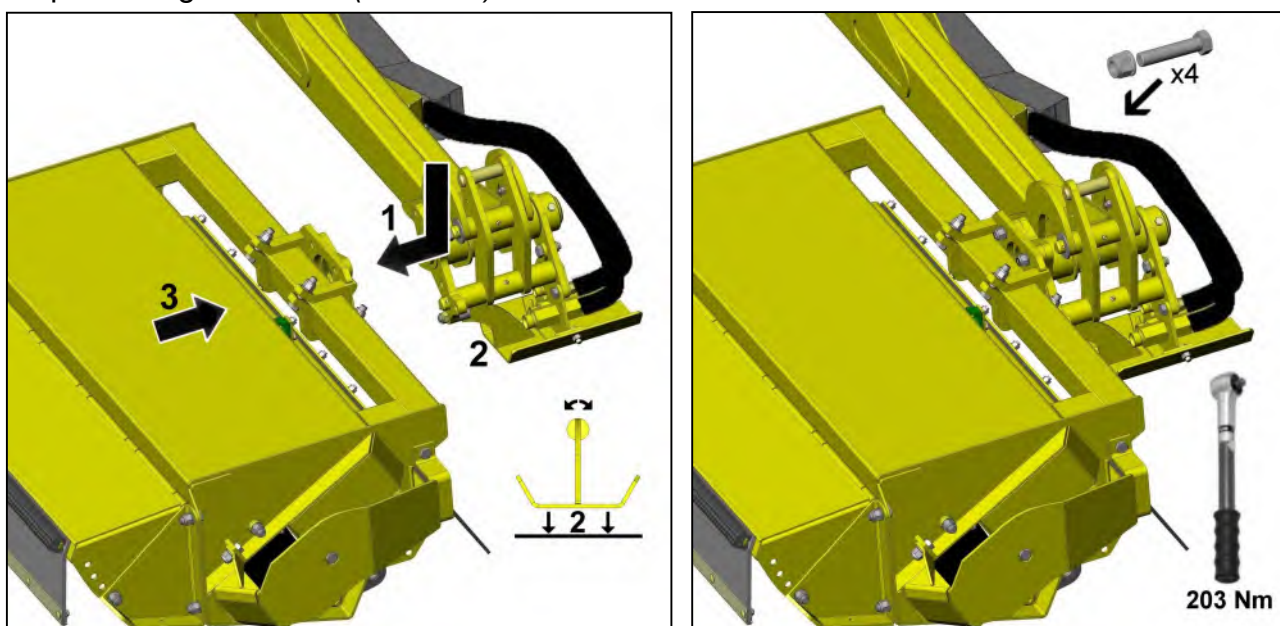


FLAILHEAD ATTACHMENT

For ease of attachment and safety this procedure is best performed on a firm level site. With the tractor parked alongside the flailhead operate the controls of the machine to position the pivot bracket of the machines head angling mechanism directly behind flailhead with the base of the hose tray (or junction bracket) parallel to the ground. Manoeuvre the flailhead backwards on its roller until the heads attachment bracket is adjacent to the machines pivot bracket. Fit the 4 attachment bolts through the brackets from the arm side - *if the holes are mis-aligned carefully operate the angling ram until the holes correspond*.

WARNING: Ensure all persons remain at a safe distance whilst operating the angling function as the geometry of the head angling mechanism produces several pinch risk areas.

With the attachment bolts correctly located through the brackets fit the self-locking nuts and tighten alternately until the brackets are drawn flush before finally tightening them to a torque setting of 203Nm (150ft.lbs).

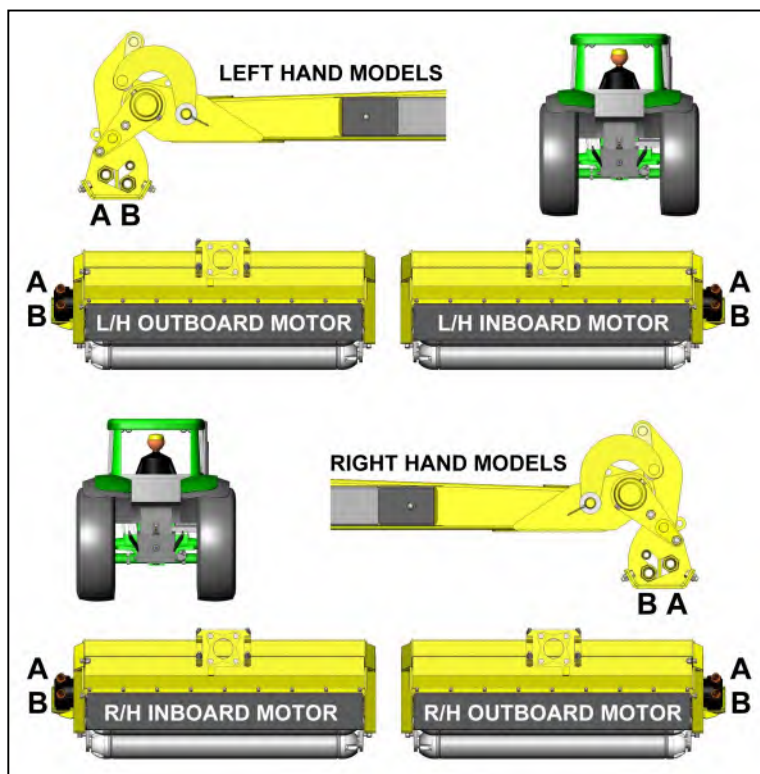


Flailhead Hose Attachment

With the flailhead attached to the machine the hydraulic hoses can now be connected – *refer to the diagrams opposite*. Upper port 'A' on the motor connects to junction bracket point 'A' on the arm and lower port 'B' on the motor connects to junction bracket point 'B' on the arm.

NOTICE

If a hose tray is already fitted to the arm it will need to be removed to allow the hoses to be connected to the junction bracket - ensure hose tray is replaced once the hoses have been connected.



RUNNING UP PROCEDURE

CAUTION

Before initial use of a new machine, all lubrication points must be greased and the gearbox and oil tank levels checked and where required topped up before attempting to use the machine. *Refer to maintenance section for details.*

- Ensure rotor control valve is in 'STOP' position, start tractor and engage PTO; allow the oil to circulate through the return line filter for about 5 minutes without operation of the armhead control lever.
- Operate the armhead controls through their complete range ensuring all movements are functioning correctly.
- Place the flail head at a safe attitude and move the rotor control to 'START' position; after initial fluctuation the rotor should settle to a steady speed.
- Increase PTO speed to approximately 360RPM. and run for a further five minutes before disengaging and stopping tractor.
- Check the hose runs and observe that they are free from any pinching, chaffing, straining or kinks.
- Re-check the oil level in the tank and top up if necessary.

EMERGENCY STOPPING

In all emergency situations machine operation and functions must be stopped immediately; **Stop PTO operation** using the tractor controls then immediately kill electrical power to the machine using the **OFF (Emergency Stop)** switch on the machine's control unit.

WARNING

Auto-Reset Machines



When the Auto-Reset feature is active the machines arm set is capable of unintentional movement even when the PTO is switched off and stationary. Always ensure that electrical power to the machine is switched 'OFF' using the **OFF (Emergency Stop)** switch on the machine's control unit in emergency situations and/or when the machine is not being operated.

WARNING

Cable Operated Machines



In certain conditions, and/or if the Auto-Reset feature is active, the arm sets on cable operated machines possess the potential to move unintentionally, even when the PTO is switched 'OFF' and stationary, if the levers were to be accidentally operated. Care must be adopted to avoid any movement of the levers when the machine is not being operated. Ensure arm sets are lowered fully to the ground when the machine is parked up or not in use.

PRE-WORK PREPARATION & PRECAUTIONS

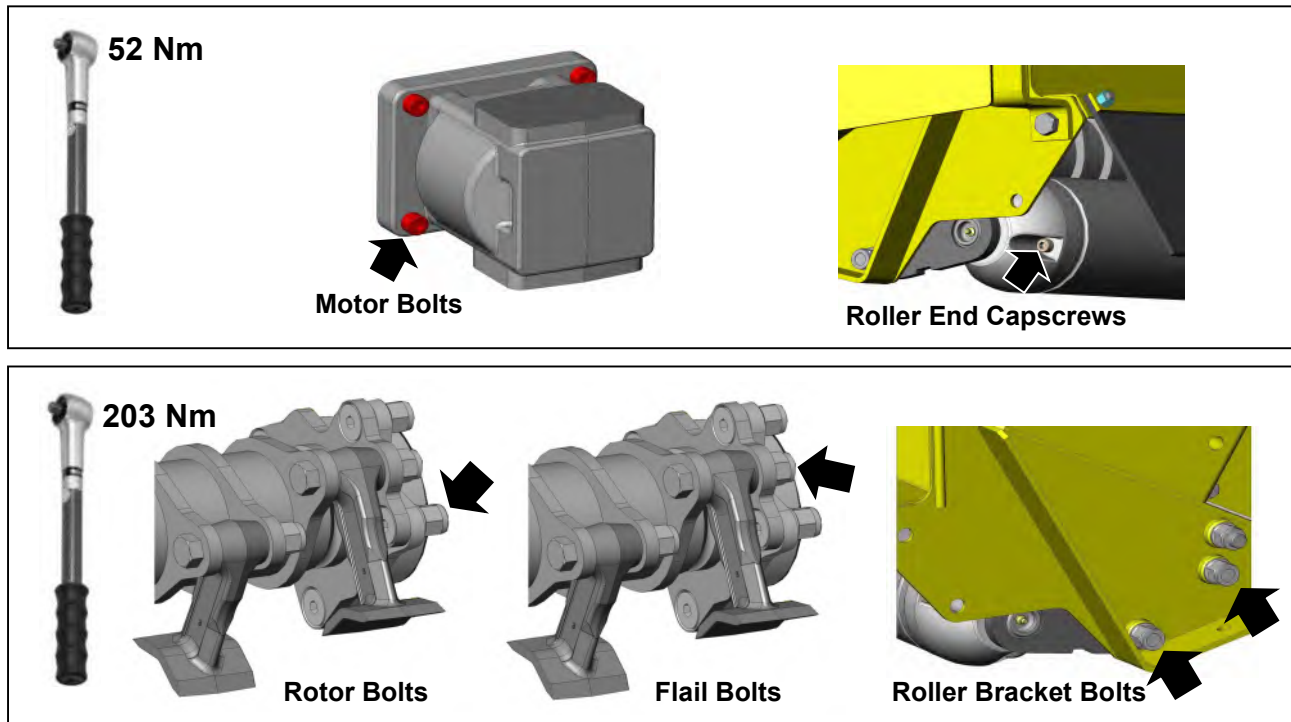
IMPORTANT: Always read the book first before attempting to operate the machine. Practise operating the machine, without the rotor running, in a safe open space until you are familiar with all controls and functions of the machine. Only begin using the machine for work when you are confident you can operate the machine in a safe manner.

CAUTION

Care must always be taken when working with the flailhead close in to avoid contact with the tractor.

Pre-work Machine Checks

Prior to use of the machine always check all bolts are tight and that the torque figures are correct for the specific locations indicated below:



General Work Precautions

Inspect the work area prior to operation, remove any hazardous materials and note any immovable objects; if necessary mark potential hazards with a visible marker that can easily be seen from the operating position in the tractor.

If the type of work being undertaken makes this important precaution impractical, always maintain a high degree of alertness and restrict the tractors forward motion to a speed that allows sufficient time to stop the tractor or avoid the hazard before contact is made.

General Working Practice

It is the operators responsibility to develop safe working procedures at all times.

Always;

- Be aware of potential hazards in the vicinity of the work area.
- Ensure all guards are fitted correctly and in good condition.
- Disengage PTO before stopping the engine.
- Wait until the flail has stopped running before leaving the tractor seat.
- Disengage the PTO, stop the engine, remove and pocket the key before making any adjustments to the machine.
- Check frequently that all nuts and bolts are tight.
- Keep bystanders at a safe distance.

REMOVAL FROM TRACTOR



⚠ DANGER

Read carefully before attempting to detach the machine from the tractor.

⚠ WARNING

Do not operate quadrant lever or machine controls through the rear cab window whilst standing on or amongst linkage components - Always seek assistance.

Detachment Procedure

Select a firm level site for parking the machine.

- Replace parking legs in their sockets and secure in their lowest position.
- Lower machine to rest on the stand legs.

Ensure lift float is turned off (*where applicable*).

- Raise machine on tractor linkage enough only to take the weight off the stabiliser.
- Open lift ram taps.
- Ensure arm is in the rear position, place flail head on the ground at half reach – push down slightly to relieve the load on the top link.
- Stop tractor engine.
- Close lift ram and slew ram taps.
- Disengage PTO and remove from tractor.
- Slacken stabiliser bars/check chains as applicable.
- Disconnect controls and/or control lines from the tractor cab and stow neatly on the machine clear of the ground.
- Disconnect stabiliser from tractors top hitch point.
- Remove draft link pins.
- Slowly and carefully drive the tractor away from the machine.

Electric Control Units

Store Electric Control Units in a clean dry location, protected from the elements.

STORAGE

Storing the Machine

If the machine is to be left standing for an extended period of time, lightly coat the exposed portions of the ram rods with grease. Subsequently, this grease should be wiped off before the rams are next moved.

Grease all lubrication points of the machine prior to storage and check the machine for broken or damaged components - repair or replace any damaged parts immediately so the machine is fully prepared for next use.

Wherever possible storage of the machine should ideally be in a clean dry location where it is protected from the elements, if the machine has to be stored outside tie a piece of tarpaulin or canvas over the control assembly as a protection from condensation, do not use plastic bags as these can increase condensation and lead to rapid corrosion of the unit. Control units and electrical power looms should be neatly stowed under the machine covers to keep them dry and clean.

After storage of the machine and prior to use all machine and PTO lubrication points should be cleaned and re-greased and machine oil levels checked - *replenish if required*.

Before use, wipe the ram rods with a clean cloth to remove any grit or other contamination that may have gathered on them during storage.

Run the machine for several minutes without operation to allow the oil to fully circulate the system before operating the arms.

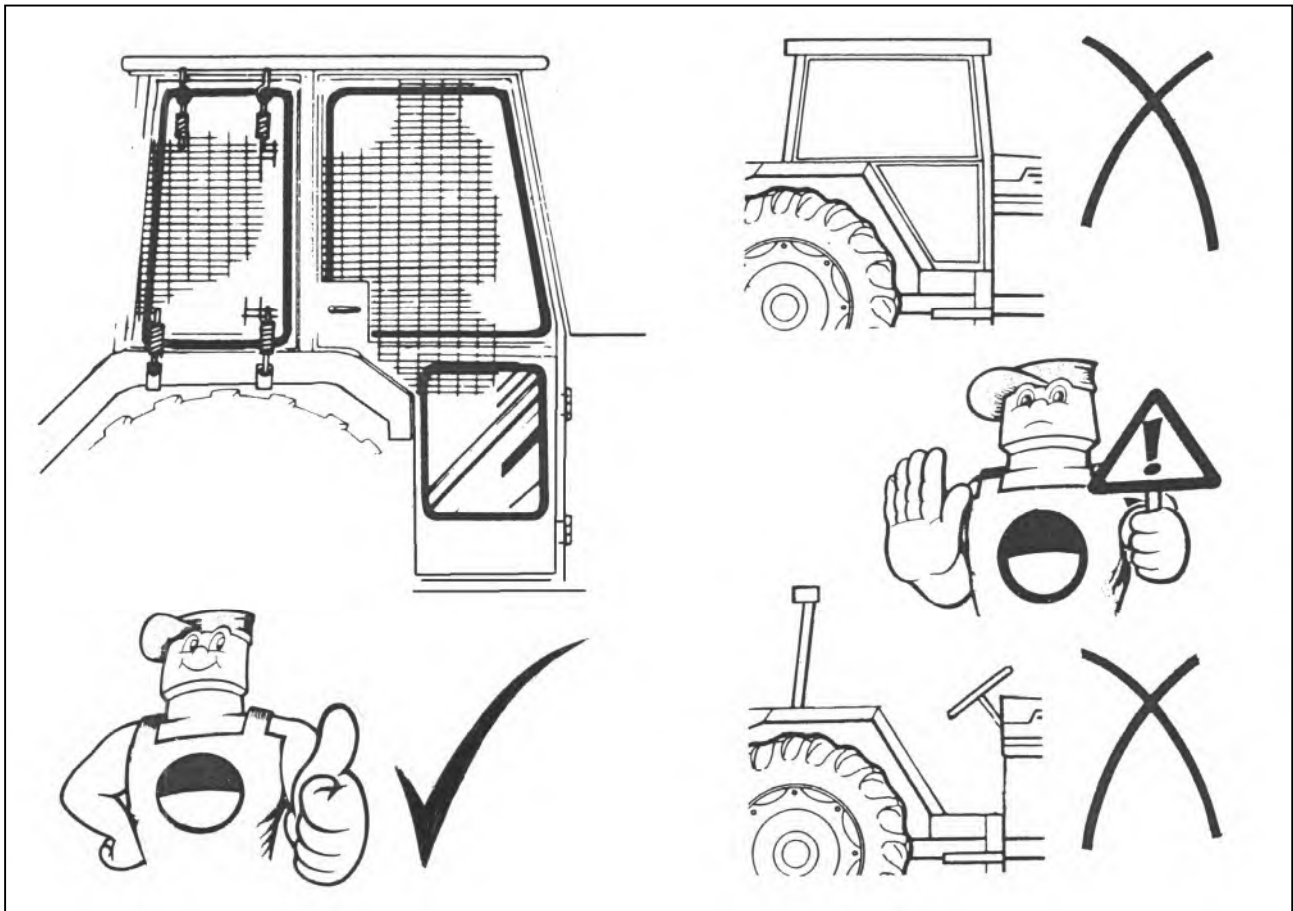
Operate the machine through its full range of movements checking that all controls and functions are working correctly.

Visually inspect hydraulic hoses and connections to ensure there are no leaks or damage.

Check safety guarding is in place and in good condition before using the machine for work.

OPERATION

Operator Guard



Machine Guards

Before each period of work, check that all the relevant tractor and machine guards are in place and are in good working condition.

Small splits and abrasions on the lower edges of the flail head rubber flaps are permissible but should one or more of these cuts or splits become fifty percent or more of the flap height they should be replaced immediately as they will have become ineffective for debris containment.

Operator Safety

During operation all the tractor windows should be kept firmly closed with the exception of the rear window which may be opened only to the extent that is sufficient to allow entry of electrical or operating cables for the machine into the cab.

Should the tractor not be fitted with a 'quiet' cab ear defenders must be worn at all times, failure to heed this warning may result in permanent damage to hearing.

Although in normal circumstances a working machine or rotating parts should never be approached it is an additional wise precaution to avoid wearing loose or flapping clothes especially scarves and neckties whilst in close proximity to a machine.

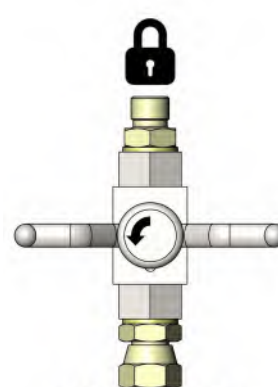
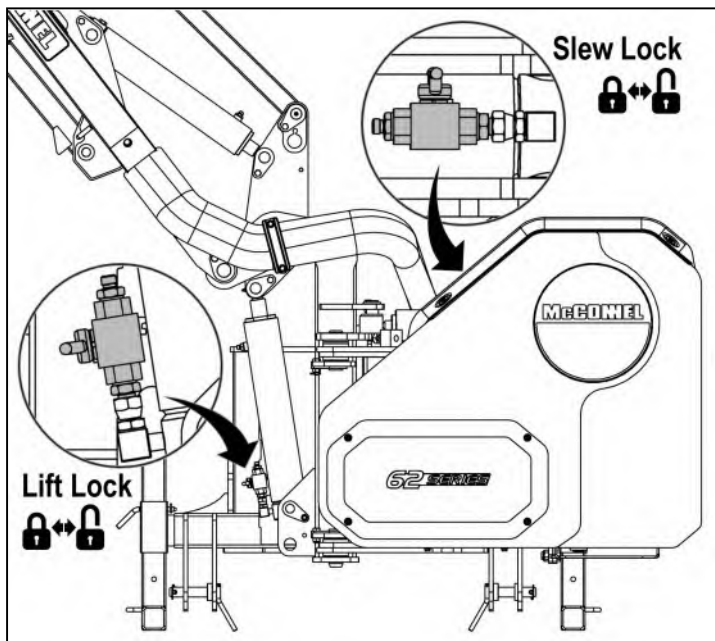
The operator should continually guard himself and others from complacency that can arise from familiarity. Never attempt to take 'short cuts', always follow the correct procedures diligently and abide by the restrictions imposed by safety considerations.

REMEMBER: there is only one right way - the safe way!

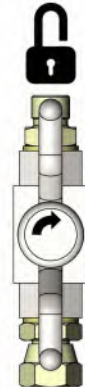
TRANSPORT LOCKS

Slew Lock & Lift Lock

All machines are equipped with 1/4-turn taps on the Lift Ram and the Slew Ram allowing them to be 'locked' for transport and storage; locations of the lock taps are shown below.



Closed Position
(Transport & Storage)



Open Position
(Work only)

⚠ CAUTION

Slew and Lift Ram taps must be closed for machine transport and storage.

CLOSE Slew and Lift lock taps when machine has been placed in its **transport position**.

OPEN Slew and Lift lock taps before moving machine from transport to **work position**.

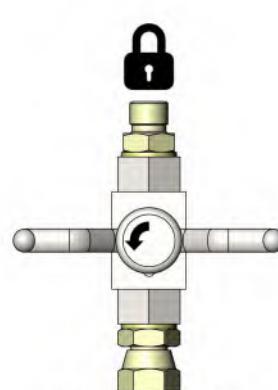
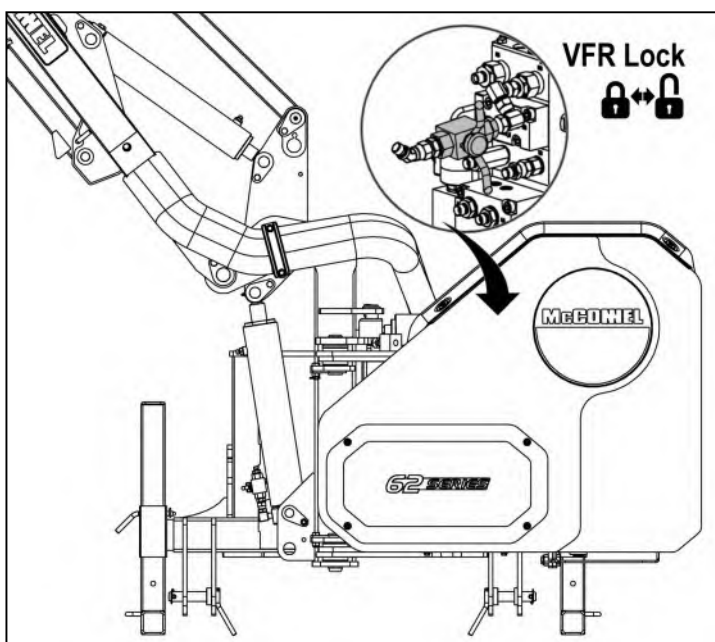
CLOSE Slew and Lift lock taps when the machine is placed in **storage**.

VFR Lock (Applicable models only)

Machines with Variable Forward Reach (VFR) arms are equipped with a 1/4-turn tap on the reach gland port of the control valve; this is to prevent arm movement during shipping.

Open the VFR lock tap before attempting to operate the machine.

The VFR lock tap should be kept open and only closed for shipping or as an added safety precaution when storing the machine detached from the tractor.



Closed Position
(Shipping & Storage)



Open Position
(Work)

⚠ CAUTION

VFR taps must be closed for shipping.
For additional safety close for storage.

VFR lock tap should ONLY BE CLOSED for shipping or for added safety during storage.

BREAKAWAY

The machine is fitted with a hydraulic breakaway system which protects the structure of the machine should an unforeseen obstacle be encountered.

NOTICE

Breakaway function does not relieve the operator of their responsibility to drive carefully. Always stay alert and avoid obvious hazards before contact occurs.

Breakaway may occur momentarily during normal work should an extra thick or dense patch of vegetation be encountered. In these instances tractor forward motion may be maintained with care.

Where breakaway has occurred as a result of contacting a post or tree etc. the tractor must be halted and the controls of the machine utilised to manoeuvre the head away from the obstacle. **Never continue forward motion to drag the head around the obstacle in the breakback position.**

NOTICE

The force required to activate the breakaway system will vary dependent on the working gradient. It will require less force when working uphill and vice versa.

On mid-cut machines the geometry of the breakaway will cause the head to initially move outwards in addition to rearwards. Therefore be aware that the breakaway action will be impeded if the outer end of the head is working against a steep bank. In this circumstance extra care must be taken during operation to avoid this occurrence.

Breakaway occurs at the slew column pivot. When an obstacle is encountered continued forward motion causes the pressure in the slew ram base to rise until the relief valve setting is exceeded.

With 'Auto Reset' selected

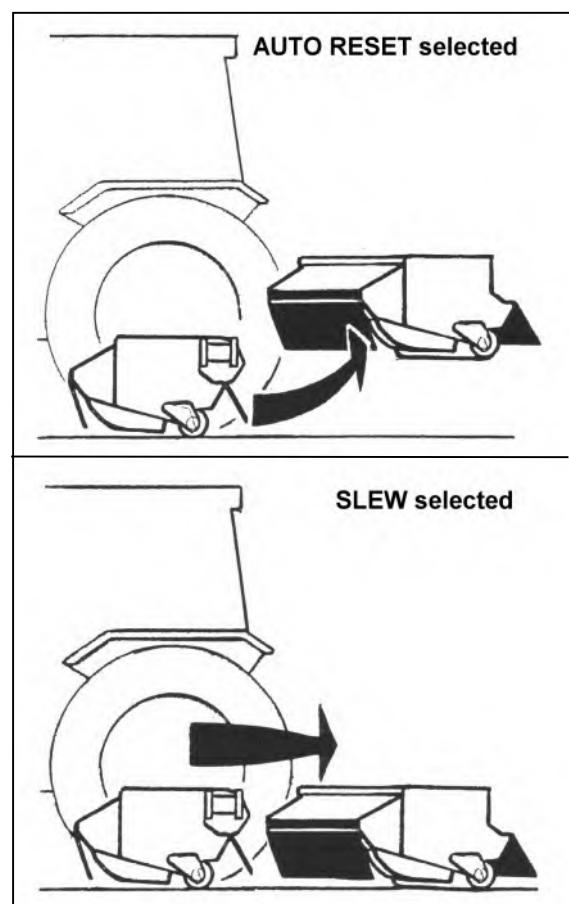
When the slew relief valve setting is exceeded oil is displaced from the slew ram into the base of the lift ram which causes the head to rise as the arm pivots backwards to clear the obstruction.

Re-setting of the head into the work position occurs automatically.

With 'Slew' selected

When the slew relief valve setting is exceeded oil is displaced from the slew ram allowing the arm to pivot backwards horizontally and the obstacle to be cleared.

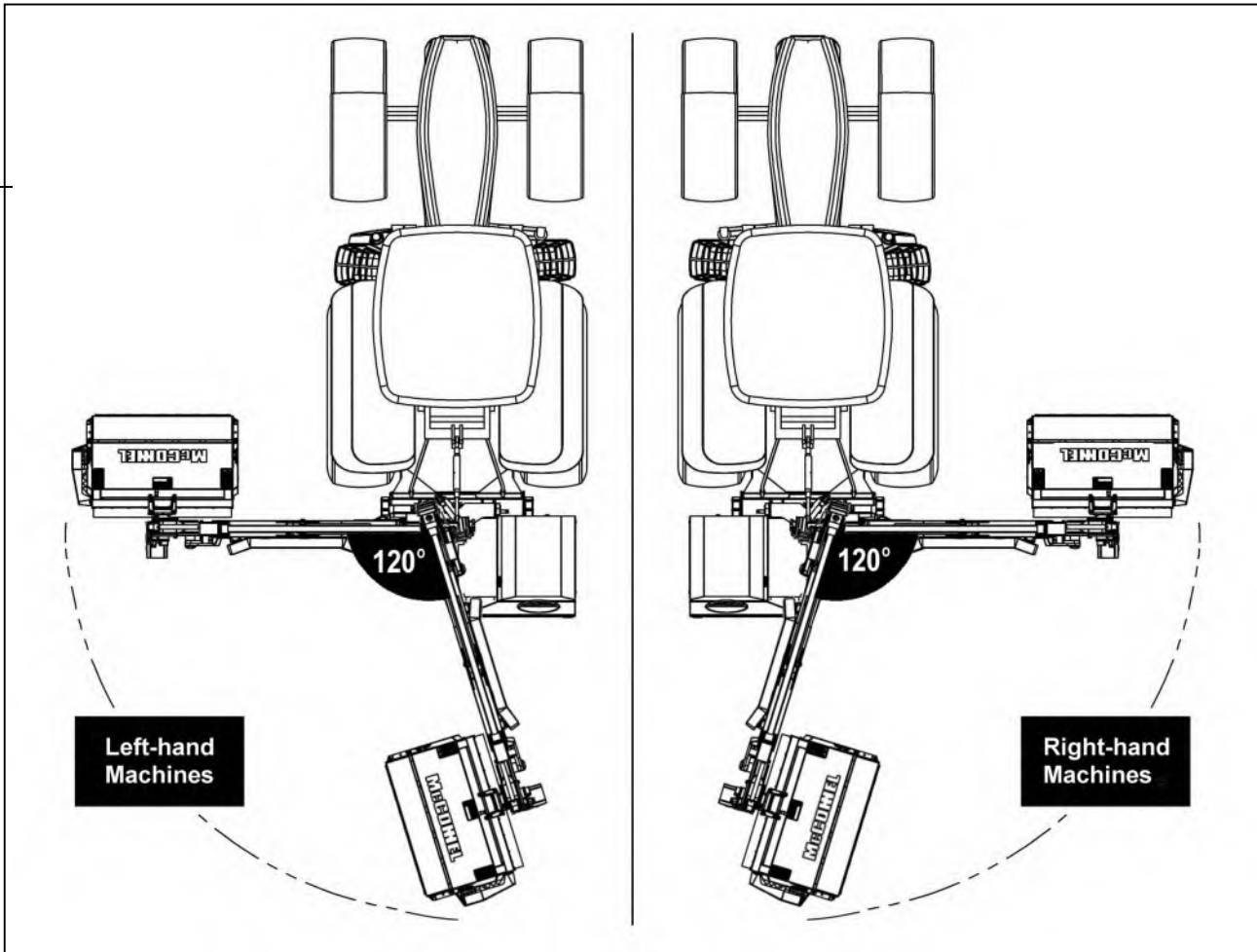
Re-setting the head into the work position is carried out manually by selecting 'Slew Out' on the control assembly.



POWERED SLEW

The slew feature allows for a 120° arc of powered arm movement on the working side from right angles to the tractor to 30° beyond the direct line astern.

This feature is required to place the machine in the transport position but can also be used to sweep the arm 'to and fro' whilst cutting awkward areas and corners, thus avoiding the need to constantly re-position the tractor. To operate in this way 'slew' must be selected on the control unit.



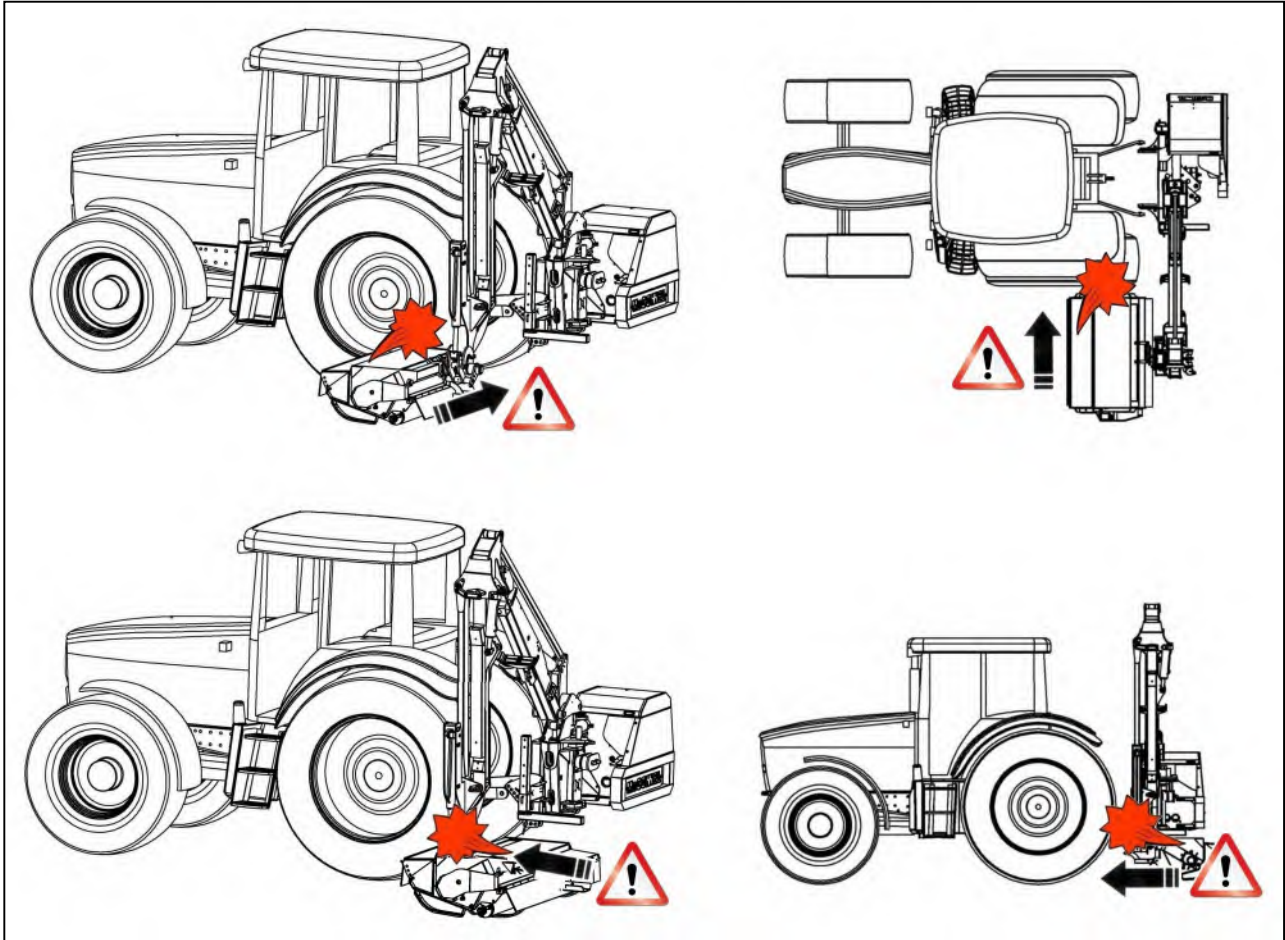
If breakaway occurs slew motion must be reversed to re-seat the slew breakaway relief valve and allow the ram to become operable again.

⚠ CAUTION

Extra care must be taken when working in 'slew' mode with 'reach' fully in; it is possible for the flail head to come into contact with the tractor and/or machine frame.

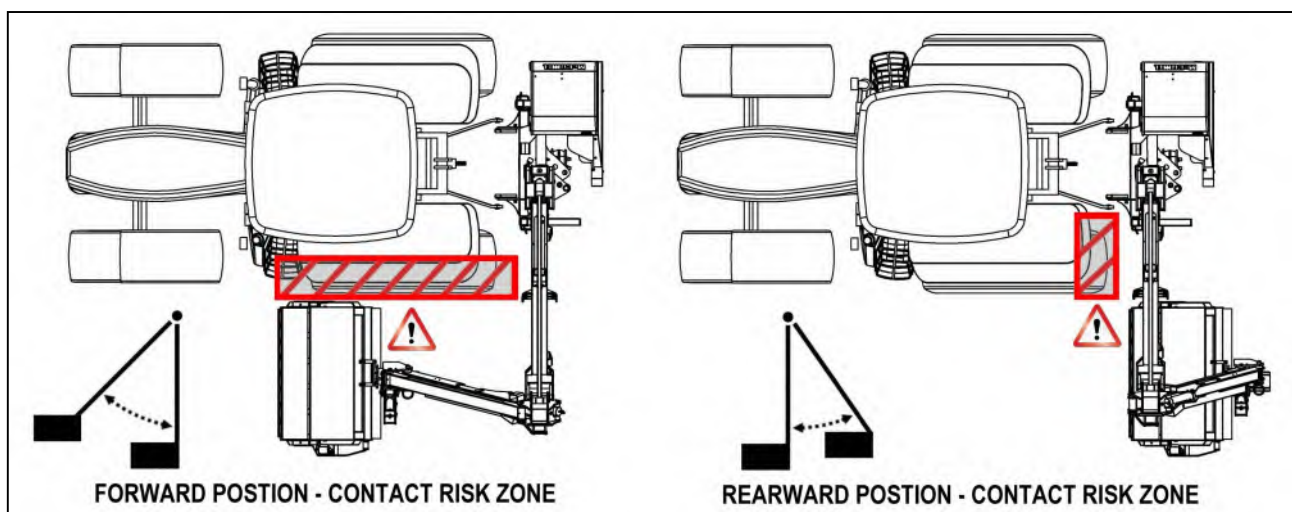
VFR ARMS : OPERATING CAUTION

The advanced manoeuvrability that VFR armsets offer permits cutting attachments to be positioned extremely close to the rear and working side of the tractor; this increases the opportunity of tractor and machine to suffer accidental damage from each other. Apply extreme caution whilst operating the armset close to the tractor and keep at a safe distance.



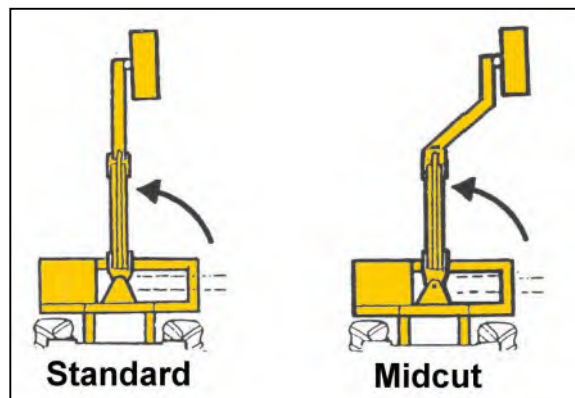
⚠ CAUTION

Ensure the head attachment and armset remain at a safe distance from the tractor during operation. Damage can occur if the machine and tractor come into contact.

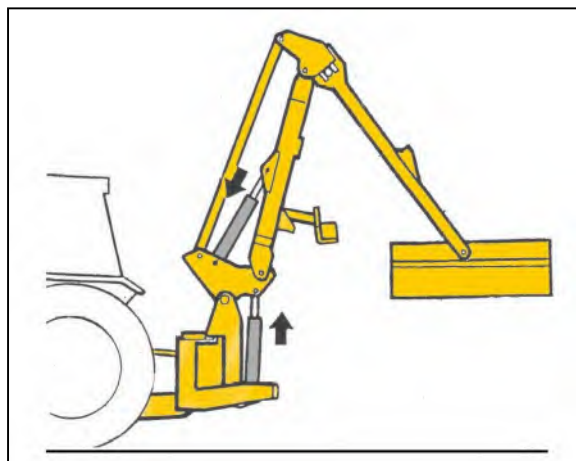


MOVING INTO TRANSPORT POSITION

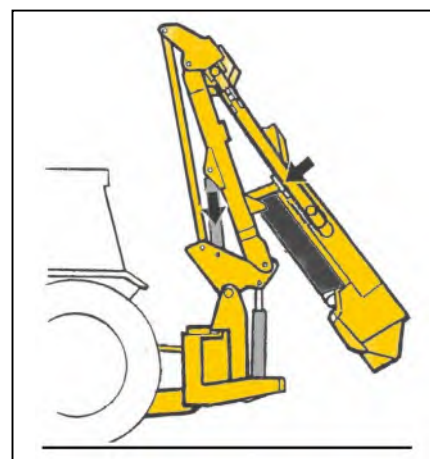
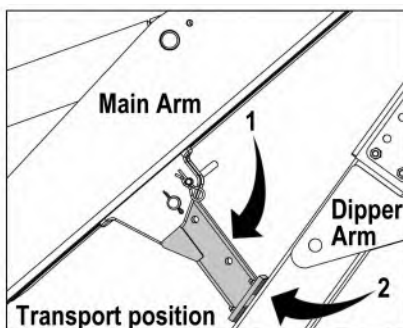
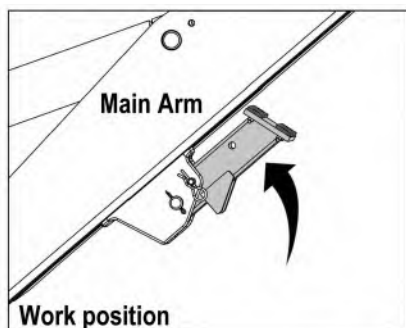
- Select '**Rotor OFF**' and wait for the rotor to stop turning completely.
- Ensure that '**Lift**' and '**Angle float**' functions are switched off.
- Select '**Slew**' mode on the controls.
- Operate '**Slew In**' function to bring the arms into position directly behind the tractor.



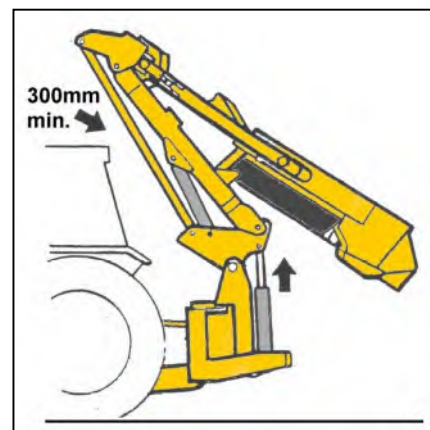
- Operate '**Lift**' and '**Reach**' to position the arms as shown in the diagram opposite.



- Place transport prop into the transport position (1).



- Operate '**Reach In**' until the dipper arm is in contact with the transport prop (2).
- Select '**Lift Up**' and raise arms until tension link is 300mm (12") from the tractor cab.
- Operate '**Angle**' to move the flail head into a position where it is as compact as possible.
- **Close lift ram tap** (transport mode).
- **Close slew ram tap** (transport position).
- Disengage the PTO shaft.
- Ensure **power** to the control unit is switched **OFF**.

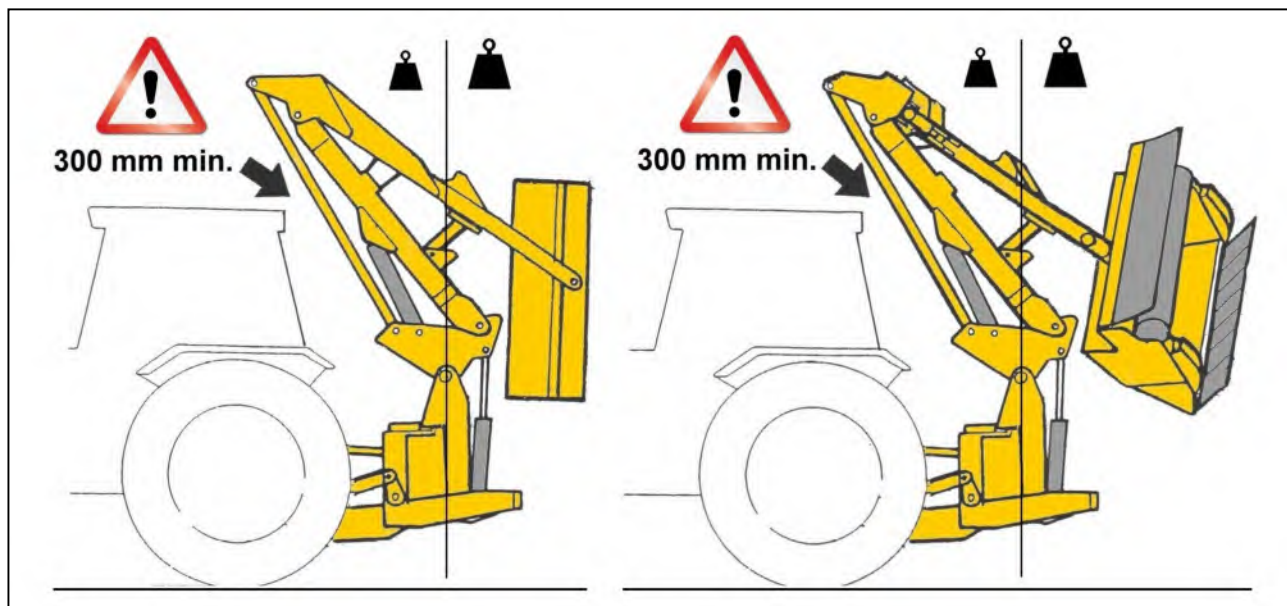


See following page for additional information regarding transport positions.

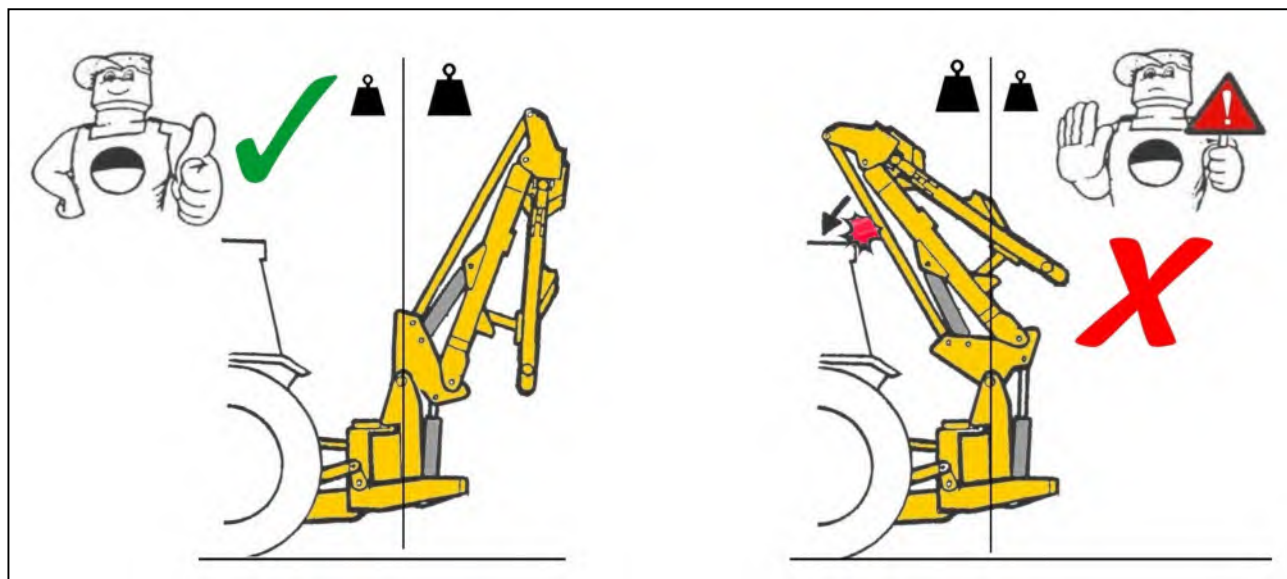
TRANSPORT POSITION

The machine is transported inline to the rear of the tractor with a minimum of 300mm (12") clearance between the tension link and the rear cross member of the tractor cab.

Transport Position with Flail Head Attached



Transport Position with Flail Head Removed



For transportation without a flail head attached, the machine's arms must be fully folded and the lift ram fully retracted so the mass of the arms is behind the centre line; *if the lift ram was extended the weight of the arms would be in front of the centre line which would result in the balance of the machine going 'over centre' causing the tension link to crash into the rear cross member of the tractor cab.*

⚠ WARNING

When transporting the machine 'SLEW' mode must ALWAYS be selected on the controls.

TRANSPORTING THE MACHINE

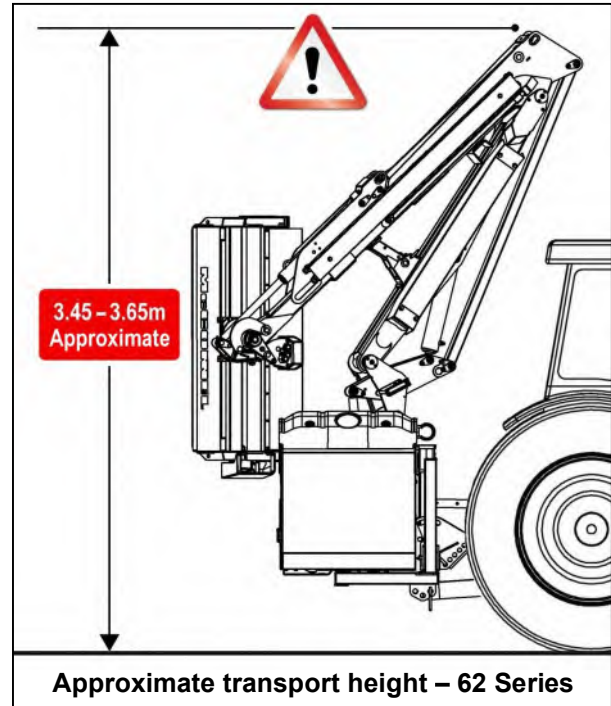
Transport Height

There is no fixed dimension for the transport height as this will vary for differing applications i.e. tractor size, carrying height, and degree of arm fold the particular tractor cab will permit. For the majority of installations the transport height for 62 Series Power Arms will fall within the region of approximately 3.45m to 3.65m. It is advisable that once the machine has been installed on your tractor that it is folded into the transport position and your own measurement taken to ensure you have an accurate figure for the transport height.



CAUTION

Always be aware of the transport height of your machine and proceed with care when manoeuvring near building, bridges and all other overhead obstructions.



Transport Speed

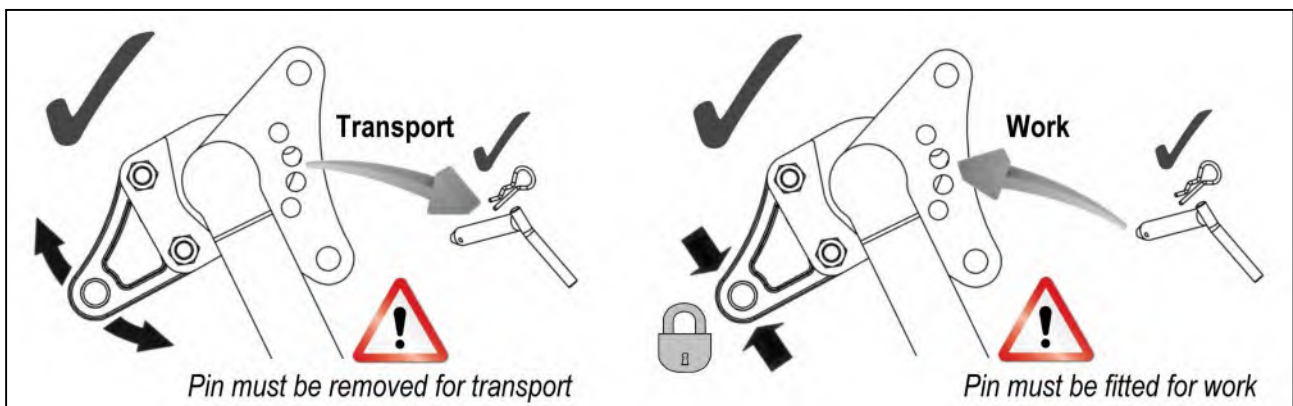
The acceptable speed of transport will vary greatly depending upon the ground conditions. In any conditions avoid driving at a speed which causes exaggerated bouncing as this will put unnecessary strain on the tractors top hitch position and increase the likelihood of the tension link coming into contact with the cab rear cross member.

WARNING

During transportation of the machine the PTO must be disengaged and power to the controls switched OFF.

CAUTION

On machines equipped with multi-hole type stabilizers it is vital that the stabilizer position pin is always removed for machine transport and only fitted for work; failure to observe this can result in serious damage to machine and/or tractor components.



MOVING FROM TRANSPORT TO WORK

Reverting to the work position is basically a reversal of the work to transport procedure.

NOTICE

Always remember to open the slew ram and lift ram lock taps before attempting to move the machine from the transport position.

Engaging Drive for Work

Ensure that the rotor control is in the 'STOP' position before engaging the PTO shaft and allow the oil to circulate for a minute or so before operating the armhead controls.

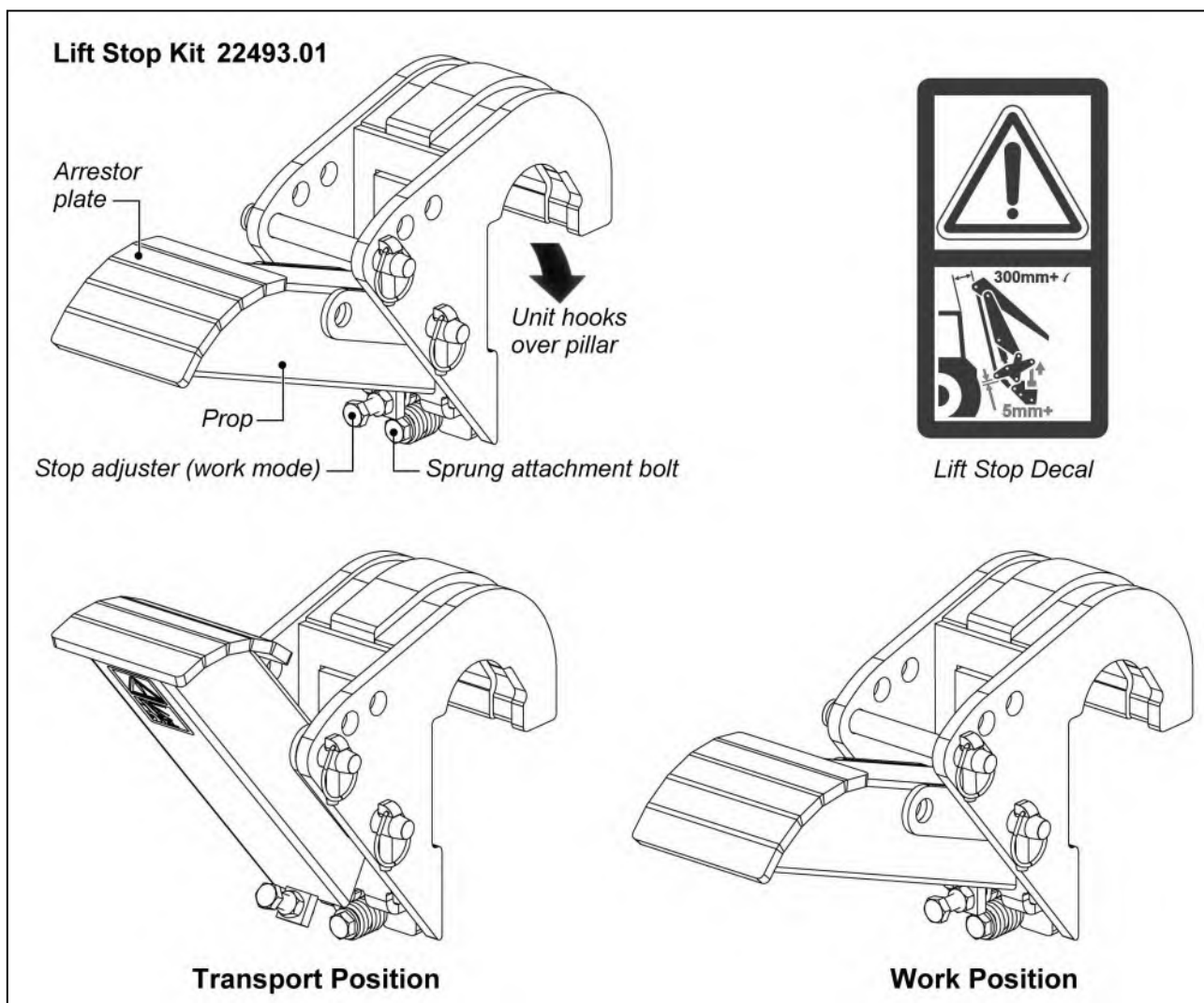
Position the flail head in a safe position, increase the engine speed to a high idle and move the rotor control to 'START'; after initial surging the rotor will run at an even speed.

LIFT STOP KIT (Option)

For additional machine and tractor protection an optional Lift Stop Kit (*Part No. 22493.01*) is available. The kit, which hooks over and bolts to the machine's pillar, is adjustable to suit a wide range of differing applications; when correctly adjusted in its respective positions it will offer both tractor cab protection during transportation and machine components protection when working the arms in and out of positions that risk components coming into contact with each other.

For machine transportation the prop must be raised and secured into one of three available positions; the desired position will depend on the particular application and will be the one that ensures the arm set is kept at a minimum distance of 300mm (12") from the tractor cab.

For work the prop must be placed into its lowered position, on initial installation the stop adjuster must be set to position the prop at a height that ensures all components remain clear of each other in all possible arm positions; once correctly set it should not require additional adjustment unless moved to another machine.



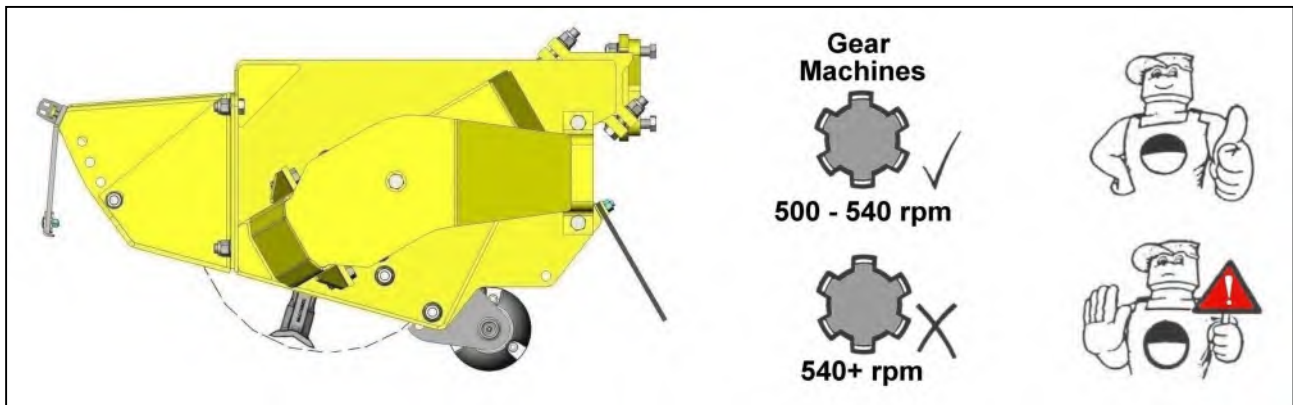
NOTICE

It is important to stress that the kit does not alleviate the operator's responsibility to work the machine with due care; its function is to provide a stop if the arm set comes too close to components, wherever possible avoid contacting the arrestor plate - if contact is made never continue to power the machine against the stop as this will risk damage to the lift ram and/or associated components.

OPERATING SPEEDS

PTO Operating Speed

The correct PTO speed for operation of these machines is: **500-540rpm (Max)**



⚠ WARNING Damage to the machine may occur if maximum PTO speed is exceeded.

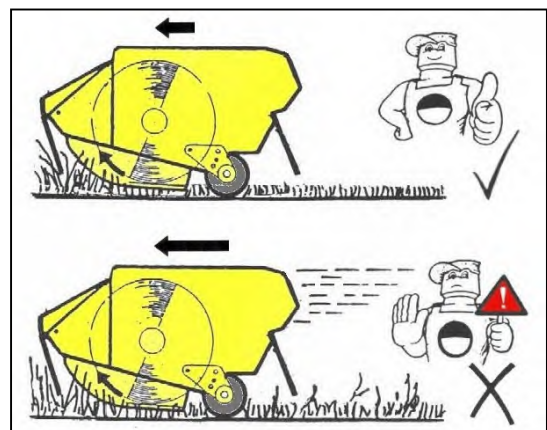
Engaging Drive

- Ensure the rotor control lever/switch is in the 'STOP' position before engaging the PTO.
- Allow the oil to circulate for a minute or so before operating the armhead controls.
- Move the flail head into a safe working position just clear of the material to be cut.
- Increase engine speed to a high idle and start the rotor; after initial 'surging' the rotor will run at an even speed.
- Carefully lower the flail head into the material and begin work.

Tractor Forward Speed

The material being cut will determine the tractor forward speed. Forward speed can be as fast as that which allows the flail head sufficient time to cut the vegetation both efficiently and neatly.

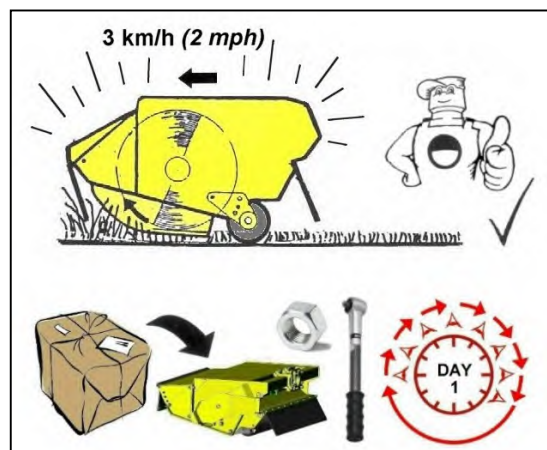
If forward speed is too fast this can be indicated by over frequent operation of the breakaway system, a fall off in tractor revs and a poor untidy finish to the work leaving ragged uncut tufts and poorly mulched cuttings.



'Running In' a New Machine

For the first days work with a new machine it is recommended that tractor forward speed is restricted to 3km/hr (2mph) maximum; this allows machine components 'bed in' and allow the operator to become familiar with the controls and their response under working conditions whilst operating at a relatively slow speed.

If possible, select a first days work that affords mainly light to average cutting with occasional heavy duty work; during this period check tightness of nuts and bolts every hour, retightening as and when required.



HAZARDS & DANGERS

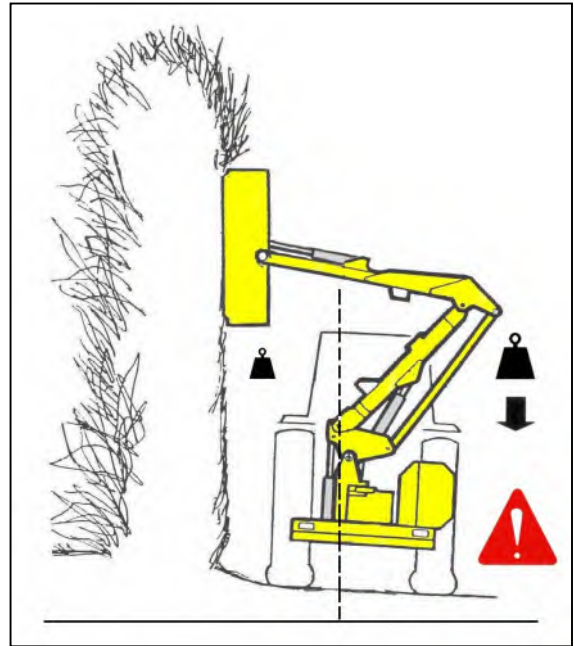
Adverse Slopes

When working with the flailhead high and reach fully in it is possible for the main arm balance to go over centre and take the weight off the lift ram. A restrictor in the gland circuit of the lift ram will prevent sudden unpredictable movements if this should occur; *for reasons of safety this restrictor should not be removed.*

⚠ DANGER

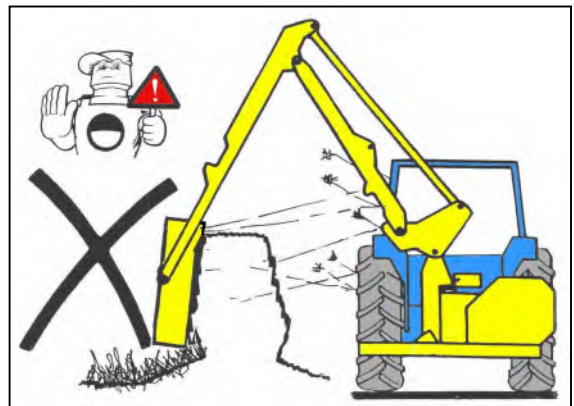
NEVER remove the restrictor from the lift ram gland circuit.

NEVER work the machine on adverse slopes with the arms positioned such that the tractor is unbalanced.



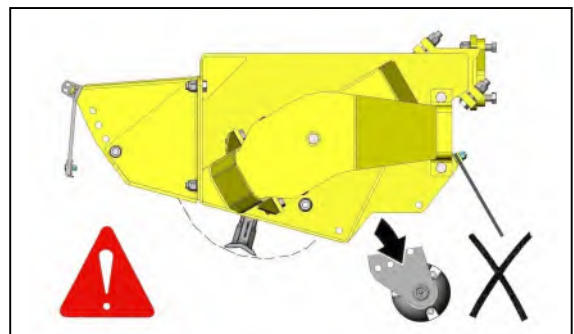
⚠ DANGER

NEVER cut to the blind side of a hedge - it is impossible to see any potential hazards or dangers and the position of the flail head would allow debris to be propelled through the hedge towards the tractor and operator.



⚠ DANGER

NEVER operate the machine with the flail head roller removed



⚠ DANGER

When grass mowing the rotor must always cut in the uphill direction with front hood fitted and the roller positioned below the cutting height of the flails



OVERHEAD POWER LINES (OHPLs)

It cannot be stressed enough the dangers involved when working in the vicinity of Overhead Power Lines (OHPLs). Some of our machines are capable of reach in excess of 8 metres (26'); they have the potential to well exceed, by possibly 3 metres (9' 9"), the lowest legal minimum height of 5.2 metres from the ground for 11,000 and 33,000 volt power lines.

Remember electrocution can occur without actually coming into contact with a power line as electricity can 'flashover' when machinery gets close to it.

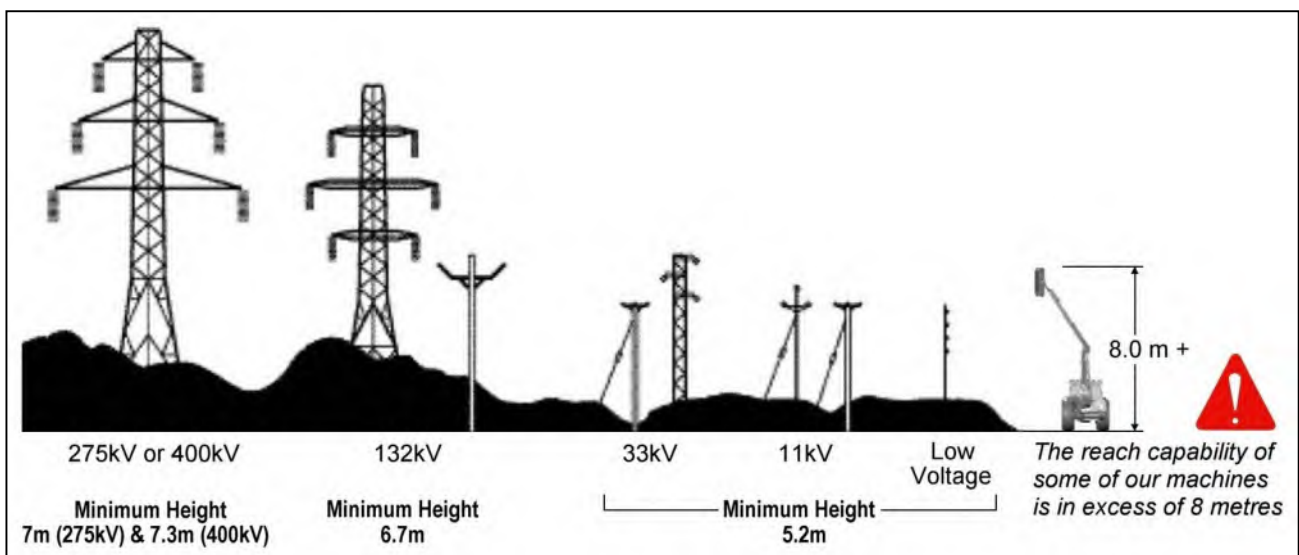
WARNING

All operators must read the following information and be aware of the risks and dangers involved when working in the vicinity of Overhead Power Lines (OHPLs).

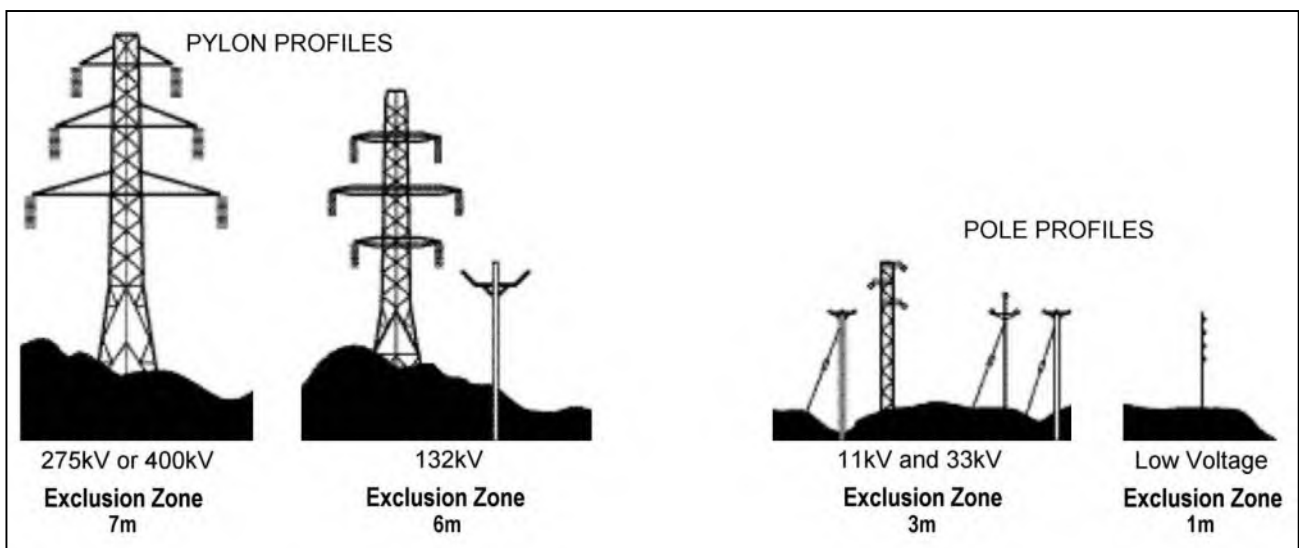
Wherever possible the safest option is always to avoid working in areas close to OHPLs. Where unavoidable, all operators must perform a risk assessment and implement a safe procedure and system of work – *see following page for details*.

All operators should perform a risk assessment before operating the machine within 10m horizontal distance of any OHPLs.

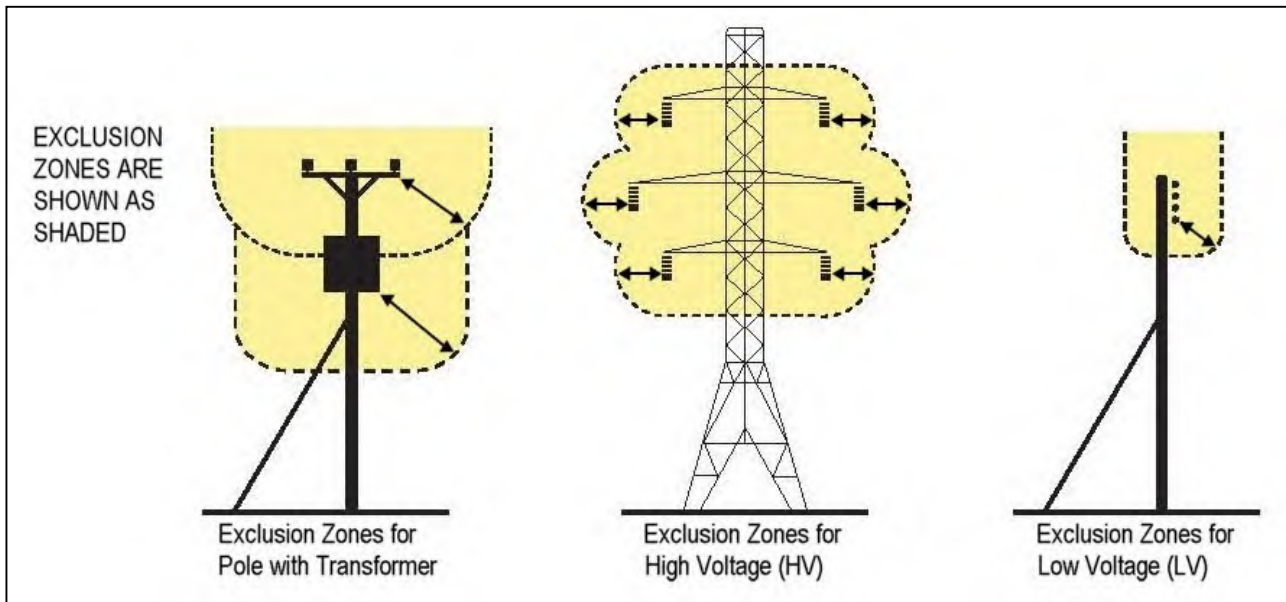
Minimum Heights for Overhead Power Lines



Absolute Minimum Exclusion Zones for Specific Overhead Power Lines



Definitions of Exclusion Zones



Risk Assessment

Before starting to work near OHPLs you should always assess the risks. The following points should be observed;

- **Know** the risks of contacting OHPLs and the risk of flashover.
- **Find out** the maximum height and maximum vertical reach of your machine.
- **Find out** the location and route of all Power Lines within the work area.
- **Find out** the operating voltage of all Power Lines within the work area.
- **Contact** the local Distribution Network Operator (DNO) who will be able to advise you on the operating voltage, safe minimum clearance distance for working, and additional precautions required.
- **Never** attempt to operate the machine in exclusion zones.
- **Always** work with extreme caution and plan your work ahead to avoid high risk areas.
- **If doubt exists** do not work in the area – never risk the safety of yourself or others.

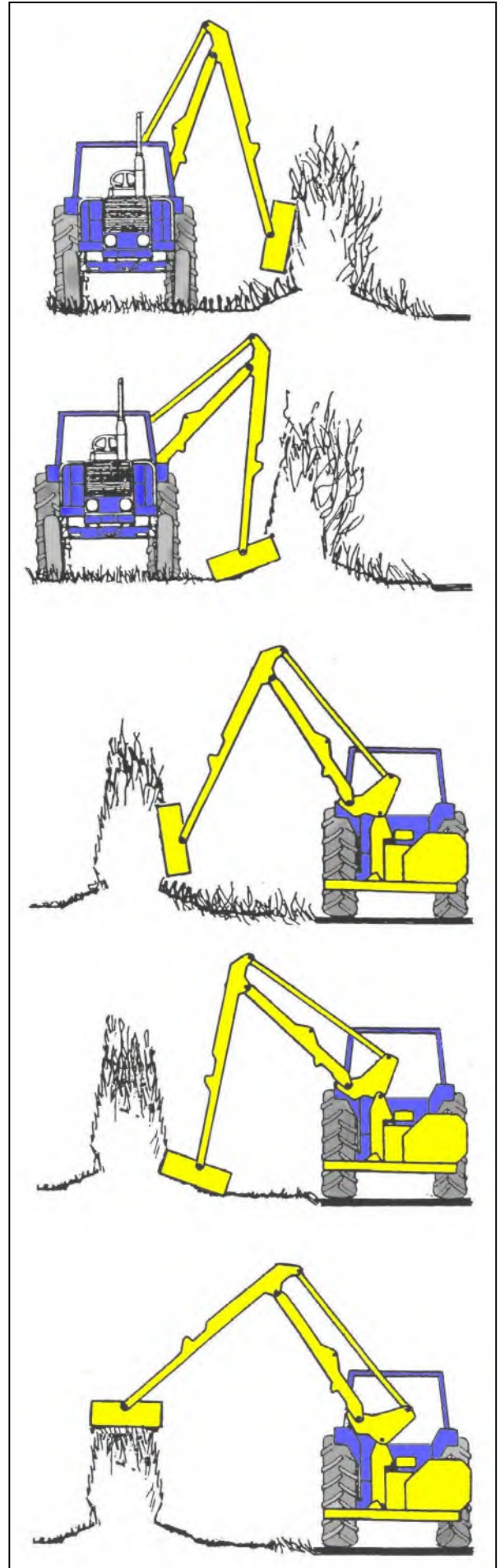
Emergency Action for Accidents Involving Electricity

- Never touch an overhead line - even if it has been brought down by machinery, or has fallen. Never assume lines are dead.
- When a machine is in contact with an overhead line, electrocution is possible if anyone touches both the machine and the ground. Stay in the machine and lower any raised parts in contact or drive the machine out of the lines if you can.
- If you need to get out to summon help or because of fire, jump out as far as you can without touching any wires or the machine - keep upright and away.
- Get the electricity company to disconnect the supply. Even if the line appears dead, do not touch it - automatic switching may reconnect the power.

Further information and leaflets on this and other agricultural safety subjects are available on the 'Health & Safety Executive' website at the following address: www.hse.gov.uk/pubns/agindex.htm

HEDGECUTTING PROCEDURE

Cut the side and bottom of the field side first. This leaves the maximum thickness of hedge on the road side to prevent the possibility of any debris being thrown through the hedge into the path of oncoming vehicles.



Cut the side and bottom of the road side.

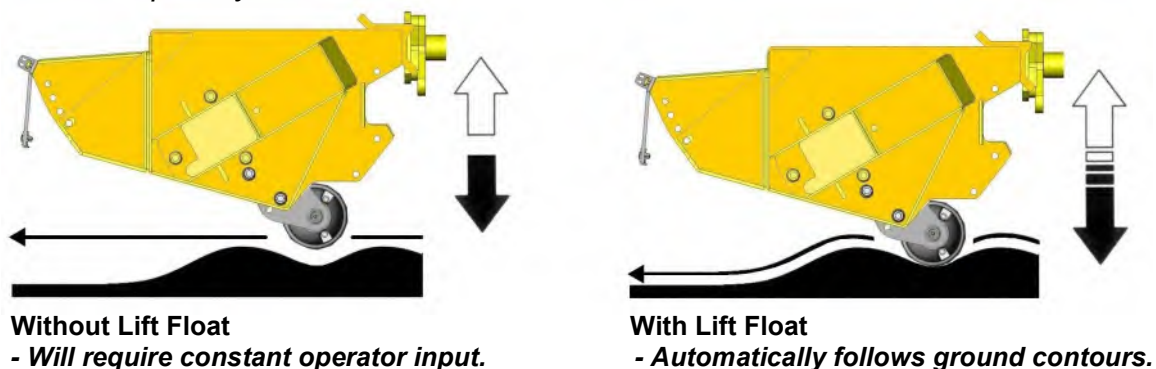
Top cut the hedge to the height required.

LIFT FLOAT (Optional Extra for Ground Work)

Work without lift float requires far more concentration and input from the operator to quickly react and re-adjust to the ground contours often resulting in patches of higher cut material where the head is cutting too high and 'scalping' of the ground where it is cutting too low; *in the case of the latter this can lead to increased flail wear, damage or even loss of flails.*

The Lift float feature is an optional extra for use during mowing work. When the function is activated the pressurised accumulator(s) work in conjunction with the valve and lift ram to take a proportion of the flailheads weight off the flail roller allowing the head to automatically follow the natural contours of the ground; this produces a cleaner more uniform cut without the need for constant operator re-adjustment. On EDS models the function has 3 user settings for differing working conditions – these are soft, medium and hard. *Refer to the relevant control section for details of selecting the required setting.*

Operation of the lift float function is as follows: with lift float switched off, position the flailhead approximately 1m clear of the ground before switching the float function on to charge the accumulator(s) – *the arms may drop at this point depending on the current level of retained pressure.* Lower the flailhead into the work position, release the lift control and proceed to work. **NOTE:** *with the exception of EDS models, occasional operation of the lift function will be required when working on downhill or uphill slopes and when reaching in or out in order to replenish the oil level within the accumulator(s) to retain optimum float capability.*



Lift float operation when supplied as a factory fitted option is controlled from the controls unit that accompanied the machine (*refer to controls section for details*), but the feature is also available for a range of models as an after market kit, in which case operation will either be via an auxiliary switch on cable controlled machines, or by utilisation of the auxiliary three-position type switch on the control unit of electric controlled machines - *this will allow for selection of 'lift float alone' or 'lift and angle float in unison' if both features are fitted.* Operation of the lift float control for these models will then be as specified in the main controls section.

Power Connection on Cable Machines

On cable controlled machines the switch supplied will need to be mounted in a convenient location in the cab. The supply cable from the poppet valve solenoid must be connected into the tractors ignition system - the brown lead is positive and the blue lead is negative.

Power Connection on Electric Machines

On electric controlled machines power to the unit is via the following connections:

Machines with 14 core looms use connection 10 and common connection 11.

Machines with 19 core looms use connection 15 and common connection 16.

Revolution Non-EDS proportional machines use connections LF and C.

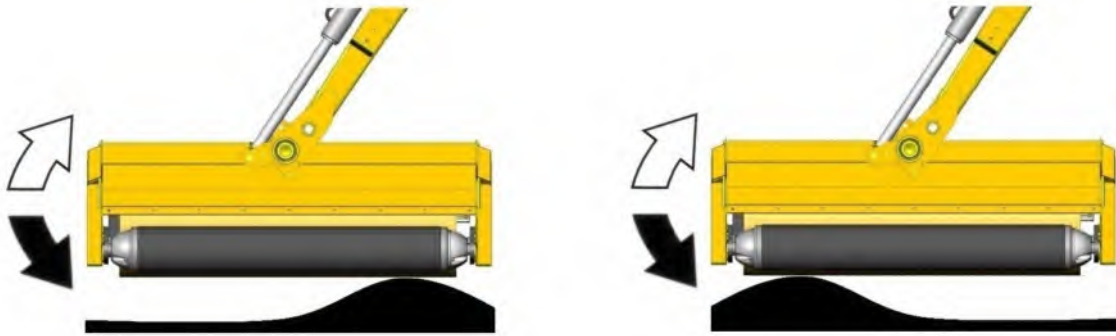
Depending on the particular machine after market lift float kits will either be frame mounted or ram mounted; they should be fitted and positioned in a location where they do not foul or interfere with other components during normal movements of the machine.

ANGLE FLOAT KIT (Standard Feature)

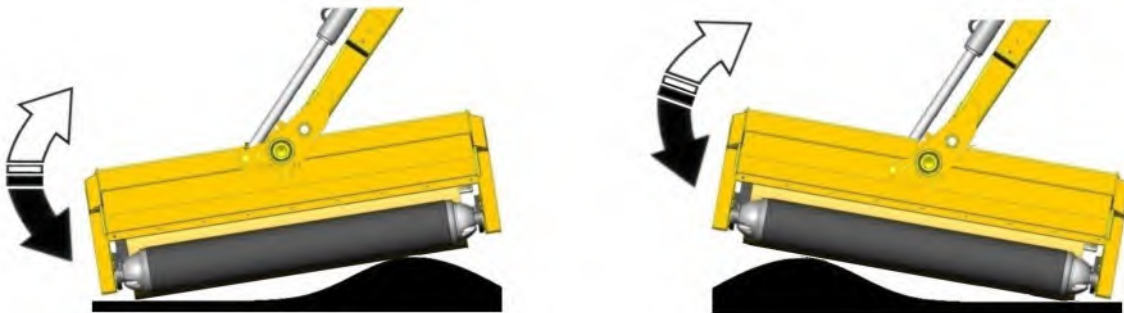
Machines are fitted with Angle Float as standard – when activated the feature connects the base and gland circuits of the angle ram to allow free movement of oil in both directions thus allowing the head to automatically angle itself to match the contours of the ground.

Refer to specific controls section for details of operation.

NOTE: On machines with Revolution Proportional Controls any operation of the angle float thumbwheel will override and de-activate the automatic angle float function, on release of the thumbwheel it will revert back to automatic angle float.



Angle Float OFF – Requires operator input to adjust flail head angle.

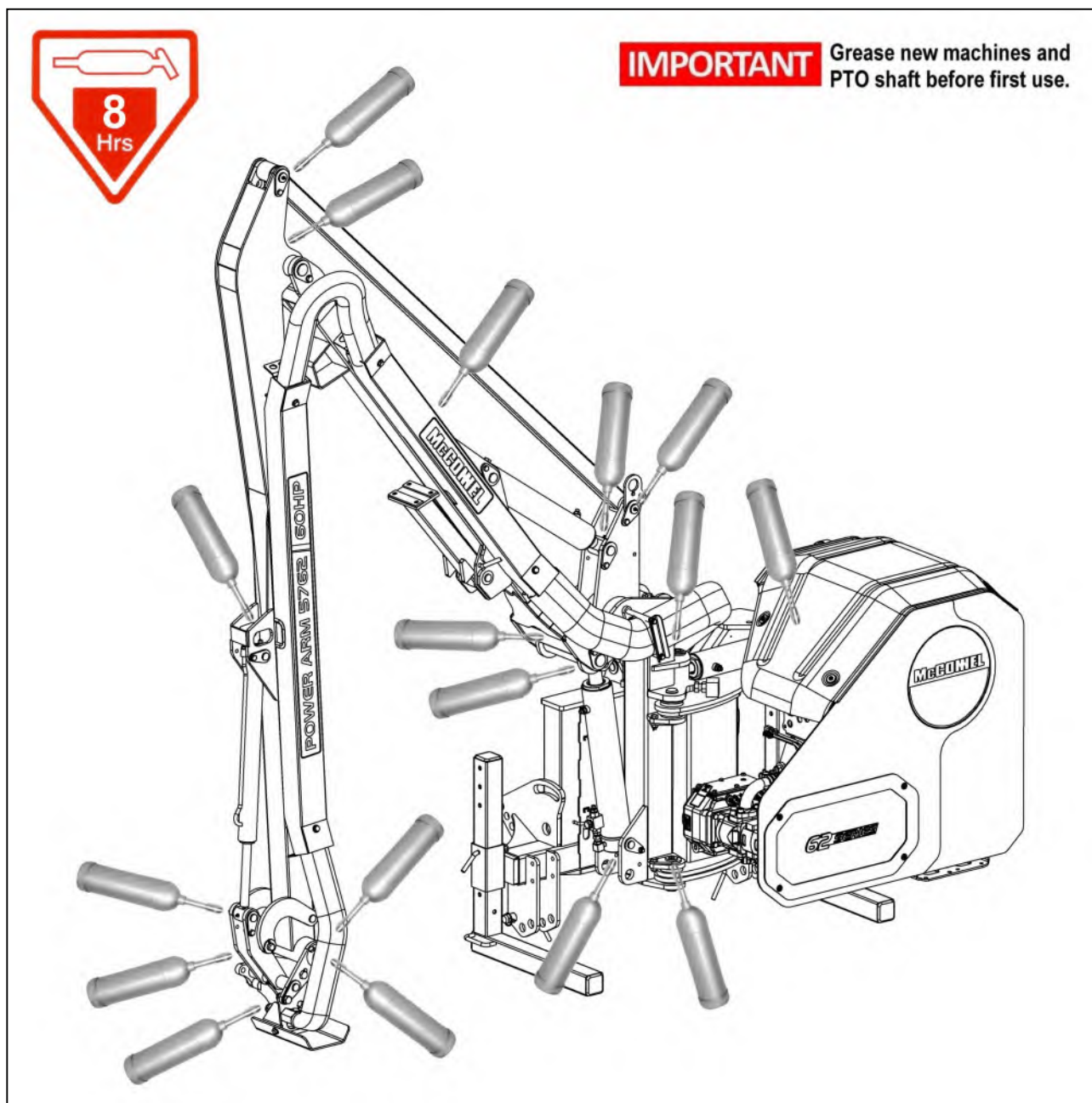


Angle Float ON – Flail head automatically angles itself to match the ground contours.

GENERAL MAINTENANCE

General Lubrication

The illustration below indicates the general locations of lubrication points - all points should be greased on a daily basis and prior storage of the machine. New machines must be greased prior to first use.



PTO Gearbox

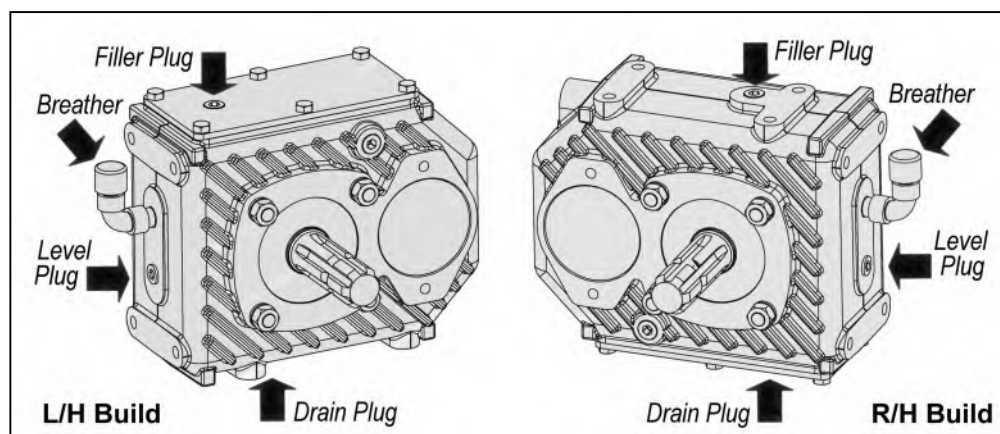
Check gearbox oil level on new machines prior to first use, top up if required before using the machine. **Replace gearbox oil after an initial 50 hours of use** and thereafter at annual or 500 hour intervals; *whichever occurs earliest*.

Gearbox Capacity

0.6 Litre SAE75W90 Fully Synthetic which meets the following minimum requirements;

Viscosity at 40°C, cSt, 100.0 min.

Viscosity at 100°C, cSt, 17.2 min.



CONTROL CABLES

The control cables operate on a push/pull system with the spool centring springs always returning the spool to the neutral position when the handle is released.

Care should be taken during installation and operation to ensure that the cables are not trapped or kinked. Any abrasion or damage to the outer casing should be sealed with plastic insulation tape to avoid moisture penetrating. No routine adjustments of the cables are necessary, as they do not stretch. The threaded collar is correctly adjusted when the lever is in a vertical position in its housing allowing an equal amount of travel in either direction.


⚠ CAUTION

On no account should any attempt be made to lubricate the cables – these are assembled with a special ‘lifelong’ lubricant during manufacture and will not require any additional lubrication.

NOTICE

Take care to ascertain the correct cable connections on both the control unit and the valve in the event of cable replacement.

SERVICE SCHEDULE

Every Day	
<ul style="list-style-type: none">• Grease machine fully prior to work (and prior to storage). NOTE: New machines <u>must be fully greased</u> before initial use.• Check for broken or damaged flails.• Check tightness of flail head nuts and bolts.• Visually check for oil leaks and damaged hoses.• Check all guards and safety shields are correctly fitted and undamaged.• Ensure all lights are working and clean.• Check oil level.• Clean cooler matrix; in dusty conditions more frequent cleaning is required.	
After initial 50-hours	
<ul style="list-style-type: none">• Change gearbox oil.	
Every 25-hours	
<ul style="list-style-type: none">• Grease PTO Shaft universal joints and tubes.	
Every Week	
<ul style="list-style-type: none">• Check tightness of all nuts and bolts.• Check gearbox oil level.• Check for wear on telescopic arm pads – <i>where applicable</i>.	
Every 100-hours	
<ul style="list-style-type: none">• Grease PTO shaft shield lubrication points.• Check bushes for wear; <i>wherever possible, remove end caps to allow inspection</i>.	
Every 500-hours	
<ul style="list-style-type: none">• Change return line filter element (<i>500-hours or annually, whichever occurs first</i>).• Change tank breather.• Change gearbox oil.• Check condition of hydraulic oil and change if required; <i>when changing the oil, new return line filter and suction strainer elements should be fitted and the return line filter changed again after 100 hours of work</i>.	
Annually	
<ul style="list-style-type: none">• Change tank breather.	

Cooler Matrix

To ensure maximum cooler efficiency, the cooler matrix must be kept as clean as possible to allow free air flow through the unit; this is especially important in dry hot arduous conditions where the matrix can rapidly become blocked by dust causing overheating. Cooler units are best cleaned using a high-pressure air line that will clear blocked areas without risking damage to the matrix.

HYDRAULIC SYSTEM

Oil Supply

Check the oil level in the reservoir daily.

Oil Condition & Replacement

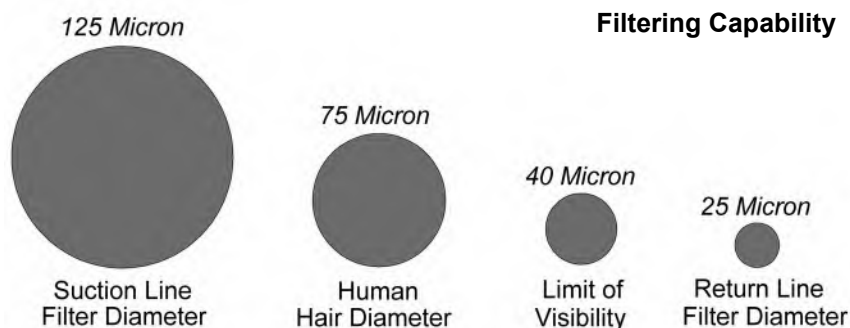
No fixed time period can be quoted for oil changes as operating conditions can vary widely but a visually inspection of the oil will often indicate its current overall state. Signs of a reduction in its condition will be apparent by changes in colour and appearance when compared to new oil. Oil in poor condition can be dark, smell rancid or burnt, or in some cases be yellow, unclear or milky in appearance indicating the presence of air or emulsified water. Moisture resulting from condensation can become entrapped in the oil causing emulsification that can block the return line filter, consequentially the filter system will be by-passed and the oil and any possible contaminants present will continue to circulate without filtration risking damage to hydraulic components. All are indications or conditions that will require replacement of the oil.

Hydraulic oil is a vital component of the machine; contaminated oil is the root cause of 70% of all hydraulic system failures. Contamination can be reduced by the following:

- Cleaning around the reservoir cap before removal and keeping the tank area clean.
- Use of clean containers when replenishing the system.
- Regular servicing of the filtration system.

Filtration System

Machines are protected by both replaceable 125-micron suction strainers and low pressure 10-micron full flow return line filters – the diagram below is a ‘scaled up’ view illustrating the filtering capability built into the hydraulic system of the machine:



Suction strainers – Stops large contamination in the oil entering the pump

The replaceable 125-micron suction strainers are fitted within the hydraulic tank and are ‘screw’ fitted with easy access for removal and replacement.

Return Line Filter– Stops small contamination in the oil entering the hydraulic tank

The 25-micron absolute filter elements should be replaced at 500-hour intervals or annually, whichever occurs first. It is important to note hours worked; if the filter becomes blocked an internal bypass within the canister will operate and no symptoms of filter malfunction will occur to jog your memory.

Tank Breather – Stops contamination from the air mixing with the oil

To reduce the risk of pump cavitation the 25-micron absolute tank breather should be changed at 500-hour intervals or annually, *whichever occurs first*.

For machines operating in dry dusty environments it is recommended that replacement be increased to 250-hour intervals or every 6 months, *whichever occurs first*.

Visit the ‘McConnel Interactive Parts’ website to obtain part numbers of service components for your machine using the machine serial number.

HYDRAULIC HOSES

The condition of all hoses should be carefully checked during routine service of the machine. Hoses that have been chaffed or damaged on their outer casing should be securely wrapped with waterproof adhesive tape to stop the metal braid from rusting. Hoses that have suffered damage to the metal braid should be changed at the earliest opportunity.


Hose Replacement

- Replace one hose at a time to avoid the risk of wrong connections.
- When the hose is screwed to an additional fitting or union, use a second spanner on the union to avoid breaking both seals.
- Do not use jointing compound on the threads.
- Avoid twisting the hose. Adjust the hose line to ensure freedom from rubbing or trapping before tightening hose end connections.


Before changing hoses study the installation these are carefully calculated to prevent hose damage during operation. Always replace hoses in exactly the same manner. This is especially important for the flail hoses where they must be crossed, upper to lower, at the dipper and head pivots.

All BSP Hydraulic Hoses fitted to McConnel Power Arms have 'Soft Seal' connections on the flail circuit and ram circuit.

Recommended torque settings for nut security:

	Nut Size	Nm	Ft-lbs	O-Ring
	1/4" BSP	24	18	P/No. 10.000.01
	3/8" BSP	33	24	P/No. 10.000.02
	1/2" BSP	44	35	P/No. 10.000.03
	5/8" BSP	58	43	P/No. 10.000.04
	3/4" BSP	84	62	P/No. 10.000.05
	1" BSP	115	85	P/No. 10.000.06

Recommended torque settings for BSP hose unions fitted in conjunction with bonded seals:

	Union Size	Nm	Ft-lbs	Bonded Seal
	1/4" BSP	34	25	P/No. 8650102
	3/8" BSP	75	55	P/No. 8650103
	1/2" BSP	102	75	P/No. 8650104
	5/8" BSP	122	90	P/No. 8650105
	3/4" BSP	183	135	P/No. 8650106
	1" BSP	203	150	P/No. 8650108

Safety Note

The soft seal hose connections are capable of holding pressure when the nut is only finger tight, it is therefore recommended when dismantling that the hose be manually flexed with the retaining nut slackened to relieve any residual pressure prior to complete disassembly.

PTO SHAFT MAINTENANCE

PTO Shaft Lubrication

The PTO shaft should be lubricated on a regular basis using lithium based grease – each end of the shaft has 2 greasing points; one for lubrication of the universal joint and one for lubricating the rotating fixing ring of the shaft shield – access to the lubrication points is gained by releasing the shaft shield from its fixing ring and sliding it back along the body of the driveshaft – *the procedure and lubrication frequency is illustrated below.*



Shaft shield fixing clasps



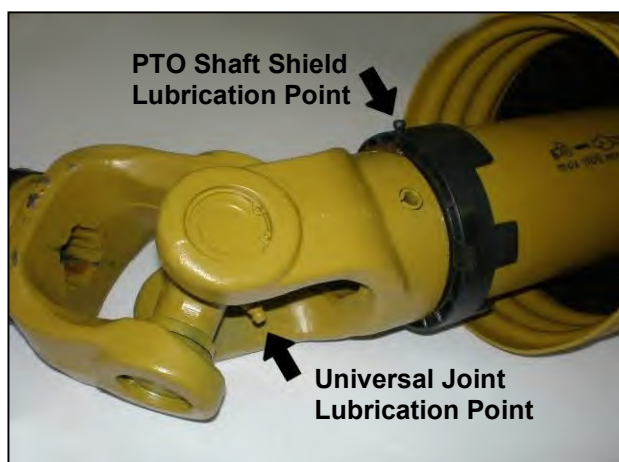
Insert screwdrivers into the clasps



Pry clasps open to release the shield



Slide shield back to reveal universal joint



Location of lubrication points



Recommended lubricating frequency

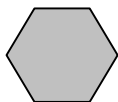
Slide the shaft shield back into place after lubrication ensuring the clasps relocate correctly in the fixing ring – always fit torque chains to the shields to stop them from rotating with the shaft during operation.

TORQUE SETTINGS FOR FASTENERS

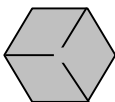
The Chart below lists the correct tightening torque for fasteners. The Chart should be referred to when tightening or replacing bolts in order to determine the grade of bolt and the correct torque unless specific torque values are assigned in the text of the manual.

*Recommended torque is quoted in Foot-Pounds and Newton-Metres within this manual.
The equation for conversion is 1 Nm. = 0.7376 ft.lbs.*

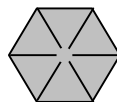
TORQUE VALUES FOR IMPERIAL BOLTS



Head Marking
No Marks
Grade Two



Head Marking
Three Lines
Grade Five



Head Marking
Six Lines
Grade Eight

NOTE:

The values in the chart apply to fasteners as received from the supplier, dry or when lubricated with normal engine oil. They DO NOT apply if special graphited, molydisulphide greases, or other extreme pressure lubricants are used. This applies to both UNF and UNC coarse threads.

Bolt Dia.
1/4"
5/16"
3/8"
7/16"
1/2"
9/16"
5/8"
3/4"
7/8"
1"
1-1/8"
1-1/4"
1-3/8"
1-1/2"

Value (Dry)	
ft.lb.	Nm.
5.5	7.5
11	15.0
20	27.0
32	43.0
50	68.0
70	95.0
100	135.0
175	240.0
175	240.0
270	360.0
375	510.0
530	720.0
700	950.0
930	1250.0

Value (Dry)	
ft.lb.	Nm.
9	12.2
18	25.0
33	45.0
52	70.0
80	110.0
115	155.0
160	220.0
280	380.0
450	610.0
675	915.0
850	115.0
1200	1626.0
1550	2100.0
2100	2850.0

Value (Dry)	
ft.lb.	Nm.
12.5	17.0
26	35.2
46	63.0
75	100.0
115	155.0
160	220.0
225	305.0
400	540.0
650	880.0
975	1325.0
1350	1830.0
1950	2650.0
2550	3460.0
3350	4550.0

TORQUE VALUES FOR METRIC BOLTS.



Head Marking
4.8



Head Marking
8.8



Head Marking
10.9



Head Marking
12.9

Bolt Dia.
6mm
8mm
10mm
12mm
14mm
16mm
18mm
20mm
22mm
24mm
27mm
30mm

Value (Dry)	
ft.lb.	Nm.
4.5	6.1
11	14.9
21	28.5
37	50.2
60	81.4
92	125.0
125	170.0
180	245.0
250	340.0
310	420.0
450	610.0
625	850.0

Value (Dry)	
ft.lb.	Nm.
8.5	11.5
20	27.1
40	54.2
70	95.0
110	150.0
175	240.0
250	340.0
350	475.0
475	645.0
600	810.0
875	1180.0
1200	1626.0

Value (Dry)	
ft.lb.	Nm.
12	16.3
30	40.1
60	81.4
105	140.0
165	225.0
255	350.0
350	475.0
500	675.0
675	915.0
850	1150.0
1250	1700.0
1700	2300.0

Value (Dry)	
ft.lb.	Nm.
14.5	20.0
35	47.5
70	95.0
120	160.0
190	260.0
300	400.0
410	550.0
580	790.0
800	1090.0
1000	1350.0
1500	2000.0
2000	2700.0

TROUBLESHOOTING CHART

The chart below lists possible causes and solutions to problems that may be encountered.

PROBLEM	POSSIBLE CAUSE	SOLUTION
Gearbox overheating	Oil level incorrect	Check oil level
	Oil grade incorrect	Check oil grade
	Implement overloaded	Reduce forward speed
	Wrong PTO speed	Ensure tractor PTO speed matches implement
Excessive belt wear	Belt and pulley condition	Replace if necessary
	Pulley alignment	Check alignment
	Incorrect belt tension	Tension belts to spec
	Overloading of implement	Reduce forward speed or increase cut height
PTO wear / UJ failure	Working angle too great	Reduce mis-alignment of drive stub shafts
	Shaft length incorrect; bottoming out	Resize PTO shaft as recommended
	Lack of maintenance	Grease PTO shaft as recommended
Cut Quality	Flails worn or damaged	Replace worn/damaged flails
	Rotor speed / direction	Check rotor direction/tractor PTO speed
	Cutting conditions	Work in suitable cutting conditions
Rotor bearing failure	Rotor out of balance	Refer to rotor vibration below
	Wire / string in bearing	Remove wire / string
	Lack of maintenance	Grease bearings to schedule
	Moisture in bearing(s)	Grease bearing(s) to expel moisture
Rotor vibration	Flails broken or missing	Replace flails
	Bearings worn or damaged	Replace bearings
	Rotor unbalanced / bent	Re-balance / replace rotor
	Debris build up	Remove debris
	Incorrect speed	Check rotor RPM
Oil tank overheating	Oil level incorrect	Fill tank to correct level
	Oil grade incorrect	Drain and refill tank with correct grade oil
	PTO speed too fast	Match the tractor's PTO speed to machine
	Ambient temperature too high	Reduce work rate / install oil cooler
	Machine overloaded	Reduce forward speed or increase cut height
Frequent Break-back	Machine overloaded	Reduce forward speed or increase cut height
	Working on excessive incline	Disable auto-reset
	Machine weight sat on rear roller	Raise head or operate with head float
	Machine not set vertical	Adjust top link
	Internal valve leakage	Contact local dealer or McConnel Service
Hydraulics not responding	Oil level low	Fill oil to correct level
	Oil pump suction filter blocked	Replace filter element
	Oil leak in pressure line	Check machine for hydraulic leaks
	Drive line broken	Check pump is rotating
Irregular arm movement	Spool contacting with housing	Check spool moves freely
	Broken spring in spool valve	Check spring in spool valve
	Ram seal failure	Replace ram seals
Electric valve unresponsive	Faulty wiring	Check wiring and switches
	Dirt in valve	Check for ingress of dirt
	Sticking valve	Replace the valve
	Insufficient voltage	Ensure power is sourced direct from battery



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