Diamond Chain Harrow
Operating Instruction Manual

Models 30, 40, 45, 45R, 50, 60

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Website (Australia): www.kellyengineering.com.au

Kelly Engineering Owner's Record

Keep in manual & retain for your own record

WARRANTY INFORMATION

KELLY DIAMOND HARROW

Kelly Engineering guarantees its products against faulty workmanship and materials. Should any defects arise, Kelly Engineering will arrange at its discretion for the replacement or repair of defective parts for a period of 12 months from the date of purchase.

Disc Chain, Prickle Chain and swivel units are considered to be wear parts and it is reasonable to expect over time that these parts may need to be replaced. Kelly Engineering does however guarantee the swivel units for a period of 12 months or 10 000 acres (4000 Ha), whichever occurs first. Furthermore, Kelly Engineering guarantees the useful working life of the Disc and Prickle Chains to be in excess of 2 years or 50 000 acres (20 000 Ha), whichever occurs first.

Kelly Engineering is not responsible for freight charges incurred.

This warranty excludes damage caused by misuse, mishandling in transit or normal wear and tear. All Kelly Engineering products should be maintained according to the maintenance section in the supplied manual. Any unauthorized modifications to the equipment may result in cancelation of warranty.

To activate the warranty a product registration form must be lodged with the manufacturer.

OWNER'S RECORD

Purchaser/owner

Name: _____

Address: _____

_____

Contact number: _____

Email address: _____

Purchase details

Place of purchase: _____

Date of purchase: _____

Model purchased: _____

Serial number: _____

Kelly Engineering Product Registration

This form must be completed & returned to Kelly Engineering, either online or by post, in order for future warranty claims to be processed

Purchaser/owner

Name: _____

Address: _____

_____

Contact number: _____

Email address: _____

Purchase details

Place of purchase: _____

Date of purchase: _____

Model purchased: _____

Serial number: _____

Purchaser's usual occupation

O Farmer O Custom operator

What brought Kelly Engineering products to your attention? – Please select from the following

O Field Day O Magazine/newspaper _____ O Referral source _____

O Friend/neighbor O Local dealer O Demonstration O Website

Is this your first Kelly Engineering product?

O Yes O No

What features do you like about Kelly Engineering products? – Please select from the following

O Design O Price O Custom built options

O Construction O Warranty O User friendly

Your impressions of: Rate product 1 Poor - 5 Excellent

Quality of manufacture _____ Quality of finish _____ Ease of use _____

Does it perform as expected? _____ Value _____ Overall experience _____

Satisfaction with dealer/agent

Was machine pre-delivered satisfactorily? O Yes O No Comment: _____

Were agents well informed about the product? O Yes O No _____

Would you recommend the agent to other farmers? O Yes O No _____

Fill in online:

(US) www.kellyharrows.com/warranty

(Australia) www.kellyengineering.com.au/warranty

or

Fax to:

011 618 8667 2250

Ensure your carrier supports international dialing

Mail to:

Kelly Engineering

PO Box 100, Booleroo Centre

South Australia 5482

Australia

Thank you for choosing a Kelly Engineering product

We trust the following instruction manual should be clear and easy to follow, however feel free to contact our company for customer support.
(details below)

Should you have any problems or wish to suggest any improvements or modifications that would help to improve our products please contact us.
We welcome feedback.

Parts can be purchased when required through your local dealer, or by contacting either Kelly Engineering in Australia or in the US, Hood & Company Inc.

Kelly Engineering
Phone: + 61 8 8667 2253
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Email: office@kellyengineering.com.au
Website (Australia): www.kellyengineering.com.au
Website (US): www.kellyharrows.com

Hood & Company Inc Springfield MO
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Fax: 417 865 2105
Email: hoodco@hoodco.com

SAFETY FIRST

Refer to section 1 in this manual on

SAFETY INFORMATION

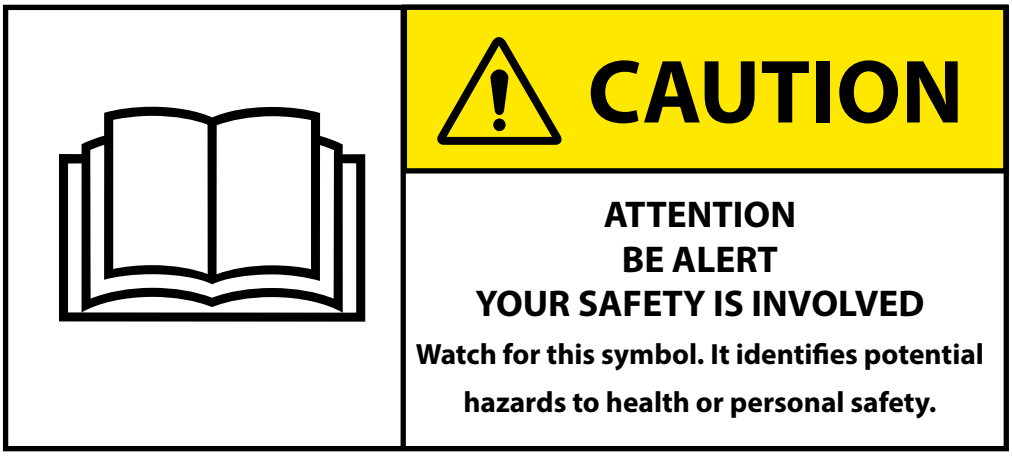
Read all assembly instructions and study all photographs thoroughly before assembling the unit.

Please note:
Left and right is determined by standing behind the machine and looking to the front.

Contents

Section 1:
Safety information

Safety information



Signal Words

A signal word - **DANGER**, **WARNING**, or **CAUTION**, is used with the safety alert symbol.
When you see this symbol on your machine or in this manual, be alert to instructions involving your personal safety and the safety of others.
Failure to follow these instructions can result in injury or death.

DANGER - Indicates an immediate hazardous situation that, if not avoided, will result in **DEATH OR SERIOUS INJURY**.

WARNING - Indicates a potentially hazardous situation that, if not avoided, could result in **DEATH OR SERIOUS INJURY.**

CAUTION - Indicates a potentially hazardous situation that, if not avoided, may result in a **MINOR OR MODERATE INJURY.**

Carefully read all safety points in this manual and on your machine. Keep all safety decals in good condition and replace ones that have been worn or lost. Replacement decals are available by contacting your local dealer.

Safety guidelines

- This equipment is dangerous to children and persons unfamiliar with its operation
- Do not allow persons to operate or assemble this unit until they have read this manual and have developed a thorough understanding of the safety precautions
- Do not attempt to operate this equipment under the influence of drugs or alcohol
- Review the safety instructions with all users annually.

Safety information

General operation

- Proceed cautiously under overhead powerlines and around power poles, as contact may result in the operator suffering a severe electrical shock
- Never allow anyone within the immediate area when operating machinery
- Stand clear when raising or lowering wings.

Transporting

- Always travel at a safe speed. **NEVER EXCEED 15mph (25kmph).** Ensure your speed is low enough for an emergency stop to be safe and secure and reduce speed prior to turns
- Fit transport safety lock to front cylinder for highway use
- Ensure safety chain is attached correctly to the towing vehicle
- Please refer to your own state laws on the rules of transporting farm machinery on roads
- Ensure that disc or prickle chains are engaged in chain guides and supports. Discs or spikes should be clear of the ground
- It may be necessary to increase the spring tension on the brake assembly for road transport
- Castor wheel assembly may oscillate when towed above the recommended towing speed
- Be aware of the height, length and width of the machine. Beware of obstacles and overhead powerlines
- Check local laws and use approved accessory lighting, flags and necessary warning devices on the highway during both day and night time transporting. Various safety lights and devices are available from your dealer.

Hydraulics

- **NEVER** remove hydraulic hoses or ends unless the machine is in either transport position or fully extended in working position. Relieve all hydraulic pressure before disconnecting hydraulic hoses and fittings
- Ensure all fittings and hoses are in good condition
- Do not search for high pressure hydraulic leaks without hand and face protection. A leak can penetrate the skin, thereby requiring immediate medical attention
- Double check that all is clear before operating hydraulics
- Maintain proper hydraulic fluid levels and pressure.

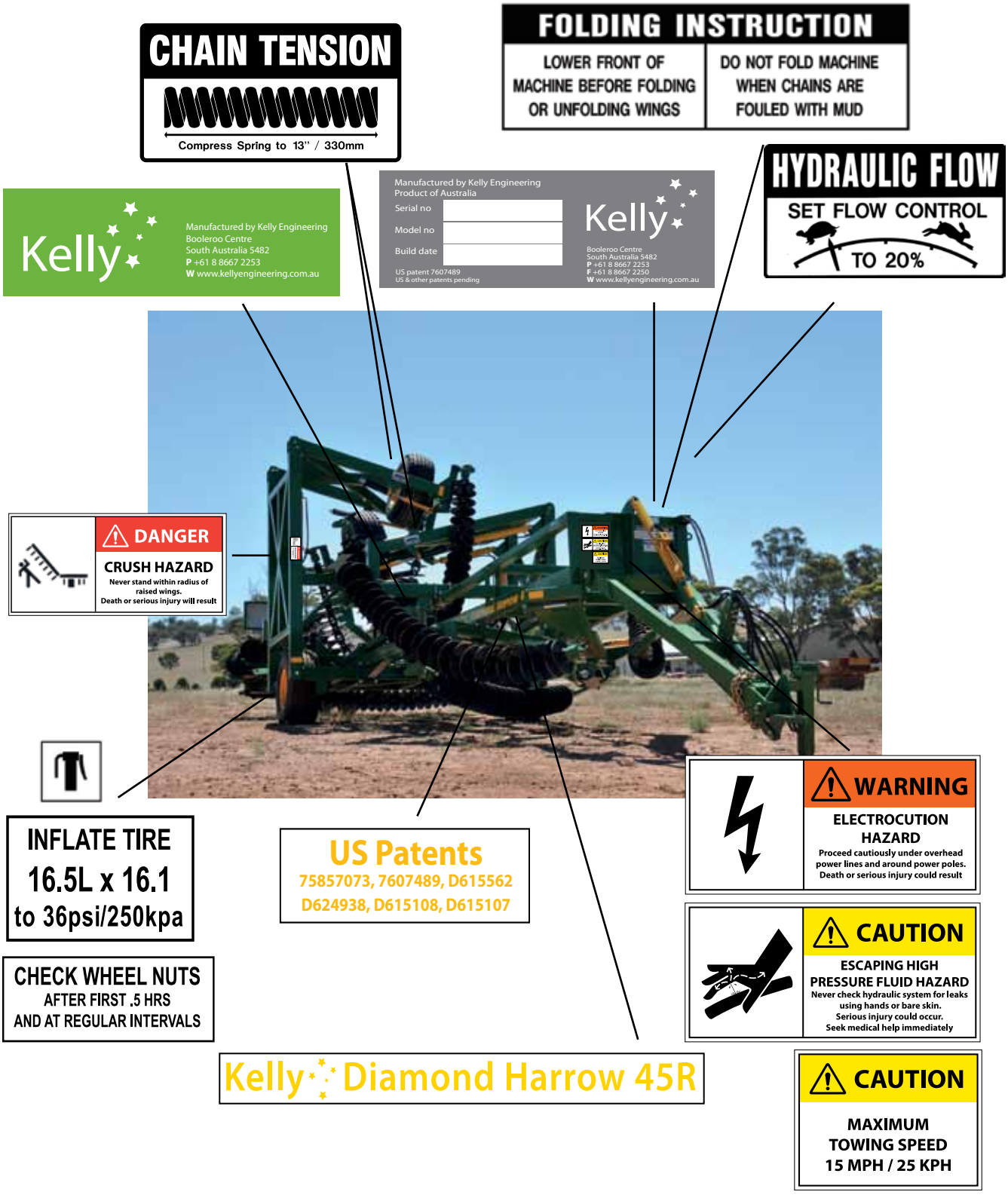
Maintenance and Inspection

- Good maintenance is your responsibility.
- Regular maintenance and inspection is imperative.

Guidelines can be found on pages 25-26 in the Operation section

Safety information

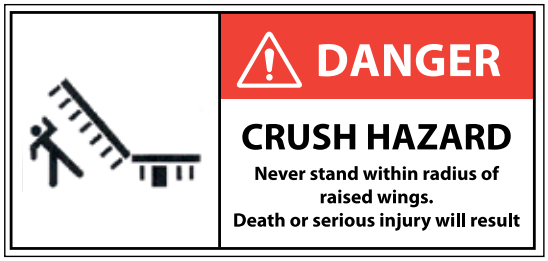
Safety decals - overview of decal placement



If any safety decals are missing please contact your local dealer immediately and do not use the machine

Safety information

Safety decals - individual placement



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Safety information

Safety decals - individual placement

BRAKE CALIPER.
INCREASE SPRING PRESSURE FOR HIGHWAY USE.

Kelly Diamond Harrow 45R

US Patents
75857073, 7607489, D615562
D624938, D615108, D615107

If any safety decals are missing please contact your local dealer immediately and do not use the machine

Safety information

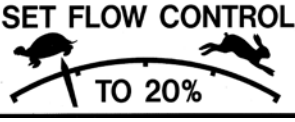
Safety decals - individual placement

FOLDING INSTRUCTION

LOWER FRONT OF MACHINE BEFORE FOLDING OR UNFOLDING WINGS	DO NOT FOLD MACHINE WHEN CHAINS ARE FOULED WITH MUD

HYDRAULIC FLOW

SET FLOW CONTROL



CHECK WHEEL NUTS
AFTER FIRST .5 HRS
AND AT REGULAR INTERVALS

INFLATE TIRE
16.5L x 16.1
to 36psi/250kpa

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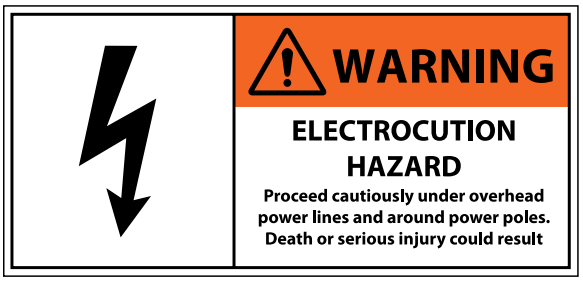
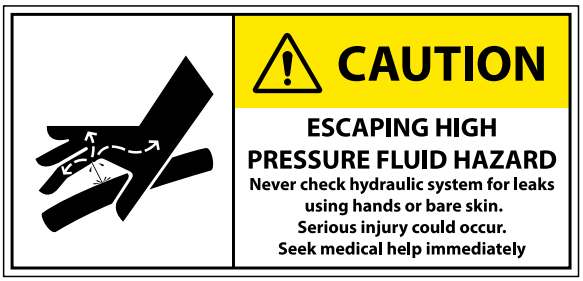
Safety information

Safety decals - individual placement



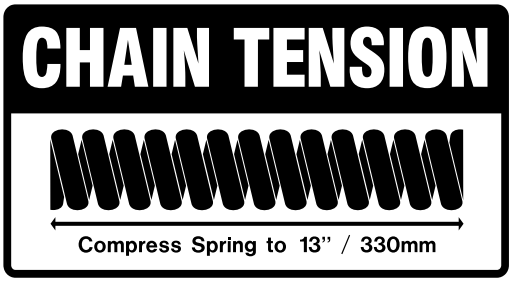


Position decals on right hand side, front face of main pull filler plate section as shown above. Position 1" (25mm) from top and RH edges of plate.

If any safety decals are missing please contact your local dealer immediately and do not use the machine

Safety information

Safety decals - individual placement



If any safety decals are missing please contact your local dealer immediately and do not use the machine

Safety information

Safety decal - individual placement

Manufactured by Kelly Engineering
Booleroo Centre
South Australia 5482
P +61 8 8667 2253
W www.kellyengineering.com.au

Manufactured by Kelly Engineering
Product of Australia

Serial no

Model no

Build date

US patent 7607489
US & other patents pending

Kelly

Booleroo Centre
South Australia 5482
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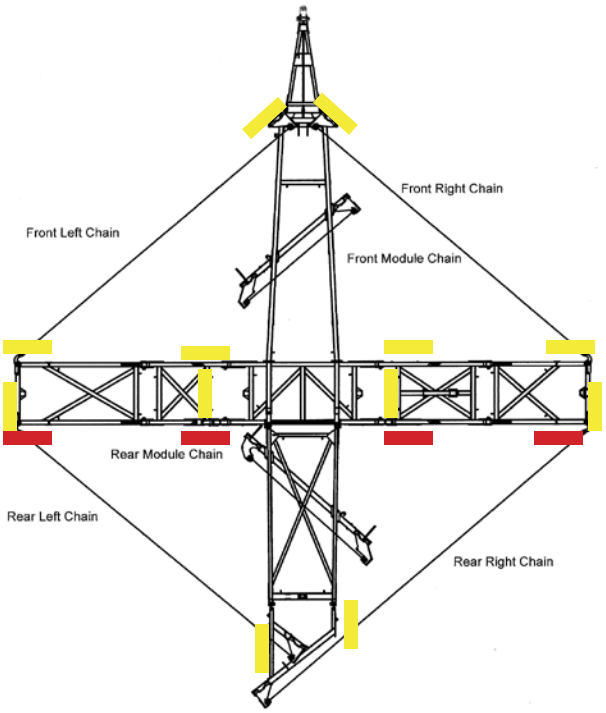
Safety information

Safety decal - individual placement



Red reflective tape

Yellow reflective tape

Red reflective tape - quantity : 4
Locate facing rearwards on each wing section
50mm (2") from end of frame tube

Yellow reflective tape - quantity: 12
Locate facing forwards on each wing section

Facing outward on outer face of outer wing

On under side of inner wing, to face out when folded

On diagonal face of main pull bearing support beam

On side face of rear tail, near rearmost corner

If any safety decals are missing please contact your local dealer immediately and do not use the machine

Section 2:
Operation

Operation

Before operation

- Carefully study and understand this manual
- Do not wear loose fitting clothing that may catch in moving parts
- Always wear protective clothing and substantial shoes
- Be sure that there are no tools lying in or on the equipment
- Do not use the machine until you are sure that the area is clear, particularly of children or animals
- If this machine is being used in a dry area, or in the presence of combustibles, care should be taken to prevent fires and fire fighting equipment should be readily available
- Don't hurry the learning process or take the machine for granted. Ease into it and become familiar with your new equipment
- Familiarize yourself and other operators with the machine's operation before using.

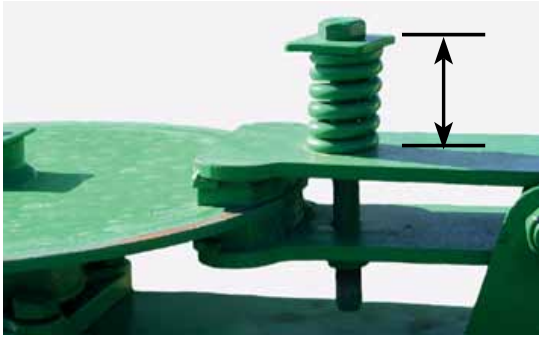
Pre-operation checklist

Check

1	All bolts and nuts are tightened to the correct torque values
2	Split pins are in place
3	Stickers and warning signs are in place
4	Hydraulic fittings are tight
5	Wheel nuts are tight
6	Chains are adjusted so that there is still travel in the adjustors and chains are tight
7	Fold machine to ensure chains engage chain hangers

Machine set up prior to operating

Unfold machine.
Extend lift cylinders until the float pins are centerd in their slots.
(To allow wing oscillation in uneven terrain).



Set brake tension on castor wheels to suit ground conditions.
Compress spring to approx 2"- 2.25" (50-63mm).
(It is usually not neccessary to constantly adjust the spring tension. A median setting that accommodates both field and highway use is practical. Make further adjustment if castor wheels oscillate during highway use).

Operation

Basic Operation

Unfolding:

1. Walk around and inspect the machine.
   a. Check that chains are not hooked on framework
   b. Check swivel bolts are in place and not broken
   c. Check that height adjusting chains have not fallen out of their slotted plates during transport.
2. Lower front A frame to working height.
3. Unfold wings holding the hydraulic lever until the tail is in working position and the main center cylinder pins have centerd in their slots.
4. Walk around and check that all chain links are straight and that working height of all swivels is correct for field conditions. Adjust if neccessary.
5. Move off with all chains in working position. If neccessary it is acceptabe to raise front A pull to transport height. This will lift the front chains off the ground and reduce the load on the tractor. Lower the front A pull once moving satisfactorily.

Folding:

1. Lower the front A frame to working height. (This is important to ensure that all chains locate correctly in their transport rests).
2. Fold the wings. They should move as follows; modules will raise, tail will raise, main center cylinders will retract, one or both, until the wings stand vertically. The left outer wing then the right outer wing will fold down.
3. Raise front A frame to transport height.
4. Walk around and check that chains have located correctly in transport rests.
   (30' only, install wing transport lock pins).

Setting for correct chain tension

Wings

Use the spanner supplied. Loosen the lock nut adjacent to the tensioner assembly body. Turn the tension bolt clockwise to compress the coil spring. Correct tension is acheived when spring retains its set length when operator rolls the chain fore and aft on the ground. Retighten the lock nut.
See table below

Spring Compression Length

Model	inches	mm
30	12.9	330
40/45/50	12.4	315
60	12.4	315

When less than 4" (100mm) of thread remains visible on the adjustor bolt then a link must be removed from the chain

Operation

Modules

Loosen the lock nut on the draw bolt.
Tighten the adjusting nut clockwise until the outer face of the spring retaining washer is flush with the body of the module tensioning unit.
Retighten the lock nut.
If more than 8" (200mm) of thread is exposed then a link should be removed to maintain correct adjustment.

Importance of chain tension

Operational

It is imperative that the correct adjustment be maintained. Only through correct adjustment can a smooth and level finish be achieved in field working.
Loose chains lead to :

- Uneven performance across the width of the machine
- Uneven weed control
- Unsatisfactory incorporation
- Ineffective levelling
- Accelerated or premature chain wear
- Chains failing to engage with transport locators when folded
- Machine damage when folding or unfolding
- Uneven field surface with ridges and furrows being created. The leading 1/3rd of a loose chain is much more aggressive than the trailing 1/3rd and the center. This will mean that middle of the machine's front pair of chains will aggressively move soil outwards. The machine's rear pair of chains, if loose, have their aggressive 1/3rd near the wing extremity. It follows then that as the front discs push soil outwards, the least aggressive portion of the rear chain follows them and does not balance the soil movement. This is exacerbated at the wings, effectively creating a broad ridge about halfway out each wing. It won't be evident in one pass, but is possible if care is not taken over time.

A correctly adjusted machine will not cause this phenomenon.

Operation

Wear

Correct chain tension will ensure that the entire length of discs will roll as one. This minimises the movement between each link. If a chain is not adjusted and runs loose, each link acts as a universal joint as the curved chain rolls along. The wear rate between each link is greatly accelerated and can lead to premature failure. The chain should not wear out before the discs are worn down. ONLY POOR ADJUSTMENT CAUSES THIS.

- The chain may sag not more than 12" (300mm) when working
- At rest there should be less than 4" (100mm) of sag in the chain.

Indicator line shows acceptable curvature when operating

Operation

Settings for correct working height

To adjust the swivel height at the wings, relocate one of the polyurethane spacers either above or below the fixed mounting tube.

Adjustment

1	Loosen chain tension completely
2	Undo self tapping screw from corresponding spacer then prise open the spacer and spring it off of the drop leg tube
3	Replace it in the selected position after raising or lowering the drop leg
4	Reinstall the self tapping screw and re-tension the chain

It is possible to install all spacers either above or below the mounting tube giving a maximum of 4" (100mm) of adjustment.

Operation

Chain mount arm height adjustment

Use the tractor hydraulics to raise the module or chain mount plate that requires adjustment.
Position a suitable block or stand to support the arm.
Using the tractor hydraulics, lower the machine until the height adjusting chains are loose.
Remove spring retaining clip.
Slide chain links through slot in lifting arm, turn links 90 degrees for fine adjustment.
Install retaining clip.
Remove stand.

Front A frame height adjustment

Main pull lower rail should be level with the ground

Ground level

Set drawbar height by fitting a selection of woah stops to the exposed cylinder rod on the A pull

Leading disc is 1" (25mm) from ground on all chains

Operation

It is important to spend some time setting up the swivel heights to achieve a good result. It is critical in achieving a level finish that the swivel heights are set correctly.

It is possible with correct adjustment to achieve a level finish in most situations by manipulating the front and rear heights of each chain.

The leading disc on each chain, if set too low has the capability of pushing up a ridge of soil that the following chains may not level out. This can occur at the front of each module, at the front of the rear chains (widest point) and at the front of the machine (either side of center).

The trailing disc on each chain, if set too low has the capability of leaving a furrow that may not be filled by other chains. Look for this at the rear of each module chain, on the wings at the rear of the front chains and at the very rear of the machine near the center line.

There is enough overlap built into the machine to ensure that it is possible to raise the front of all of the chains just clear of the ground and still achieve a full cut.

The optimum setting may vary depending on soil cover. In heavy stubble and unworked ground it is possible to set the swivels low to the ground. In light stubble or loose soil it is best to raise the leading discs so that the chains 'feather in' to the soil.

The main pull and rear tail should both be horizontal. ie parallel to the ground. Fine adjustments should be made using the adjustor chains at each bearing mount plate.

Once the main pull is set correctly apply whoa stop spacers (supplied) to the rod of the front A pull cylinder. This sets the draw bar height correctly for your tractor.

It is important to note that lowering the swivels will not cause the discs to dig deeper or more aggressively. It will result in premature wear of swivel hardware and the first two chain links. It will also cause ridges and furrows to appear.

Digging effectiveness is a result of soil conditions and disc chain construction. The weight, shape, angle and spacing of the discs are the factors which influence efficacy. On hard dry soils it is unrealistic to expect the discs to dig fully or evenly. They will however still perform well for residue breakdown and seed stimulation.

To prevent injury never lubricate or service Chain Harrow while it is moving (folding up or down or in working motion)

Operation

Maintenance and inspection

Good maintenance is your responsibility

- Before working on machine, ensure all moving parts have stopped
- Always use a safety support and block the wheels
- Use extreme caution when making adjustments
- Replace shields and guards after servicing and before moving
- After servicing, make sure all tools, parts and service equipment are removed
- Where replacement parts are necessary for periodic maintenance and servicing, genuine factory parts must be used. Kelly Engineering will not claim responsibility for use of unapproved parts and other damages as a result of their use and will not be liable for injury or warranty if equipment has been altered in any way
- A fire extinguisher and first aid kit should be kept readily available while performing maintenance.

Intervals

1. After FIRST use

- Visual check after first usage. Check for loose or missing hardware, oil leaks
- Retighten wheel nuts.

2. Daily

- Check chain tension
- Visual check for loose or missing hardware, especially chain/bearing bolts and pin retaining hardware
- Check for oil leaks or damaged hydraulic hoses.
  Immediately after stopping the machine, walk around and check the swivel units. A significant increase in temperature indicates a failing bearing. Replace with the spare swivel unit supplied and rebuild or replace the failed unit. Aproximate operating temperature is 131 deg F (55 deg C). Failure is indicated at approx. 176 deg F (80 deg C).

3. After 25 hours of use

- Grease kingpin bearings on castor wheel assembly at rear of machine
- Grease wing tension assembly threads
- Grease wing hinge pins x 8
- Grease brake caliper pivot bush
- Grease center frame cylinder pins (cylinder knuckles).

4. End of season ready for storage

- Lubricate threads on the chain tensioners for out of season storage. The machine is designed so that all cylinders are retracted for storage
- Ideally cover chain swivels to prevent ingress of water during storage.

Operation

Maintenance and inspection

5. Pre-season. After storage

- Check chain tension
- Visual check for loose or missing hardware, especially chain/bearing bolts
- Check for oil leaks or damaged hydraulic hoses
- Check tire inflation pressures
- Grease all points
- Check chain swivels for free and smooth rotation.
- Check wheel nuts
- Check pivot pins and cylinder pins for wear
- Check and repack wheel bearings and hubs with grease.

Trouble shooting

The majority of Chain Harrow operating problems can be traced to improper adjustment. This trouble shooting section may help you by suggesting a probable cause and a recommended solution.

Symptom	Problem	Solution
Wings bouncing	Wing tire pressure too low	Refer to page 18 for tire pressure specifications
	Operating speed is too fast for field conditions	Reduce speed
Back tires wearing	Castor wheel oscillation	Increase brake spring tension
	Possible king pin bearing failure	Check and replace bearing
	Wheel bearing failure	Check and repair bearing
	Flat tire	Check and repair
	Excessive brake pad wear	Replace brake pads
	Mud build up between wheels and on frame	Remove mud
	Stone jammed between wheels	Remove stone
Chain Links wearing	Chain too loose. Chain loops back when working.	Check length and adjust to correct tension. See pg 19-20
	Swivel set too close to ground.	Raise to correct height.
Difficulties in folding of the machine	Low tractor hydraulic pressure	Refer to local dealer
	Hydraulic flow too high	Set hydraulic flow to slow. 20% or 8gpm (30Lpm)

Operation

Trouble shooting

Symptom	Problem	Solution
	Sequence valve maladjusted	Refer to section 4 -Sequence valve adjustment.
Chain not rotating	Bearing failure in swivel unit	Check and replace
	Front chain swivels on machine too low Foreign material fouling bearings	Lift front swivels using adjustors / front cylinder Clear foreign material from the chains, especially around bearings
Uneven tread wear on transport wheels	Tire pressure too low Excessive road speed	Inflate to correct pressure See table pg 29 Travel at prescribed speed
Chains not locating properly on chain hangers	Front too high when folding machine	Pull should be at working height when folding machine
	Folding chain up on uneven ground	Refold on flat even surface
	Chain out of adjustment - too slack	Adjust chain tension
Operation leaves central ridge behind machine	Front chain swivels are too low	Raise front swivel/s
Operation leaves central furrow behind machine	Rear chain swivels are too low	Raise rear swivels
Ridging on outside edge of machine	Leading end of corresponding rear chain is too low	Raise corresponding wing swivel
Furrow on outside edge	Rear of front chain set too low	Raise corresponding wing swivel
Ridge 5' (1.5m) either side of center line.	Leading disc on a module chain is set too low.	Riase the corresponding chain mount arm
Furrow 5' (1.5m) either side of center line.	Trailing disc on a module chain is set too low	Raise the corresponding chain mount arm

Never attempt to fold for transport if the chain is clogged with weeds or mud as the extra weight may damage hydraulics or frame

Section 3:
Specifications

Specifications

Operating speeds

Operating speeds for normal conditions	
Chain type	**Speed**
Prickle Chain	6-10 Mph / 10-16 kmph
Disc Mulch Chain	6-8 Mph / 10-12 kmph
Transport / towing on roads	15 Mph / 25 kmph

Tire pressure

Tire size	Ply	PSI	KPA
16.5L x 16.1	14	36	250
H40 x 14.5-19	26	60	410
11L - 15	10	44	300
15.5/80/24	16	58	400
16.5/85/24	16	55	380
550/60/22.5	16	40	280
400/60/22.5	16	50	350
12.5/80/18	14	85	590
15.0/70/18	14	71	490

Chain Harrow specifications

Model	20'/6m	30'/9m	40'/12m	45'/13.5m	50'/15m	62'/18m	65'
Working width	19.5'/6.0m	28.5'/8.6m	41'/12.3m	43.5'/13.5m	48.5'/14.8m	62'/18.3m	62'/18.3m
Transport width	6.5'/2.0m	11.5'/3.5m	11.5'/3.5m	13.5'/4.1m	17'/5.2m	17'/5.2m	16.3'/5.0m
Transport height	11.5'/3.5m	13'/4.0m	12'/3.7m	13'/3.9m	15'/3.5m	14.6'/4.5m	14.6'/4.5m
Transport length	30'/9.0m	46'/14.0m	53'/16.0m	55'/16.7m	62'/19.0m	72'/22.0m	72'/22.0m

Bolt Torque Settings

Bolt Type	Wheel nut				U Bolt			Grade 8.8 Bolt					Grade 10.9 Bolt	
Bolt Size	M18	M20	1/2"	9/16"	M10	M12	M16	M10	M12	M16	M20	M24	M20	M24
Ft lb	255	265	90	100	22	36	55	32	48	140	190	270	300	350
Nm	345	360	125	140	30	50	75	44	65	190	260	370	406	475

[1] When fitting a wheel & tire to a hub, do the wheel nuts up in rotation to the correct tension. To achieve this choose a wheel nut & tighten, then go clockwise to the next wheel nut & tighten & so on until all wheel nuts are tight. Then repeat the procedure to check that all nuts are tight. Do not use impact tools to tighten wheel nuts. For a guide to the correct tension of the wheel nuts please use the appropriate tension for your size wheel nuts from the Bolt Torque Settings table.

Torque values are for dry threads and surfaces however it is permissible to apply a small amount of anti corrosive oil to the threads.

Specifications

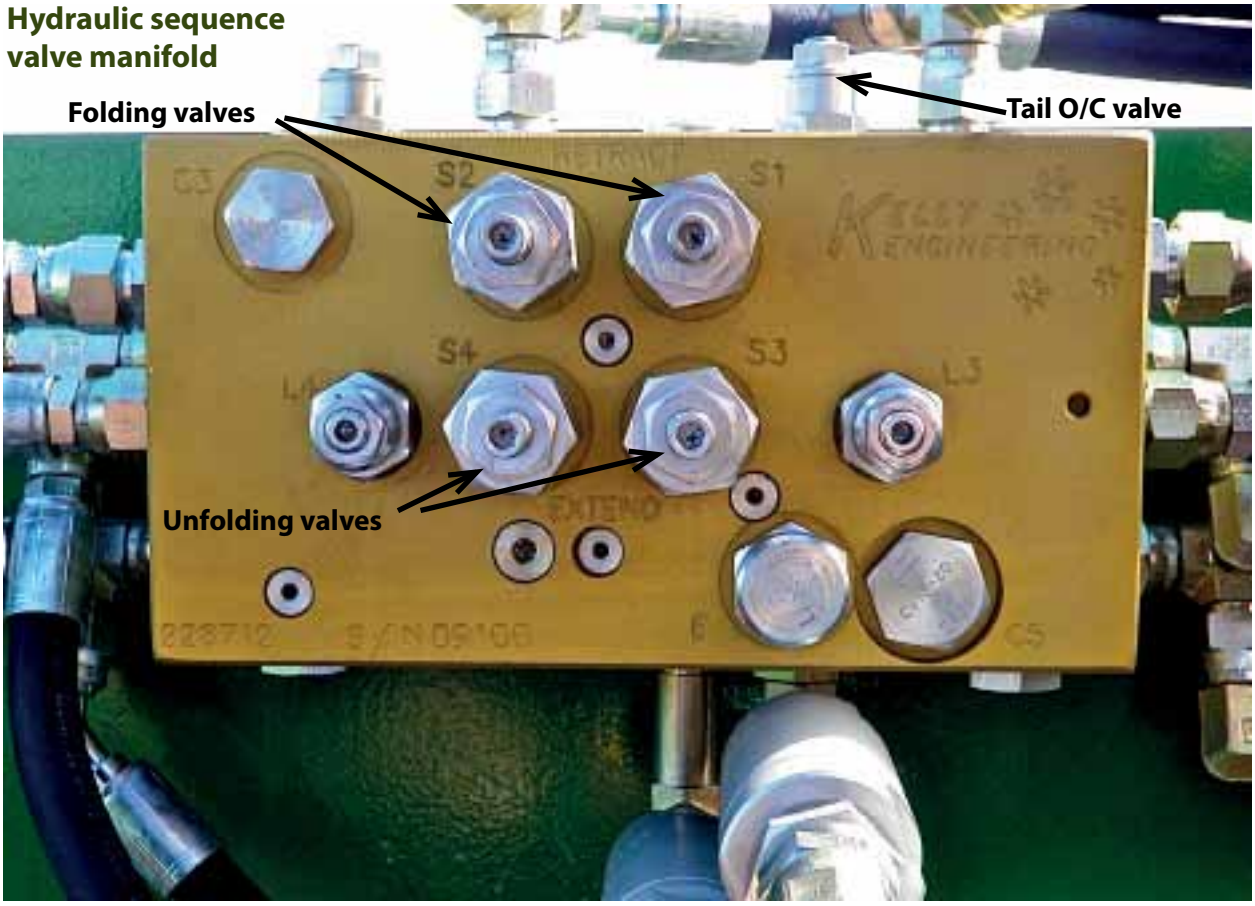
Disc Chain lengths

				Chain type	
Model		**Length**	**W36**	**CL1**	**R300**
60'	Front right	36.7'/11.2m	65	68	89
	Front left	36.7'/11.2m	65	68	89
	Rear right	42.3'/12.9m	75	77	102
	Rear left	36.7'/11.2m	65	68	89
	Modules front	10.3'/3.15m	18	19	25
	Modules rear	10.3'/3.15m	18	19	25
50'	Front right	30'/9.0m	54	56	72
	Front left	30'/9.0m	54	56	72
	Rear right	35'/10.7m	62	65	72
	Rear left	30'/9.0m	54	56	72
	Modules front	10.3'/3.15m	18	19	25
	Modules rear	10.3'/3.15m	18	19	25
45'	Front right	26.6'/8.1m	47	48	64
	Front left	26.6'/8.1m	47	49	64
	Rear right	33'/10.1m	57	59	80
	Rear left	26.6'/8.1m	47	48	64
	Modules front	8.9'/2.7m	16	17	21
	Modules rear	8.9'/2.7m	16	17	21
40'	Front right	25'/7.6m	44	46	59
	Front left	25'/7.6m	44	46	59
	Rear right	29.8'/9.1m	53	55	73
	Rear left	25'/7.6m	44	46	59
	Modules front	8.9'/2.7m	16	17	21
	Modules rear	8.9'/2.7m	16	17	21
30'	Front right	19'/5.8m	33	35	46
	Front left	19'/5.8m	33	35	46
	Rear right	24.4'/7.45m	41	43	59
	Rear left	19'/5.8m	33	35	46
	Modules front	7.4'/2.25m	14	16	18
	Modules rear	5.9'/1.8m	12	13	15

Section 4:
Sequence valve adjustments
For models 40 / 45 / 45R / 50 / 60

Sequence valve adjustments

Hydraulic flow setting on tractor must be set to 20% - Max flow 8 gallons per minute



Sequence valve overview

The sequencing valve manifold incorporated in Kelly Engineering Diamond Series Chain Harrows has been designed specifically for our purpose. The sequence valve is manufactured by Oilpath Pty Ltd in Adelaide, South Australia to a high standard of accuracy. All components are high quality and very precise.

Like all hydraulic components the main enemy is contamination. Care should be taken at all times to prevent contamination entering the hydraulic circuit.

The valve manifold controls the folding and unfolding of the Diamond Chain Harrow. A single pair of hoses connects the valve manifold to the tractor. Oil is directed to the first stage of a fold or unfold sequence. When the cylinders reach the end of their stroke and pressure mounts, a valve is triggered allowing oil to flow to the next stage. The valves automatically reset themselves when system pressure allows.

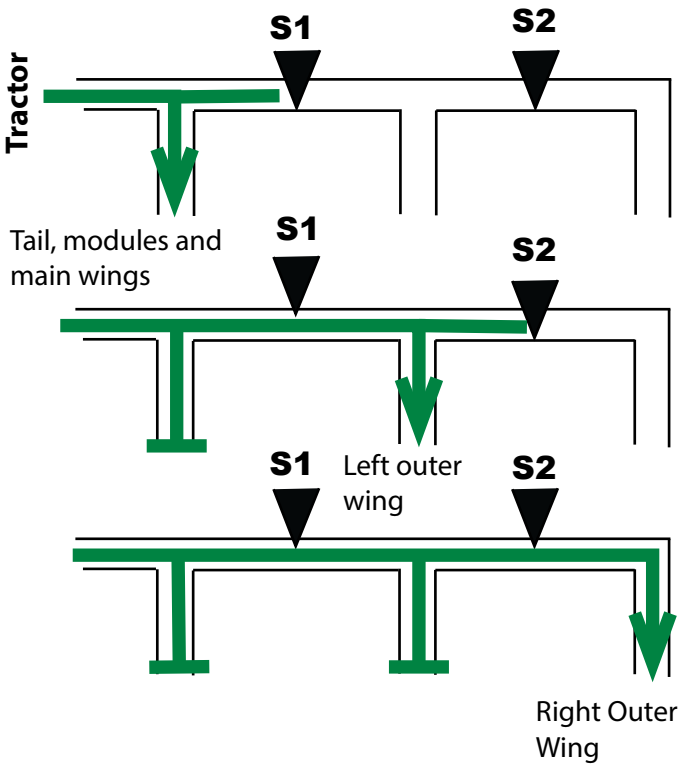
The valve manifold incorporates over-center valves as a safety measure. These valves prevent the tail or wings from falling in the event that one of the tractor hoses should fail.

Note. The sequence valve manifold has a maximum flow capacity of 8 Gallons (US) per minute (30Lpm). For the purposes of this instruction view all directions as though standing behind the machine looking forward.

Sequence valve adjustments

Sequence valve manifold flow chart

FOLD

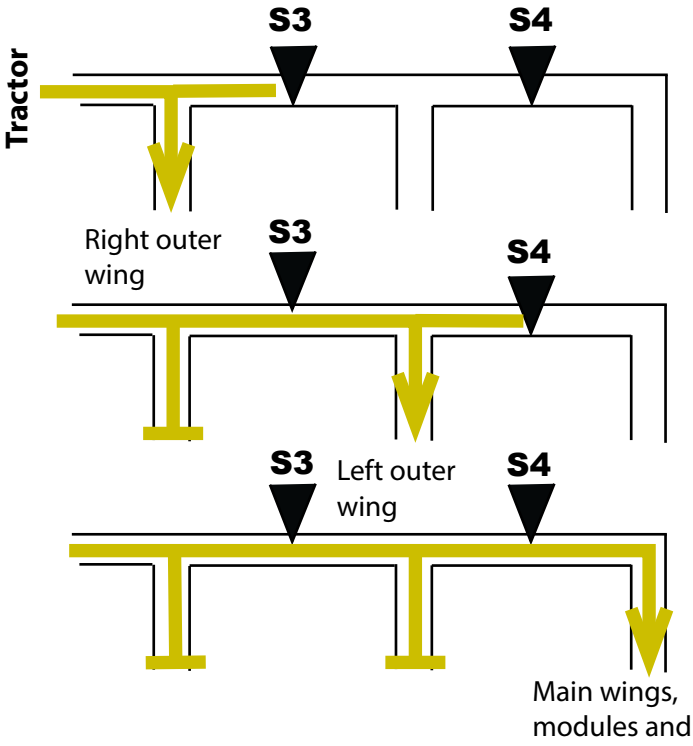


Stage 1
S1 closed. Oil is flowing to tail, modules and main wing cylinders

Stage 2
S1 open, S2 closed. Oil is flowing to left outer wing

Stage 3
S1 open, S2 open. Oil is flowing to right outer wing

UNFOLD



Stage 1
S3 closed. Oil is flowing to right outer wing

Stage 2
S3 open, S4 closed. Oil is flowing to left outer wing

Stage 3
S3 open S4 open. Oil is flowing to main wings, modules and tail

Sequence valve adjustments

Trouble shooting

Problem with:	Symptom	Page
Unfolding	Right wing won't rise from folded position	34
	Right wing rises but left wing won't rise	35
	Center cylinders extend before outer wings are both straight (vertical)	35
	No movement at all	35
	Sequence was working but becomes erratic	35
Folding	Left hand outer wing starts to fold first	36
	Center cylinders begin to close but left outer starts to move before main wings are vertical	36
	Either outer wing starts to move before both main wings are vertical	36
	Chain misses rear carriers - chain low	37
	Chain misses rear carriers - chain high	37
	Sequence was working but becomes erratic	38
Unresolved	Contact service agent or manufacturer	38

Unfolding

During unfolding, oil travels directly to the right hand outer wing cylinders until they are fully extended. Oil then passes over S3 to the left hand outer wing cylinders. When these are fully extended oil flows past S4 to the center cylinders, the tail cylinder and the module cylinders. There is an over-center valve that protects the main wings from falling. There is also an over-center valve that holds the tail in the raised position for transport. The tail should be the last section to lower when unfolding.

RIGHT WING WON'T RISE FROM FOLDED POSITION

If the pressure required to raise the right wing is greater than tractor pressure then oil will not flow. This may occur if chain is full of mud or other matter increasing the weight of the chain.

Solution

Clean chains of mud and debris.
Check that tractor hydraulic oil pressure is adequate (2200psi / 151Bar).

Sequence valve adjustments

Unfolding

RIGHT WING WONT RISE OR WONT RISE COMPLETELY BUT MAIN WINGS BEGIN TO OPEN

If the pressure required to raise the right wing is greater than that set by S3 then oil will flow past S3 to the left wing. As the right wing rests on top of the left wing and neither can move then oil is also forced past S4 to the main wing cylinders causing them to extend while the outer wings are still folded. As the main wings unfold and the weight is transferred from the outer wings then the oil will flow to the outer wing cylinders allowing the wings to straighten.

Solution

If chains are clean then increase the pressure setting on S3.
Loosen the locknut with a 16mm (5/8") wrench then using a 5mm Allen key turn the center clockwise. Adjust 1/4 of a turn then test. Repeat if necessary.

CENTER CYLINDERS EXTEND BEFORE OUTER WINGS ARE BOTH STRAIGHT (VERTICAL)

See above. Oil must flow past S3 and S4 to extend the main wing cylinders. Increasing the pressure setting at S4 should be sufficient.

NO MOVEMENT AT ALL

Solution

See first point. Check and if necessary clean chains of mud or debris.
Check that hose tips are correctly engaged in tractor breakaway sockets.
Check that any taps or electronic transport locks are open on the tractor.
Check that hydraulic flow on the tractor is not set to very low or off.
Check tractor hydraulic pressure (should exceed 2200 psi -151 Bar).
Call service technician. Test for oil flow. If flow is present isolate cylinders one at a time to ensure integrity of cylinder piston seal.

SEQUENCE WAS WORKING BUT HAS BECOME ERRATIC

The sequence valve manifold has an oil flow capacity of 8 gallons (US) per minute (30Lpm). At this flow the sequence cartridges are able to cope with the flow of oil and operate at their correct settings. If the flow rate is set too high, pressure in the manifold builds up and may unseat the sequence valves prematurely or in an unpredictable manner.

Solution

Set tractor hydraulic remote oil flows to slow (20%).
Engage tractor hydraulic lever slowly.

Occasionally foreign material may lodge in one of the check valves. This will allow oil to flow in a seemingly illogical manner. Symptoms suggest valve adjustments however the logical adjustments have no effect.

Solution

The large blind plugs in the sequence valve are actually check valves. There is a large steel ball and spring contained behind the plug. After relieving system pressure, carefully remove each plug and inspect for foreign matter lodged around the ball. Clean and replace.

Sequence valve adjustments

Folding

During folding, oil travels directly to the tail and module cylinders and to the main wing cylinders. When these are all closed oil moves past S1 to the left outer wing. When these cylinders close oil moves past S2 to fold the right outer wing.

LEFT HAND OUTER WING STARTS TO FOLD FIRST

If the pressure required to raise the wings to vertical is greater than the pressure setting on S1 then oil will pass S1 and cause the left hand outer wing cylinders to retract. This may occur if there is excessive load such as mud or debris or on occasions where the chains may have become blocked and buried.

Solution

Check and clean if necessary any mud or debris from chains. Do not attempt to fold the machine if the chains are buried during a blockage. Clear away the soil from the chains first.
If the chains are clean but problem persists it may be necessary to adjust S1. Loosen lock nut using a 16mm (5/8") spanner, then using a 5mm socket head wrench increase the pressure setting by screwing the center clockwise 1/4 turn.
Test and repeat if needed.

CENTER CYLINDERS BEGIN TO CLOSE, RAISING THE WINGS BUT LEFT HAND OUTER COMMENCES TO FOLD BEFORE BOTH WINGS ARE VERTICAL

As above, the center cylinders should be closed before any oil passes S1 to the left outer wing cylinders.

Solution

Clean mud and debris from discs.
Adjust S1. Loosen lock nut using a 16mm (5/8") spanner, then using a 5mm socket head wrench increase the pressure setting by screwing the center clockwise 1/4 turn.
Test and repeat if needed.

EITHER OUTER WING BEGINS TO FOLD BEFORE BOTH CENTER WINGS ARE VERTICAL

The center cylinders should be closed before any oil passes S1 to the left outer wing cylinders or S2 to the right hand outer wing cylinders. For either left or right the oil must first pass over S1 therefore adjustments to S1 as above should cure the problem.

Sequence valve adjustments

Folding

CHAIN MISSES REAR CARRIERS – TOO LOW

The tail section of the machine is hinged at the rear of the main frame. If the transport cylinder at the front of the machine is raised, the rear chains are loosened when the wings are raised.

Solution

Leave front of the machine in working position until wings are folded and chains locate in their hangers.

CHAIN MISSES REAR CARRIERS – TOO HIGH

If folding on uneven ground it may be possible for the tail section to be below the level of the machine. This will cause the rear chains to tighten and possibly swing above the transport hangers when folding.

Solution

Move to level ground before folding.
Slightly raise the front of the machine to compensate.

SEQUENCE WAS WORKING FINE BUT HAS BECOME ERRATIC

The sequence valve manifold has an oil flow capacity of 8 gallons (US) per minute. (30Lpm). At this flow the sequence cartridges are able to cope with the flow of oil and operate at their correct settings. If the flow rate is set too high, pressure in the manifold builds up and may unseat the sequence valves prematurely or in an unpredictable manner.

Occasionally foreign material may lodge in one of the check valves. This will allow oil to flow in a seemingly illogical manner. Symptoms suggest valve adjustments however the logical adjustments have no effect.

Solution

Set tractor hydraulic remote oil flows to slow.
The large blind plugs in the sequence valve are actually check valves. There is a large steel ball and spring contained behind the plug. After relieving system pressure, carefully remove each plug and inspect for foreign matter lodged around the ball. Clean and replace.

Sequence valve adjustments

Folding

NO MOVEMENT AT ALL

Solution

Check that hose tips are correctly engaged in tractor breakaway sockets.
Check that any taps or electronic transport locks are open on the tractor.
Check that hydraulic flow on the tractor is not set to very low or off.
Check tractor hydraulic pressure (should exceed 2200psi - 151 Bar).
Call service technician. Test for oil flow. If flow is present isolate cylinders one at a time to ensure integrity of cylinder piston seal.

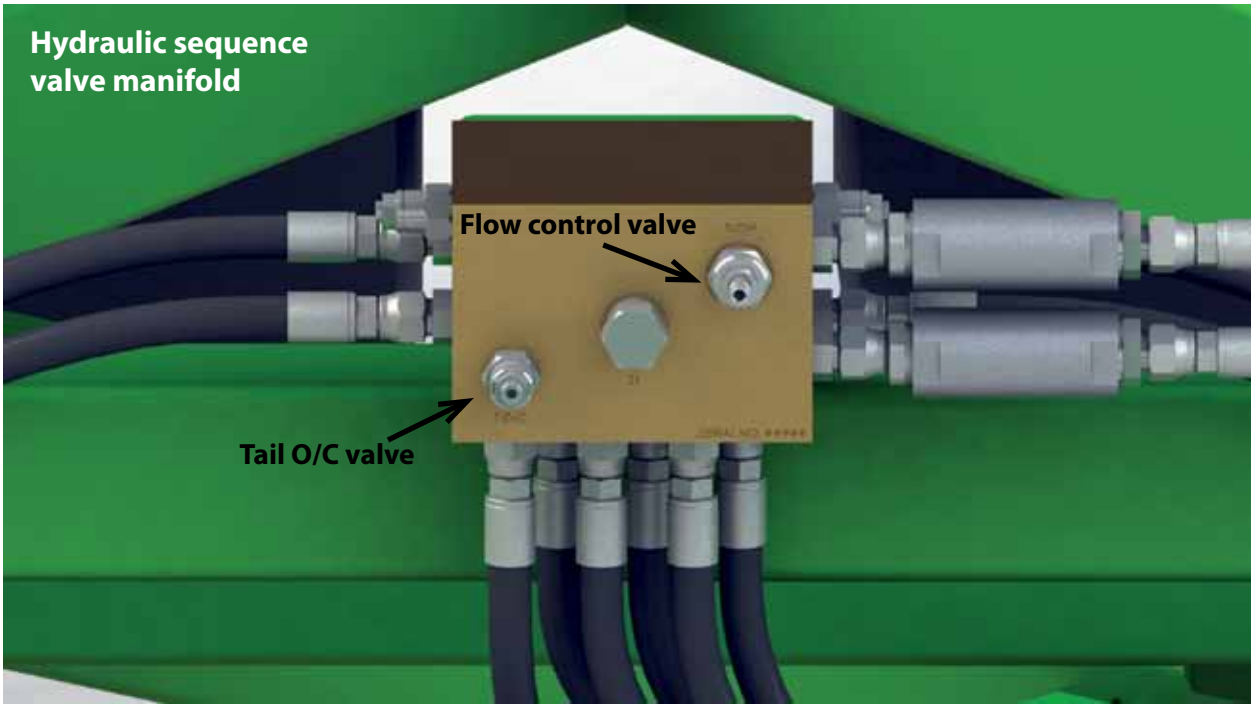
IF THESE ADJUSTMENTS DO NOT SOLVE THE PROBLEM

Contact your service agent for assistance. There may be a fault with one of the cartridges. The valve manifolds are tested at factory and again prior to shipping. The assembling agent will also have ensured the correct operation prior to delivery. Very rarely, but occasionally valves do fail. The usual cause is ingress of contaminant.

You may also contact Kelly Engineering for technical advice and assistance.
International : 011 618 8667 2253
USA: 417-865-2100
Canada: 306-213-6675
From within Australia: 08 8667 2253

Section 5:
Sequence Valve Adjustments
For model 30

Sequence valve adjustments



Sequence valve overview

The sequencing valve manifold incorporated in Kelly Engineering Diamond Series Chain Harrows has been designed specifically for our purpose. The sequence valve is manufactured by Oilpath Pty Ltd in Adelaide, South Australia to a high standard of accuracy. All components are high quality and very precise.

Like all hydraulic components the main enemy is contamination. Care should be taken at all times to prevent contamination entering the hydraulic circuit.

The valve manifold controls the folding and unfolding of the Diamond Chain Harrow. A single pair of hoses connect the valve manifold to the tractor, oil is directed to the first stage of a fold or unfold sequence. When the cylinders reach the end of their stroke and pressure mounts, a valve is triggered allowing oil to flow to the next stage. The valves automatically reset themselves when system pressure allows.

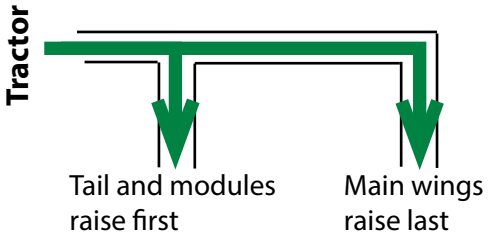
The valve manifold incorporates overcenter valves as a safety measure. These valves prevent the tail or wings from falling in the event that one of the tractor hoses should fail.

NB. For the purposes of this instruction view all directions as though standing behind the machine looking forward.

Sequence valve adjustments

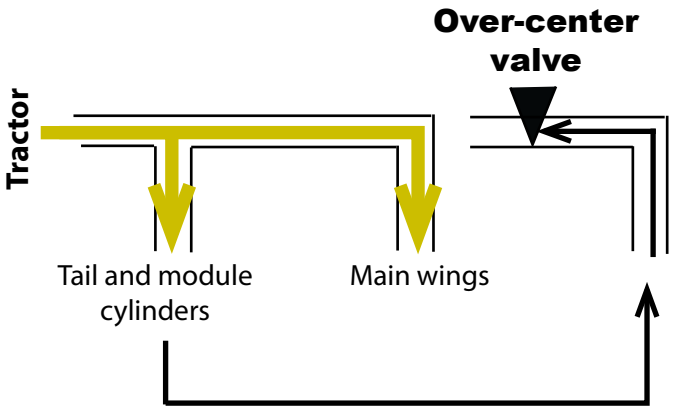
Sequence valve manifold flow chart (Model 30)

FOLD



Stage 1
Oil is flowing to the retract end of the centre cylinders, tail cylinder and module cylinders. The heaviest load (highest pressure) is at the main wing cylinders therefore the tail and modules raise first.
The main wings raise last.

UNFOLD



Stage 1
Oil flows to all cylinders.

Return oil from the tail cylinder is checked by the over-center valve. The back pressure prevents the tail from moving until the wings are fully unfolded and pressure increases.

Sequence valve adjustments

Trouble shooting

Problem with:	Symptom	Page
Unfolding	Wing cylinders won't extend	42
	Tail section will not lower	43
	Tail lowers before wings are fully extended	43
	No movement at all	43
Folding	Chain misses rear carriers - chain low	44
	Chain misses rear carriers - chain high	44
Unresolved	Contact service agent or manufacturer	45

Caution:
Do not remove valve cartridges from valve manifold housing as high pressure oil may be present.

Unfolding

During unfolding oil travels directly to the wing cylinders until they are fully extended. Once the cylinder pins have centered in their slots the pressure will rise forcing the tail section to lower. There is an over-center valve that protects the main wings from falling. There is also an over-center valve that holds the tail in the raised position for transport. The tail should be the last section to lower when unfolding.

WING CYLINDERS WON'T EXTEND
Oil travels first to the wing cylinders. Check that transport pins have been removed and stowed.

Solution
Remove transport safety pins.
Check that hose tips are connected to tractor.

Sequence valve adjustments

Unfolding

TAIL SECTION WILL NOT LOWER

There is an over center valve holding the tail in the raised position. It serves two purposes, transport safety and sequencing. If tail will not lower to working position the valve's pressure setting may be too high.

Solution

Loosen the locknut with a 9/16" wrench then using a 3/16" Allen Key turn the center clock wise. Adjust 1/4 of a turn then test. Repeat if necessary. (These SUN cartridges adjust counter clockwise to increase pressure and clockwise to decrease pressure.)

TAIL LOWERS BEFORE WINGS ARE FULLY EXTENDED

See above.

Solution

Increase pressure on tail over center valve. Loosen the locknut with a 9/16" wrench then using a 3/16" Allen key turn the center counter clockwise. Adjust 1/4 of a turn then test. Repeat if neccessary.

NO MOVEMENT AT ALL

Solution

Check transport locking pins are removed and stowed.
Check that hose tips are correctly engaged in tractor breakaway sockets.
Check that any taps or electronic transport locks are open on the tractor.
Check that hydraulic flow on the tractor is not set to very low or off.
Check Tractor Hydraulic Pressure. (Should exceed 2200 psi - 151 Bar)
Call service technician. Test for oil flow. If flow is present isolate cylinders one at a time to ensure integrity of cylinder piston seal.

Sequence valve adjustments

Folding

During folding, oil travels directly to all cylinders. The design of the machine is such that each function requires different operating pressure to perform. The module and tail cylinders will raise at a lower pressure than that required by the main wing cylinders. Logically then the tail and modules will raise first, followed by the main wings.

CHAIN MISSES REAR CARRIERS – TOO LOW

The tail section of the machine is hinged at the rear of the main frame. If the transport cylinder at the front of the machine is raised, the rear chains are loosened when the wings are raised.

Solution

Leave front of the machine in working position until wings are folded and chains locate in their hangers.

CHAIN MISSES REAR CARRIERS – TOO HIGH

If folding on uneven ground it may be possible for the tail section to be below the level of the machine. This will cause the rear chains to tighten and possibly swing above the transport hangers when folding.

Solution

Move to level ground before folding.
Slightly raise the front of the machine to compensate.

NO MOVEMENT AT ALL

Solution

Check that hose tips are correctly engaged in tractor breakaway sockets.
Check that any taps or electronic transport locks are open on the tractor.
Check that hydraulic flow on the tractor is not set to very low or off.
Check tractor hydraulic pressure. (Should exceed 2200 psi - 151 Bar)
Call service technician. Test for oil flow. If flow is present isolate cylinders one at a time to ensure integrity of cylinder.

Sequence valve adjustments

IF THESE ADJUSTMENTS DO NOT SOLVE THE PROBLEM

Contact your service agent for assistance. There may be a fault with one of the cartridges. The valve manifolds are tested at factory and again prior to shipping. The assembling agent will also have ensured the correct operation prior to delivery. Very rarely but occasionally valves do fail. The usual cause is ingress of contaminant.

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