P/N – Issue/Date: 77121A A / 8.06

Additional:
- Set-up Instructions,
- Operating Instructions,
- Recommendations.

(For Australian AH2000, CH2000, RC2000 Series Rotavators.)

Note: For European models HR40 – HR61 Series refer to 77121.

ROTAVATOR NOTES – Aust.

Index

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Important Set-up, Operation & Maintenance Issues

Your attention is alerted to the subjects listed below and the SET-UP CHECKLIST overleaf.

These are important as they significantly affect the reliability and longevity of your Rotavator.

They are indexed here to provide a clear and concise reference point.

Detailed instructions relating to each subject are highlighted in the relevant section of the text and are shown;

Text providing details of important instructions.

Rotavator Set-Up Checklist

Tractor

Lower links set with sway blocks to match Rotavator (Cat 2 or 3 typ.)..... ☐

Lower link arms level / equal height off ground. (Note: Tyre pressure should be equal.) ☐

Tractor lift rods should be in float positon..... ☐

The Rotavator must be able to float up & down each side within the linkage.

Check / align pin sockets..... ☐

Top link length readily adjustable. (Required to level Rotavator gearbox) ☐

Clean, inspect and oil PTO shaft on tractor ..... ☐

Test fit universal shaft yoke on tractor PTO. Yoke should slide on freely and lock. ☐

Clean, lubricate, repair or replace required components if necessary.

Remove or slide tractor drawbar to ensure it will not foul universal shaft..... ☐

Rotavator

Lubricate universal shaft crosses …… ☐

This is best done while crosses are warm. Only a few pumps are typically required.

Grease must exude from ALL FOUR caps. If not - dismantle and clean ot rectify.

Clean and lubricate universal shaft sliding members…….. ☐

Check clutch is free / correctly adjusted. ☐

Check all oil levels - Primary gearbox & side drive(s)…….. ☐

Watch / frequently check for any oil leaks

Clean regulary oil cooling circuit strainer(s) if fitted…….. ☐

Metal debris may indicate immenent problems.

Check fastener tightness…… ☐

Check wheels are secure and tyre pressure is adequate. ☐

Check blades, scroll pattern and fasteners are tight. Replace bent or damaged blades……... ☐

Check end flange wear protectors & weed cutters are fitted / servicable. ☐

Attach the Rotavator to the tractor and check:

Drive shaft length and clearances throughout lifting arc…….. ☐

Parking stands are raised / removed. ☐

In Operation

Gearbox is level at working depth…… ☐

Clutch adjustment allows it to slip if obstacles are hit. ☐

Keep rotor speed as slow as possible to achieve tilth required…… ☐

Keep depth of cultivation to the minimum requied to achieve required cultivation. ☐

Operate with rear soil shields raised if possible…….. ☐

Work only in a straight line. AVOID SHARP TURNS. Long gradual turns are acceptable. ☐

Ensure tractor is moving forward as Rotovator is lowered into and out of ground…….. ☐

This avoids creating a trench / ridge typical when tractor is stationary.

DRIVE-SHAFT

Drive-shaft Length

> ☞ Ensure drive-shaft length is correct. If too long (or too short), damage to the tractor PTO, universal drive-shaft or Rotavator gearbox may occur.

Splined Bar Drive-shafts. Note that the outer or female splined section nib is only 120mm (4.3/4") long and is welded into the tube section which connects to the yoke.

- To shorten or lengthen a splined bar drive-shaft, the best method is to replace the female section (yoke, tube and outer spline welded assembly) with a unit of suitable length from the drive-shaft manufacturer. [Covers can be easily cut or replaced as required.]
- Shortening or lengthening of splined bar drive-shafts by machining and re-welding can be performed by local engineers. Truck driveline specialists are recommended due to their driveline experience. **Note that the yokes each end of the sliding members must remain aligned** (That is, the bores for the universal cross must be in the same plane) and the sliding members must be in line. If this is not correct, the Rotavator will vibrate and universal cross life will be low.

PTO Shaft & Gearbox Input Shaft Alignment

Velocity fluctuations are created by each cross because of the cross geometry during rotation, however two crosses at the same angle cancel out this problem.

> ☞ When setting up the Rotavator to the tractor, it is important that the tractor PTO shaft and gearbox input shaft remain parallel over the working range.

Acceptable 'out of parallel error' at working angles of 15-20° is +/- 2° [At 1000 rpm.] However if the angle of one universal cross can be limited to a maximum of 9° it is allowable that the other cross angle can vary from 0-9°.

Drive-shaft Working Angle

> ☞ Ensure drive-shaft angles, especially when lifted, do not exceed the capacity of the yokes as this will cause severe damage. Limit lift if necessary.

- Drive-shaft ratings given by manufacturers are typically for working angles of 10°.
- Working angles over 17.5° should be avoided if possible.
- Optimum universal cross life is achieved at 5°.
- As working angles increase, drive-shaft life or power capacity drop. [Drive-shaft universal cross life reduces by approximately half for every 5° increase in working angle.]

On smaller machines subjected to high power, arduous conditions and /or high drive-shaft working angles it is possible to fit a larger drive-shaft if the universal cross life is inadequate. However on the CH & RC Series Rotavators, the Series 12 Bypy drive-shaft fitted is the largest available agricultural shaft, consequently this option is not available. To maximise universal cross life, focus on reducing the drive-shaft working angle by:

- Working the Rotavator to the minimum depth of cultivation required.
- Using a tractor with a PTO height as close as possible to that of the Rotavator gearbox input shaft height when working.

- Using a tractor with as large as possible horizontal distance between the PTO shaft and implement pick up points. [The use of a quick hitch is recommended for this reason and for safety.]

Turning at Headlands

Limit lift such that the Rotavator and wheels, or roller, just clear the ground. This maintains the tractor PTO and gearbox input shafts closest to their parallel alignment as set-up for working.

If it is necessary to lift the Rotavator high, and the PTO and gearbox input shafts lose their parallel alignment, disengage the PTO drive as the rotor clears the ground. Do so before raising the Rotavator to full height and turning. Re-engage the PTO drive again when positioned for the next run and the rotor is just above the ground.

Universal Cross Lubrication

Universal crosses require greasing daily or every 8 hours as a minimum. In extremely dusty and/or arduous conditions, greasing every 4 hours may be necessary. Ensure grease exudes from each cap. (Any cap not exuding grease will not receive new lubricant and is likely to subsequently fail.)

Crosses with 4 grease nipples (1 on each cap). Experience indicates that this system in combination with plugging of the central grease gallery increases universal joint life as it ensures that new grease is supplied to each cap when greasing. [Note that although some shaft assemblies have been fitted with this system, the central grease gallery may not have been plugged. If greasing each cap is necessary to ensure grease is exuded from all caps this will indicate that the central gallery has been plugged.]

Grease while the universal cross is warm if possible (grease within cross is at its lowest viscosity).

DO NOT use a grease containing molybdenum disulphide or graphite in the universal crosses. [The molybdenum disulphide or graphite particles tend to 'cushion' the rollers and they then slide rather than roll.]

Greases recommended for universals to date are; Castrol: BTX Grease or APXT. TRU-BLU: UHT EP Grease. Shell: Retinax HD2.

Lubrication of the Sliding Sections

These must be kept clean and lubricated to ensure they slide under load. Failure to do this may cause the thrust forces generated as the Rotavator rises and falls, to reduce universal cross life and potentially break the gearbox input or the tractor PTO shaft.

Grease containing molybdenum disulphide is advantageous but DO NOT use in universal crosses.

Some form of sealing system to retain lubricant and prevent dust access to the sliding shaft sections is recommended. While there are no suitable kits available as yet, adapting a concertina rubber tube from a motor cycle front fork cover is suggested. Some operators prefer the sliding members to be kept totally clean and dry to avoid the problems associated with dust sticking to the grease. In these situations a dry, solid lubricant is recommended such as:

- Dow Corning: 321R Moly Spray.
- Molybond: 122L Etch Primer. Available in 300ml spray cans from Industrial distributors such as Blackwoods.
- John Deere: Super Lube - product code TY22034.

Causes of Poor Universal Cross Life

Factors most likely to affect the life of universal crosses and solutions are:

Lubrication Frequency: Increase.

Lubricant Quality: Use the best available.

Working Angle: Reduce.

Unequal Working Angles: Correct

Shock Loads: Reduce with clutch setting.

Lubrication of Sliding Members: Keep clean and lubricated.

FRICTION CLUTCH

Clutch Setting

> ☞ Correct clutch setting is critical to maximise universal cross life and to prevent shock loads damaging other components in the transmission.

The friction plate clutch should be set such that it will not slip in normal working conditions, but will slip should any significant obstacle be struck.

NOTE: DURING INITIAL USE, CHECK CLUTCH REGULARLY FOR EXCESSIVE HEAT. The clutch will 'bed in' and require re-setting after a short period of use. Failure to do this may result in excessive wear of the clutch components.

UNDER-TIGHTENING of the clutch springs will cause unnecessary slippage of the clutch, resulting in excessive wear of plates. In normal obstacle free operation, the clutch should be no hotter than the gearbox. If the clutch overheats, increase clutch spring compression by ¼ turn on each nut and re-check clutch temperature after 0.5-1 hours operation and re-adjust if necessary. WARNING - Do not over-tighten clutch.

OVER-TIGHTENING of the clutch springs will not allow the clutch to function correctly, possibly resulting in torque induced shear failure of drive line components, should an obstacle be encountered. [Note: Failures caused by over-tightened clutch springs are not covered by warranty.]

Clutch Seizure During Storage

RUSTING of the steel clutch plate facings due to atmospheric moisture and/or rain may result in the clutch seizing. Seizure of the clutch will prevent it functioning correctly, possibly resulting in torque induced shear failure of drive line components, should an obstacle be struck. [Note: Failures caused by a seized clutch are not covered by warranty.] To prevent this occurring it is necessary to 'free the clutch' and ensure that it slips, then reset it. This should be part of pre-season servicing of the Rotavator. To do this, follow the steps below in 'To Free Clutch'.

To Free Clutch

> ☞ This must be performed before beginning work if the Rotavator has been stored for any length of time.

1 Slacken off the clutch springs until compression in springs is almost nil.

2 Connect the Rotavator to the tractor and engage the PTO drive and ensure clutch spins freely (ie does not drive the rotor). This will also polish any rust from clutch plate facings.

3 If the clutch will not disengage it may be necessary to remove it from the Rotavator and clean or repair as required.

4 Reset the clutch.

LUBRICATION

Lubrication Oil Type

Howard Australia has been installing Optimol Optigear BM460 gear oil on new machines for a number of years. It is an SAE 140EP (ISO viscosity 460) oil with an advanced performance additive package intended to compensate for; the lack of 'running in' that machinery receives today and for some of the misalignments from working load deflections in the structure.

Alternative lubricants can be used when replacing oil after the first oil change – refer to Service Bulletin 40 for assistance with alternatives. However the Primary Gearbox and Side Drive(s) are significantly different with respect to lubrication issues and need to be considered separately.

1. **Primary Gearbox (and oil cooling circuit).** Do not dump a large quantity of good quality Optigear BM460 gear oil and replace it with a lower specification gear oil at the first oil change without good reason. The Optigear BM460 gear oil will last 1000 hours or 3 years (whichever is the lesser) and really only needs to be replaced if contaminated – refer to oil change interval.
2. **CH2000 Primary Gearbox.** As this model is not fitted with an oil cooling circuit (containing a filter and additional oil) it is recommended that an initial oil change be completed at 50 hours to ensure that any manufacturing debris or initial wear particles are removed. Subsequent oil changes if using Optigear BM460 oil are as above.
3. **Side/Chain Drive(s).** Due to the relatively low volume of oil plus the fact that any wear contaminants are likely to collect at the bottom of the side drive in the area of both the rotor drive bearing and face seal, it is recommended that an initial oil change be completed at 50 hours, then regularly at 250 hours or annually.
   Experience is that the Optigear BM460 additive package is not critical to the chain side drives and a more conventional or standard 140EP gear oil is adequate, however because of the points listed previously, the more regular changes of the oil in the side drive(s) are recommended. Recommended alternative lubricants are: Castrol EPX 85W140, or 80W90.

Warm Up Transmission Before Beginning Work

It is recommended that <u>before beginning work</u> the Rotavator be run at no load and normal operating revs for approximately 5 minutes. This allows the transmission lubricant to warm up sufficiently for splash lubrication to become fully effective. When cold, lubrication oil clings to the gears or chain drive and may not provide adequate splash lubrication to some transmission bearings.

Failure to warm up transmission before beginning work may cause bearings to fail prematurely due to inadequate lubrication.

Synthetic lubricants, which do not vary as significantly in viscosity with temperature, are the only suitable alternative to this warm-up requirement. Recommended Synthetic Lubricants are:

Primary Gearbox: Optimol Optigear Synthetic A320 – (Contains the same additive package as Optigear BM460).

Side/Chain Drive: Castrol Syntrax E or Castrol SAF-XJ.

Recommended Maximum Operating Temperatures

Optimol BM460 Gear Oil: 100°C. Oil life expectancy 2000 hours.

Note: Optimol BM460 can sustain working temperatures up to 120°C, however the oil life expectancy given above halves for each additional 10° over 100°C. As the oil life expectancy is only 500 hours under good conditions at 120°C, rigorous monitoring of the oils condition will be required to avoid the risk of transmission failure as a consequence of the dramatic fall off in lubrication performance with breakdown.)

Typical EP Gear Oils (Mineral Base): 80°C. Oil life expectancy 1000 hours.

Synthetic Gear Oils: Refer to manufacturer.

Note that the limit for sustained hand contact is about 65ºC thus operating temperatures can only be accurately measured with a suitable thermometer.

Resolving 'Excessive' Operating Temperatures

MEASURE the oil temperature with either a thermometer or suitable measuring device. (See above for limit of hand contact temperature.)

Ensure Optigear BM460 or alternative good quality oil is installed.

Check oil level is correct.

Ensure oil cooling circuit is functioning (if fitted).

- Check oil strainer is not blocked.
- Check the front frame tube at the oil inlet end. It should be the same temperature as the gearbox.
- Check oil is circulating. It is usually sufficient to feel hoses. If necessary, remove return hose to gearbox, run unit for 30 seconds at no load and collect oil in a suitable container to confirm flow. (Return collected oil to gearbox when completed.)

Check oil is not foaming and/or pressurised breather is fitted. Refer 'Aeration or Foaming of Lubrication Oil' below.

Examine gears for correct mesh and/or pitting.

- If the full width of gear is wearing smoothly and polished - wear is correct. Pitting, scouring or wear at one end of the tooth indicates problems. Use a flashlight and check all teeth on the working face. (Feel any working faces that you cannot see.)

Ensure bearing preloads are not too high. Excessive preloads will generate heat quickly and can usually be detected by hand within 5 minutes of running, from cold, at no load. (Provided the bearing is not too deep within the gearbox.)

Ensure power requirements are not excessive. Blunt blades or trash build up will increase power requirements.

Oil Change Interval

Oil changes are required to replace deteriorated lubricant with new. Deterioration is usually as a consequence of one or more of the following:

- Contamination of the lubricant with wear metal.
- Moisture ingested into the gearbox, usually by condensation.
- Oil breakdown from excessive operating temperature – oil becomes black and/or smells burnt.

In relation to the **Primary Gearbox**, if the above deterioration causes can be avoided or reduced by a combination of the following, the working life of the Optimol BM460 gear oil can be extended, however do not extend change intervals beyond either 1000 hours or 3 years without very careful monitoring of the oils condition.

- Filters, strainers or magnets to clear wear particles and other contaminants from the oil.
- Filtering breathers to prevent external contaminants entering the gearbox. (Including closed breather systems.)
- Storing machine under cover and away from excessive temperature changes to prevent moisture entering the gearbox.
- Operation at lower working temperature by either lower input power or alternatively the addition of an oil cooling system.

In relation to the **Side Drive(s),** due to the relatively low volume of oil plus the fact that any wear contaminants are likely to collect at the bottom of the side drive in the area of both the rotor drive bearing and face seal it is recommended that an initial oil change be completed at 50 hours then regularly at 250 hours or annually.

Aeration or Foaming of Lubrication Oil

Howard Australia install 'free to air' breathers, however if these become blocked or have been replaced by 'pressurised breathers', certain combinations of oil and operating conditions can result in aeration or foaming of the oil. Although it is not considered to reduce the lubricating performance of modern EP based lubricants, experience is that higher operating temperatures often result. This indicates that there are either increased frictional losses and/or a reduction in the ability of the oil to dissipate heat. Additionally, breathers will eject small quantities of oil producing the appearance of large oil losses once it is absorbed by dust.

If aeration or foaming of the oil is suspected;

- Replace any pressurised breathers with 'free to air' versions. It may be necessary to also place these on extensions.
- Consider changing to another brand of oil.

Breathers

Check and clean these regularly to prevent dust entering the gearbox and / or blockages.

The standard breathers fitted do not include significant filtration. Remove and wash clean in kerosene as dictated by the extent of dust build up. After washing immerse in light oil or diesel then allow to drain, before re-fitting. This coats the metal with oil so as to trap dust particles.

If dust is significantly abrasive or better filtration is required, replaceable foam element breathers, offering filtration to 40 microns can be can be fitted. Recommended versions are:

- Ryco Hydraulics: R350-0640 Dia 77 x 75.

Replaceable paper element breathers, offering filtration to 10 microns can be can be fitted if preferred. Recommended versions are:

- Ryco Hydraulics: R350-0610 Dia 77 x 75.
- Mobil Tech: MACAIR 1 Dia 68 x 75 - Requires additional ½-3/4" BSP nipple.
- Any replaceable oil filter is suitable, however the above are recommended due to their smaller size.

Gear Noise

Gear Noise Beginning During Operation

Any gear noise that starts during operation will usually indicate that there is significant damage to at least one gear working tooth face. This will usually get worse quickly and any metal particles will also damage other components. Consequently prompt identification of the noise source and rectification is vital.

Gear Noise During Re-building of Gearboxes

Refer Servicing

OPERATING ADJUSTMENTS

Blade Cut

The 'blade cut' is the distance (along the ground) between successive blade cuts or blade penetrations into the soil. Apart from the position of the trailing boards it is the prime factor in governing the size of clod produced by the Rotavator. Blade cut is controlled by; Rotor RPM, Tractor or working speed and Blade Configuration. [Blade configuration being either; 3 blade (3 x LH plus 3 x RH blades per flange) or 2 blade (2 x LH plus 2 x RH blades per flange)] The blade cut can be calculated from the equations below or the tables below.

$$\text{Blade Cut (cm)} = \frac{\text{Tractor Speed (km/h)} \times 10{,}000}{6 \times \text{Rotor Blade Configuration [2 or 3]} \times \text{Rotor RPM}}$$

$$\text{Blade Cut (inches)} = \frac{\text{Tractor Speed (mph)} \times 1{,}056}{\text{Rotor Blade Configuration [2 or 3]} \times \text{Rotor RPM}}$$

BLADE CUT (cm)

Rotor RPM	Tractor Speed (km/h) 1.5	2	2.5	3	3.5	4	4.5	5
160	5.2	6.9	8.7	10.4	12.2	13.9	NA	NA
180	4.6	6.2	7.7	9.3	10.8	12.3	13.9	NA
200	4.2	5.6	6.9	8.3	9.7	11.1	12.5	13.9
220	3.8	5.1	6.3	7.6	8.8	10.1	11.4	12.6
240	3.5	4.6	5.8	6.9	8.1	9.3	10.4	11.6
260	3.2	4.3	5.3	6.4	7.5	8.5	9.6	10.7
280	3.0	4.0	5.0	6.0	6.9	7.9	8.9	9.9
300	2.8	3.7	4.6	5.6	6.5	7.4	8.3	9.3

BLADE CUT (cm) for 3 BLADE CONFIG.

(For 2 BLADE CONFIG. BLADE CUT IS 1.5 x SHOWN VALUE)

NOTE: Recommended max. blade cut is: 14.7cm (22cm with 2 blade config.).

BLADE CUT (Inches)

Rotor RPM	Tractor Speed (mph) 0.5	1	1.5	2	2.5	3	3.5	4
160	1.1	2.2	3.3	4.4	5.5	N/A	N/A	N/A
180	1.0	2.0	3.0	4.0	5.0	N/A	N/A	N/A
200	0.9	1.8	2.6	3.5	4.4	5.3	N/A	N/A
220	0.8	1.6	2.4	3.2	4.0	4.8	5.6	N/A
240	0.7	1.5	2.2	2.9	3.7	4.4	5.1	N/A
260	0.7	1.4	2.0	2.7	3.4	4.1	4.7	5.4
280	1.3	1.4	2.0	2.7	3.4	4.1	4.7	5.4
300	0.6	1.2	1.8	2.3	2.9	3.5	4.1	4.7

BLADE CUT (inches) for 3 BLADE CONFIG.

(For 2 BLADE CONFIG. BLADE CUT IS 1.5 x SHOWN VALUE)

NOTE: Recommended max. blade cut: 5.8" (8.7" with 2 blade configuration).

Working Speed

Assuming the rotor speed and engine speed are constant, the size of the soil slice can be varied by use of the tractor gears; low speeds will produce a fine tilth, higher speeds will produce a progressively coarser finish.

Travel speeds between 1.5 - 5 km/h are usually used. Higher speeds may be used for shallow scalping passes for weed control and shallow seedbeds in previously broken ground, provided the rotor speed is increased proportionately.

Working Rates

$$\text{Work Rate} = \frac{\text{Width (m)} \times \text{Tractor Speed (km/h)}}{10} \quad \text{(Hectares/h)}$$

$$\text{Work Rate} = \frac{\text{Width (“)} \times \text{Tractor Speed (mph)}}{100} \quad \text{(Acres/hr)}$$

Note: For a 4m or 160” wide machine the work rate in acres per hour is equal to the forward speed in km/hr.

Trailing Boards

Lowered trailing boards produce a finer tilth as clods thrown against the trailing boards are broken up and those retained under the hull are subjected to repeated cuts and re-circulation over the rotor. Additionally, trash is buried and the boards will have a levelling effect.

Raised trailing boards produce a relatively coarse tilth, since the soil cut by the blades is thrown out from under the hull with the larger clods remaining on top. Trash and weed roots are also thrown out and stay on the surface to die. Less power is required to operate with the boards raised allowing the tractor to be driven at higher speeds. There is also less tendency for damp soil to clog the rotor and stick to the underside of the trailing boards.

BLADES

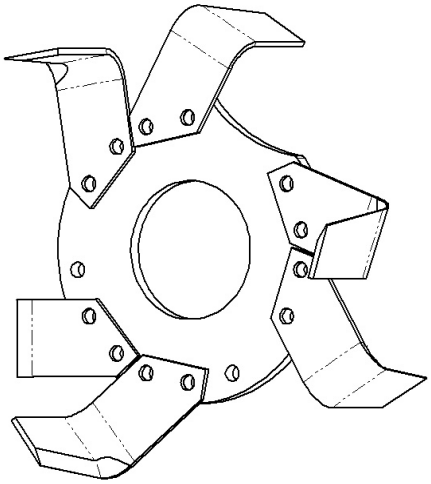
Blade Types

Rotavators are usually supplied with 'power' or 'L' blades for general work.

When working heavy and puggy clay soils, or where clearance of crop residue is a problem, the 'speed' or 'C' blade should be used. This blade has a more efficient self-cleaning action, uses less power and produces a coarser finish than other blades.

The 'long shank' blade, as the name implies, has a longer shank than the standard power blade. This allows greater clearance between blade and rotor. With this, a greater depth of cultivation is obtainable if tractor power and conditions allow.

Blade Configuration

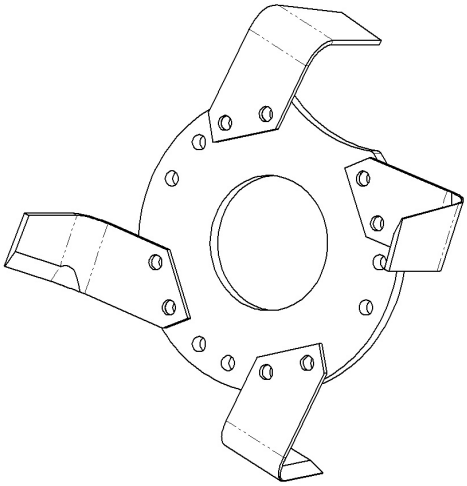


3 Blade Configuration

for ANTI-CLOCKWISE scrolled rotors.

(Reverse LH & RH blades for CLOCKWISE scroll.)

This is the standard blade configuration and has three pairs of blades per flange.



2 Blade Configuration

for ANTI-CLOCKWISE scrolled rotors.

(Reverse LH & RH blades for CLOCKWISE scroll.)

Advantages of the two blade configuration:

- There is less tendency of the rotor to clog in sticky soil conditions.
- The rotor is self-cleaning in heavy crop residues or trash conditions (ie. sugar cane, maize stalks, etc.) and under these conditions it is possible to work a greater depth, thus providing more soil to mix with the residue.
- A 'cloddy' finish is easier to obtain.
- The rotor can be driven at faster RPM.

Blade Fixings

Insert blade bolts from blade side, head against the blade, spring washer and nut against the flange.

Fitting Blades to Dual Rotor Machines

Left Side Rotor. Fit all blades to the Left Hand Side of the flanges except last flange adjacent to the centre bearing - fit blades to the Right Hand Side of the flange**.**

Right Hand Side Rotor. Mirror above.

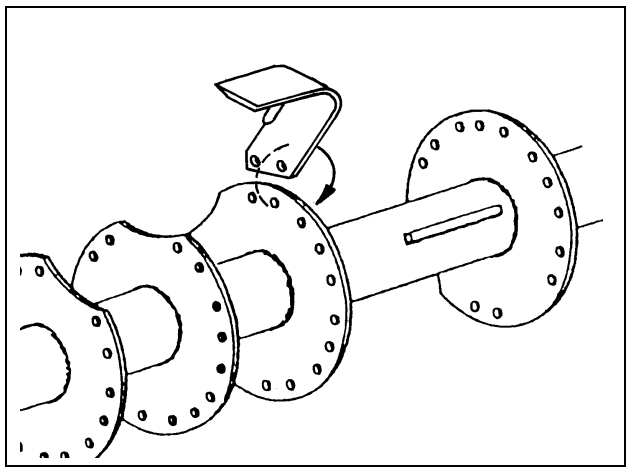
Anticlockwise Scrolled Rotor. Blade flanges as shown in 3 Blade & 2 Blade Configuration Figures. **LH** blade **leads** blade pairs. (Usually LH Side Rotor)

Clockwise Scrolled Rotor. Blade flanges as mirror image of that shown in 3 Blade & 2 Blade Configuration Figures. **RH** blade **leads** blade pairs. (Usually LH Side Rotor)

Rotors with Removable Flanges

When ratooning flanges, slip flanges or removable flanges are removed, swap the LH blades on the left hand side of the uncultivated section to the RH side of the flange as shown in the figure right.

(This is necessary to ensure blades cross over the rotor flange to protect it from wear.)



Maximising Blade Life in Abrasive Soils

To maximise blade life when working in abrasive conditions or soils it is recommended to:

- Keep the rotor RPM as low as possible,
- Work the minimum cultivation depth necessary,
- Use 'Long Shank' blades,
- Work when the soil is moist.

Note:

In extremely abrasive working conditions, rotor flange wear may be reduced by fitting the left hand blades to the right hand side of the flange, however the power required may increase.

MISCELLANEOUS Notes

Corrosion During Storage

In areas of high humidity or tropical areas, atmospheric moisture condensing inside transmissions can cause significant rust damage and oil degradation.

Store machine under cover, away from moisture and sunlight to minimise ambient temperature changes and ingestion of atmospheric moisture.

Store the machine with suitable stable blocks under the park stands and wheels (or roller) such that the rotor can be turned. Periodically (weekly) turn the rotor over slowly by foot to provide a protective oil film on all transmission components.

Temperature Monitoring Kits

Sudden increases in gearbox temperature during working will often indicate imminent failure of gears and/or bearings. (These systems cannot warn of an impending shaft failure however.)

Suitable equipment is available at a reasonable cost to monitor gearbox temperature and warn when an adjustable preset temperature is exceeded.

Although not currently available as a kit, it is readily assembled and once the monitoring gauge and alarm is fitted to the tractor, additional senders/sensors can be fitted to other equipment to enable monitoring of them when used.

Contact Howard Australia for drawing 109 949 for details.

SERVICING NOTES

'During Operation' Servicing

Refer also to Maintenance & Adjustments in the Operators Manual for daily or regular maintenance and servicing intervals. Daily greasing and oil level checks should be accompanied by visual checks for indications of potential problems. Oil leaks or unusually large play in shafts etc. need to be investigated / rectified to prevent any consequential damage.

Initial Oil Service and Oil Change Intervals

Refer to LUBRICATION Section – Oil Change Interval.

Major or Pre-Season Service/Inspection

The Rotavator is typically a critical implement and as such inspection / servicing prior to use is recommended.

Objective - To ensure machine reliability is maximised and to prevent catastrophic failure of any component from causing avoidable consequential damage.

These involve typically draining all oil and removal of inspection covers (and/or sufficient dismantling of the Rotavator) to enable a detailed examination of primarily the transmission components to check for:

- Excessively worn components. For example clutch discs.
- Excessive bearing endfloat (indicating bearing wear).
- Damaged or badly worn gears.

The frequency of major services depends on:

- Application - arduous or light conditions.
- Tractor power - relative to the Rotavators capacity.
- Amount of work per year.
- Reliability required.

Recommendations on service frequency are:

- Low use applications - every 2nd or 3rd year.
- High use applications - yearly or at 500 hour intervals.
  Note: Typically these services are completed in the 'off season' prior to commencing work. As a service history builds up indicating no problems are occurring in a particular application, it is possible to lengthen the service frequency.

The 'Rotavator Pre-Season Checklist' included is suitable to conduct this inspection. It is available as an Excel spreadsheet (and can be edited to suit specific applications) be emailing Engineering@howard-australia.com

Bearing Adjustments

On the larger Rotavators correct bearing adjustment is necessary to ensure that both gears and bearings are positioned correctly to optimise the life of all components.

Before finalizing bearing adjustments, taper roller bearings must have significant axial loads applied and then rotated to ensure inner and outer races are seated fully and the rollers have positioned themselves correctly under load. Axial loads typically required are in the tonnes, making turning of the shafts difficult, consequently torque arms such as socket and handles are necessary. Once seated this initial loading is backed off and the bearings can be adjusted to the required setting.

Bearing end-float measurement must be accomplished by use of a dial gauge and axial forces applied by suitable levers. Pushing the shaft to and fro by hand alone does not provide sufficient force. Use two small pry bars or large screwdrivers positioned to enable axially forcing the shaft 'to and fro' to obtain end-float measurement.

Worn Bearings. The settings given for end-float inside the gearbox are for new bearings, for worn bearings increase indicated end-float by 0.025mm (0.001").

Gear Noise

The best approach is to identify any gear noise problems during the re-assembly process, that is; before the gearbox is fully assembled, fitted to the Rotavator, lubricant added and attached to the tractor.

If the gear mesh feels rough (each tooth engagement can be felt) when turned over by hand, it will generally be noisy in operation. Thus, during re-assembly for each crownwheel and pinion combination:

- Check the mesh for smooth tooth engagement.
- Turn the gear set over as quickly as possible to check for noise. Note:
  Turn the shaft with the larger gear fitted as this gives the maximum speed possible.
  Turn the output shaft in the reverse direction to mesh the working faces of the teeth (noise from the non working side is not important). Often a gear set will be quiet in one direction only.
- Check mesh by blueing teeth.
- Concentrate on bevel gears. From experience, straight cut bevel gears have been the source of gear noise in 95% of cases. [Spur gears are rarely the source of gear noise and cannot be adjusted. If noise is isolated to a spur gear set, the only option available is to replace/swap either or both gears.]
- As an initial guide as to which gear and direction to adjust, bevel gear sets are usually designed to have the back of the teeth flush.