

# SERVICE BULLETIN 59

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## UNIVERSAL DRIVE SHAFTS

Howard supplies the most suitable agricultural universal drive shafts available to connect Howard machines to the tractor. The size and type are selected on the basis of the drive shaft manufacturers' recommendations and take into account the rated power capacity of the relevant implements.

Recently, there has been an increase in drive shaft failures and, in some cases, tractor PTO's. Some owners incorrectly believe that such failures are automatically covered by Howard warranty. They are not. Drive shafts are covered by their manufacturers' warranty, and claims will be submitted to them, or their representatives.

Additionally, specifications on some drive shafts and components have been changed (for example phased spline versions and four grease nipple crosses). While these specifications may be viewed as improvements, Howard is not obliged to retrospectively change all units previously sold to the new specification and the continuance of some of the failures in some cases indicates that this would not always be justified.

Late model, higher-powered tractors may be contributing to these failures, especially if the PTO height increases the drive shaft working angles.

Alternative, higher specified universal drive shafts can be supplied in lieu of the standard drive shaft if requested, and since these generally cost more than the standard drive shaft, there will be an additional charge.

**Note:** Any alternative drive shaft will need to accommodate the existing overload protection device (clutch) supplied by Howard or provide an equivalent that is accepted by Howard.

## Recommendations

Drive shaft set up and maintenance need significant attention to ensure drive shaft life is maximised. These issues have been updated in the latest version of the '**ROTAVATOR NOTES**' booklet (P/N 77121) and have been reproduced here for reference.

## DRIVESHAFT

### Driveshaft Length



**Ensure driveshaft length is correct. If too long (or short) damage to the tractor PTO, universal driveshaft and Rotavator gearbox may occur.**

- Tubular sections. (Tri-lobal, Lemon, Star) Manufacturers' recommendations are that the amount of shaft engaged should equal 1/3 of the cross to cross length when working.
- **Splined Bar.** (Note that the outer or female spline section 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 driveshaft, the best method is to replace the female section (yoke, tube and outer spline welded assembly) with a unit of suitable length from the driveshaft manufacturer. [Covers can be easily cut or replaced as required.]
  - Shortening or lengthening of splined bar driveshafts 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** (ie 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 & 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.]
- Note however that if one cross angle can be limited to a maximum of 9° it is allowable that the other cross angle can vary from 0 - 9°.

### Driveshaft Working Angle



**Ensure driveshaft angles, especially when lifted, do not exceed the capacity of yokes as this will cause severe damage. Limit lift if necessary.**

- Driveshaft ratings given by manufacturers are typically for working angles of 10°. Working angles over 17.5° should be avoided if possible on high power applications such as on HR41 and bigger Rotavators. Optimum universal cross life is achieved at 5°.

- As working angles increase, driveshaft life or power capacity drop. [NOTE: Driveshaft universal cross life reduces by approximately half for every 5° increase in working angle.]
- On smaller machines subjected to high power, arduous conditions and high driveshaft working angles it is possible to fit a bigger driveshaft if universal cross life is low.
- The Series 12 Bypy driveshaft on the HR60 is the largest readily available agricultural shaft. To maximise universal cross life focus on reducing the working angle of the driveshaft by:
  - Working the Rotavator to the minimum depth of cultivation required.
  - Moving the Rotavator rearwards by using it behind a front mounted ripper. [These will also reduce the power required by the Rotavator, thus additionally improving universal cross life.]
  - 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 so the Rotavator and wheels, or roller, just clear the ground. This prevents the tractor PTO and gearbox input shafts losing their parallel alignment.
- 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.




**HR60: Grease universal crosses every 4 hours.**

- 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.] Continued overleaf.


- On HR60 / Series 12 shafts: If the life of the universal is poor due to high horse power and working angles over 10°, recommendations are that the main grease gallery in the universal cross be plugged such that each cap is greased individually. This ensures that each cap receives new grease and contaminated grease is purged from that cap. It also prevents any dirt ingested into any one cap, (or worn metal particles) from cross contaminating other caps. [Plug material 10.1-10.2mm nylon rod - selected stock - cut and press in 4 x 20mm long per cross]
- 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
  - Castrol: APXT
  - TRU-BLU: U.H.T. E.P. Grease
  - Shell: Retinax HD2.

**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.

**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.**

- A 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. Note that the outer tube should also be plugged with something like foam plastic to filter/protect from dust entry into tube from the cross end.
- 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.