

Hydra

HUGH TILLEY on how to get the best from your system

Hydraulics are a very flexible means of transmitting power and one which is being used increasingly on golf course machinery.

From the original concept by Harry Ferguson, hydraulics have developed from tractor implement lift to driving and controlling all manner of machinery, and these uses are constantly being expanded and refined. In particular a growing number of machines, such as self-propelled mowers, have hydrostatic drive for its flexibility and manoeuvrability, however the advantages of this drive are gained with a loss of efficiency and 'feel,' though this is seldom a problem unless engine power and tractive power are critical – as they could be on slopes, towing trailers or ground driven (trailed) gang mowers. For most tractor users the conventional clutch and gearbox is still the most efficient means of power transmission, and this only needs serious questioning if the main use is for high manoeuvrability work such as loader work – where the torque converter is well proven. For mowers and (perhaps) turf maintenance vehicles, hydrostatic drive is normally ideal, although not all operators like it because it is not 'positive.'

Many users remain woefully ignorant about how to get the best from their systems, nor do machinery suppliers always know the best ways of fitting and operating their machines on all tractors. This ignorance is liable to mean below optimum output, inefficient operation and may even lead to injury or damage to man or machine, nor should the maintenance requirements be ignored.

To many greenkeepers 'maintenance' means simply checking the oil level, this is a minimum requirement and regular inspections should be made of pipes and fittings to ensure that they are in good order. A common problem is chafing damage because fastenings or protective covers have been lost, – hot oil at well over 2500 psi is a very potent force. With hydraulics, cleanliness is certainly next to godliness and those who ignore it risk expensive problems for the future. In daily terms 'clean' means not adding oil from a can or jug which is covered in dust, dirt or water, replacing dust covers and wiping hose connectors clean

before connecting them. Damage caused by the ingress of dirt and water can be very expensive – even if it does not stop the machine it is likely to cause a dramatic loss of efficiency. Most manufacturers fit an efficient filtration system, but don't overload it and always service (that normally means *replace*) the filter as per the manual. Diagnosis and repair beyond simple replacement usually means calling in a specialist dealer.

Most tractors use a multi-purpose oil drawn from the back axle, whereas mowers and 'closed' hydraulic systems, including some tractor steering systems, normally use special hydraulic grade oil, thus it is usually necessary to keep more than one grade of oil in the shed, – ensure that everyone knows which is for what! Change intervals for hydraulic oils are infrequent – thus they are often forgotten. Hydraulic oil is not good for turf, leaks are often caused by damaged washers or 'O' rings – these are cheap and mostly easy to replace.

Tractor Hydraulic Systems

To many greenkeepers operating an implement on the rear linkage is simply a matter of attaching it and operating the lever. However most tractors over 45hp provide two control modes – 'position' and 'draft.' With position control the links are positioned in direct relationship to the position of the lever in a quadrant, while draft control is designed for ploughing or cultivating and thus is seldom required on the golf course – though in theory they could work with slitters. Older David Brown and Massey Ferguson tractors have another mode (TCU or pressure control) which gives a 'semi-float' option providing a constant but adjustable lift force – this can be very useful in suitable circumstances. Newer tractors may have a 'mix' facility to allow position and draft modes to be intermixed, – for golf course work set it to 'position' and forget it – unless operating a plough or cultivator! Any tractor with a position quadrant should have adjustable 'stops' which can be set to limit or lock the lever – they are useful and a safety measure so keep them functional. Electronic control is coming to progressively smaller tractors – this gives fingertip control

with a dial to set height and a simple switch for up and down – it is very positive, accurate, simple and strongly to be recommended.

Compact tractors may have a similar position control system with the lever operating in a quadrant, but some have a simple spool valve, which means you have to hold the lever in lift or lower position until the links have reached the height required, thus chains or stays are necessary to ensure that the implement cannot be dropped too low (or raised too high) by accident. Draft control may be factory fitted or available as an option should it be needed.

Spool valves

Today's tractor is expected to operate or control a multitude of machines using its external hydraulics, these include simply tipping a trailer, driving the spreading mechanism of a topdresser or operating gang mowers. These external services are normally controlled from a spool valve or valves with quick release couplings fitted at the back of the tractor, although it is often possible to plumb into the lift linkage system, – with older tractors this may be the only way to do it.

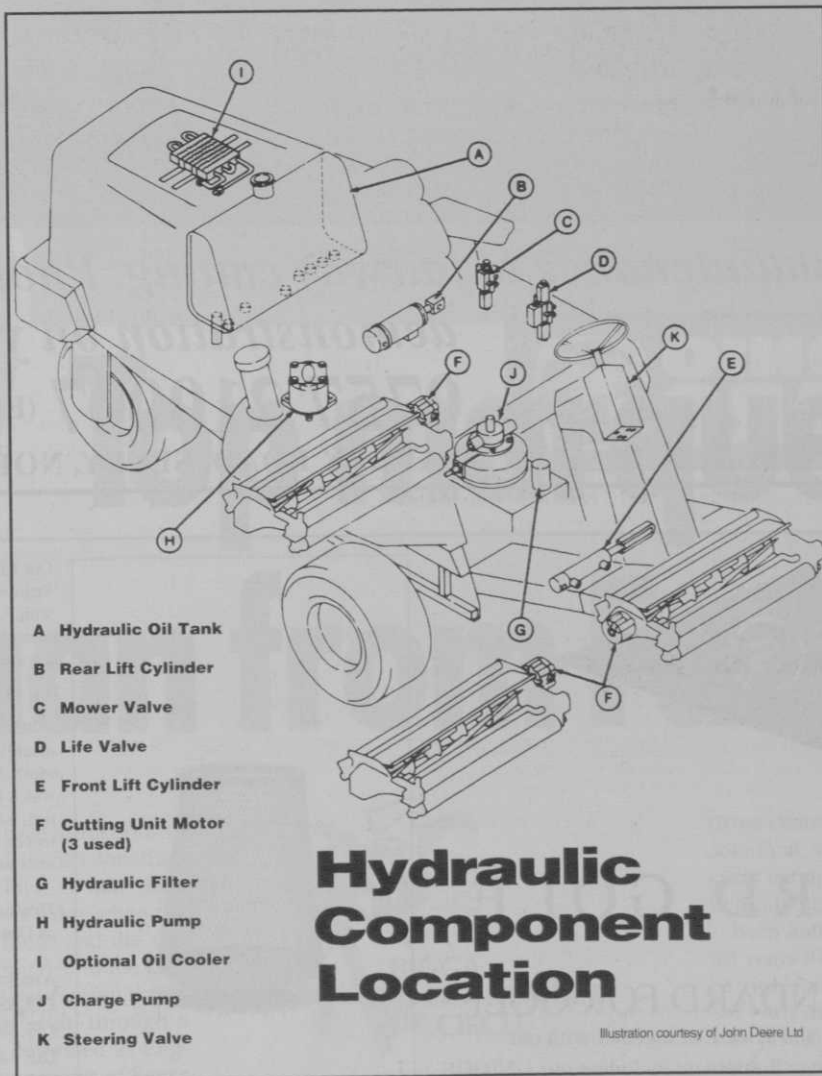
The spool valve is simply a device to control oil flow, most tractors have at least one as standard with the option to fit more in a bank. Quick release (push fit) couplings have become standard, these are faster, cleaner and safer than screw type (Dowty) connectors. Modern practice in fitting should ensure that they pull out easily and safely if the operator drives off without disconnecting – as is inevitable sooner or later.

Common spool valves are anything but common and they come with a bewildering variety of features such as float position, kick-out, motor detent and zero leak – or without if you don't specify them. Most valves can be used for both single and double acting rams (a double acting ram is powered both ways – out and in), however it should be possible to lock them so that they only work one way, this means that the single hydraulic pipe has to be connected to the correct coupling. The 'float' ability is useful for a loader, however it is also useful for any other situation where the ram/s

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need to be free to move while the machine works, such as with some sweepers and mowers where height control wheels take the implement weight. A zero leak spool is required where the hydraulic service needs to be 'locked' without 'creeping,' (with pressure in the ram) during work, although standard valves are seldom a problem. If it is a problem the first option is to replace the spool's 'O' rings, and if this does not cure the problem look at the seals in the ram before considering replacement - either may be worn or scored. A kick-out spool valve allows the operator to move the lever to its extreme and leave it, knowing that when the oil pressure builds up as the ram is stopped the lever will 'kick-out,' this is useful in situations such as lifting and lowering trailed gang mowers, as the operator can then concentrate on turning. The kick-out should be adjustable and can be disabled for other operations. A motor detent valve is specifically for hydraulic motors, it holds the spool open for a constant flow but it must not block the return flow when returned to the middle

(neutral) position. Ideally it should be capable of being set so that the motor cannot be inadvertently reversed, - with some motors, stopping the return flow abruptly and/or reversing them will blow the seals. The common alternative of using a piece of string to hold the lever is potentially dangerous as it may be impossible to stop the oil flow quickly in an emergency, this similarly applies to the locks, catches or pins sometimes fitted as a 'kit.' In older tractors with only single acting valves - or those which use the linkage lift hydraulic circuit for driving a hydraulic motor it may be essential to install a separate return pipe to the tractor - some tractors have a special port for this, others may need a special arrangement such as drilling into the oil filler.



Hydraulic Component Location

Illustration courtesy of John Deere Ltd

Controls

Common problems with spool valves are that there may not be enough of them or they are in the wrong place - this is often the case with loaders. Answers from loader manufacturers vary but most use a separate spool valve block. There is a safety requirement to keep all high pressure hydraulic pipes away from the operator, i.e. outside the cab - this may mean longer levers or even Bowden cables, both of which are prone to problems and generally lack precision. Up market loaders are likely to use electro-hydraulic controls, which have the advantages of fingertip actuation and simple flexible fitting, further they can combine up to three actions in a single lever, the third action, for instance the clam of a 4 in 1 bucket, being operated by a rocker switch on top of the

lever. A relatively simple answer to not having enough spool valves, suitable mainly for single acting and infrequently used services, is to use a diverter valve, these are available for manual or electric actuation. Electric actuation is gaining in popularity, particularly for mowers, as it allows the designer flexibility to optimise his pipework, thereby reducing the risks of damage and leaks, it also lends itself to tidy control consoles and automatic operation. For most operations a simple on/off or up/down actuation is all that is required, however for some operations - like loader or hedgecutting operations - it is best if the operator has lever control with proportional control so that he has a graduated response. Flow adjustment may be built into the spool valve, into the tractor hydraulic system or into the hydraulic circuit itself. If an implement drops too fast or raises too slowly the first consideration should be to see if there is an adjustment. Occasionally a restrictor is fitted into the circuit, often a disc with a small hole, this may not be the correct size for the machine, tractor or oil grade, however it is easily replaced. Remember that oil

is thinner when hot.

Other users

While tractors were the prime users of hydraulics, on today's golf course the most intensive user of the principles are inevitably ride-on mowers, particularly greens triples, however these are purpose built and self contained thus it can be assumed that the hydraulics are 'right,' - nevertheless no less care, cleanliness and maintenance is required, especially when all power transmission and control is hydraulic. Many turf maintenance vehicles also provide a hydraulic service and rudimentary lift linkages, one model is also hydrostatically driven, however it is electronically controlled to give it constant speed.