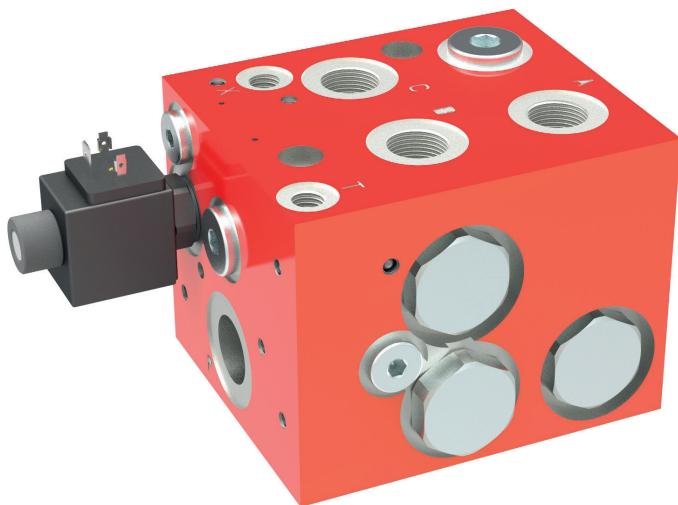


Technical article

# No Matter How Rough the Terrain

## High planning certainty and energy efficiency with differential lock valves from Bucher Hydraulics

Terrain that makes for difficult driving, such as steep inclines, icy road surfaces or soft ground, is always a challenge for self-propelled and towed machines. The innovative differential lock valves from Bucher Hydraulics overcome these problems thanks to Power on Demand, so the machines always work reliably, guaranteeing a high degree of certainty in task-planning. In normal driving conditions, when the differential lock function is not required, the valve is not activated and the entire power is available to the drive. This increases the efficiency by a significant amount. The differential lock valves are suitable for all standard motors and can be individually configured to meet the requirements of each application.

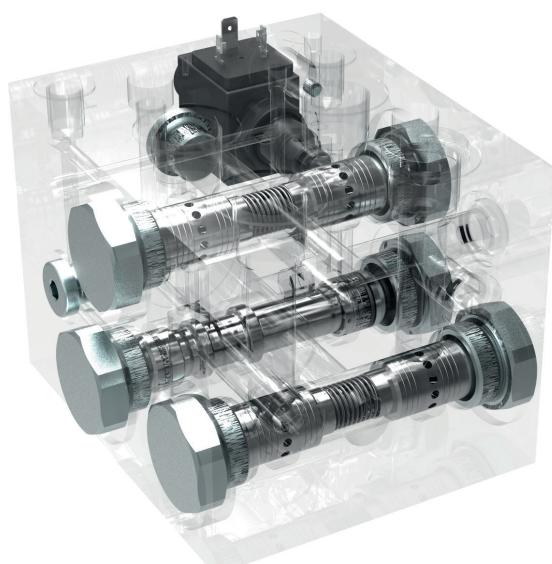


Triple differential lock valve MT08DVD

The rugged and reliable MT..DV series differential lock valves from Bucher Hydraulics are marked out above all by their energy efficiency over the whole flow range.

Machines have to be ready to work at any time and in spite of any obstacles, and they must be energy efficient as well. Nevertheless, some operating circumstances or surrounding conditions impose constraints in this area and often necessitate costly and time-consuming measures. Examples still commonplace today are the redeployment or transfer of construction vehicles to new job sites, restrictions on ride-on mowers due to steep gradients, or harvesters that in the worst case simply have to wait for dry periods and thus compromise the schedule for the entire logistics chain. For everyday situations such as these, differential lock valves from Bucher Hydraulics are an interesting and future-proof solution that is based on a proven design.

Basically, differential lock valves ensure that force is distributed to the individual wheels or axles of a vehicle to suit the prevailing situation. For example, to prevent a wheel from slipping or spinning on ice, snow or muddy ground, its oil supply must be reduced by reallocating it among the other wheels. This hydrostatic-drive principle is by no means new, but the continuous developments by Bucher Hydraulics clearly show the additional benefits that the differential lock valves from Klettgau can already offer, so they are having a decisive influence on the ride comfort as well as the traction, operational readiness and safety of machinery.



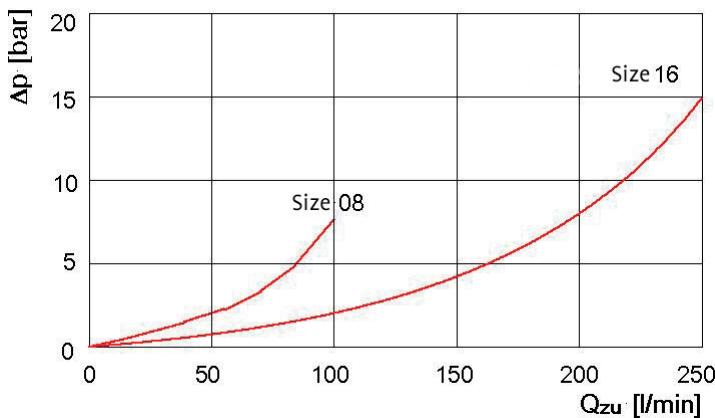
Triple differential lock valve MT08DVD

Bucher Hydraulics supplies the MT..DV series of differential lock valves in various standard models as well as in customized versions.

### Power on Demand, focusing on overall performance

The main components of a differential lock valve are a double-acting flow divider that can both combine as well as divide flows, and a control spool that enables the flow divider to be bypassed when it is not needed. When the differential lock valve is switched off, the oil flow can apportion itself among the motors in the vehicle without any restrictions. In the case of the Bucher valves, the total power is available to the drive when the valve is not activated.

This is made possible by the detailed design, which features large cross sections and optimized flow channels in the valve block, yielding a lower delta P. In plain language: the oil gets to its destination faster thanks to lower resistance, and the vehicle saves energy when it is being driven if the valve is not activated. This means that a size 08 differential lock valve handling 50 l/min [13.2 gpm] would need only 2.5 bar [36 psi] when not activated and barely 10 bar [145 psi] when activated (see graph). This smart flow division results in such low pressure losses that the total power for the travel drive is hardly affected.



The smart flow division results in such low pressure losses that the total power for the travel drive is hardly affected. As the graph shows, a size 08 differential lock valve handling 50 l/min [13.2 gpm] would need only 2.5 bar [36 psi] when not activated, and for the same flow rate the figure for the size 16 valve is even lower.

### Off-road and steep hills? No problem

This high efficiency level of the Bucher valve is the vital foundation for tests with aerial work access platforms that were successfully conducted. Equipped with a Bucher Hydraulics differential lock valve, an aerial work platform coped with a 45° slope. No road in the world is that steep. However, thanks to the use of these differential lock valves, aerial work platforms as well as compaction rollers and other construction site vehicles can now drive up ramps onto a truck under their own power, to then be taken to the next job site.

Even with ride-on and golf course mowers, the ability to cope smoothly with major height differences can be decisive when municipalities are choosing off-road vehicles for hilly parkland, or when golf courses must look well maintained in all weathers. In these cases, the differential lock valve proves itself with three motors: both front wheels are completely locked with respect to each other and to the rigid rear axle, a situation which – depending on the weight distribution of the machine – can of course also be implemented the other way around.

### Predictable planning in the field 24/7

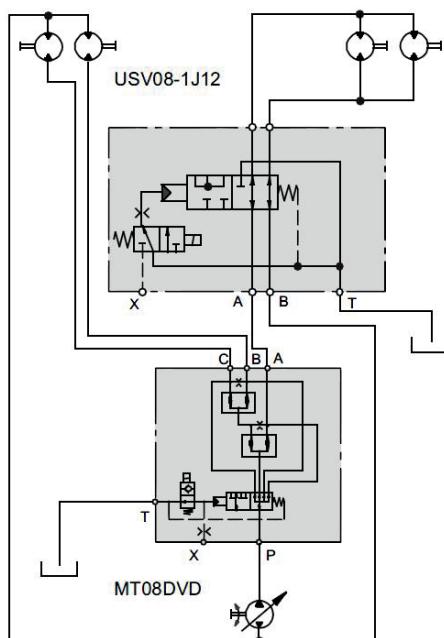
The efficiency of the differential lock valves is evident not only in self-propelled machines but also in towed ones such as potato harvesters. In this case, an integral auxiliary drive with differential lock valve ensures that maximum traction is achieved even in very soft, muddy ground conditions, and the towing vehicle is helped by an additional 'push'.

This on-demand power reserve based on the differential lock valves gives a significant advantage: the total harvest time can be fully utilized even with the sudden onset of adverse weather and ground conditions. The harvest is therefore completely feasible regardless of obstacles, so the end user does not have to make any costly changes with regard to the deployment of employees or the overall logistics chain for the harvested crop. Here, the differential lock valve enables working hours to be predicted at all times, a feature that has already proven itself with similarly equipped trailers for forestry machines.

### Faster road speed instead of expensive transport

The whole concept of differential lock valves is directed towards the increasing demands of users, particularly in terms of cost reduction and efficiency improvement. This is also reflected in a new changeover valve, which Bucher Hydraulics offers in addition to the differential lock valve and which is focused on speed. When vehicles such as road sweepers have to be relocated from one job site to the next, the time required is usually twice as expensive: the vehicle is non-productive during the period, and it requires costly transport.

Incorporating a differential lock valve with changeover valve, model USV08 (size 08) or USV16 (size 16), now makes it possible to achieve all the drive variants: in difficult road conditions the lock is activated, while for relocation the lock is deactivated and fast-speed mode is engaged – and all at the touch of a button. During normal driving the oil flow is distributed equally between the two axles, but the changeover valve causes the entire flow to be fed to just one axle, while the second axle simply free-wheels. This means that maximum speed can be achieved, and the sweeper can travel to the next job site under its own power. In addition to road sweepers, the changeover valve can be used on all mobile machines.



Drive circuit with MTDVD and changeover valve, for example in road sweepers

Incorporating a differential lock valve with changeover valve, model USV08 (size 08), makes it possible to achieve all the drive variants: in difficult road conditions the lock is activated, while for rapid machine relocation the valve is deactivated and fast-speed mode is engaged – and all at the touch of a button.



### Rugged and reliable

Using their extensive product and application knowledge, the valve specialists at Bucher Hydraulics developed the MT..DV series in nominal sizes 08 and 16. With ratings of 100 or 250 l/min [26.4 or 66 gpm], the maximum flow rates correspond to those of the well-known high-pressure flow divider valves; the same also applies to the working pressure of 420 bar [6000 psi]. Above this rating, and after discussion and depending on the operating conditions, peak pressures of up to 520 bar [7500 psi] may be acceptable. A customized version of the valve demonstrated this capability when used in a field sprayer. The application required an operating pressure of 420 bar [6000 psi] over long periods and peak pressures of 520 bar [7500 psi] for short periods.

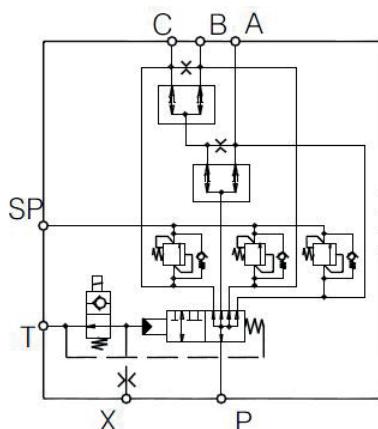
Related to the number of driving motors used in the application, Bucher Hydraulics offers models for two, three and four motors. The dual model (MT..DV) typically locks the front and rear axles relative to each other. The version for three motors (MT..DVD) can completely lock two individual wheels and one axle. Telescopic work access platforms, combine harvesters, graders and forwarders are ideally suited for applying the 4-gang lock valve (MT..DVV), which can lock each wheel individually and therefore both axles as well.

### Numerous options and customized models

Responding to market requirements, Bucher Hydraulics also offers a low-cost differential lock valve (MTDA..HD). In these double-acting flow divider valves, the flow is permanently routed through the flow divider. The low-cost solution is particularly suitable when the ability to switch between travel mode and locked-differential mode is not needed.

With all variants, other functions can be directly integrated to ensure optimum matching with the particular application. These include incorporating the changeover valve mentioned earlier, on/off valves for releasing the brakes, and shock/make-up valves to protect the motor when an external force is suddenly applied to the wheels (for example, by the edge of curb stones).

Characteristic of all versions is the simple, robust and therefore reliable design that requires no maintenance. This lowers costs and at the same time increases machine availability. This is the route to achieving accurate results without the use of costly electronics. Users can apply the differential lock valves with all popular motors. In addition, the valves can be supplied with the usual electrical connectors for this type of application. These feature ingress protection up to class IP68, so high-pressure cleaning of the vehicles is not a problem.



Symbol for MTDVD with make-up valves

To ensure optimum matching with the particular application, other functions can be integrated directly into the differential lock valve. If a hydraulic motor might experience under-supply, users can specify the differential lock with make-up valves.



Application: telescopic work access platform

Self-propelled telescopic work access platforms have to demonstrate their versatility and maneuverability in outdoor use every day. They are an ideal case for using the 4-gang differential lock valve (MT..DVV), which can lock each wheel individually and therefore both axles as well.



Application: self-propelled harvester

Differential lock valves that can be activated when necessary prove their great effectiveness in both self-propelled harvesters as well as in towed machines. Regardless of bad weather and poor ground conditions, it is always possible to calculate and plan work assignments with a high degree of certainty.



Application: logging trailer

When the differential lock valve in a logging trailer is activated, the hydraulic motors are compelled to operate in parallel, and they are supplied with a constant, load-independent flow of oil. This prevents individual wheels from slipping and spinning on difficult-to-negotiate forest floors, and thus enables the machine to work efficiently and with the minimum of damage to the ground.

**Contact for reader enquiries:**

Bucher Hydraulics GmbH  
D-79771 Klettgau  
[Info.kl@bucherhydraulics.com](mailto:Info.kl@bucherhydraulics.com)  
[www.bucherhydraulics.com](http://www.bucherhydraulics.com)

**Contact for editors:**

Norbert Menden  
Sales Product Promotion  
Tel.: +49 (0)7742 85 21 78  
Fax: +49(0)7742 85 24 178  
E-Mail: [norbert.menden@bucherhydraulics.com](mailto:norbert.menden@bucherhydraulics.com)

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