

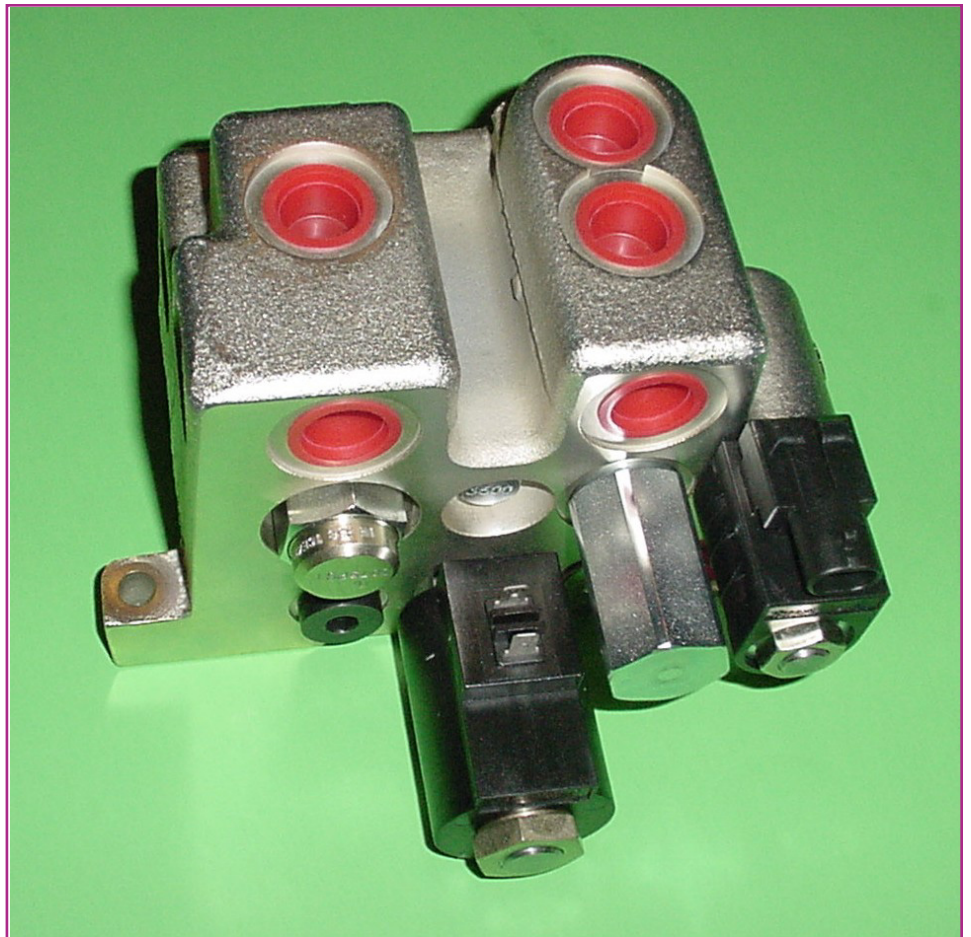


Delta Power Company

INTRODUCES

BI-DIRECTIONAL SELF-LEVELING Valves
that really WORK!

On the
level



BDSL

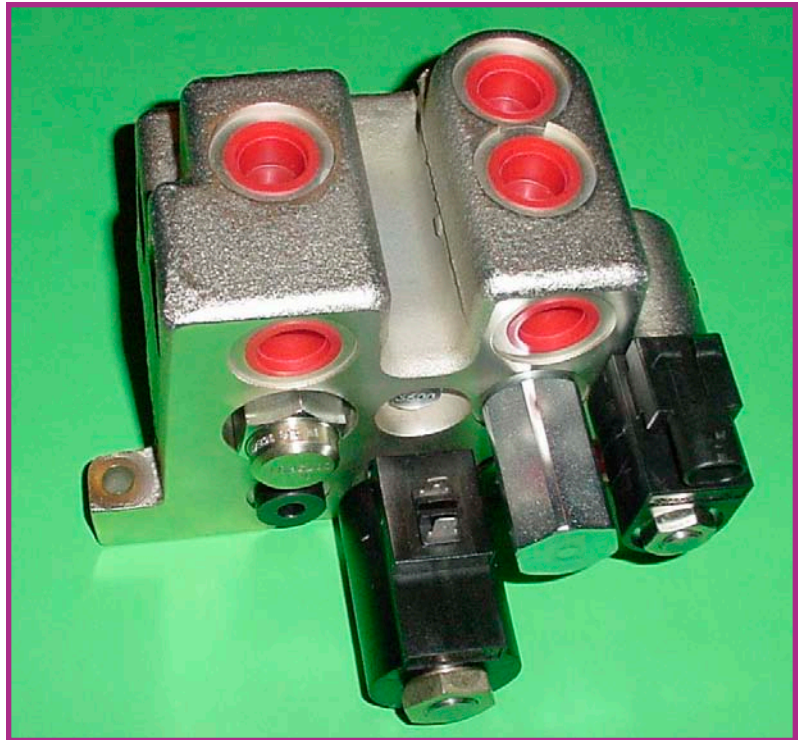
and

BDSL-PLUS

On the level

Automatically keeping loads level during both the raise and lower cycles provides optimum productivity and enhanced safety

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Manufacturers of various types of loaders have for years been seeking a reliable and economical attachment self-leveling system that would operate in both directions (raise and lower). While directional leveling has been available with the raise function, it has not satisfied the real needs. More and more vehicles are being used in rental fleets and by less experienced operators. That makes self-leveling in both directions a very desirable feature, as it improves Productivity and reduces the risks of operator errors. Premature dumping of loads and/or pallet drop can cause unnecessary work and delays on the job site, and can also be a safety concern. For this reason, vehicle manufacturers of these types of machines have been using either mechanical or single-directional hydraulic leveling.

Mechanical self-leveling systems, while very accurate, have inherent problems. They reduce operator visibility because of the structure, are very costly, and have a high incidence of failure. Failures on the mechanical type of systems are caused because the cylinders are often forced to cavitate to achieve the leveling functions. This creates voids

in the cylinders and if external forces are applied, such as an obstruction in the work medium, the mechanical forces are sent to the structure rather than using the cushioning effect of hydraulics.

Single-direction hydraulic leveling systems have been used for many years. While they work well and are less costly than mechanical systems, they have severe shortcomings in functionality. The inability of these systems to keep the load level during lowering functions causes the operator to have to intervene with the controls and only very experienced operators can do this effectively.

Delta Power Company has solved these problems. During five years of development and exhaustive field testing it has developed two bi-directional self-leveling hydraulic systems that meet the needs of the industry. These patented systems - the BDSL and BDSL-PLUS are self-contained, very cost-effective, work in almost every type of hydraulic system below 30 gallons/minute (115 litres/minute), and unlike some of the systems that have been marketed by others, they really work!

The unique circuit design and internal functions of the components make the BDSL and BDSL-PLUS the only choice available for an economic, trouble-free bi-directional self-leveling system. The systems are in production and ready for your applications. They have been fitted to many vehicles, including those of manufacturers such as CNH, AGCO and Fendt. Ongoing development is underway for even higher-flow systems.

The BDSL and BDSL-PLUS are intended for automatic leveling functions on machinery such as skid-steer loaders, tractor loaders, fork attachments, etc. These systems are designed to keep the tilt at a fixed angle with respect to the ground as the lift arm is raised and lowered. Automatic leveling eliminates the need for input from the operator. The circuit design also allows the operator to override leveling at any time.

System description

The BDSL valves (see back page) can consist of the following components depending on individual system needs and desired options:

- Flow/divider/combiner - this provides a predetermined flow split between the boom and tilt cylinders in both the raise and lower modes.
- Counterbalance valve - this prevents tilt over running conditions in both leveling and independent multi-function operations.
- P.O. checks - These are used for maintaining tilt position.
- Drop modulator - this controls leveling down. This is required on open-center systems and is optional on closed-center systems.
- Four-way, two position solenoid valve - this is activated when independent operation of the boom and attachment is required, and also in 'float' mode.
- Relief valves - These are used for tilt rod protection, anti-cavitation, and craning.

Principals of operation

The BDSL valve is intended to provide automatic leveling of machine attachments, such as bucket, pallet forks, augers, etc., while raising and lowering.

The standard BDSL system is designed for implementation predominately on applications with closed-center LS hydraulic systems.

The BDSL-PLUS version can be used in both open-center and closed-center circuits.

Raise/leveling

When raising, the boom spool of the control valve is shifted and the base of the boom cylinder(s) is pressurized and in motion, oil from the rod end, enters the common port of the flow/divider/combiner. The flow/divider split is set to a predetermined value and sends only the required portion of oil to the base end of the tilt cylinder(s). This initiates the tilt-lower function and, combined with continuous boom lift, provides precision leveling.

To provide stability and prevent a tilt overrunning condition, exhaust oil from the rod end of the attachment cylinder(s) is controlled by a counterbalance valve. The return oil from the rod end is combined with the flow/divider's excess oil and directed toward the return port of the control valve.

Lower/leveling

When lowering, the boom spool of the control valve is shifted in the opposite direction, which allows pressurized oil to enter the flow/divider/combiner and the tilt cylinder(s) rod end. The flow/divider/combiner split sends only the required amount of oil to the rod end of the tilt cylinder(s), which initiates a roll-back motion. Exhaust oil from the base end of the tilt cylinder(s) is directed toward the other leg of the flow/divider/combiner, which works in the combining mode. This combined volume is directed from the common port of the flow/divider/combiner to the rod end of the boom cylinder(s). The base end of the boom cylinder(s) is connected to the return port of the control valve or the drop modulator valve. This function provides precision leveling in the lowering mode. The counterbalance valve is bypassed via the free-flow, built-in check valve.

'Float' mode

For a 'float' operation the boom spool of the control valve is shifted to 'float' position, which allows both chambers of the boom cylinder(s) to communicate with the hydraulic return line. The base end of the boom cylinder(s) is connected directly to the control valve and the rod end is connected via the energized four-way, and two-way solenoid valves.

Multi-function operation

When multi-function control of the boom and tilt cylinder(s) is required, the four-way, two-position valve is energized, disabling the leveling mode.

Guidelines for BDSL system selection

Typical applications for BDSL systems are skid-steer loaders and tractor loaders. Traditionally, skid-steer loaders are equipped with a series directional control valve and tractor loaders with parallel directional control valves. Delta's BDSL systems work well with either type of hydraulic valve. Also, some of the hydraulic systems are open center and others are closed-center load sensing. The BDSL systems include provisions and solutions for both hydraulic systems and a variety of variations within either one.

The main decision in selecting whether to use the BDSL or BDSL-PLUS is as follows:

The BDSL system consists of three main components: a flow/divider/combiner, a four-way, two-position solenoid valve and a counterbalance valve. This system performs well in closed-center load-sensing hydraulic systems with either series or parallel control valves. Much more universal is the BDSL-PLUS system that can be used in both open-center and closed-center hydraulic circuits providing that the drop modulator is used. This will create back-pressure in the system, which is used to activate the tilt cylinder in lowering mode. This means that the leveling system does not have to rely on specific characteristics of the loader valve. The advantage of this system is that it can be applied to any type of hydraulic system without the requirement for control valve modifications - simply pick the desired features and you are "On the Level".

