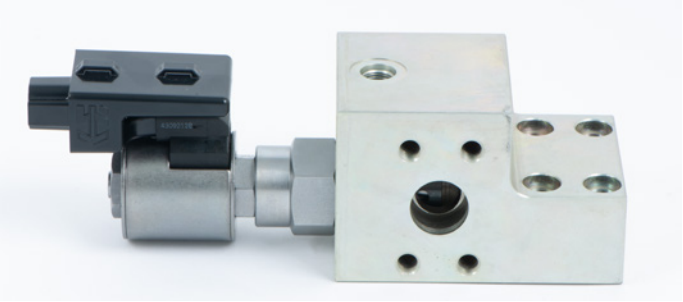
EHBL Digital Boom Control Protects from Hose/Hydraulic Failure

Overview

Excavators are used daily on construction sites to dig and move large quantities of earth. They also get used for lifting tasks such as moving concrete pipe into a freshly excavated trench. During these lifting operations, special safety concerns arise for workers in the area. There is a safety standard (ISO 8643 - 2017) that recommends excavators use a lowering control device to protect workers against uncontrolled lowering due to hydraulic system or line failure. This standard defines the necessary performance for the system and a testing regime to verify compliance.

Motion control for excavator and other types of boom arms is typically provided by the use of a counterbalance valve attached directly to the hydraulic cylinder. Counterbalance valves are able to hold a load when the cylinder is not moving, but can open and meter out when pressure rises in the opposite end of the cylinder. This requires a pressure difference across the piston and valves are available in different pilot ratios to match the desired performance of the system. This also allows control of overrunning loads when pressure in the opposite end of the cylinder drops.

As the industry moves away from hydraulically piloted controls in favor of electrohydraulic control, there is a need to replace hydraulically piloted boom lock valves. This presents an opportunity to improve efficiency and save energy. That is why HydraForce has developed the new EHBL Electro-Hydraulic Boom Lock valve.



HydraForce EHBL

The HydraForce EHBL takes a unique approach to this problem employing an electroproportional pressure relief valve for boom lowering, and a rod-side pressure sensor (similar to the pilot line used with counterbalance valves) to determine downward force. This configuration offers a variable ratio to maintain stability. Counterbalance valves operate on a fixed ratio.

Sometimes used instead of counterbalance valves, hydraulically piloted boom lock valves control the stroke of the poppet using pilot pressure from the control lever in the cab. This arrangement requires the operator to move the lever to neutral to stop the boom from falling. Using the HydraForce EHBL, this is not required thereby greatly improving the efficiency of the typical dig-and-dump cycle.

EHBL varies both pilot ratio and relief pressure dynamically throughout the operating cycle. This results in lower pressure drop when compared to counterbalance valves or hydraulically piloted boom lock valves. Testing has demonstrated these valuable advantages:

- No boom drift
- Improved operator feel
- Reduced pressure drop:
  - Lowering: 4 second period at 155 lpm (41 gpm) yields 12 bar (175 psi) compared to 22 bar (325 psi) with traditional boom lock valve.
  - Regen lowering: 2 second period at 310 lpm (82 gpm) yields 14.5 bar (210 psi) compared to 51.7 bar (750 psi) with traditional boom lock valve.
- Assuming a 20 second operation continuously over an 8 hour workday: 2.4% fuel savings (depending on operation).
- Meets ISO 8643 hose-burst testing requirements

For detailed information and specifications, visit www.hydraforce.com or contact your local HydraForce representative at www.hydraforce.com/distribs/world.htm

HydraForce Inc
500 Barclay Blvd.
Lincolnshire, IL 60069
Phone: +1 847 793 2300
Fax: +1 847 793 0086
Email: sales-us@hydraforce.com
Member: National Fluid Power Assoc.
ISO 9001

HydraForce Hydraulics Ltd
Advanced Manufacturing Hub
250 Aston Hall Road
Birmingham B6 7FE United Kingdom
Phone: +44 121 333 1800
Fax: +44 121 333 1810
Email: sales-uk@hydraforce.com
Member: British Fluid Power Association and Verband Deutscher Maschinen - und Anlagenbau e.V. (VDMA)
ISO 9001 & ISO 14001

HydraForce Hydraulics Systems (Changzhou) Co., Ltd
388 W. Huanghe Road, Building 15A
GDH Changzhou Airport Indl Park
Xinbei District
Changzhou, China 213022
Phone: +86 519 6988 1200
Fax: +86 519 6988 1205
Email: Vincentz@hydraforce.com
ISO 9001

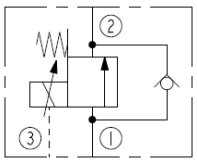
HydraForce Hydraulics Ltda
Av. Laurita Ortega Mari,
499 Taboao da Serra
São Paulo, 06766-360 Brazil
Phone: +55 (11) 4786-4555
Fax: +55 (11) 4786-2050
Central@hydraforce.com

Ratings and Specifications

Description

EHBL is a proportional pressure relief with reverse check valve. It is factory assembled valve and body unit. The regulated pressure is inversely proportional to the electrical current input.

Symbol



Operation

EHBL blocks flow from port 1 to port 2 until the pressure at port 1 is sufficient to overcome the balance between the mechanical preset and electromagnetically variable forces. From port 2 to port 1, a reverse check valve permits flow. Port 3 is drain.

Typical configuration is cylinder base at port 1 and port 2 connected to inlet. EHBL setting at 0 amp should be 15% higher than system pressure, permitting flow from 1 to 2 only when current is applied. In the event of a hose burst, current must be immediately reduced to zero to close valve.

Ratings

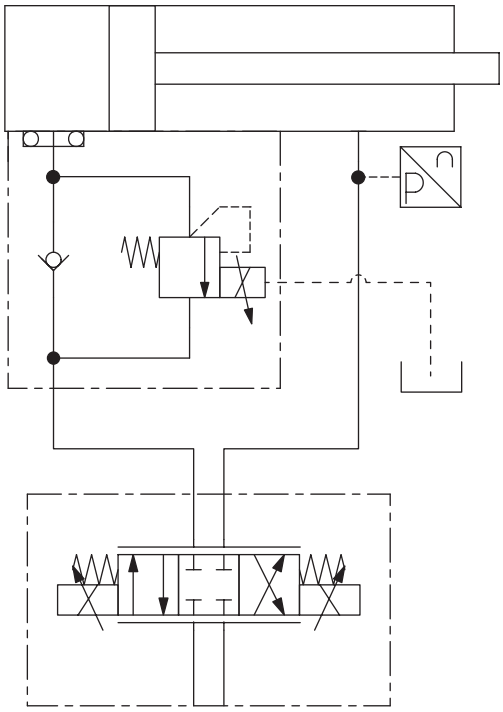
- Pressure rating: 450 bar (6500 psi) at port 1
414 bar (6000 psi) at port 2
103 bar (1500 psi) at port 3
- Crack pressure: 450 bar (3500 psi) at zero current
- Flow rating: 322 lpm (85 gpm) 3/4 in port
454 lpm (120 gpm) 1 in port
- Leakage: 100 cm^3/min (6.1 in^3/min)
- Operating temperature: -40 to 100 °C (-40 to 212 °F)

Application

The EHBL is attached directly to the boom cylinder(s) via Code 61 or Code 62 flange mount. Two sizes are available 3/4 in and 1 in. A pressure sensor feeds rod-end pressure to the control unit. A check valve allows free flow into the base end of the cylinder when raising. When lowering, the proportional pressure relief valve meters flow out at a pressure set by the control unit.

Using a pressure control for lowering is comparable to using a counterbalance valve. With a counterbalance valve, pressure in the base end of the cylinder is a fixed ratio above pressure in the rod end. Whereas when using the EHBL, the pressure sensor on the rod end monitors resistance to movement, allowing the pressure control to dynamically adjust the base end pressure maintaining stability.

Typical Circuit



The on-board electronics play a significant role in this process, but that gives system designer complete control over performance. EHBL eliminates the need for the operator to move the control to neutral to stop the load from falling in the event of a hose rupture or hydraulic failure. EHBL is able to achieve motion control with a dramatically lower pressure drop.

Advantages

Traditional pilot-operated boom lock valves used on excavators today were added in response to earlier safety directives and therefore were patched-in between the cylinder and the main hydraulic control valve. The main purpose of this valve is to control descent in the event of a burst hose or catastrophic hydraulic failure. Because pilot operated valves operate in series with the main control valve, and because they add additional pressure drop, it can disrupt the smooth and responsive control of the boom under various load conditions. This approach creates inefficiency in the hydraulic system and wastes energy.

The HydraForce EHBL is a solution that meets the safety requirements without impeding smooth operation and wasting energy. It also provides the potential to improve productivity, lower the boom using gravity, and can be used creatively in hybrid (energy recovery) circuits to further reduce energy consumption. This solution is a key part of the overall hydraulic system, improving responsiveness rather than hindering the smooth control as pilot operated boom lock and counterbalance valves sometimes do.