General

TECHNICAL INFORMATION

For the

Hydraulic Actuators Weight–loaded (HAWL)
Hydraulic Actuators Weight-loaded (HAWL)
Brake and Lift Cylinder

Introduction

Features

Hydraulic Actuators Weight Loaded (type HAWL) are used wherever valves installed at crucial
points of pipe networks have to close or to open in a secure and reliable manner even on failure of
external operating energy. Thus, they have to meet the most stringent requirements in terms of
functional safety.
Thanks to their solid and state-of-the-art design, Hydraulic Actuators Weight Loaded (type HAWL)
(compact type) are optimized and economical solution.

The Compact electro-
hydraulic equipment brake and
lift cylinder are complete unit.
All operating, regulating and
controlling devices are
combined in one assembly.
HYDROMAT Hydraulic Actuators
Weight Loaded (type HAWL) are
used for operating valves with a
drive shaft rotating by max. 90°.
The Weight-loaded Hydraulic
Actuator is equipped with an
energy accumulator. The weight
loaded lever provides the energy
required for a single closing or
opening operation of the valve.

Depending on the
particular application and
service required the HYDROMAT
Hydraulic Actuators Weight
Loaded (type HAWL) may be
incorporated in Ball Valves,
Butterfly Valves. A range of
sizes and standardized
interfaces combined with a
perfected modular concept enable us to supply the best solution for valves of all sizes and pressure
ratings.
HYDROMAT Hydraulic Actuators Weight-Loaded (type HAWL) excels by their compact design. The weight-loaded hydraulic actuator incorporated in the valve includes not only the mechanical components as weight-loaded lever, bracket, and support plate (for cylinder attachment) but also the hydraulic damping and opening cylinder incorporating the hydraulic unit. All hydraulic components as motor pump, manual pump, oil tank, and control block with various valve combinations are rigidly fixed on the cylinder using little tubing.
Hydraulic Diagram and Description of Performance

**Hydraulic diagram** for Hydraulic Actuators Weight Loaded (type HAWL) – standard design and performance.

**Open-circuit concept.**
Solenoid valve (Pos 7) or pilot valve de-energized. Weight drops when energizing the solenoid valve.

**Opening:**
The pumps (motor or manual pump) suck up the oil from the cylinder chamber on the rod side or from the oil tank and produce a pressure on the piston side of the cylinder which raises the weight-loaded lever. In OPEN position, oil must not escape from the cylinder (Pos 1). This will be ensured by means of the control block (Pos 9) and its valve combinations.

Electrically and mechanically operated solenoid valve (Pos 7) which isolates or releases oil flow from the cylinder.

The actuator is hydraulically maintained in "working position" (weight loaded lever raised). This brings about the advantage that the lowering of the weight loaded lever immediately shows the oil losses due to internal leakage.
Manually opening:
In case of total power failure or control block burst, weight loaded lever will always move to closed position. In such an event it's possible to open the valve with a hand oil pump. For this operation block ball valve (Pos.4) must be in closed position.

Open position automatic self-up keeping
Inadmissible lowering of the weight–loaded lever out of the OPEN position, will be detected by limit switch which initiates automatic starting of the motor pump (<90% without any command), switched on and it restores pressure returning to fully OPEN position.

Electrification and tripping movement to closing:
Closing process the Hydraulic Actuators Weight Loaded (type HAWL) in standard design HYDROMAT offer in two stages:

1. Stage: Open 100 % → 70 %.
2. Stage: 70 % → 0 % Open (Closed)

The lowering velocity for the first damping stage (about 70% of the cylinder stroke or open valve) can be adjusted at flow control valve (Pos 6), the velocity for the second damping stage at the flow control valve (Pos 3). Flow control valves keep the flow rate constant irrespective of the differential pressure.

This principle permits phase operating laws for the lowering weight–loaded lever. These phases are necessary in order to keep the pressure increase (water hammer, backflow) in the pipeline within an admissible range, with the closing times being as short as possible.

For detecting and signalling the different positions of the valve, several limit switches are mounted on the cover plate or angle transducer on the valve shaft. Apart from signalling, this limit switches also serve for controlling the electric components at the actuator.

The basic standard design provides two limit switches for OPEN and CLOSE positions.

With the electrical solenoid valves or pilot valves, the closing movement is tripped by energizing (open–circuit concept) or de–energizing (closed–circuit concept) the solenoid valve (Pos 7). Thus, lowering of the weight–loaded lever is started. The components (motor pump Pos. 17), thermal switch and limit switches) must be controlled electrically. Upon request, HYDROMAT can also supply the electrical control system for local/remote controlling and signalling.

On the customer request a simple version of the Hydraulic Actuators Weight Loaded (type HAWL) is only mounted junction box for the remote connection “wire by wire”.
NOTE: Each damping is adjustable individually, allowing damping performance to be matched in the application and technical characteristics of the size each HYDROMAT Hydraulic Actuators Weight Loaded (type HAWL).

In case of control line burst come to un-damped closing and it’s only activated damping of last 30% degrees (second stage). Second stage damping is made like a security device for dangerous lowering situation.

For this performance in the bottom of the Hydraulic Actuators Weight Loaded (type HAWL) is placed damping cone with 3 tapers, sized to absorb the energy developed during 30% of the end stroke braking in a constant way, thereby drastically reducing thrust and guaranteeing progressive braking action, bringing the pressure states in the chamber up to a value that provides ideal damping.

\[ E = \frac{1}{2} J_m \omega^2 + mgR\theta \]

Where:
- \( E \) = energy to be absorbed, Joules
- \( J_m \) = rotational mass moment of inertia, kgm²
- \( \omega \) = rotational velocity of load, rads/sec
- \( m \) = mass of load, kg
- \( g \) = acceleration due to gravity, 9.81 m/s²
- \( R \) = radius of rotation, m
- \( \theta \) = angle of cushioning, (rads)
Standard and Modular Concept

Standard concept of the HYDROMAT Hydraulic Actuators Weight Loaded (type HAWL)
- Two stages of closing process across two adjustable stages, (see Time closing characteristic)
- Compact design with incorporated hydraulic unit (motor pump and manual pump) as well as thermal switch, pressure limiting valve, pressure low and high switches, heater, oil low level switch
- Control by means of solenoid valve (open-circuit/closed-circuit concept), emergency lowering with manually push button of solenoid valve.

Modular concept:
Among others, the following types are available within the modular concept:
- Hydraulic Actuators Weight Loaded (type HAWL) without hydraulic unit, i.e., equipped only with weight–loaded lever and cylinder assembly for connecting to hydraulic unit supplied by customer,
- one or three stages operating laws, depending on the requirement and application of the plant,
- mechanical control of the main valve (if there is no external energy available on site)
- hydraulic unit equipped with hydro accumulator
<table>
<thead>
<tr>
<th>HYDROMAT Performance</th>
<th>Users' Advantages</th>
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<tbody>
<tr>
<td>Hydraulic Actuators Weight Loaded (type HAWL) is brake and lift cylinder in a complete unit</td>
<td>The user doesn’t have to provide hydraulic units or cylinders. It isn’t necessary to lay expensive hydraulic lines on site. The hydraulic moments are absorbed and supported within the valve, no transmission onto the structure.</td>
</tr>
<tr>
<td>Control block and control valves are directly mounted cylinder in &quot;block design&quot; with little tubing.</td>
<td>Even in case of break of the control line, the on the valve does not close in an inadmissible dangerous manner.</td>
</tr>
<tr>
<td>Closing law adjustable separately for each operating–law stages by means of high–quality flow control valves operating independently of the pressure.</td>
<td>Precise adaptation to the plant and operating conditions possible. Thus, minimizing of water hammer. Exactly reproducible closing or opening laws can be set.</td>
</tr>
<tr>
<td>Solenoid valves with small electrical output, irrespective of actuator and valve size.</td>
<td>Economical and safe operation ensured.</td>
</tr>
<tr>
<td>High–grade corrosion protection of complete Actuator unit with epoxy coating. Valves, pipe, pipe accessories, etc... zinc–coated steel, block anodized aluminium On customer request are valves, block and accessories made in stainless materials.</td>
<td>Long–time protection, long life.</td>
</tr>
<tr>
<td>The actuator can optionally be operated with biologically decomposable hydraulic liquid.</td>
<td>Ecological operation possible.</td>
</tr>
<tr>
<td>Safety devices as e.g. pressure limiting and temperature monitoring and control devices are incorporated in the standard actuator.</td>
<td>High functionality and safety.</td>
</tr>
<tr>
<td>Package solution: Hydraulic Actuators Weight Loaded (type HAWL) with measuring and control system incl. control box as well as assembly and commissioning services (HYDROMAT system engineering).</td>
<td>One single supplier – one partner! Adaptation of the individual components. Functionality and safety ensured.</td>
</tr>
</tbody>
</table>
Limit switches

The limit switches required for controlling electric-motor pump. The limit switches must be connected according with electric circuit diagrams on, respectively. The basic design provides 2 limit switches as follows:

1. Limit switch “Open”
2. Limit switch “Close”

Sizing and Dimensioning

HYDROMAT Hydraulic Actuators Weight Loaded (type HAWL) is designed according to the case of application and the hydraulic conditions. The required parameters are given in below check list. The Hydraulic Actuators Weight Loaded (type HAWL) are sized and designed to the modular concept.

Essential data for determining, dimensioning and assigning the actuators to the valves:

- Max. actual dynamic opening/closing torque (depending on the case of application as well as pressure and flow rate conditions).
- Max. operating torque for seating and off–seating the closed valve.
- Case of application and existing specifications.

Necessary Parameters

For submitting a quotation for each specific requirement, the following data are necessary:

- Valve type
- Size DN
- Pressure rating PN
- Application
  - Main burst control valve
  - Combined pump discharge and non-return valve
  - Turbine inlet safety valve
  - Quick–opening valve
  - Others, please describe! Flow velocity or flow rate (min., normal, max.)
- Pressure conditions (upstream and downstream), static and dynamic incl. water hammer Tripping flow rate (for a main burst control valve)
- Operating times for opening and closing
- Lowering process of the weight–loaded lever initiated by means of:
  - mechanical impulse (without external energy)
  - electrical impulse (electrical data to be specified)
- Raising of weight–loaded lever by means of:
  - electro–hydraulic pump (electrical data to be specified)
  - manual oil pump

For further information about valves with HYDROMAT Hydraulic Actuators Weight Loaded (type HAWL), special technical descriptions will be upon request submitted.
## Technical Data/Scope of Supply

<table>
<thead>
<tr>
<th>Range of torques: (dynamic/static)</th>
<th>100 – 150000 Nm (divided into 7 different standard Hydraulic Actuators Weight Loaded (type HAWL) sizes HAWL0.0150.06 to HAWL6.1600.16). For bigger torques on request.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actuators for</td>
<td>Butterfly Valve DN 150 – DN 1600, PN 10–40</td>
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<td>Ball Valve DN 100 – DN 1200, PN 10–100</td>
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### Main components:

<table>
<thead>
<tr>
<th>Component</th>
<th>Material/Coating</th>
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<tr>
<td>Actuator bracket/lever hub</td>
<td>Ductile cast iron SG GGG/epoxy coating or welded steel</td>
</tr>
<tr>
<td>Drive lever and cylinder</td>
<td>Steel/epoxy coating</td>
</tr>
<tr>
<td>Weight</td>
<td>Cast iron GG/epoxy coating</td>
</tr>
<tr>
<td>Piston rod/control lines</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>Screwed pipe unions</td>
<td>Zinc-coated steel or stainless steel</td>
</tr>
<tr>
<td>Control block</td>
<td>Anodized aluminium, with screwed-on flow control valves, manual valves and solenoid valves</td>
</tr>
</tbody>
</table>