Microhydraulics makes it feasible to obtain several tons of force from a minimal power source within a very restricted space envelope.

The techniques of microhydraulics allow simple easy-to-use solutions to problems that are often at or beyond the limits of traditional mechanical options.

HYDRO LEDUC offers a complete range of micropumps, hydraulic micromotors and valves, which all have proven capability of operation in extreme conditions of temperature and environment.

Based on a "standard" range, customized models can also be offered, with a choice of:
- drive shafts;
- inlet and outlet ports;
- flanges or threaded connections.

Furthermore, for your specific projects, HYDRO LEDUC offers complete integrated pump-motor units, and complete power packs, designed and built to meet your specifications.

Let us surprise you with the innovative solutions possible from HYDRO LEDUC!

Contact us for your next requirements!
Definition and main applications

LEDUC micro-hydraulics offers a complete and original design wherever considerable force is required within a small space envelope with very limited output power available.

Examples of particularly demanding applications already mastered include:
- providing 13 tons of crimping force for a hand tool barely larger than a cordless drill;
- ensuring the operational reliability of oil tools for exploration and measurement while drilling, where the entire hydraulics envelope may fit into a housing of no more than 1.18 to 1.57 in (30 to 40 mm) in diameter;
- allowing oceanographic research drifters, deployed throughout the world’s oceans, to resurface regularly, and above all with total reliability;
- guaranteeing the efficiency of guidance systems installed on the most modern fighter aircraft.

The wide range of high technology industries concerned all require extensive know-how, and each new application tends to push through the limits of previous technology.

How to determine your LEDUC pump

1. Conversion table imperial/metric

<table>
<thead>
<tr>
<th>Value</th>
<th>SI unit</th>
<th>Imperial unit</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement / Volume</td>
<td>mm³</td>
<td>Cu.in (in³)</td>
<td>1 cu.in = 16 387 mm³</td>
</tr>
<tr>
<td>Torque</td>
<td>N.m</td>
<td>Lbs.ft</td>
<td>1 lbs.ft = 1.356 N.m</td>
</tr>
<tr>
<td>Length</td>
<td>mm</td>
<td>In</td>
<td>1 in = 25.4 mm</td>
</tr>
<tr>
<td>Pressure</td>
<td>bar</td>
<td>PSI</td>
<td>1 bar = 14.5 PSI</td>
</tr>
<tr>
<td>Power</td>
<td>W</td>
<td>HP (horsepower)</td>
<td>1 HP = 746 W</td>
</tr>
<tr>
<td>Flow</td>
<td>cm³/min</td>
<td>USgal/min (ou GPM)</td>
<td>1 USgal/min = 3785 cm³/min</td>
</tr>
<tr>
<td>Weight</td>
<td>kg</td>
<td>Lbs (pound)</td>
<td>1 kg = 2.2 lbs</td>
</tr>
</tbody>
</table>

2. Determining the pump displacement required

2.1. If we know the flow Q and motor speed N, we can calculate the required pump displacement cyl:

\[
\text{cyl} = \frac{Q \times N}{1000}
\]

or

\[
\text{cyl} = \frac{Q \times N}{231}
\]

2.2. Choose the closest displacement pump in our catalogue, then adapt flow or rotating speed depending on the application:

\[
Q = \text{cyl} \times \frac{N}{1000}
\]

or

\[
N = \frac{Q \times 1000}{\text{cyl}}
\]

For your most demanding applications, HYDRO LEDUC can make the exact displacement to suit the application. Please contact us.

3. Calculating actual flow

All hydraulic pumps have an internal leakage which is proportional to working pressure. This leakage volume is quantified by the volumetric efficiency \( \mu_{\text{vol.}} \). Actual flow is calculated with the following formula:

\[
Q_{\text{real}} = Q \times \frac{\mu_{\text{vol.}}}{100}
\]

Volumetric efficiency \( \mu_{\text{vol.}} \) as a function of working pressure is given for each fixed displacement pump. The values shown are for standard usage (room temperature and mineral-based hydraulic fluid), and will vary by application.

4. Calculating torque calculation

The torque \( C_{\text{th}} \) absorbed by the pump is calculated from its displacement cyl and pressure \( P \):

\[
C_{\text{th}} = \frac{1.59 \times \text{cyl} \times P}{1000}
\]

Increase torque \( C_{\text{th}} \) by estimated mechanical efficiency \( \mu_{\text{mech.}} \) to get actual drive torque \( C_{\text{d}} \):

\[
C_{\text{d}} = C_{\text{th}} \times \frac{100}{\mu_{\text{mech.}}}
\]

Initially, use 80% as estimate of mechanical efficiency.

5. Calculating power on motor shaft

Motor power \( W \) is calculated using torque \( C_{\text{th}} \) and rotating speed \( N \):

\[
W = \frac{C_{\text{th}} \times N}{9.55}
\]

6. Quick calculation formula

An approximate value for power absorbed by the pump can be calculated using the following formula:

\[
W = \frac{\text{cyl} \times P \times N}{480 000}
\]

Calculations in METRIC units are shown in blue and calculations in IMPERIAL units are shown in green.
Fixed displacement micropumps  
PB32 - PB32.5 - PB33 - PB33.5 - PB33HP

Characteristics

<table>
<thead>
<tr>
<th>Type of pump</th>
<th>Displacement</th>
<th>Direction of rotation</th>
<th>Max. rotating speed (rpm)</th>
<th>Max. pressure continuous</th>
<th>Max. pressure peak</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mm³</td>
<td>Cu.in</td>
<td>CW &amp; CCW</td>
<td>continuous</td>
<td>peak</td>
</tr>
<tr>
<td>PB32</td>
<td>0518110 12</td>
<td>0.0007</td>
<td></td>
<td>5000</td>
<td>6000</td>
</tr>
<tr>
<td></td>
<td>0523370 20</td>
<td>0.0012</td>
<td></td>
<td>5000</td>
<td>6000</td>
</tr>
<tr>
<td></td>
<td>0523380 25</td>
<td>0.0015</td>
<td></td>
<td>5000</td>
<td>6000</td>
</tr>
<tr>
<td>PB32.5</td>
<td>0511860 45</td>
<td>0.0027</td>
<td></td>
<td>5000</td>
<td>6000</td>
</tr>
<tr>
<td>PB33</td>
<td>053220 45</td>
<td>0.0027</td>
<td>CCW</td>
<td>5000</td>
<td>6000</td>
</tr>
<tr>
<td>PB33.5</td>
<td>057000 70</td>
<td>0.0042</td>
<td>CCW</td>
<td>5000</td>
<td>6000</td>
</tr>
<tr>
<td>PB33 HP</td>
<td>054560 45</td>
<td>0.0027</td>
<td>CW</td>
<td>5000</td>
<td>6000</td>
</tr>
</tbody>
</table>

- Up to 1000 bar peak

Technical characteristics

- Max. operating temperature: 200°C (392°F)
- Weight (standard pump): 0.33 kg (0.66 lbs)

Absorbed torque as a function of pump outlet pressure

Theoretical values; calculation formula on page 1.
Fixed displacement micropumps

Flow as a function of rotating speed

Volumetric efficiency as a function of outlet pressure

Absorbed torque as a function of outlet pressure – PB33HP

Theoretical values; calculation formula on page 1.
Fixed displacement micropumps  PB36.5

![Micropump Diagram]

### Characteristics

<table>
<thead>
<tr>
<th>Type of pump</th>
<th>Displacement</th>
<th>Direction of rotation</th>
<th>Max. rotating speed (rpm)</th>
<th>Max. pressure continuous</th>
<th>Max. pressure peak</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mm³</td>
<td>Cu.in</td>
<td>continuous</td>
<td>peak</td>
<td>bar</td>
</tr>
<tr>
<td>PB36.5</td>
<td>050720</td>
<td>115</td>
<td>0.0070</td>
<td>CCW</td>
<td>5000</td>
</tr>
<tr>
<td></td>
<td>050790</td>
<td>280</td>
<td>0.0170</td>
<td>CW</td>
<td>5000</td>
</tr>
<tr>
<td></td>
<td>057310</td>
<td>360</td>
<td>0.0220</td>
<td>CCW</td>
<td>5000</td>
</tr>
</tbody>
</table>

### Technical characteristics

- Max. operating temperature: 200°C (392°F)
- Weight (standard pump): 0.6 kg (1.32 lbs)
Fixed displacement micropumps

Absorbed torque as a function of outlet pressure

Flow as a function of rotating speed

Volumetric efficiency as a function of outlet pressure

HYDRO LEDUC R&D Laboratory results, fluid viscosity 65 cSt.
Fixed displacement micropumps PF56.5

![Image of micropump](image_url)

**Technical characteristics**

- Max. operating temperature: 200°C (392°F)
- Weight (standard pump): 2.5 kg (5.5 lbs)

**Characteristics**

<table>
<thead>
<tr>
<th>Type of pump</th>
<th>Displacement</th>
<th>Direction of rotation</th>
<th>Max. rotating speed continuous</th>
<th>Max. pressure continuous</th>
<th>Max. pressure peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF56.5</td>
<td>0.0458</td>
<td>CW</td>
<td>4000</td>
<td>300 bar 4350 PSI</td>
<td>350 bar 5075 PSI</td>
</tr>
<tr>
<td></td>
<td>0.0610</td>
<td>SH</td>
<td>4000</td>
<td>300 bar 4350 PSI</td>
<td>350 bar 5075 PSI</td>
</tr>
</tbody>
</table>

Shaft, flanges, inlet and outlet ports can all be adapted to your need, under specific conditions; please contact us.
Fixed displacement micropumps

Absorbed torque as a function of outlet pressure

Flow as a function of rotating speed

Volumetric efficiency as a function of outlet pressure
### Characteristics

<table>
<thead>
<tr>
<th>Type of pump</th>
<th>Displacement</th>
<th>Direction of rotation</th>
<th>Max. rotating speed continuous rpm</th>
<th>Max. pressure continuous bar</th>
<th>Max. pressure continuous PSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>PB1.3</td>
<td>0515640</td>
<td>1300</td>
<td>CCW</td>
<td>4000</td>
<td>350</td>
</tr>
<tr>
<td>PB1.75</td>
<td>0526410</td>
<td>1750</td>
<td>CCW</td>
<td>4000</td>
<td>350</td>
</tr>
<tr>
<td>PB2.2</td>
<td>0515160</td>
<td>2200</td>
<td>CCW</td>
<td>4000</td>
<td>350</td>
</tr>
</tbody>
</table>

### Technical characteristics

- Max. operating temperature: 200°C (392°F)
- Weight (standard pump): 2.2 kg (4.8 lbs)
Fixed displacement micropumps PB1.3 - PB1.75 - PB2.2

Absorbed torque as a function of outlet pressure

Flow as a function of rotating speed

Volumetric efficiency as a function of outlet pressure

Theoretical values; calculation formula on page 1.
### Technical characteristics

- Max. operating temperature: 200°C (392°F)
- Weight (standard pump) 4.2 kg (9.3 lbs)

### Graphs (see page 12)

- Power consumption
- Flow as a function of outlet pressure

---

**Adjusatable pumps (with factory set adjustment)**

The displacement of PBV pumps is adjustable as a function of outlet pressure, in order to limit power consumption.

When outlet pressure is low, the pump operates at maximum flow. When outlet pressure increases, pump displacement and flow gradually decrease (see graphs on page 12).

#### Characteristics

<table>
<thead>
<tr>
<th>Type of pump</th>
<th>Inlet</th>
<th>Direction of rotation</th>
<th>Rotating speed (rpm)</th>
<th>Displacement mini</th>
<th>Displacement maxi</th>
<th>Absorbed power at nominal speed with regulation</th>
<th>Max. pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>nominal permissible continuous operating</td>
<td>mm³</td>
<td>Cu.in</td>
<td>mm³</td>
<td>Cu.in</td>
</tr>
<tr>
<td>PBV56.5</td>
<td>0520570</td>
<td>Radial</td>
<td>CW</td>
<td>3150 3500</td>
<td>300 0.0183</td>
<td>1100 0.0671</td>
<td>550 0.737 250 3625 350 5075</td>
</tr>
<tr>
<td></td>
<td>058120</td>
<td>Rear</td>
<td>CW</td>
<td>3150 3500</td>
<td>300 0.0183</td>
<td>1100 0.0671</td>
<td>550 0.737 250 3625 350 5075</td>
</tr>
<tr>
<td>PBV57.5</td>
<td>0511740</td>
<td>Radial</td>
<td>CW</td>
<td>3500 3500</td>
<td>300 0.0183</td>
<td>1500 0.0915</td>
<td>1100 1.475 250 3625 350 5075</td>
</tr>
</tbody>
</table>

The minimum displacement and the maximum power consumption are factory set (see graphs) and cannot be modified by the user. Other settings are possible; please contact us.

### Also available with rear inlet

- 2 implantations SAE J 514
- 2x SAE J 514 fitting

Shaft, flanges, inlet and outlet ports can all be adapted to your need, under specific conditions; please contact us.
Variable displacement micropumps

PVE56.5 - PVE76.5

Technical characteristics

- Max. operating temperature: 200°C (392°F)
- Weight (standard pump) 4 kg (8.8 lbs)

Graphs (see page 12)

- Power consumption
- Flow as a function of output pressure
Example of setting, PBV56.5 pump.
For other settings, please contact us.

These graphs are the results of testwork done in the HL R&D laboratory, on a specific test bench. Viscosity of the fluid: 65 cSt.
MOTOR WITH DUAL DIRECTION OF ROTATION

■ Characteristics

<table>
<thead>
<tr>
<th>Motor type</th>
<th>Direction of rotation</th>
<th>Max. rotating speed (rpm)</th>
<th>Displacement</th>
<th>Max. pressure continuous</th>
<th>Max. pressure peak</th>
<th>Max. pressure on the drain line</th>
</tr>
</thead>
<tbody>
<tr>
<td>MH450 DS</td>
<td>0521960</td>
<td>350 → 6500</td>
<td>463 → 0.0283</td>
<td>330 → 4780</td>
<td>400 → 5800</td>
<td>3 → 45</td>
</tr>
</tbody>
</table>

■ Technical characteristics
- Max. operating temperature: 150°C (302°F), and 175°C (347°F) peak (up to 5% of the time).
- Type of accepted fluids: hydraulic mineral oils, for other fluids please contact us.
- Weight: 0.7 kg (1.5 lbs)

■ Graphs (see page 14)
- Torque as a function of inlet pressure.
- Rotating speed as a function of inlet flow.
These graphs are the results of testwork done in the HL R&D laboratory, on a specific test bench. Viscosity of the fluid: 65 cSt.
HYDRO LEDUC also offers a range of customized accessories adapted to your needs.

**Check valve**

- **LEDUC code**: 0513690
- Max. operating pressure: 300 bar (4350 PSI)
- Max. flow: 2000 cm³/min (0.53 USgal/min)
- Temperature range: –30°C to 200°C (–22°F to 392°F)

<table>
<thead>
<tr>
<th>Viscosity</th>
<th>Q max cm³/min</th>
<th>USgal/min</th>
<th>ΔP bar</th>
<th>ΔP PSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 cSt</td>
<td>1550</td>
<td>0.41</td>
<td>3.80</td>
<td>55.1</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>0.013</td>
<td>0.18</td>
<td>2.6</td>
</tr>
<tr>
<td>60 cSt</td>
<td>1550</td>
<td>0.41</td>
<td>1.00</td>
<td>14.5</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>0.013</td>
<td>0.14</td>
<td>2.0</td>
</tr>
<tr>
<td>2 cSt</td>
<td>1550</td>
<td>0.41</td>
<td>0.35</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>0.013</td>
<td>0.12</td>
<td>1.7</td>
</tr>
</tbody>
</table>

**Miniature check valve**

- **LEDUC code**: 0515080
- Max. flow: 1000 cm³/min (0.26 USgal/min)
- Max. operating pressure: 300 bar (4350 PSI)
- Temperature range: –30°C to 200°C (–22°F to 392°F)

<table>
<thead>
<tr>
<th>Viscosity</th>
<th>Q max cm³/min</th>
<th>USgal/min</th>
<th>ΔP bar</th>
<th>ΔP PSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 cSt</td>
<td>800</td>
<td>0.21</td>
<td>45.6</td>
<td>661.3</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>0.013</td>
<td>4.3</td>
<td>62.3</td>
</tr>
<tr>
<td>60 cSt</td>
<td>800</td>
<td>0.21</td>
<td>19.3</td>
<td>279.9</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>0.013</td>
<td>0.5</td>
<td>7.2</td>
</tr>
<tr>
<td>2 cSt</td>
<td>800</td>
<td>0.21</td>
<td>4.6</td>
<td>66.7</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>0.013</td>
<td>0.1</td>
<td>1.4</td>
</tr>
</tbody>
</table>
■ Relief valve maximum pressure 300 bar

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEDUC code</td>
<td>0513700</td>
</tr>
<tr>
<td>Max. flow</td>
<td>2000 cm³/min (0.53 USgal/min)</td>
</tr>
<tr>
<td>Opening pressure range</td>
<td>20 to 300 bar (290 to 4350 PSI)</td>
</tr>
<tr>
<td>Temperature range</td>
<td>–30°C to 200°C (–22°F to 392°F)</td>
</tr>
</tbody>
</table>

Flow direction of the fluid

Example of 0513700 valves assembly
---

**0513540 pilot valves**

Design your solution using HYDRO LEDUC components. The 0513540 pilot valve is designed to add pilot operation on the HYDRO LEDUC check and relief valves.

---

**With 0513690 check valve**

Pilot pressure from 3 to 120 bar max. (44 to 1740 PSI max.), depending on back pressure 2.

![Diagram of check valve](image)

Pilot report

\[
P_3 = 0.05 \times P_2
\]

---

**With relief valve ref. 0513700**

Pilot pressure from 1 to 15 bar max (10 to 210 PSI max.) as a function of relief valve opening pressure.

![Diagram of relief valve](image)

Pilot report

\[
P_3 = 0.4 \times P_{\text{Load}}
\]
Complete functions

HYDRO LEDUC offers, on request, complete solutions to design and manufacture hydraulic power-packs incorporating pump, electric motor, valving, tank, relief valve, actuators etc., all to fit within your particular space envelope.

The hydraulic pump is at the heart of our know-how, but the R&D department also masters the technology of the surrounding components. This allows a wide choice of solutions, and custom-designed developments.

An efficient partnership with a highly skilled and experienced team will guarantee your requirements will be satisfied.

HYDRO LEDUC can integrate your solution by proposing the following services:
- Mechanical integration of YOUR components;
- Hydraulic integration (high and low pressure tubes, Purge and oil filling, fluid contamination control…);
- Electrical integration (wiring);
- Qualification and testing of the complete assembly by simulating your working conditions, in terms of temperature and ambient pressure.

Hydraulic power pack for oceanographic buoy

Pump-motor unit for oil tool
All micro-hydraulic pumps and units are tested individually on specific test benches, to guarantee performance. However, once in your application, guaranteeing performance depends on how well the following guidelines are adhered to. The following recommendations apply to both micro-pumps and micro-motors.

- **Before using a micropump**

  LEDUC micro-pumps are supplied in a storage fluid, to protect the components from corrosion. It is a mineral oil of general use, mixible in all proportions with most typical hydraulic fluids. Before installing the micropump, simply empty the storage fluid, no rinsing required, then fill with your usual hydraulic fluid (chosen in line with our recommendations).

- **Direction of rotation**

  Most LEDUC micro-pumps are manufactured for a given direction of rotation. The direction of rotation is always determined by looking at the pump shaft; it is engraved on the housing:

  - CW: clockwise
  - CCW: counterclockwise

  For those models made in one direction of rotation only, it is possible, on request, to produce the same pump for the other direction of rotation.

- **Fluids**

  Micro-hydraulic pumps and motors are generally used with mineral-based hydraulic fluids. However, new fluids are also compatible with most LEDUC pumps and motors:
  - Synthetic oils,
  - Biological and biodegradable,
  - Fluids with some water content.

  LEDUC pumps and motors accept a wide range of viscosity. For extreme viscosity, the rotating speed and the inlet pressure of the pump must be adapted. Please ask our Technical Department.

  Whatever fluid is used, it is essential, to ensure a controlled cleanliness class during the start-up. We recommend the use of contamination class 15/14/12 according to ISO 4406 (equivalent to a class 6 according to standard NAS 1638 or lower).

  For all special applications, please ask our Technical Department. To enable us to assist you in your choice and to optimize your microhydraulic installation, we will ask you to advise:
  - The product will be required to operate at the working cycle (flow-pressure),
  - Type of fluid, viscosity and operating temperature,
  - Supply conditions (pressurization, design of inlet line),
  - The drive mode.

- **Drive modes**

  Direct drive (pump directly flanged onto the motor) is always the preferred solution. If another drive mode is used, please avoid any load on the pump shaft (axial or radial load).

  Considering the specificity of these pumps, please contact our Technical Department to check your project feasibility.
Filtration

The cleanliness of the fluid is vital for hydraulic component, to run satisfactorily, and to allow optimal service life. As well as using fluid of the right cleanliness class (ISO4406 15/14/12), we also recommend fitting a 3-10 μm filter on the return line. LEDUC pumps can be supplied fitted with a 40micron protective screen, which avoids start-up accidents in cases where a contaminant (end of thread, tiny piece of hosing, flake of paint etc.) might get into the pump supply circuit.

Installation precautions

Carefully clean and rinse the tank and all pipes and hoses to remove any contaminants that could damage the installation.

Installation position (see figures at the bottom of the page)

Microhydraulic components can be used in any position. However, some installation positions can complicate the start-up (see the start-up part).

Horizontal position, submerged in oil (fig.1): bleeding will happen naturally. After filling, wait several minutes before starting up.

Horizontal position, tank above the pump (fig.4): the pump will bleed itself in about one minute. Start up and run the pump slowly at first, until the air is purged from the fluid.

Supply line

The inlet line must be as direct as possible, and well dimensioned to avoid any pressure losses. Avoid all curves that could cause the fluid flow to slow down, or cause an air trap.

Inlet line performance can be improved by pressurizing the tank. HYDRO LEDUC’s is technical department can help you to design your inlet circuit.

Start-up

The pump must be filled with oil and the circuit bled before starting the pump. The best bleed procedure to guarantee pump priming is as follows:
- when possible, position are of the inlet ports facing up, to evacuate air;
- it is good to turn the pump slightly during bleeding process, to displace the air pockets which may have formed during filling;
- initial start-up should be at low speed (around 500 rpm). If this is not possible (constant speed motor), operate on/off intermittently.
- initial start-up must be without load on the bearing. Then apply load gradually if possible.

HYDRO LEDUC can fit its pumps with a self-priming system, adapted to difficult operating conditions (vertical position, risk of interruption of supply flow…). Please ask us.

Checking inspection

On start-up, check oil outlet flow is constant and regular. Fluid must not be emulsified, if it is, restart purge process.

Maintenance

LEDUC pumps do not require any particular maintenance and are designed to ensure long service life. However, the fluid in the circuit should be changed every 500 to 1000 hours of operation (depending on the contamination and the type of fluid).
A dedicated R&D team means HYDRO LEDUC is able to adapt or create products to meet specific customer requirements. Working in close cooperation with the decision-making teams of its customers, HYDRO LEDUC optimizes proposals based on the specifications submitted.

**we are passionate about hydraulics...**

**HYDRO LEDUC**

**mobile and industrial pumps**
Fixed displacement pumps, the W series, and variable displacement pumps, the DELTA series. High pressure capabilities within minimal size.
- **W series**: flanges to ISO 3019/2, shafts to DIN 5480.
- **DELTA series**: SAE shafts and flanges.

**piston pumps for trucks**
HYDRO LEDUC offers 3 ranges of piston pumps perfectly suited to all truck, construction equipment, and PTO–mount applications. Fixed and variable displacement from 12 to 150 cc (0.73 to 9.25 Cu.In).

**micro-hydraulics**
This is a field of exceptional HYDRO LEDUC know-how:
- axial and radial piston pumps, of fixed and variable displacement,
- axial piston micro-hydraulic motors,
- micro-hydraulic units incorporating pump, electric motors, valving, controls, etc.
To users of hydraulic components which have to be housed in extremely small spaces, HYDRO LEDUC offers complete, original and reliable solutions for even the most difficult environments.

**other product lines**

**hydraulic motors**
Fixed displacement bent-axis piston motors. Models from 5 to 180 cc (0.3 to 11 Cu.In). Available both in ISO and SAE versions.

**mobile and industrial pumps**
Fixed displacement pumps, the W series, and variable displacement pumps, the DELTA series. High pressure capabilities within minimal size.
- **W series**: flanges to ISO 3019/2, shafts to DIN 5480.
- **DELTA series**: SAE shafts and flanges.

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**accumulate**
Bladder, diaphragm and piston accumulators.
Spherical and cylindrical accumulators.
Volume capacities from 1.22 Cu.In to 13.21 gallons (20 cc to 50 liters).
Pressures up to 7250 psi (500 bar).
Accessories for use with hydraulic accumulators.

**hydro-pneumatical**

**HYDRO LEDUC**

A dedicated R&D team means HYDRO LEDUC is able to adapt or create products to meet specific customer requirements. Working in close cooperation with the decision-making teams of its customers, HYDRO LEDUC optimizes proposals based on the specifications submitted.