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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!





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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

Microhydraulics solutions

Examples of particularly demanding applications already mastered include:

- providing 13 tons of crimping force for a handtool barely larger than a cordless
- 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

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.





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

- 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:

$$cyl = \frac{Q}{N} \times 1000$$

$$cyl = \frac{Q}{N} \times 231$$

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

$$Q = \frac{cyl \times N}{1000}$$

$$Q = \frac{cyl \times N}{231}$$

$$N = \frac{O \times 1000}{cyl}$$

$$N = \frac{Q \times 231}{cyl}$$

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 $\mu_{vol.}$ Actual flow is calculated with the following formula:

$$Q_{real} = Q \times \frac{\mu_{vol.}}{100}$$

$$Q_{real} = Q \times \frac{\mu_{vol.}}{100}$$

Volumetric efficiency μ_{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_{th} absorbed by the pump is calculated from its displacement cyl and pressure P

$$C_{th} = \frac{1.59 \times cyl \times P}{100\,000}$$

$$C_{th} = \frac{cyl \times P}{75.4}$$

Increase torque C_{th} by estimated mechanical efficiency $\mu_{meca.}$ to get actual drive torque C_u:

$$C_u = C_{th} \times \frac{100}{\mu_{meca.}}$$

$$C_u = C_{th} \times \frac{100}{\mu_{meca.}}$$

Initially, use 80% as estimate of mechanical efficiency.

5. Calculating power on motor shaft

Motor power W is calculated using torque Cu and rotating speed N.

$$W = \frac{C_u \times N}{9.55}$$

$$W = \frac{C_u \times N}{5254}$$

6. Quick calculation formula

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

$$W = \frac{cyl \times P \times N}{480\ 000}$$

$$W = \frac{cyl \times P \times N}{317\,000}$$

Calculations in METRIC units are shown in blue and calculations in IMPERIAL units are shown in green

Characteristics

mm (inches)

Type of pump		Displacement		Direction		ating speed	Max. pressure					
		Бюріа	Comone	of rotation	(rpm)		conti	nuous	peak			
		mm³	Cu.in		continuous	peak	bar	PSI	bar	PSI		
	0518110	12	0.0007		5000	6000	300	4350	350	5075		
PB32	0523370	20	0.0012	CW	5000	6000	300	4350	350	5075		
	0523380	25	0.0015	& CCW	5000	6000	300	4350	350	5075		
PB32.5	0511860	45	0.0027	0011	5000	6000	300	4350	350	5075		
PB33	053220	45	0.0027	CCW	5000	6000	300	4350	350	5075		
PB33.5	057000	70	0.0042	CCW	5000	6000	300	4350	350	5075		
חוו מחוו	054500	45	0.0007	OW	5000	0000	000	42050	4000	44500		
PB33 HP	054560	45	0.0027	CW	5000	6000	900	13050	1000	14500		

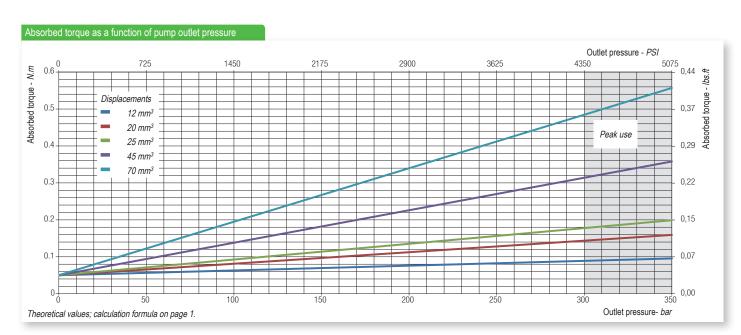
Up to 1000 bar peak

■ Technical characteristics

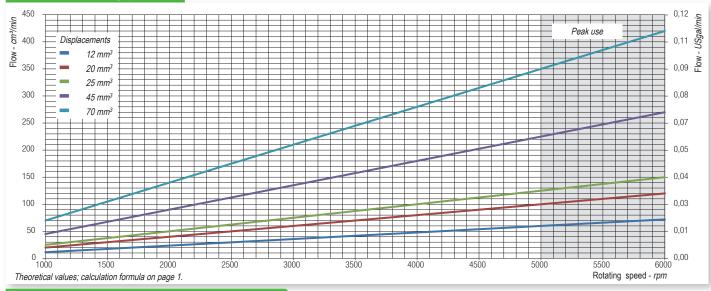
- Max. operating temperature: 200°C (392°F)

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

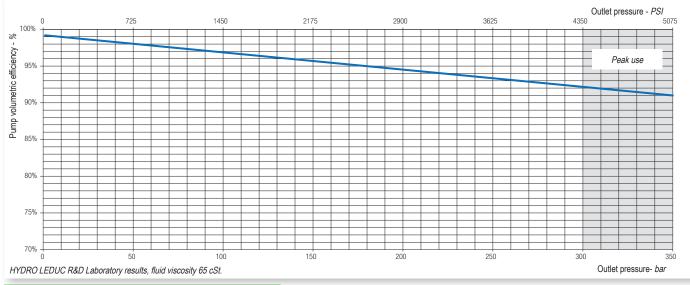
- Weight (standard pump): 0.33 kg (0.66 lbs)



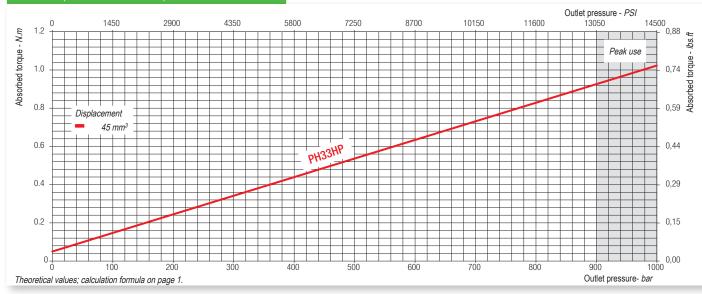




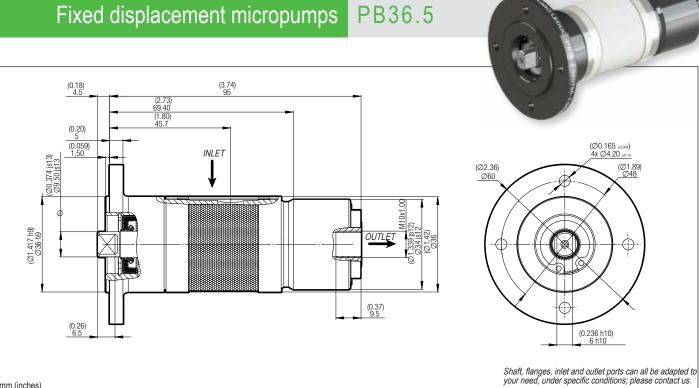
Volumetric efficiency as a function of outlet pressure



Absorbed torque as a function of outlet pressure – PB33HF



Fixed displacement micropumps



Characteristics

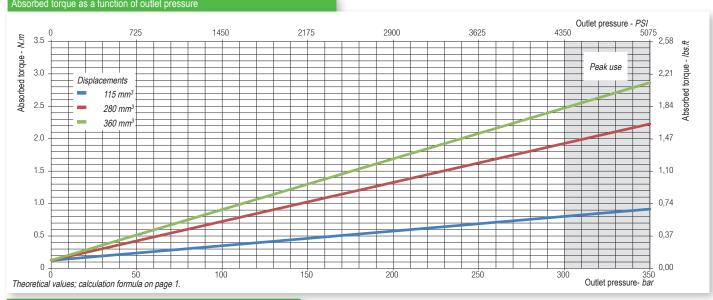
mm (inches)

Type of pump		Displa	cement	Direction of rotation		Max. rotating speed (rpm)		Max. pressure				
			Cu.in		continuous	peak	bar	PSI	bar	PSI		
	050720	115	0.0070	CCW	5000	6000	300	4350	350	5075		
PB36.5	050790	280	0.0170	CW	5000	6000	300	4350	350	5075		
	057310	360	0.0220	CCW	5000	6000	300	4350	350	5075		

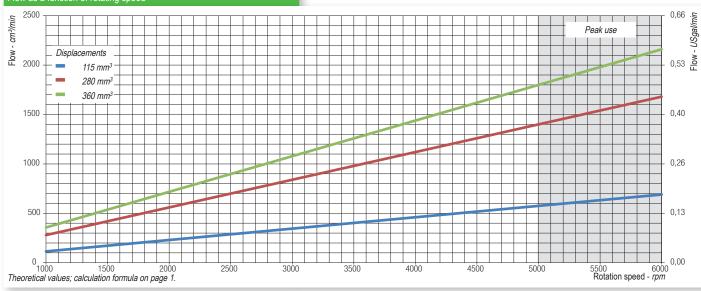
■ Technical characteristics

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

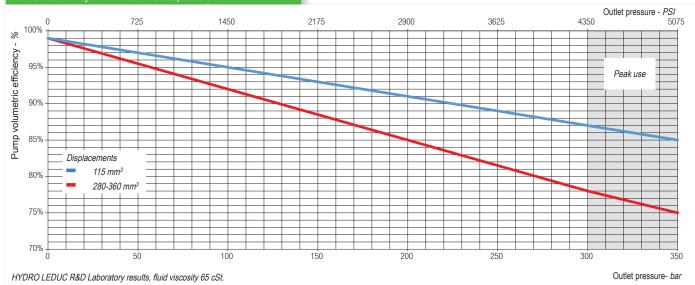
Absorbed torque as a function of outlet pressure

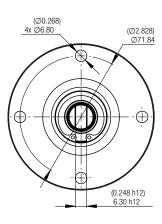


Flow as a function of rotating speed



Volumetric efficiency as a function of outlet pressure





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

Characteristics

mm (inches)

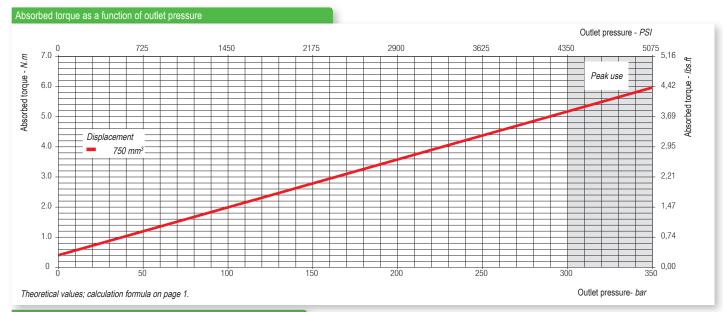
Type of pump		Displacement		Direction of rotation	Max. rotating speed continuous	Max. pressure			
			Cu.in	orrotation	rpm	bar	PSI	bar	PSI
DEEC E	0523400	750	0.0458	CW	4000	300	4350	350	5075
PF56.5	0515970	1000	0.0610	SH	4000	300	4350	350	5075

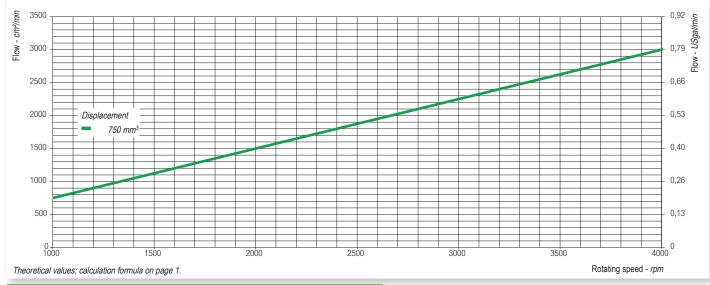
Technical characteristics

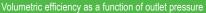
- Max. operating temperature: 200°C (392°F)

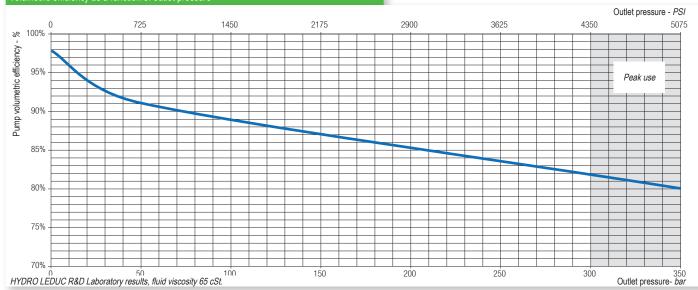
- Weight (standard pump): 2.5 kg (5.5 lbs)

Fixed displacement micropumps PF56.5

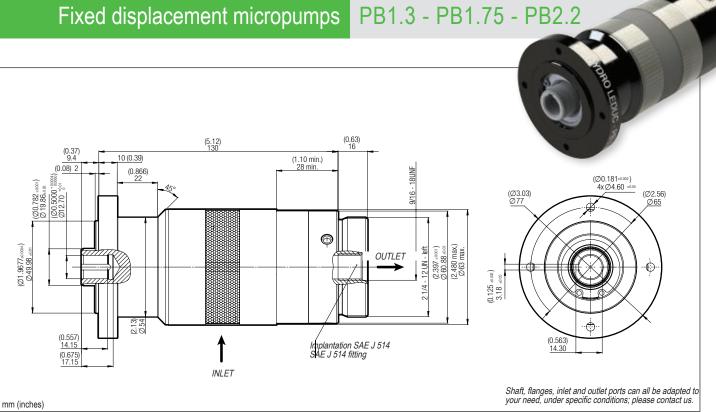








Fixed displacement micropumps



Characteristics

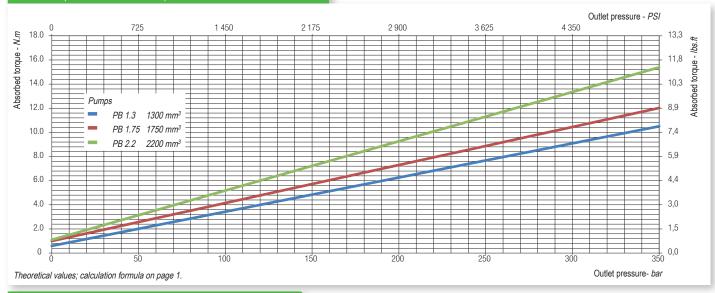
Type of pump		Displac	cement	Direction	Max. rotating speed continuous	Max. pressure continuous			
.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			Cu.in	of rotation	rpm	bar	PSI		
PB1.3	0515640	1300	0.0793	CCW	4000	350	5075		
PB1.75	0526410	1750	0.1068	CCW	4000	350	5075		
PB2.2	0515160	2200	0.1343	CCW	4000	350	5075		

■ Technical characteristics

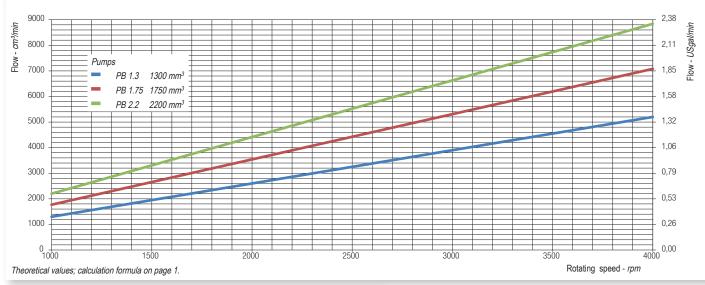
- Max. operating temperature: 200°C (392°F)

- Weight (standard pump): 2.2 kg (4.8 lbs)

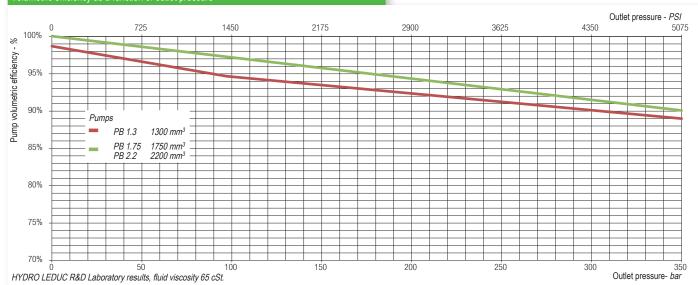
Absorbed torque as a function of outlet pressure



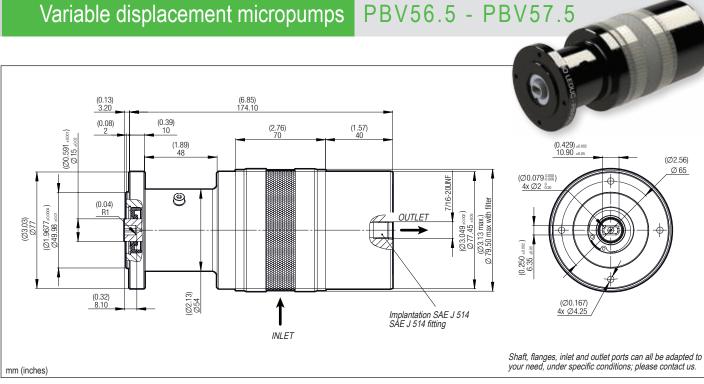
Flow as a function of rotating speed



Volumetric efficiency as a function of outlet pressure



Variable displacement micropumps



ADJUSTABLE 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

			Direction of	Rotating speed (rpm)		Displacement mini				Absorbed power at nominal speed with		IVIAX DIESSUIE			
Type of pump		Inlet	rotation	nominal permis-	' I maxi I					regulation		continuous		peak	
				sible continuous operating	us peak	mm³	Cu.in	mm³	Cu.in	W	HP	bar	PSI	bar	PSI
DD\/EG E	0520570	Radial	CW	3150	3500	300	0.0183	1100	0.0671	550	0.737	250	3625	350	5075
PBV56.5	058120	Rear	CW	3150	3500	300	0.0183	1100	0.0671	550	0.737	250	3625	350	5075
PBV57.5	0511740	Radial	CW	3500	3500	540	0.0330	1500	0.0915	1100	1.475	250	3625	350	5075

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.

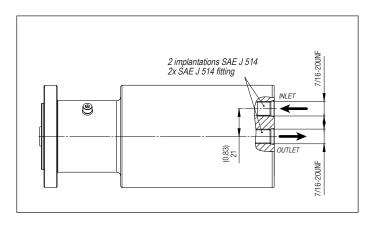
■ Technical characteristics

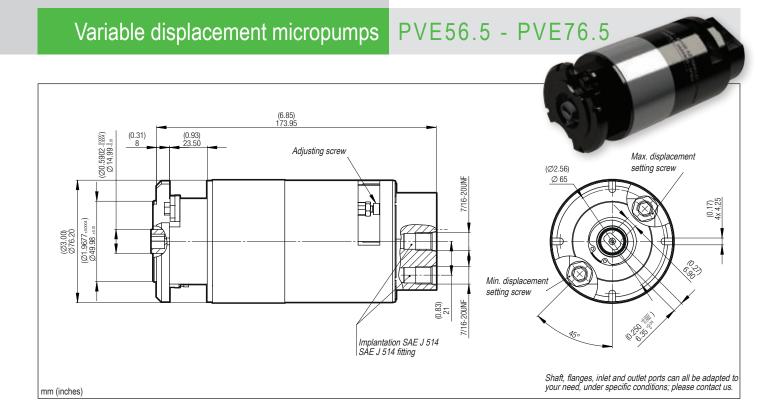
- Max. operating temperature: 200°C (392°F)
- Weight (standard pump) 4.2 kg (9.3 lbs)

Graphs (see page 12)

- Power consumption
- Flow as a function of outlet pressure

Also available with rear inlet





ADJUSTABLE PUMPS (with external adjustment screw)

PVE pumps offer the same possibilities as the PBV (adjustment of the displacement as a function of outlet pressure). These pumps are fully adjustable by the user in terms of:

- max. displacement
- min. displacement
- pressure at which the flow regulation starts

Characteristics

			Direction of Rotation speed (rpm)			Displac	ement setting		Max. pressure				
Type of pump					MINI		MAXI		continuous		peak		
			nominal	maximal	mm³	Cu.in	mm ³	Cu.in	bar	PSI	bar	PSI	
PVE56.5	0520380	CW	3150	3500	0 to 750	0 to 0.0458	400 to 1150	0.0244 to 0.0702	250	3625	350	5075	
PVE76.5	0522800	CW	3150	3500	0 to 1050	0 to 0.0641	560 to 1610	0.0342 to 0.0982	250	3625	350	5075	

Maximum absorbed power corresponds to the standard factory setting (see graphs). Other settings are available, please contact us.

Technical characteristics

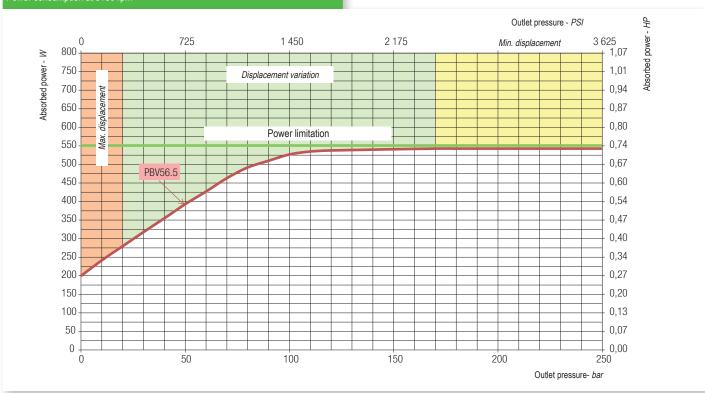
- Max. operating temperature: 200°C (392°F)
- Weight (standard pump) 4 kg (8.8 lbs)

Graphs (see page 12)

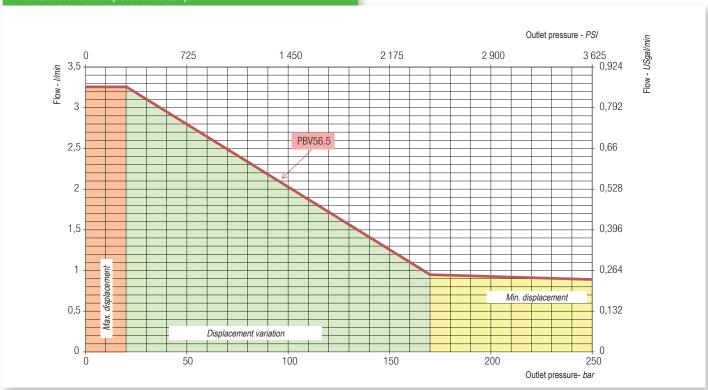
- Power consumption
- Flow as a function of output pressure

Example of setting, PBV56.5 pump. For other settings, please contact us.

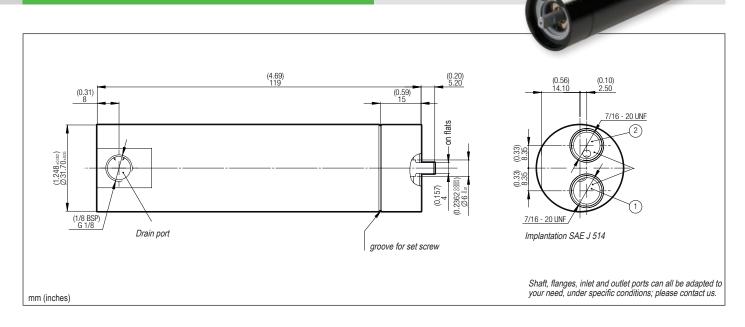
Power consumption at 3150 rpm



Flow as a function of outlet pressure at 3150 rpm



Micro-hydraulic motor MH450 DS



MOTOR WITH DUAL DIRECTION OF ROTATION

Characteristics

	Motor type		Max. rotating speed (rpm)		Displacement			Мах. р	Max. pressure on the drain			
Moto							continuous		peak		line	
				maxi		Cu.in	bar	PSI	bar	PSI	bar	PSI
MH450 DS	0521960	①→②CW ②→①CCW	350	6500	463	0.0283	330	4780	400	5800	3	45

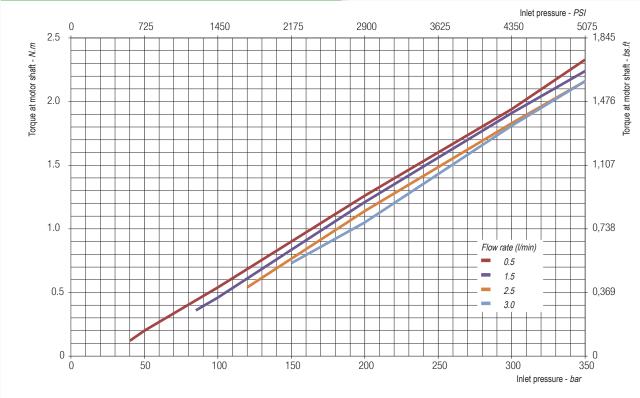
■ Technical characteristics

- 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)

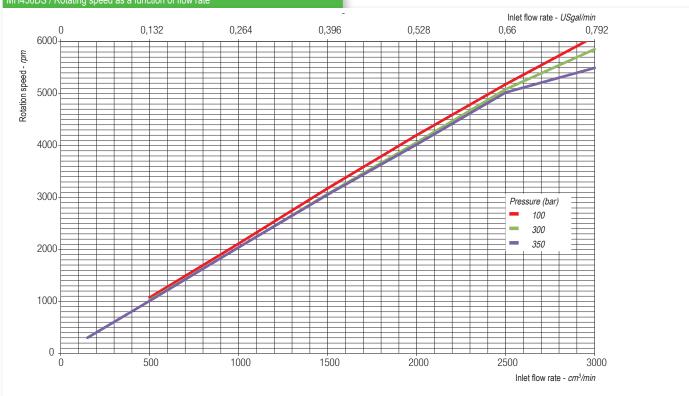
Graphs (see page 14)

- Torque as a function of inlet pressure.
- Rotating speed as a function of inlet flow.





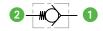
MH450DS / Rotating speed as a function of flow rate



Microhydraulics accessories

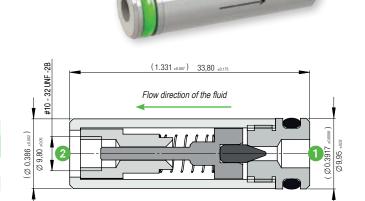
HYDRO LEDUC also offers a range of customized accessories adapted to your

■ Check valve

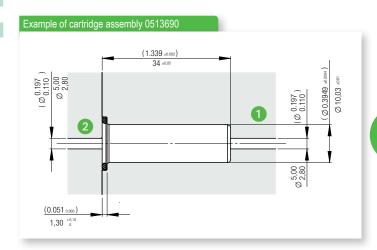


LEDUC code	0513690
Max. operating pressure	300 bar (4350 PSI)
Max. flow	2000 cm³/min (0.53 USgal/min)
Temperature range	- 30°C to 200°C (- 22°F to 392°F)

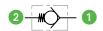
		Reduce	ed pressure drop			
	Q n		ΔΡ			
Viscosity	cm³/mn	USgal/min	bar	PSI		
200 cSt	1550	0.41	3.80	55.1		
200 631	50	0.013	0.18	2.6		
60 cSt	1550	0.41	1.00	14.5		
00 031	50	0.013	0.14	2.0		
2 cSt	1550	0.41	0.35	5.0		
2 (3)	50	0.013	0.12	1.7		



CHECK VALVE

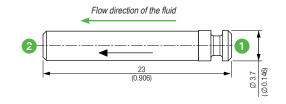


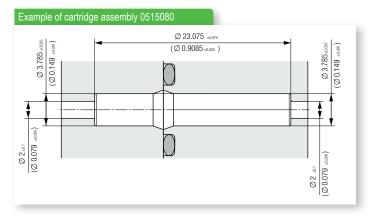
■ Miniature check valve



LEDUC code	0515080
Max. flow	1000 cm ³ /min (0.26 USgal/min)
Max. operating pressure	300 bar (4350 PSI)
Temperature range	- 30°C to 200°C (- 22°F to 392°F)

	Q n	nax	ΔΡ				
Viscosity	cm³/mn	USgal/min	bar	PSI			
200 cSt	800	0.21	45.6	661.3			
200 631	50	0.013	4.3	62.3			
60 cSt	800	0.21	19.3	279.9			
60 CSI	50	0.013	0.5	7.2			
0 -04	800	0.21	4.6	66.7			
2 cSt	50	0.013	0.1	1.4			



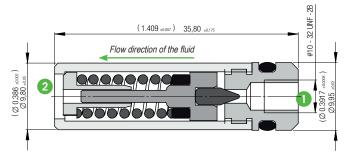


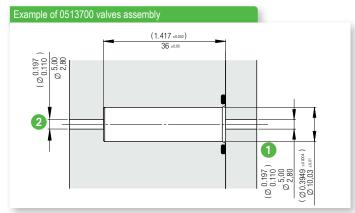


■ Relief valve maximum pressure 300 bar

LEDUC code	0513700
Max. flow	2000 cm³/min (0.53 USgal/min)
Opening pressure range	20 to 300 bar (290 to 4350 PSI)
Temperature range	- 30°C to 200°C (- 22°F to 392°F)







Microhydraulics accessories

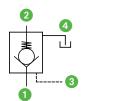
■ 0513540 pilot valves

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

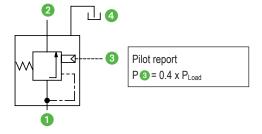
Pilot pressure from 3 to 120 bar max. (44 to 1740 PSI max.), depending on back



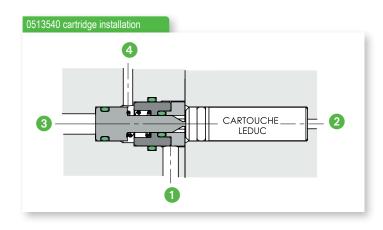
Pilot report $P2 = 0.05 \times P2$

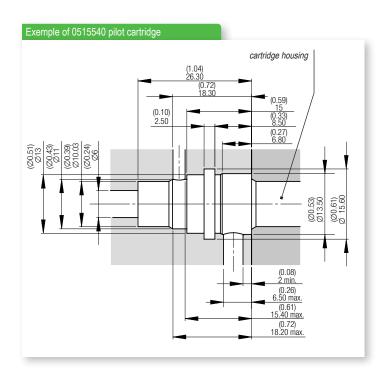
■ With relief valve ref. 0513700

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









Microhydraulics Complete functions

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



Microhydraulics Installation and start-up

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:





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

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.

Microhydraulics Installation and start-up

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.

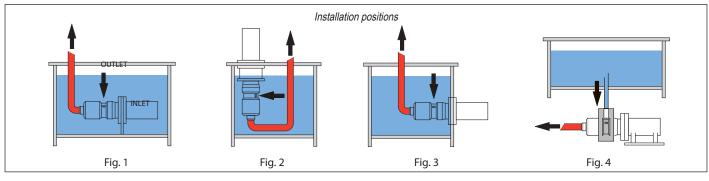
HYDRO LEDUC can fit its pumps with a self-priming system, adapted to difficult operating conditions (vertical position, risk of interruption of supply flow...). Please ask us.

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).



other product lines

hydraulic motors

Fixed displacement bent-axis piston motors.

Models from 5 to 180 cc (0.3 to 11 Cu.ln).

Available both in ISO and SAE versions.



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.ln).

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.

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.



hydro-pneumatical

accumulators

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.

we are passionate about hydraulics...



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.

a passion for hydraulics

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HYDRO LEDUC

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