



Professionals turn to hydraulic tools when they need to get the job done. Nothing matches the performance of hydraulic tools as compressed oil transfers energy more efficiently than compressed air. The inherent efficiencies result in longer life of the tool along with increased power and reliability.

Advantages of Hydraulic Tools



	Hydraulic		Pneumatic	
Durability	Small engine power unit is easy to maintain	✓	Large compressor engine requires high maintenance	X
Versatility	Several tools can be run off of same power source	✓	Limited tools can be ran	X
Cost	Power units starting at a few thousand dollars, cost of ownership is low	✓	Air compressors are much higher price and require more maintenance	X
Cold Weather Performance	Operates in sub-zero temperatures	✓	Air lines freeze	X
Enclosed Spaces	Zero exhaust, easier to operate in confined areas	✓	Compressed air exhaust spreads dust and debris	X
Portability	Small and lightweight power units are easy to move to jobsite	✓	Large tow behind compressor cannot access remote areas	X

THE BASIC PRINCIPLE OF HYDRAULICS FOR TOOL OPERATION

The basic principle of hydraulics used for tool operation can be compared with a typical household water system.

The typical rotary car-wash brush tool, that is operated from water through a garden hose, is in actuality a hydraulic tool. Water rushing through the garden hose drives a small motor in the car-wash tool which, in turn, rotates the brush. However, it is not just the rushing water that is driving the motor. There is also pressure associated with the rushing water—about 60 pounds per square inch (psi). Without the pressure, the tool would have no power. Without pressure, any force applied to the tool, such as pushing down on the tool, would stall the tool.

Water rushing through the hose (or the flow of water) is measured in gallons per minute (gpm) and results in the speed of the tool (in the case of the car-wash tool, the speed of the brush). Pressure associated with the water provides power to the tool.

The same principle applies in one of our tools. In a breaker, for example, the flow results in the speed of the tool and the resistance to that flow creates a demand for pressure. If the system has the capacity to deliver the pressure, power is transmitted to the tool to do work.

Hydraulic tools actually use less flow (gpm) than that produced through a garden hose. The pressure, however, is considerably higher. Hydraulic tools require pressures up to 2000 psi / 140 bar but only need 5 to 10 gpm to operate effectively. Of course, a typical HTMA hydraulic system returns fluid to a reservoir for re-use as opposed to the household water system that spills fluid to waste.

OPEN-CENTER AND CLOSED-CENTER SYSTEMS

There are two basic types of hydraulic systems — Open-Center and Closed-Center.

OPEN-CENTER IS CONSTANT FLOW — VARIABLE PRESSURE

When a tool valve is in the OFF position, hydraulic oil flows through the ON/OFF valve ports of the tool and back to the reservoir. The system is constantly flowing oil through the tool valve ports and back to the reservoir at no pressure. When the tool valve is ON, oil circulates through the tool causing the tool to operate, and then returns to the reservoir. Pressure is created when resistance to flow is sensed by the system. This occurs when the tool is put to work. Pressure will increase as the tool needs it up to the relief setting in the hydraulic system.

CLOSED-CENTER IS CONSTANT PRESSURE — VARIABLE FLOW

When a tool valve is in the OFF position, hydraulic oil flow stops at the ON/OFF valve port of the tool. The system will build and hold pressure without returning oil to the reservoir. When the tool valve is ON, oil circulates through the tool causing the tool to operate, and then returns to the reservoir. Pressure tends to be constant in the system. Pressure will increase as the tool needs it up to the settings in the hydraulic

system. And if pressures higher than the system setting are demanded by the work, flow will decrease.

FLUID TEMPERATURE

The following information will serve to assist those installing hydraulics in mobile applications for handheld tools. While many hydraulic circuits can run upwards to 200° F / 93° C, temperatures over 110° F / 43° C are uncomfortable to human touch. Our desire is to hold oil temperature to a maximum of 140° F / 43° C.

In almost any hydraulic tool circuit, oil cooling methods will be required except for very short periods of operation or in underwater and extreme cold environments. If you are involved in the design of a hydraulic tool circuit, use the following as guidelines.

BASIC DON'TS FOR COOL OIL CONTROL

1. DON'T — Rely on a large reservoir to control oil heating. Large reservoirs, even with good air circulation, do not adequately dissipate heat.
2. DON'T — Set relief pressure too low (open-center circuits) for percussion type tools (breakers, hammer drills, etc.). Pressure peaks may run up to 350 PSI over gauge pressure, popping the relief and causing heat as well as low tool performance.
3. DON'T — Pump more oil than the tool should use and avoid flow controls if possible. Instead, size the pump for desired flow volume. Gear type flow dividers can be used to reduce flow more efficiently than valves, reducing heat.
4. DON'T — Use heavy oils such as 30W or 10W30 engine oils. These will cause resistance in lines and add to backpressure and heat.
5. DON'T — Run return oil through control valves or other circuit components, except coolers and return line filters.

DO THE FOLLOWING TO REDUCE HEAT GENERATION

1. Operate pumps at moderate speed — gear pumps usually generate less heat and are less prone to cavitation at speeds of 1,000-2,000 RPM.
2. Use generous line sizes — Especially on pump suction and return from tool to tank.
3. Use oils in 130-225 SSU at 100° F / 38° C range with high viscosity index. (see hydraulic fluid recommendations at the end of this section)

PROVIDE GOOD COOLING FOR HYDRAULIC OIL

1. Use an air-to-oil cooler of maximum size for space available. Use a shrouded, high capacity fan. Many vehicles do not cool well when parked with engine at low speed. Do NOT use a "thermal" viscous-drive fan because these fans do not draw air unless the engine is hot.

FLUIDS FOR MOBILE HYDRAULIC TOOL CIRCUITS

The specification listed here will provide good all season operation if your circuit is of proper design and normal maintenance is performed. (Periodic filter change, draining of condensate, etc.)

SPECIFICATIONS

Item	U.S.A.	Metric
Viscosity (Fluid Thickness)	50° F 450 SSU Max.	10° C 95 Centistokes Max.
Viscosity (Fluid Thickness)	100° F 130-225 SSU	38° C 27-42 Centistokes
Viscosity (Fluid Thickness)	140° F 85 SSE Min.	60° C 16.5 Centistokes Min.
Pour Point (Min. for cold startup)	-10° F	23° C
Viscosity Index	(ASTM D2220)	140 Minimum
Demulsibility	(ASTM D1401)	30 Minutes Max.
Flash Point	(ASTM D92)	340° F Min.
Rust Inhibition	(ASTM D665 A&B)	Pass
Oxidation	(ASTM D943)	1000 Hours Min.
Pump Wear Test	(ASTM D2882)	60 mg Max.
Biodegradability	CEC-L-33-A94	>60%

RECOMMENDED FLUIDS

The fluids listed here work well over a wide temperature range at start-up, allow moisture to settle out, and resist biological growth likely in cool-operating hydraulic circuits. These fluids are recommended by Stanley Hydraulic Tools for use in our tools. Other fluids that meet or exceed the specifications of these fluids may also be used. Biodegradable fluids listed are compatible with all tool seals and hoses.

RECOMMENDED FLUIDS

Brand	Biodegradable	Description
CITGO	No	Hydurance All Temp
AMS Oil	No	HVH 32
Exxon Mobil	No	Univis HVI26*
Exxon Mobil	No	DTE 10 Excel
Shell	No	S2 V 32
Chevron	No	Rando HDZ 32
Conoco Phillips	No	Unax AW-WR-32
Clarion (CITGO)	Yes	Green Bio 32
Exxon Mobil	Yes	EAL 224H
Chevron	Yes	Clarity AW32
RSC Bio Solutions	Yes	Envirologic 132
Shell	Yes	Naturelle HF-E-32

*Recommended for extreme cold weather operation.