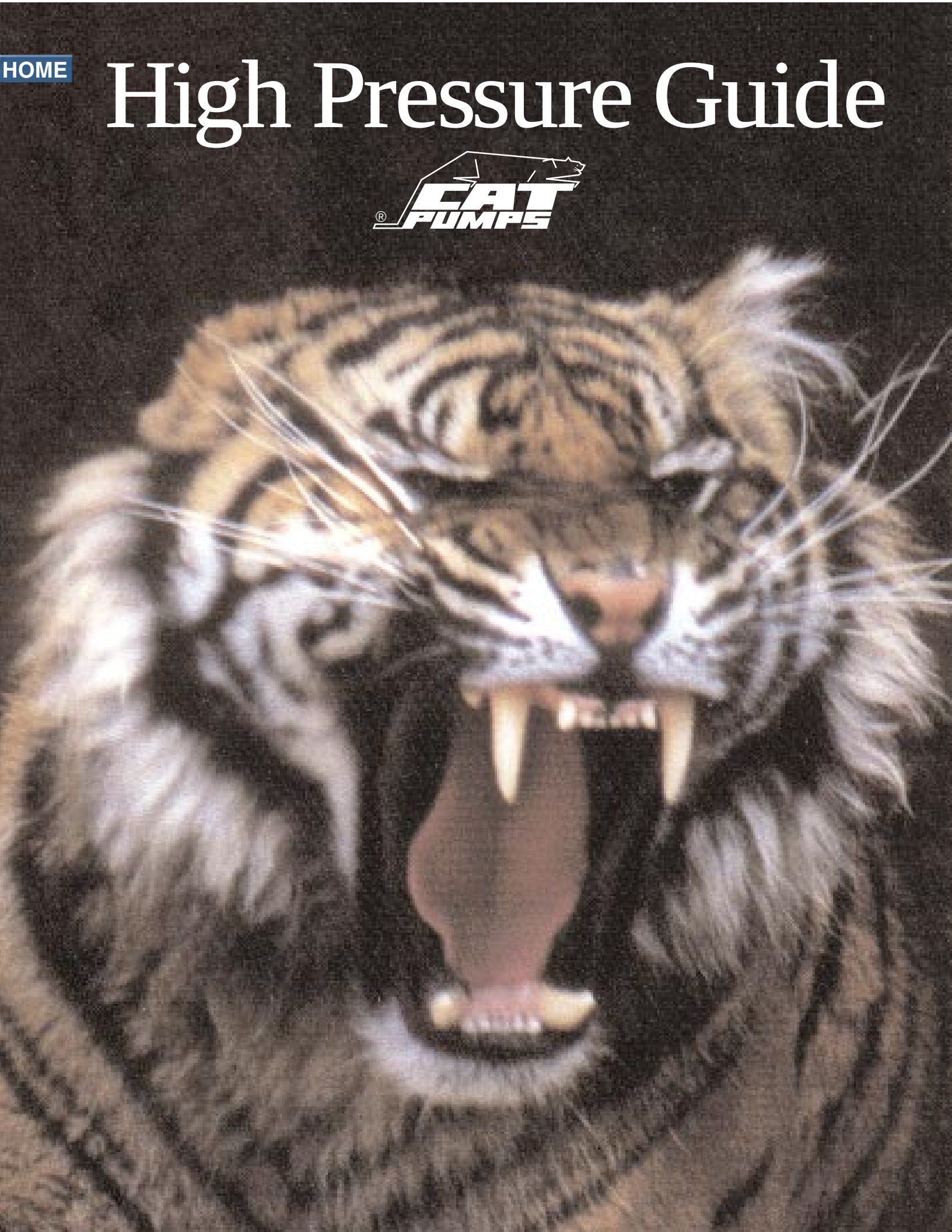
HOME

High Pressure Guide

CAT PUMPS®



9 Reasons Why You Should Be Using Cat Pumps High Pressure Triplex Pumps

1. Total Commitment To The Industry

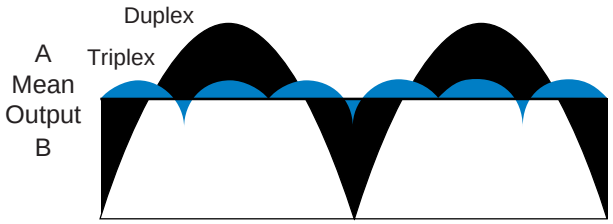
Our business—our commitment—is the design, manufacture, sales and service of high pressure CAT PUMPS. Since 1968, our engineers have literally revolutionized the small industrial pump business, developing completely new concepts and innovations to meet changing customer requirements. We are totally dedicated to building for today, designing for tomorrow—being ready when tomorrow's needs are reality.

2. Performance Dependability

CAT PUMPS have a proven continuous, heavy-duty performance record indicating long intervals between servicing. This assures you of the best return on your investment.

TRIPLEX DESIGN One of the most cost-efficient ways to insure extra long life for your high pressure system is to use a CAT PUMP with its three-cylinder design. This triplex design gives you much smoother flow (approximately 1/7th the pressure variations of comparable two-cylinder pumps) and minimizes the possibility of system failure due to excessive pulsation.

Pressure Variation



	Duplex	Triplex
A Variation Above Mean	60%	6.1%
B Variation Below Mean	100%	16.9%
Total Variation	160%	23%

PLUNGER DESIGN The triplex plunger pumps perform smoothly and quietly. The preset seals require no adjustment and enable consistent high pressures. The natural lubricity of the pumped fluid cools and lubricates the seals. The hardened, polished solid ceramic plungers provide extremely durable wear surfaces, abrasion resistance and maximum seal life. And the interchangeable all stainless steel valve assemblies keep parts to a minimum and service quick and simple.

UNIFLOW DESIGN The uniflow concept takes advantage of the inertia of the moving fluid—no jarring stops, just a smooth, continuous flow in one direction through the pump. This means less pulsation on the inlet side of the pump and minimizes the possibility of cavitation.

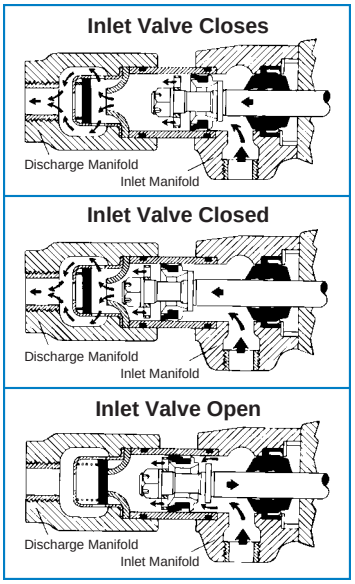
The inlet valves of the piston pump are mechanically actuated and do not rely on pressure differential to operate. This further reduces cavitation possibilities and means the pump has capabilities for self priming and strong lift—up to 20 feet (depending upon fluid temperatures and viscosity).

How Uniflow Design Works

As the name suggests, fluid flows in only one direction through the pump. At the beginning of the stroke, the mechanically actuated inlet valve, (actually the piston head) closes.

As the piston moves forward, fluid is forced out through the discharge valves. At the same time, fluid is flowing in *behind* the piston.

As the piston rod reverses direction, the inlet valve (the piston) opens mechanically allowing the fluid to continue its forward velocity flowing through the piston into the discharge chamber until the beginning of the stroke is reached.



3. Modular Flexibility

CAT PUMPS manufactures more than 150 different models each built on one of several basic horsepower frame sizes. Capacities range from 1-70 GPM with working pressures from 100 to 5,000 PSI.

Our Unique system of interchangeable parts allow conversion from one model to another within the same frame size in minutes.

To the end user, this modular flexibility means a more dependable pump because of uniformity of parts and quality control during manufacture. It also means faster delivery and service. To the CAT PUMPS distributor, this modular approach means lower cost pump and parts inventories.

When capacity requirements are higher, multiple CAT PUMPS may be linked together with real economies.

4. On-The-Job Servicing

CAT PUMPS have an outstanding record for dependability—seldom needing service. But when they do, convenient repair kits let you do the work in minutes—on the job! No need for long downtime. No need to take your pump out of service for lengthy trips to the repair shop. You can completely overhaul the wet-end of the pump, quickly and easily on-sight. Without special tools.

5. Sales And Service Training Schools

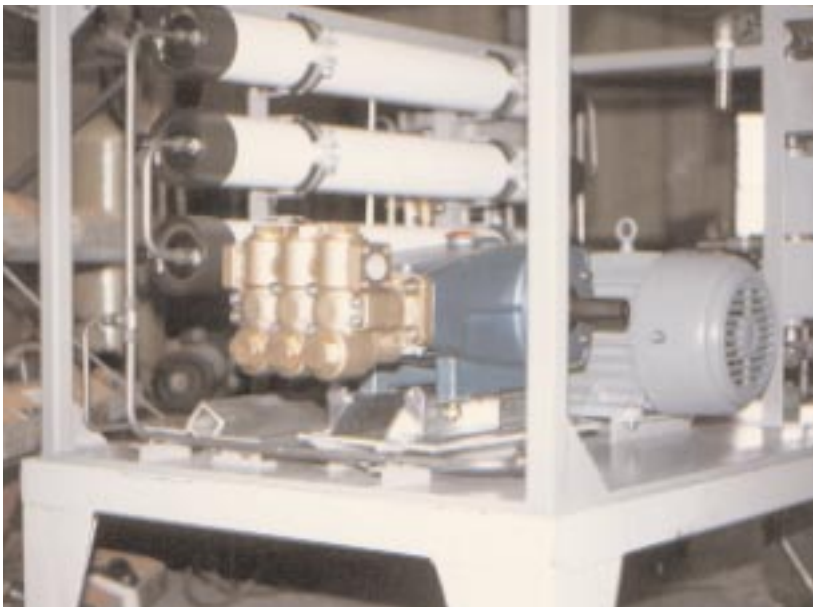
There's nothing tricky about servicing a CAT PUMP. However, we offer regular in-house and in-field training schools for all CAT PUMP distributor and OEM personnel. These schools keep CAT PUMP people well-informed on new products, techniques, and market applications.

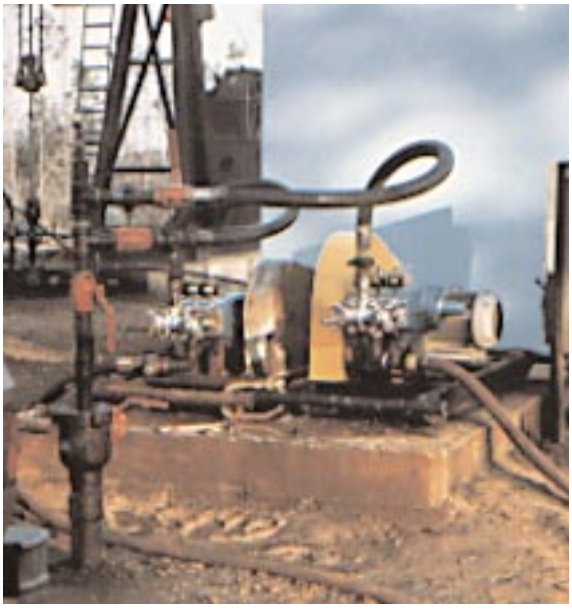
6. Application and Installation Versatility

You can select the pump model best suited for your industrial needs. Now available…special corrosion resistant models constructed of Nickel Aluminum Bronze and 316 Stainless Steel, convenient gear box pumps for simple direct gas engine mount or direct drive motorized pump units.

Check these cost effective applications!

- o pressure cleaning
- o salt water injecting
- o wet sandblasting
- o hydrostatic testing
- o reverse osmosis
- o dust suppression
- o vehicle wash
- o mechanical sep.
- o boiler feed
- o injection
- o machine tool coolant
- o spraying, misting





7. Total System Components

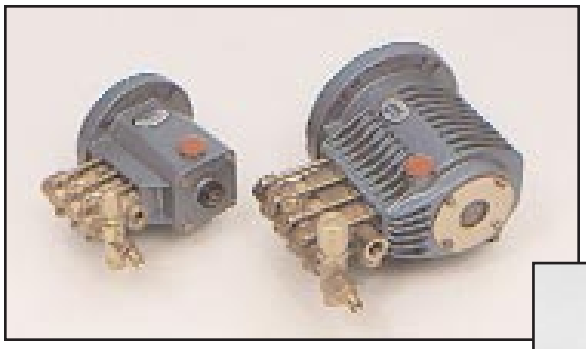
Improve Operating Efficiency, Reduce Maintenance Expense and Downtime Demand CAT PUMPS Products in Your System.

CAT PUMPS offers complementary accessories to match the flow and pressure of the CAT PUMP selected for your system... all available from stock... to keep your system running safely and smoothly.

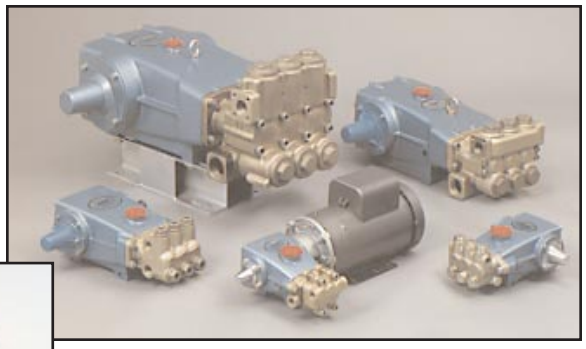
- Regulators • Unloaders • Guns • Lances • Sandblasters • Gauges
- Pulsation Dampeners • Pop-Off Valves • Inlet Pressure Regulators
- Chemical Injectors • Thermo Valves • Filters • Quick Start Valves
- Pressure Switches • Adjustable Nozzles • Spray Nozzles

Special Drive Options and Construction Materials to Custom fit Each Application

2SF AND 4SF DIRECT DRIVE PUMPS

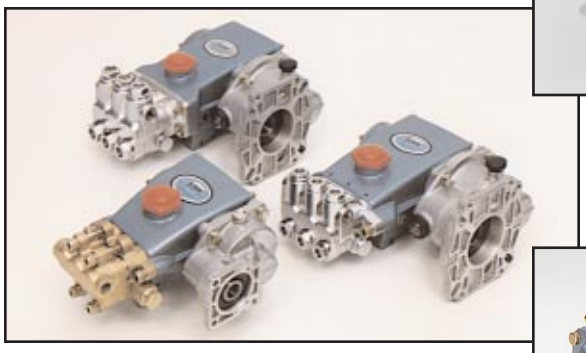


CORROSION RESISTANT PUMPS



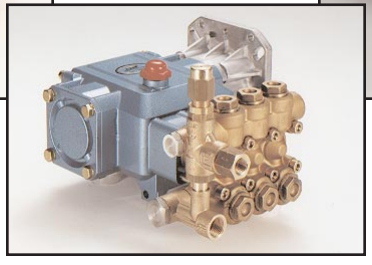
CP PLUNGER PUMPS

GEARBOX PUMPS

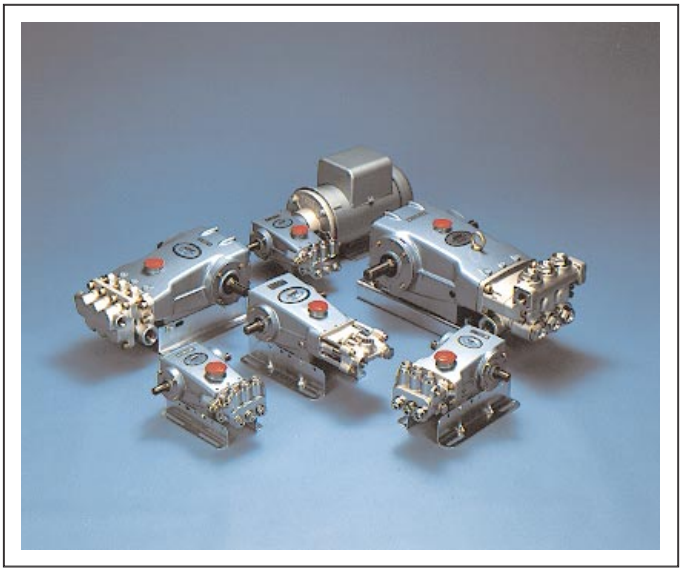


MOTORIZED PUMPS

5DX PLUNGER PUMPS



CAT PUMPS Offers You the Highest Quality Pump with the Longest Life!



Triplex Piston Pumps

Model	Capacity GPM (L/M)	Max. Press. PSI (BAR)	Max. RPM Req.	Max. Hp. Req.
280	3.0 (11)	1000 (70)	1330	2.1
290	3.5 (13)	1200 (85)	1200	2.9
323	5.0 (19)	1500 (105)	1000	5.2
333	4.0 (15)	1200 (85)	1070	3.3
390	12.0 (45)	600 (40)	1200	5.0

Model	Capacity GPM (L/M)	Max. Press. PSI (BAR)	Max. RPM Req.	Max. Hp. Req.
430	5.0 (19)	1000 (70)	1040	3.4
623	6.0 (23)	1200 (85)	850	5.0
820	10.0 (38)	1000 (70)	940	6.9
1010	12.0 (45)	700 (50)	900	5.8
1520	15.0 (57)	1000 (70)	830	10.3

Model	Capacity GPM (L/M)	Max. Press. PSI (BAR)	Max. RPM Req.	Max. Hp. Req.
2520 p 2527	25.0 (95)	800 (55)	772	13.7
6020	60.0 (227)	1000 (70)	500	41.2
6024	12.0 (45)	5000 (350)	500	41.2
6040	40.0 (151)	1500 (105)	500	41.2
6044	20.0 (76)	3000 (210)	500	41.2

Triplex Plunger Pumps

Model	Capacity GPM (L/M)	Max. Press. PSI (BAR)	Max. RPM Req.	Max. Hp. Req.
■ 230 ★237 Δ231	2.3 (9)	1500 (105)	1725	2.4
■ 240 ★247 Δ241	3.5 (13)	1500 (105)	1725	3.6
270 ★277 Δ271	3.5 (13)	1500 (105)	1420	3.6
● 279	3.5 (13)	1500 (105)	1420	3.6
310 ★317 Δ311	4.0 (15)	2000 (140)	950	5.5
■ 340 ★347 Δ341	4.0 (15)	2000 (140)	1725	5.5
● 34G1	4.0 (15)	2000 (140)	1725	5.5
■ 350 ★357 Δ351	5.0 (19)	1500 (105)	1725	5.9
35G1	5.0 (19)	1500 (105)	1725	5.0
45G1	4.0 (15)	3500 (245)	1475	8.3
● 51G1, 118	4.0 (15)	3000 (210)	1570	7.6

Model	Capacity GPM (L/M)	Max. Press. PSI (BAR)	Max. RPM Req.	Max. Hp. Req.
530	5.0 (19)	2150 (150)	1100	7.4
550	4.0 (15)	3000 (210)	990	8.2
56	5.5 (21)	3500 (245)	1210	13.0
57	4.5 (17)	4000 (280)	1285	12.4
● 58G1, 118	5.0 (19)	2500 (175)	1570	8.6
● 59G1, 118	5.5 (21)	3500 (245)	1570	13.2
650 Δ 651	7.0 (27)	3000 (210)	1000	14.4
70	4.5 (17)	5000 (350)	1700	15.4
1050 ★1057 Δ1051	10.0 (38)	2200 (155)	1000	15.0
2530 ★2537 ▲2831	20.0 (76)	1000 (70)	900	14.0
★ 3507 ▲3801	9.0 (33)	5000 (350)	800	30.9

Model	Capacity GPM (L/M)	Max. Press. PSI (BAR)	Max. RPM Req.	Max. Hp. Req.
★ 3517	14.0 (50)	3000 (210)	800	28.9
3520 ★3527 Δ3521	23.0 (83)	2000 (140)	800	31.6
3535 ★3537 Δ3531	36.0 (134)	1200 (85)	800	29.7
3545	45.0 (171)	1000 (70)	800	30.9
▲3821	23.0 (83)	2000 (140)	800	31.6
▲3831	36.0 (134)	1200 (85)	800	29.7
★ 6767 ▲6861	70.0 (260)	1000 (70)	520	50.0
▲6811	15.0 (57)	7000 (500)	600	55.1
▲6821	25.0 (95)	3000 (210)	615	55.1
▲6831	40.0 (152)	2300 (160)	625	63.1
▲6841	47.5 (180)	2000 (140)	615	65.2

2SF and 4SF Plunger Pumps

Model	Capacity GPM (L/M)	Max. Press. PSI (BAR)	Max. RPM Req.	Max. Hp. Req.
■ 2SF22EL	2.2 (8)	1200 (85)	1725	2.0
■ 2SF22E	2.2 (8)	1200 (85)	3450	2.0
2SF22G	2.2 (8)	1200 (85)	3450	2.0
■ 2SF22GEH	2.2 (8)	1500 (105)	3450	2.3
2SF22GS	2.2 (8)	2000 (140)	3450	3.0
■ 2SF29SL	2.85 (7.6)	1200 (85)	1725	2.4

Model	Capacity GPM (L/M)	Max. Press. PSI (BAR)	Max. RPM Req.	Max. Hp. Req.
■ 2SF30E	3.0 (11)	1200 (85)	3450	2.5
■ 2SF30GEH,GH	3.0 (11)	1500 (105)	3450	3.1
2SF30G	3.0 (11)	1200 (85)	3450	2.5
2SF30GS	3.0 (11)	2000 (140)	3450	4.1
■ 2SF35E	3.5 (13)	1200 (85)	3450	3.0
2SF35G	3.5 (13)	1200 (85)	3450	3.0

Model	Capacity GPM (L/M)	Max. Press. PSI (BAR)	Max. RPM Req.	Max. Hp. Req.
4SF35GS1	3.5 (13)	3000 (210)	3200	7.2
■ 4SF40ELS	4.0 (15)	3000 (210)	1725	8.3
4SF40GS1	4.0 (15)	3000 (210)	3200	8.3
■ 4SF45ELS	4.5 (17)	3000 (210)	1725	9.3
4SF45GS1,118	4.5 (17)	3000 (210)	3200	9.3
■ 4SF50GS1	5.0 (19)	2500 (175)	3200	10.3

2DX and 5DX Plunger Pumps

Model	Capacity GPM (L/M)	Max. Press. PSI (BAR)	Max. RPM Req.	Max. Hp. Req.
■ 2DX20E	2.0 (7.6)	1500 (105)	3450	2.1
■ 2DX20EN	2.0 (7.6)	1500 (105)	3450	2.1
■ 2DX30GS	3.0 (11)	2000 (140)	3200	4.2
■ 2DX30GNS	3.0 (11)	2000 (140)	3200	4.2

Model	Capacity GPM (L/M)	Max. Press. PSI (BAR)	Max. RPM Req.	Max. Hp. Req.
■ 5DX35G1	3.5 (13)	3200 (224)	3200	7.7
■ 5DX35GG1	3.5 (13)	2000 (224)	3200	7.7
■ 5DX40G1	4.0 (15)	3200 (224)	3200	8.8
■ 5DX40GG1	4.0 (15)	2000 (224)	3200	8.8

CP Plunger Pumps

Model	Capacity GPM (L/M)	Max. Press. PSI (BAR)	Max. RPM Req.	Max. Hp. Req.
3CP1120	4.0 (15)	2200 (155)	1750	6.0
5CP2120	4.0 (15)	2500 (175)	950	7.7
5CP3120	4.5 (17)	3500 (245)	1645	10.8
5CP5120	5.0 (15)	3000 (210)	1415	10.3

■ Direct Drive Elect/Gas Models ● Gear Box pump models ★ Corrosion Resistant Nickel Aluminum Bronze ▲ 316 SS Block Style Manifold Δ 316 SS Manifold p Hi-Temp 210°F

A Powerful and Lasting Impression

CAT PUMPS TUFF CAT®

HIGH PRESSURE CLEANING SYSTEM

Standard Features

The TUFF CAT is a complete High Pressure Cleaning System built totally with industrial quality components and offering the optimum in cleaning versatility. The new "Hi-Temp" models handle 190°F high pressure water with automatic shut-off when the trigger is released. These units come standard with many deluxe features: • the proven dependability of the **CAT PUMP SF ceramic plunger pump** offering unequaled performance life in its horsepower range • a custom designed **American made, industrial electric motor** featuring a thermal overload protection with reset button and low amp draw performance • a 35 foot electrical cord with **Ground-Fault Circuit-Interrupter** protection for maximum safety during operation • a convenient pop-up cord wrap making carrying and storing easy and neat • **Vari-Nozzle** permitting pressure adjustment from high to low as well as from 0° to 60° spray angle • a 30 foot non-marking **high pressure hose** with swivel and quick disconnect for convenience in assembly, use and storage • a **chemical injector** for application of various cleaning chemicals • an easy-to-read glycerine filled **pressure gauge** to monitor pressure to meet exact spraying or cleaning needs.

The TUFF CAT cleaning system is attractively housed in a compact high impact molded plastic case and is extremely easy to use with many quick connecting accessories.

Standard Models

2X1000 (2.0 GPM, 1000 PSI)
2X1500 (2.0 GPM, 1500 PSI)
2X2000 (2.2 GPM, 2000 PSI)
3X1000 (3.0 GPM, 1000 PSI)

Hi-Temp Models

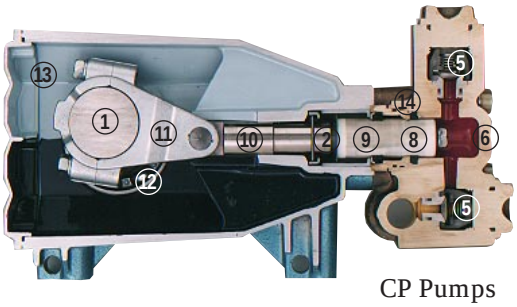
2X1000HT (2.0 GPM, 1000 PSI)
2X1500HT (2.0 GPM, 1500 PSI)
2X2000HT (2.2 GPM, 2000 PSI)
3X1000HT (3.0 GPM, 1000 PSI)
3X1500HT (3.0 GPM, 1500 PSI)

Pulsator Models

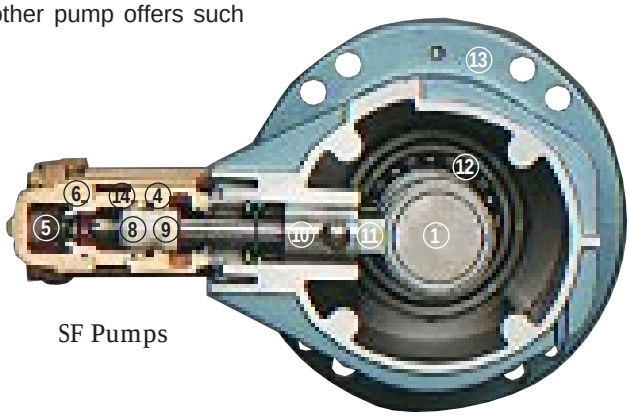
2X1000P (2.0 GPM, 1000 PSI)
2X1000HTP (2.0 GPM, 1000 PSI)
2X1500HTP (2.0 GPM, 1500 PSI)
3X1000P (3.0 GPM, 1000 PSI)
3X1000HTP (3.0 GPM, 1000 PSI)

8. Proven Design and Quality Components Assure Long-Term Performance

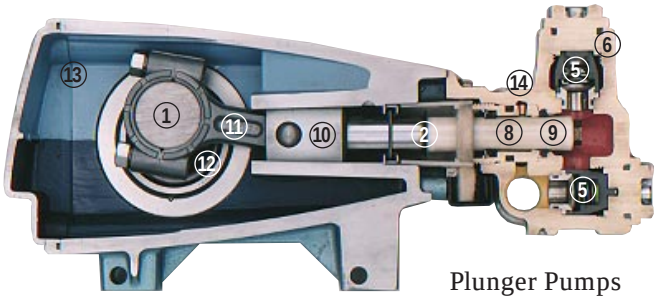
CAT PUMPS are constructed of the highest quality materials manufactured under close tolerance control and fully tested before leaving the factory. No other pump offers such consistently high standards.



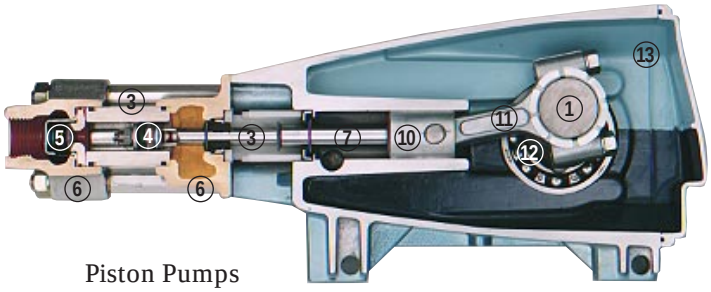
CP Pumps



SF Pumps



Plunger Pumps



Piston Pumps

① Chrome-moly crankshaft provides unmatched strength and surface hardness for long life.

② The stainless steel slinger provides back-up protection for the piston rod seal, keeping pumped fluids out of the crankcase.

③ The cylinder and sleeve wear surfaces are hard chrome-plated stainless steel for longer service life.

④ 100% wet cup/seal design adds to service life by allowing pumped fluids to cool and lubricate the elastomers on both sides.

⑤ Stainless steel valves, seats, and springs provide corrosion-resistance, positive seating, and long life.

⑥ High strength forged brass manifolds are also available in 316 stainless steel or nickel aluminum bronze for special corrosion resistance.

⑦ The patented stepped piston rod with hard chrome-plated sleeve provides a durable wear surface and easy wet end servicing.

⑧ Precision-polished solid ceramic plungers provide maximum resistance to corrosion and abrasion.

⑨ The close tolerance concentricity of the ceramic plunger maximizes seal life.

⑩ The high strength stainless steel plunger rods have a 360° supported crosshead providing uncompromising plunger rod alignment.

⑪ Matched oversized connecting rods are made of high strength material with exceptional bearing quality.

⑫ Oversized ball bearings or tapered roller bearings provide extended bearing life.

⑬ Diecast aluminum crankcase means high strength, lightweight, and excellent tolerance control.

⑭ Specially formulated, CAT PUMP exclusive Hi-Pressure Seal offers unmatched performance and seal life.

9. Worldwide Availability of Pumps and Parts

When you need a part for your CAT PUMP, you can count on our extensive worldwide network of sales and service representatives. Each location is equipped with pumps, complementary accessories and parts. Each location is trained to assist you in the selection, installation and maintenance of your CAT PUMPS. We're there when you need us; down the block…around the clock. No matter where you are, you're in CAT PUMP country.

UNITED STATES

Alabama	Colorado	Hawaii	Kansas	Massachusetts
Alaska	Connecticut	Illinois	Kentucky	Michigan
Arizona	Delaware	Idaho	Louisiana	Minnesota
Arkansas	Florida	Indiana	Maine	Mississippi
California	Georgia	Iowa	Maryland	Missouri
Montana	New York	Oregon	Utah	
Nebraska	North Carolina	Pennsylvania	Virginia	
Nevada	North Dakota	Puerto Rico	Washington	
New Jersey	Ohio	South Carolina	West Virginia	
New Mexico	Oklahoma	Tennessee	Wisconsin	
		Texas	Wyoming	

INTERNATIONAL

Alberta	Chile	Ireland	Peru
British Columbia	China	Israel	Philippians
Manitoba	Columbia	Italy	South Africa
Ontario	Denmark	Kuwait	Singapore
Quebec	Ecuador	Malaysia	Sri Lanka
Nova Scotia	France	Mexico	Spain
Argentina	Greece	The Netherlands	Switzerland
Australia	Honduras	New Zealand	Turkey
Belgium	Iceland	Pakistan	Venezuela

How to Choose and Protect Your Pressure Pump and System

by Steve Bruggeman, President, CAT PUMPS

When you invest in a pressure cleaning system, you're not just buying a machine, you're getting a time-saving, money-saving piece of industrial equipment.

So you should be aware of all components that go into the creation of a pressure cleaning system, taking time to evaluate each for cost effectiveness, reliability and service record.

Essentially, a pressure cleaner is a power source driving a pump to generate high pressure through a wand with a high pressure nozzle.

A malfunction or failure of the pump renders the system 'dead'. It is therefore imperative that you carefully scrutinize that pump to see that it will provide the proper support for your pressure system.

Choosing the Pump.

Be careful not to fall into the price trap and buy an undersized pump with an oversized rating designed for intermittent duty. Investigate the longevity of the pump, the typical length of intervals between servicing required. Immediate availability of parts is, of course, also important.

Correct installation and good maintenance of a pump can also make the difference between profits and problems — even once you've chosen a high-quality pump.

Accessories Are Important.

A quality high pressure system must be equipped with a pressure regulating unloader or relief valve and a filtration device on the inlet line. Though not imperative, a pulsation dampener and a pressure gauge are also highly recommended.

The pumps being used in modern pressure systems are positive displacement, which means as long as the crankshaft is turning, the pump will produce flow. Since liquids are not significantly compressible, pressure is created by the restriction on the discharge line, normally a spray nozzle. However, when a piece of foreign material clogs the nozzle, or when the trigger gun is shut off, the pistons are literally pounding against something as solid as concrete — for the fraction of a second it takes to destroy the pump — unless there is a relief valve to divert the flow.

Protection Against Excess Pressure.

A relief valve, preferably a regulating unloader, offers protection against damage build-up of excessive pressure. If a trigger shut-off gun is used, the highest quality regulator unloader available becomes a necessity rather than a luxury.

When a trigger gun is used, and the bypass from the regulator is returned back to the inlet of the pump, another potential problem area develops. When the system is in the bypass mode, the horsepower the pump is using is transmitted into heating of the water in the bypass loop.

The longer the system is left in the bypass mode, the hotter the water will become. After as short a period of time as three minutes in the bypass mode, damage to the pump seals and packings can occur from over-heating.

Protect Your Pump From Over-heating.

This potential problem area has prompted the recent development of a valve placed in the bypass line between the unloader and the pump inlet, which 'senses' the temperature of the fluid. When the temperature of the fluid rises to a preset temperature, the valve opens, letting some of the hot water out of the loop and allowing cold water into the loop to take its place. As a result: the loop temperature is reduced; the valve closes; and the pump is protected.

This thermostatically-controlled valve can be very helpful in reducing downtime and other costs.

Filter Essential to Good Pump Life.

A good quality filter and the maintenance of that filter are also essential to good pump life.

Premature failure of cups and seals is most often caused by abrasives in the fluid being pumped. You assume that since your water source is clean and good to drink — you don't need a filter, right? Wrong. If you think the particle impurity of 'pure clean' water is a myth, unscrew the mixing nozzle of the faucet on the kitchen sink and look at the fine, hard grit that collects on the screen. The miniscule particles of minerals in your water can literally plate the wear areas of your pump. Examination of this deposits may seem as harmless as the stain in a teacup, but they are, nonetheless, abrasive. In extreme cases, a pump that may have delivered thousands of hours of great service can have its cups or seals destroyed in only a few hours.

It is critical to install and maintain a good filter in your pressure system. These same abrasive particles in the water that shorten pump life also shorten the life of the regulator-unloader, the pulsation dampener, the hose and especially the nozzle.

Remember that pressure results from restriction only. When the restriction is enlarged, most often caused by nozzle wear, the pressure falls and the equipment's effectiveness is reduced.

More Pressure System Aids.

There are other components besides the pump which must be observed if downtime is to be avoided:

Nozzles: Brass or ordinary stainless steel nozzles have a relatively short life, since the passage of water under high pressure will enlarge the orifice in a few to several hours of use. Ceramic is probably superior to anything but tungsten carbide. Hardened steel is better than ordinary stainless and far superior to plain brass nozzles.

Pressure Gauges: give readings that might be likened to those of a cardiogram of the human heart. An abnormally high reading indicates a restriction in the discharge portion of the pumping system. A low reading may be nothing more than a worn nozzle orifice. This makes cleaning less effective, even though there is no apparent visual difference in the spray pattern of the pressure behind it.

Prrrrr-O-Lators [Pulsation Dampeners]: minimize pump wear and prolong the life of the total pressure system as well as minimizing operator fatigue. It is important for a pulsation dampener to be checked for proper nitrogen precharge on a regulator basis to insure maximum effectiveness.

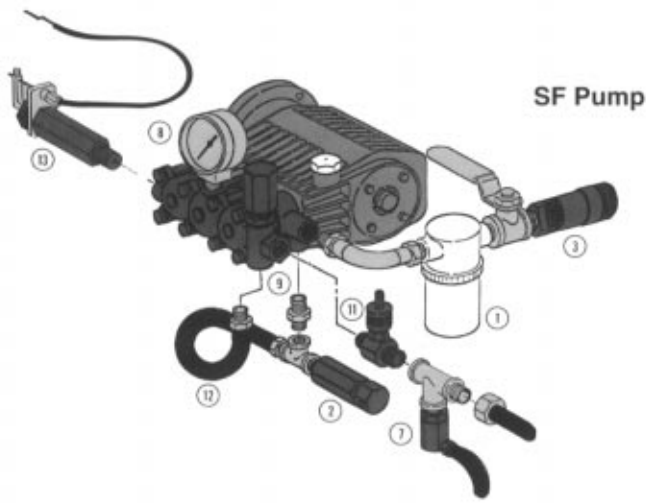
Maintenance Check List

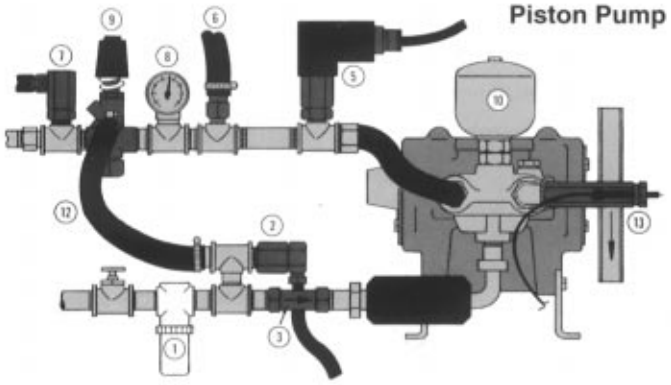
For optimum benefits and service, the use of this sample maintenance program is strongly recommended:

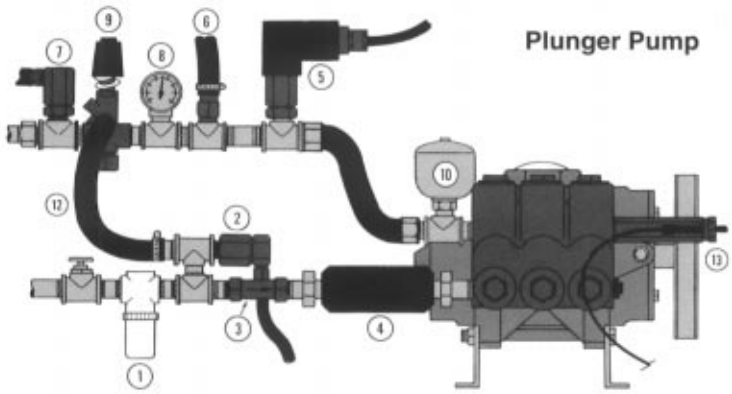
1. With a new industrial-type pump it is advisable to change oil after a brief run-in period. Wherever there is rubbing friction, as there is in all bearings, connecting rods, etc., some particles are shed during the run-in period. Changing the oil eliminates premature wear caused by particles of metal suspended in the oil.
2. Level of oil (of the quality and viscosity recommended by the manufacturer) in the pump should be checked every day the unit is used and should be changed at regular intervals as recommended by the manufacturer.
3. Inlet filters should be checked and cleaned on a regular basis.
4. Other lubrication, such as oilers, recommended by the manufacturer, is to be carried out regularly.
5. The unit should never be run dry.
6. No fluids are to be pumped through the system that are not approved by the manufacturer of the pump.
7. Select and install quality accessories to protect your pump and pressure system.
8. Inlet flow to the pump should not be restricted by undersized lines, excessive negative suction or water turbulence.

CAT PUMPS has distributors in every major U.S.A. market and in key international markets. World headquarters are located in Minneapolis, Minnesota, U.S.A. with branches in Belgium, England and West Germany.

Typical Installation







1 Inlet Filter
2 Thermo Valve
3 Inlet Pressure Regulator
4 C.A.T. Tube (Captive Acceleration Tube)
5 Pressure Switch
6 Pop-Off Valve
7 Quick Start Valve
8 Pressure Gauge
9 Pressure Regulator/Unloader
10 Pulsation Dampener
11 Chemical Injector
12 By-Pass Hose
13 Throttle Controller

These illustrations show the basic elements for a typical installation of a high pressure piston or plunger pump. **Not all components shown are required for all applications or systems.** Each component presents potential problems that too often are ascribed to a perfectly functioning pump, such as: a clogged strainer, a partially closed shut-off valve, a faulty gauge, or a malfunctioning regulator/unloader. Proper system installation, routine lubrication, monitoring and maintenance of components are your basic guarantees of optimum pump performance. CAT PUMPS does not assume any liability or responsibility for the design or operation of a customer's high pressure system.

★Preferred mounting of the Pulsation Dampener is directly on the discharge manifold of the pump, however, following a pressure unloader is required when the by-pass is returned to the inlet of the pump and an Inlet Pressure Regulator or Check Valve is used.

Handy Formulas to Help You

Q. **How can I find the RPM needed to get specific GPM (Gallons Per Minute) I want?**

A. Desired RPM = Desired GPM x $\frac{\text{Rated RPM}}{\text{Rated GPM}}$

Q. **I have to run my pump at a certain RPM. How do I figure the GPM I'll get?**

A. Desired GPM = Desired RPM x $\frac{\text{Rated GPM}}{\text{Rated RPM}}$

Q. **Is there a simple way to find the approximate horsepower I'll need to run the pump?**

A. Electric Brake Horsepower Required = $\frac{\text{GPM x PSI}}{1460}$ (Standard 85% Mech. Efficiency)

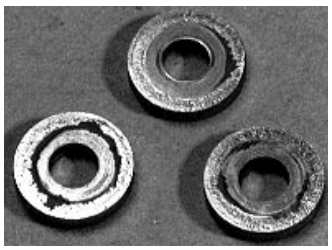
Q. **What size motor pulley should I use?**

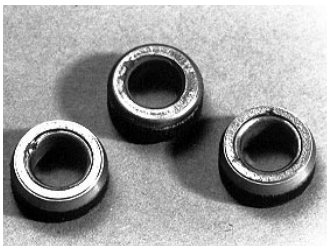
A. Pump Pulley (Outer Diameter) x $\frac{\text{Pump RPM}}{\text{Motor/Engine RPM}}$ (Consult Engine Mfr.)

Q. **How do I calculate the torque for my hydraulic drive system?**

A. Torque (ft. lbs.) = 3.6 $\left(\frac{\text{GPM x PSI}}{\text{RPM}}\right)$

Avoid Cavitation Damage





One or several of the conditions shown in the chart below may contribute to cavitation in a system resulting in premature wear, system downtime and unnecessary operating costs.

CONDITION	SOLUTION
Inadequate inlet line size	• Increase line size to the inlet port or one size larger
Water hammering fluid acceleration/ deacceleration	• Install C.A.T. Tube • Move pump closer to fluid supply
Rigid Inlet Plumbing	• Use flexible wire reinforced hose to absorb pulsation and pressure spikes
Excessive Elbows in Inlet Plumbing	• Keep elbows to a minimum and less than 90°
Excessive Fluid Temperature	• Use Thermo Valve in bypass line • Do not exceed pump temperature specifications • Substitute closed loop with baffled holding tank • Adequately size tank for frequent or high volume bypass • **Pressure feed high temperature fluids** • Properly ventilate cabinets and rooms
Air Leaks in Plumbing	• Check all connections • Use Teflon tape
Agitation in Supply Tank	• Size tank according to pump output — **Minimum 6-10 times system GPM** • Baffle tank to purge air from fluid and separate inlet from discharge
High Viscosity Fluids	• Verify viscosity against pump specifications before operation • Elevate fluid temperature enough to reduce viscosity • Lower RPM of pump • Pressure feed pump • Increase inlet line size
Clogged Filters	• Perform regular maintenance or use clean filters to monitor build up • Use adequate mesh size for fluid and pump specifications

Simple C.A.T. Tube Stops Pump Cavitation

APPLIED FLUID MECHANICS. The technology of the Captive Acceleration Tube (C. A.T.) is a recently perfected application of fluid mechanics. The C. A.T. has undergone 6 years of rigorous trials in the U.K. and overseas and has lived up to its promise. The following is a glimpse of the technology behind the C. A.T.

WHAT IS CAVITATION?

Cavitation in piston and plunger pumps is caused by the formation and collapse of gaseous cavities in the liquid being pumped and it is the energy of the collapse during the suction stroke which erodes the surfaces of the pump.

The most obvious indication of cavitation is a **hammering noise**. This noise can be either continuous or intermittent depending upon the degree of cavitation. **Vibration** of the pump and system will also be noticeable as the pump becomes starved of fluid. Eventually **flow and pressure will decrease.**

WHAT IS A C.A.T.?

A C. A.T. is an energy source that releases energy at the frequency (speed) needed to ensure that the cylinders are filled from the beginning of the stroke. Once this is achieved, the risk of cavitation is virtually eliminated. Inlet Pulsation Dampeners have been tried as a cure but while they may reduce one of the symptoms, especially with low speed pumps, they do nothing to relieve the cavitation regime. A C. A.T., on the other hand, kicks liquid into the cylinder at the required frequency to match the opening of inlet valves of even high speed pumps.

The C. A.T. is not designed for suction inlet conditions as the energy storing hose inside will collapse and be non-functional.

WHAT SYSTEMS BENEFIT MOST?

Although most installations of piston and plunger pumps will benefit from a C. A.T., those most in need of one are where the **inlet pressure is boosted**, where the **inlet temperature is high** (over 120° F) and where the **inlet line is long or torturous.**

HOW MUCH COULD BE GAINED?

Here are solid facts of what the C. A.T. has achieved for some systems.

In one installation containing two pumps, the annual costs of spares is now only $176.00 for each pump. this showed a savings of over 90%.

In yet another case, the yearly cost of spares fell from $1600.00 to $240.00

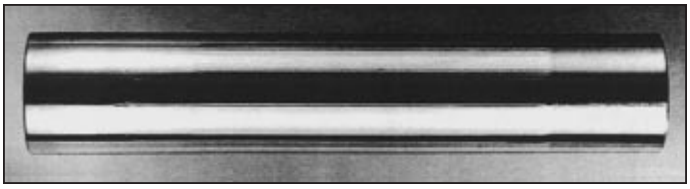
Remember, C. A.T.s are not a gimmick and their cost is not an insignificant part of the price of a pump package. We offer them with the absolute certainty that they will perform the “miracles” we promise when installed properly.

Spiking Pump Cavitation

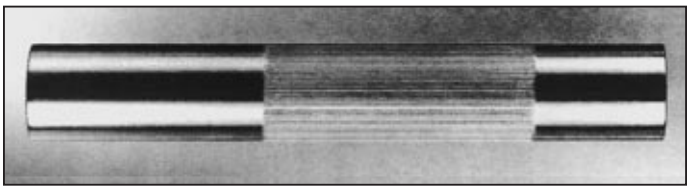
A simple piece of lateral thinking has solved the cavitation problems which can plague piston and plunger pumps. Essentially the solution is a piece of flexible hose which gives a boost as the inlet valve opens. but the effects are dramatic. The director of *CAT PUMPS (UK)* who perfected the concept quotes examples in pumping and water hydraulics where the C.A.T. (captive acceleration tube) has cut maintenance costs by 90%.

The real trick as ever was in isolating the right problem. The design began with work on reverse osmosis systems producing fresh water at sea. There, centrifugal pumps were being used to boost the flow into the main positive displacement pumps (PDP). Where the two were not in tune, cavitation became an horrendous problem unless mammoth pumps were used at low speeds.

The inlet to the PDP was at the heart of the difficulty. If, when the inlet valve opens there is not an immediate flow to the cylinder, then a low pressure regime is followed by a sudden pressure spike rushing in to fill the gap. Traditional solutions had attempted to cut of the top of the pressure spike using an inlet pulsation dampener. However, this was merely treating the symptoms, which in fact follows the low pressure regime, not curing the cavitation.

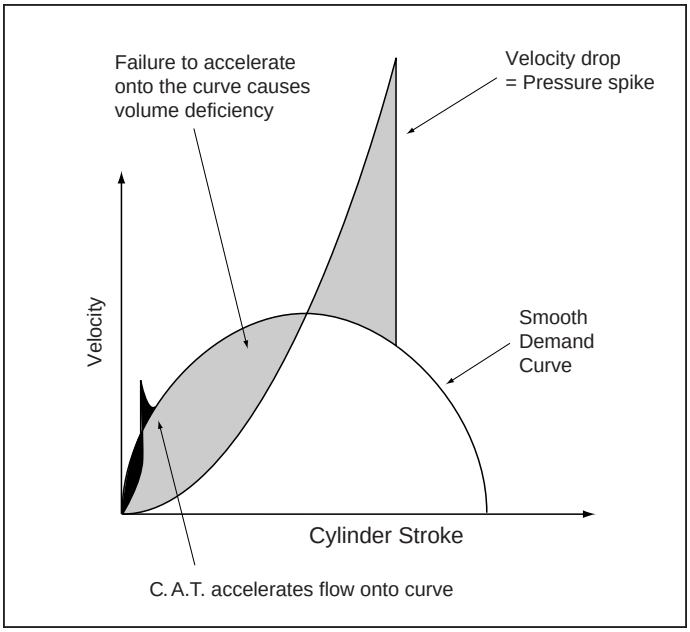


Mild Cavitation



Severe Cavitation

The mechanism by which cavitation damages pumps is complex. The pressure drop forms pockets of vapor in the liquid, which therefore gain latent heat of vaporization. When a vapor pocket touches a metal surface, it loses this heat instantaneously and implodes. The resulting shock wave bounces off an adjacent surface, pulling metal molecules with it. The resulting damage (above) could be mistaken for severe abrasive wear, but can occur no matter how pure the liquid being pumped.



Instead the need was to “kick” the flow into the inlet as soon as it opened to avoid the cylinder running on empty, early on it its stroke. Once that has happened, the flow neatly follows demand in a smooth curve with no cavitation and no pressure spike (see graph).

The C.A.T. system uses a piece of flexible hose, which expands slightly, ready to provide this acceleration at the critical inlet opening point. The painstaking part which took six years, was to balance hose size and pump frequency.

Main beneficiaries are likely to be in cases where a boost pump is used; where high inlet temperature (over 50°C) lowers vapor pressure at the inlet; and where tortuous inlet lines slow flow acceleration. It cannot be used though where pumps suck or for pressure over 50 psi.

One clear application is in water hydraulics, notably in several British Steel mills. An earlier example at Morganite Crucible, on its hydrostatic press for cold forming pipe fittings illustrates the point. Two triplex plunger pumps replaced gear pumps early in 1985, running periodically at 782 rpm with a 95/5 fluid and pressure to 140 bar. Spares usage after nearly four years only amounted to $900. The gear pumps were being replaced every three months.

June 1989 CAT PUMPS (UK)

Use These Handy Charts for Your Pressure System

STANDARD NOZZLE SELECTION CHART

Nozzle Volume (GPM) at Various Pressures (PSI)

St'd. Nozzle (Size) Number	Equiv. Orifice Diam. (Inches)	40	100	250	500	600	700	800	1000	1200	1500	2000	2500	3000
2.0	.034	.20	.32	.50	.71	.77	.84	.89	1.00	1.10	1.20	1.40	1.60	1.70
4.0	.052	.40	.63	1.00	1.40	1.50	1.70	1.80	2.00	2.20	2.40	2.80	3.20	3.50
4.5	.055	.45	.71	1.10	1.60	1.70	1.90	2.00	2.20	2.40	2.80	3.20	3.60	3.90
5.0	.057	.50	.79	1.30	1.80	1.90	2.10	2.20	2.50	2.70	3.10	3.50	4.00	4.30
5.5	.060	.55	.87	1.40	1.90	2.10	2.30	2.50	2.80	3.00	3.40	3.90	4.30	4.80
6.0	.062	.60	.95	1.50	2.10	2.30	2.50	2.70	3.00	3.30	3.70	4.20	4.70	5.20
6.5	.064	.65	1.00	1.60	2.30	2.50	2.70	2.90	3.30	3.60	4.00	4.60	5.10	5.60
7.0	.067	.70	1.10	1.80	2.50	2.70	2.90	3.10	3.50	3.80	4.30	5.00	5.50	6.10
7.5	.070	.75	1.20	1.90	2.70	2.90	3.10	3.40	3.80	4.10	4.60	5.30	5.90	6.50
8.0	.072	.80	1.30	2.00	2.80	3.10	3.30	3.60	4.00	4.40	4.90	5.60	6.30	6.90
8.5	.074	.85	1.30	2.30	3.00	3.30	3.60	3.80	4.30	4.60	5.20	6.00	6.70	7.40
9.0	.076	.90	1.40	2.30	3.20	3.50	3.80	4.00	4.50	4.90	5.50	6.40	7.10	7.60
9.5	.078	.95	1.50	2.40	3.40	3.70	4.00	4.20	4.80	5.20	5.80	6.70	7.50	8.20
10.0	.080	1.00	1.60	2.50	3.50	3.90	4.20	4.50	5.00	5.50	6.10	7.10	7.90	8.70
12.0	.087	1.20	1.90	3.00	4.20	4.60	5.00	5.40	6.00	6.60	7.30	8.50	9.50	10.40
15.0	.094	1.50	2.40	3.80	5.30	5.80	6.30	6.70	7.50	8.20	9.20	10.60	11.90	13.00
20.0	.109	2.00	3.20	5.00	7.10	7.70	8.40	8.90	10.00	11.00	12.20	14.10	15.80	17.30
30.0	.141	3.00	4.70	7.50	10.60	11.60	12.50	13.40	15.00	16.40	18.40	21.20	23.70	26.00
40.0	.156	4.00	6.30	10.00	14.10	15.50	16.70	17.90	20.00	21.90	24.50	28.30	31.60	34.60

*A commonly used standard for nozzle size is the "nozzle number" which is equivalent to the nozzle capacity in GPM at 4000 PSI. Spray angle does not affect nozzle volume.
See Jet-Eye Nozzle data sheet for complete selection.

HOSE FRICTION LOSS

Water* Flow Gal/Min	PRESSURE DROP IN PSI PER 100 FT OF HOSE WITH TYPICAL WATER FLOW RATES — Hose Inside Diameters, Inches						
	1/4	5/16	3/8	1/2	5/8	3/4	1"
0.5	16	5	2				
1	54	20	7	2			
2	180	60	25	6	2		
3	380	120	50	13	4	2	
4		220	90	24	7	3	
5		320	130	34	10	4	
6			220	52	16	7	1
8			300	80	25	10	2
10			450	120	38	14	3
15			900	250	80	30	7
20			1600	400	121	50	12
25				650	200	76	19
30					250	96	24
40					410	162	42
50					600	235	62
60						370	93

*At a fixed flow rate with a given size hose, the pressure drop across a given hose length will be directly proportional. A 50 ft. hose will exhibit one-half the pressure drop of a 100 ft. hose. Above values shown are valid at all pressure levels.

RESISTANCE OF VALUES AND FITTINGS

Nominal Pipe Size Inches	Inside Diameter Inches	Equivalent Length of Standard Pipe in Feet — Gate Valve	Globe Valve	Angle Valve	45° Elbow	90° Elbow	180° Close Ret	Tee Thru Run	Tee Thru Branch
1/2	0.622	0.41	18.5	9.3	0.78	1.67	3.71	0.93	3.33
3/4	0.824	0.54	24.5	12.3	1.03	2.21	4.90	1.23	4.41
1	1.049	0.69	31.2	15.6	1.31	2.81	6.25	1.56	5.62
1 1/4	1.380	0.90	41.0	20.5	1.73	3.70	8.22	2.06	7.40
1 1/2	1.610	1.05	48.0	24.0	2.15	4.31	9.59	2.40	8.63
2	2.067	1.35	61.5	30.8	2.59	5.55	12.30	3.08	11.60
2 1/2	2.469	1.62	73.5	36.8	3.09	6.61	14.70	3.68	13.20
3	3.068	2.01	91.5	45.8	3.84	8.23	18.20	4.57	16.40
4	4.026	2.64	120.0	60.0	5.03	10.80	23.90	6.00	21.60

Arriving at a total line pressure loss, consideration should then be given to pressure loss created by values, fittings and elevation of lines.

If a sufficient number of values and fittings are incorporated in the system to materially affect the total line loss, add to the total line length, the equivalent length of line of each value or fitting.

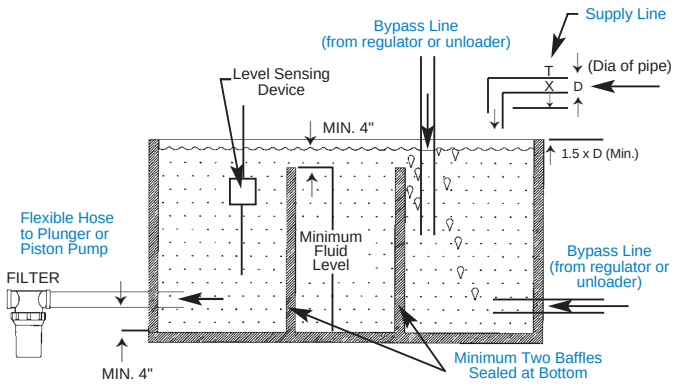
WATER LINE PRESSURE LOSS

PRESSURE DROP IN PSI PER 100 FEET

Water GPM	Steel Pipe—Nominal Dia. 1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	Brass Pipe—Nominal Dia. 1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	Copper Tubing O.D. Type L 1/4	3/8	1/2	5/8	3/4	7/8
1	8.5	1.9						6.0	1.6						120	13	2.9	1.0		
2	30	7.0	2.1					20	5.6	1.8					400	45	10	3.4	1.3	
3	60	14	4.5	1.1				40	11	3.6						94	20	6.7	2.6	
5	150	36	12	2.8				100	28	9.0	2.2					230	50	17	6.1	3.0
8	330	86	28	6.7	1.9			220	62	21	5.2	1.6				500	120	40	15	6.5
10	520	130	43	10	3.0			320	90	30	7.8	2.4					180	56	22	10
15		270	90	21	6.2	1.6			190	62	16	5.0	1.5					120	44	20
25		670	240	56	16	4.2	2.0		470	150	40	12	3.8	1.7				330	110	50
40					66	17	8.0					39	11	5.0				550	200	88
60						37	17						23	11						
80						52	29						40	19						
100					210	107	48						61	28						

TYPICAL RESERVOIR TANK

RECOMMENDED 6 TO 10 TIMES SYSTEM CAPACITY



At least two baffles are recommended. The tank feed connection should be on the opposite side from the discharge connection to the pump.

Additional precautions may be necessary with Hi-Temp fluids and chemicals.

Thank You for considering CAT PUMPS.
If you should have any questions after reviewing this brochure, please contact us.

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Products described hereon are covered by one or more of the following U.S. patents 3558244, 3652188, 3809508, 3920356, 3930756 and 5035580

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