QUANTUM™ E.S.P.

Electric Servo Pump

WATERJET CUTTING SYSTEMS

TECHNI Waterjet™

www.techniwaterjet.com

Innovation Through Passion

INNOVATION AND TECHNOLOGY

Core Technology - *Proven & Reliable*

The TECHNI *Waterjet*™ Quantum ESP™ (Electric Servo Pump) incorporates core "direct servo" technology that was first applied by NASA for the Space Shuttle Program by replacing old-fashioned hydraulic cylinders with new, highly compact, efficient, reliable and infinitely controllable Servo Linear Actuators. This same style actuator is used today in many high end machine tools and presses replacing inefficient hydraulic systems. Similarly, TECHNI *Waterjet*™ is the first waterjet manufacturer to utilize "direct servo" technology in an ultra-high pressure waterjet pump and has developed patented designs to integrate the core technology into the most efficient, reliable and controllable ultra-high pressure (UHP) waterjet cutting pump.

Existing Technology - *The Best of Both Worlds*

Traditional waterjet pumps are categorized into two main types – intensifier pumps and direct drive crankshaft pumps. These two types offer different benefits, but both have considerable limitations.

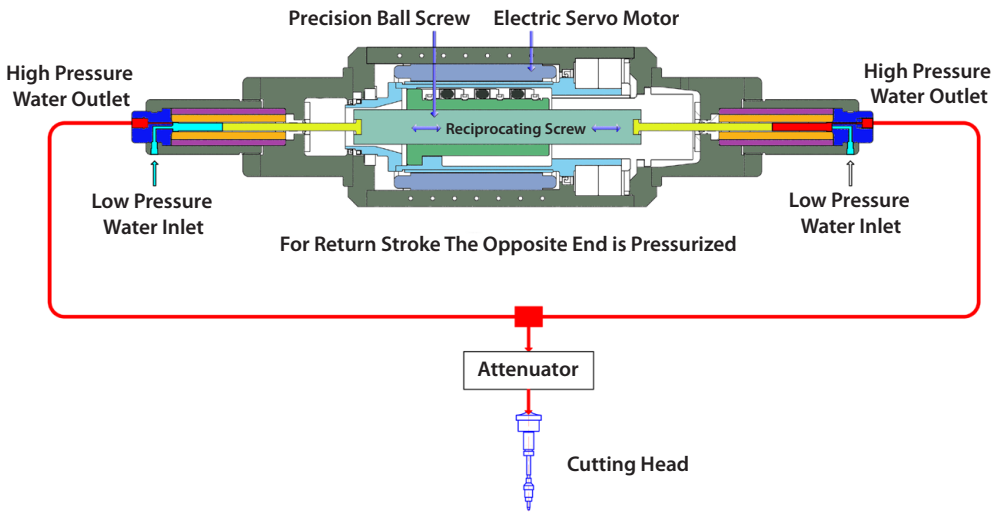
1) Intensifier pumps are capable of delivering higher operating pressures, can support multiple nozzles, and can be "dead-headed" by holding pressure without any water being displaced. While dead-heading is desirable to pause or hold the cutting operation, it results in unwanted pressure spikes of up to 10% of the operating pressure, which is harmful to components and causes failure in high pressure piping and fittings. Intensifier pumps are typically very inefficient, large and noisy.

2) Direct drive crankshaft pumps are smaller, quieter and more efficient, but cannot dead-head, and must displace the water whenever the motor is on, which is done by dumping the water over a relief valve to drain. As a result, it is not practical to run multiple heads or varying orifices, as the unused water and energy is wasted. Direct drive crankshaft pumps are not suitable for running varying pressures, and are less reliable than intensifier pumps due to their high plunger piston speeds.

The TECHNI Waterjet™ Quantum ESP™ takes advantage of all the best features of the two existing technology pumps, while having none of their limitations.

New Technology - *The Future in Waterjet Cutting*

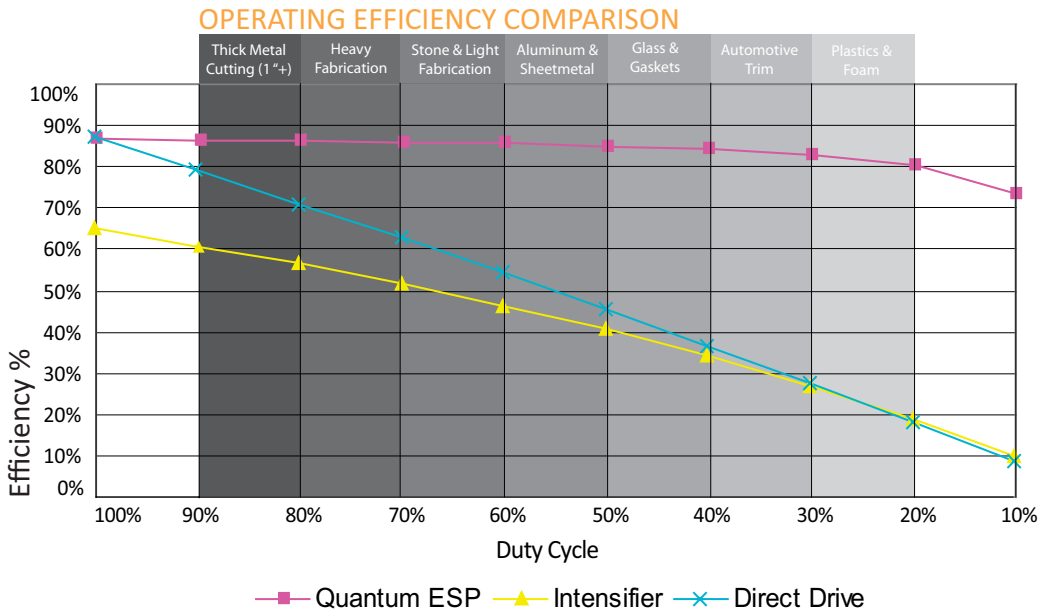
The TECHNI Waterjet™ Quantum ESP™ is a revolutionary concept in waterjet cutting. It incorporates a servo motor directly enveloping a high load, precision ball screw. The ball screw directly houses the ceramic plungers, which reciprocate back and forth to create the pumping action, in much the same way as a hydraulic cylinder works on an intensifier pump. The infinite control of the servo motor and precision of the ball screw, enable extremely accurate control over the output pressure and volume of the water displaced, and eliminates pressure spikes when dead-heading. This infinite control gives an operator the ability to program virtually any pressure and flow rate from zero to full capacity, while only using the power displaced at the cutting head.



EFFICIENCY

Real Efficiency - *Real Savings*

The TECHNI *Waterjet*™ Quantum ESP™ is by far the most efficient waterjet pump available on the market, delivering "real" efficiency gains and "real" savings. Direct drive crankshaft pumps have traditionally been marketed for their efficiency, however, they are only efficient while the cutting head is open and the full capacity of the pump is being used. When the head closes while the material is being loaded, unloaded, and re-loaded, or while the machine positions for the next cut, almost all of the energy is directed over a relief valve, literally sending power, water and money down the drain. Intensifier pumps are inherently less efficient due to the power required to simply run the hydraulic system. They also use a large percentage of their power regardless whether cutting or idle, as the hydraulic oil is passed over a relief valve in the hydraulic system. The Quantum ESP™ only ever uses the power required for the cutting process. This means that regardless of whether the cutting head is open or closed, or the pressure or flow is reduced, there are no additional power losses. The below graph highlights the increasing efficiency gains achieved with the Quantum ESP™ as duty cycles decrease.



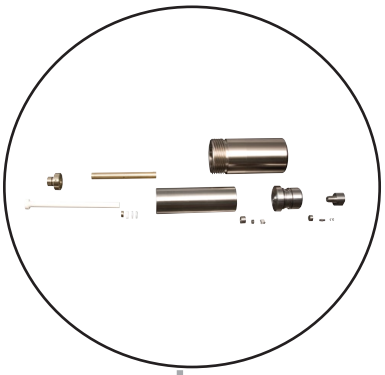
Duty cycles equate to the percentage of time that the cutting head is open, cutting, and actually removing material. As with any profile cutting machine, a percentage of time is used to positioning the head between cuts and while sheets are being loaded and unloaded. Typical duty cycles range from 90% for heavy plate cutting, down to 20% for plastics, foams and automotive trim components. Most common waterjet applications such as metal cutting, fabrication, stone, and glass run at about a 60% duty cycle.

Electric Servo Pump

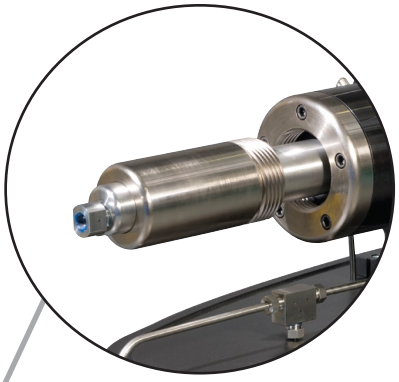
- **Most Efficient Waterjet Pump – up to 60% more efficient than standard hydraulic intensifiers**
- **Lowest Cooling Water Requirement – up to 75% less cooling water than standard hydraulic intensifiers**
- **Most Quiet – <68dBA with almost silent operation**
- **Smallest Footprint – over 50% less sq. ft. than an average hydraulic intensifier and lower profile and more ergonomic**
- **Longest Life Fittings and Tubing – due to the elimination of "dead head" pressure spikes**
- **Easiest Maintenance – easy access and improved visual diagnostics**
- **Superior Design - quick-change seal components for the fastest seal change in the industry**
- **Smartest – Intelligent Diagnostic Control reduces maintenance and increases uptime**
- **Environmentally Friendly – significantly less consumption of water & power, and minimal oil usage compared to standard hydraulic intensifiers**

TECHNI Waterjet™ is proud to introduce the Quantum ESP™, another TECHNI "first" in the waterjet industry. This revolutionary product follows in line behind our other industry "firsts" including Breakaway Head, Precision Stainless Steel Band Drive (PSSBD), Techjet-X2® Linear Magnetic Scales Feedback, Tech-Sense™ Abrasive Monitoring System and the PAC55™ 5-axis bevel cutting with taper elimination. The Quantum ESP™ demonstrates TECHNI Waterjet's™ commitment to developing innovative products that truly benefit the customer."

Darren Reukers, Managing Director



Long Life High Pressure Components, Designed for Ease and Speed of Maintenance



Quick Change Threaded Cylinder Retaining Sleeve for Increased Safety and Fast Maintenance

Hard Wearing UHMWPE Work Bench that Resists Chipping, Scratching and will not Damage or Dent Components during Maintenance

Automatic Lubrication System with Filtration and Cooling

Quick Action Removable Hinged Panels for Ease of Maintenance

**International Patents Pending*

THE FACTS

The Relationship between Pressure, Flow Rate and Horsepower

The TECHNI Waterjet™ Quantum ESP™ offers the unique ability to set varying output pressures, flow rates and power usage. The Quantum ESP™ is the only waterjet pump that uses only the power required for any given pressure and flow rate. Other pumps adjust pressure and flow rate by dumping either the excess cutting water, or the excess hydraulic oil, over a relief valve.

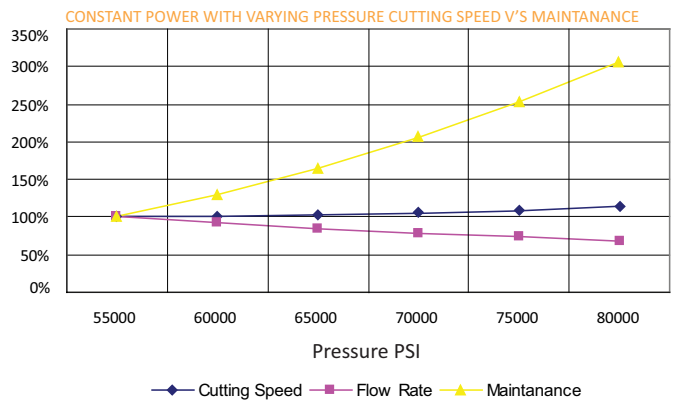
In order for a user to correctly decide the best set up for a particular application, it is important to understand the relationship between pressure, flow rate and power.

There is much misinformation available which suggests that simply increasing pressure will result in significant increases in cutting speed. While this might be true, but only if you ignore the fact that as pressure increases, so does the power requirement, or the flow rate must be proportionately reduced by using a smaller orifice. For example, a 50% increase in pressure will result in a 50% reduction in flow rate (using a smaller orifice) while maintaining an equal power consumption. Because most traditional pumps have a fixed maximum available power, there is no choice but to reduce the flow rate if higher pressures are desired.

As pressures increase, there is a small improvement in efficiency due to reduced friction, as the same amount of energy is being distributed over a smaller area. Typically, this will result in an increased cutting speed of approximately 20% of the increase in pressure (assuming that the power, garnet supply and focusing tube size remain constant.) For example, using a 50 hp pump with a cutting head set up with a .010" orifice, .030" focusing tube and 0.5 lb/min garnet flow, and increasing the pressure 50% from 55,000 psi (@ 1 gpm) to 80,000 psi (@.65 gpm), will result in approximately a 10% increase in cutting speed.

The Relationship between Pressure and Maintenance

Another important consideration before deciding to increase pressure is the significant increase in maintenance, consumable cost and machine downtime. Pressure (force) has a non-linear relationship with fatigue related wear, and for many mechanical machine components, it has a cubed (x^3) relationship. That means that a 50% increase in pressure will reduce the design life of many mechanical components by about 70%. For example, a 50% increase in pressure from 55,000 psi to 80,000 psi, will reduce the expected life of a component by 70% from 10,000 hours to 3,000 hours.

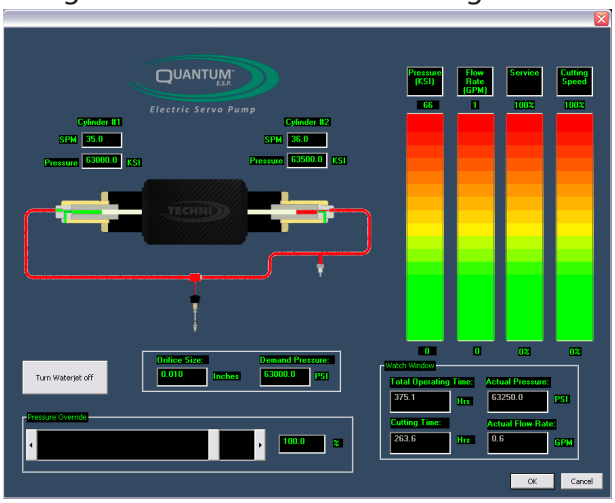


So, using this example, in order to achieve a 10% increase in cutting speed, the required maintenance will increase by approximately 300%. The cost of components and consumables at pressures over 66,000psi are also typically 50-100% more expensive than standard waterjet components. Plus, add the fact that whenever maintenance is being performed, your very valuable investment sits idle, and it is clear that the decision to simply increase the pressure, should not be taken lightly.

ULTIMATE CONTROL

Control and Diagnostics

Ultra High Pressure water can very quickly cause major failure of high pressure components, if leaks go undetected. The precise control of the Quantum ESP™ allows rapid detection of leaks and assists the user to identify the location of the leak, thereby saving valuable time and minimizing the chance of a simple leak turning into a major breakdown.



The diagnostic control will help determine the following common fault conditions and help identify the fault location:

- Orifice or Cutting Head
- Fitting or Tubing
- High Pressure Seals
- Dump Valve
- Low Pressure or High Pressure Check Valve

The Quantum ESP™ software diagnostic screen gives a quick and easy-to-read analysis of the pump performance, with an in-time graphical representation of the relationship between pressure, flowrate, maintenance and cutting speeds. This will help the operator determine the correct set up for a given application.

Cutting Speeds (Straight Line-Medium Finish)

MATERIAL	0.25" (6mm)	0.50" (12mm)	1" (25mm)	2" (50mm)
Mild Steel ipm (mm/min)	14.9 (378)	6.7 (170)	3.0 (76)	1.3 (33)
Hardened Tool Steel	14.7 (373)	6.5 (165)	2.9 (73)	1.2 (30)
Stainless Steel 316	15.6 (396)	7.0 (177)	3.1 (78)	1.4 (35)
Titanium	18.2 (462)	8.2 (208)	3.6 (91)	1.6 (40)
Aluminium	44 (1117)	21 (533)	9.1 (231)	4.1 (104)
Granite	85 (2159)	38 (965)	17.5 (444)	7.5 (190)
Glass	90 (2286)	42 (1066)	20 (508)	8 (203)

Machine Specification

MODEL	ESP-55	ESP-66	ESP-55 Dual	ESP-66 Dual
Max Output Pressure PSI (BAR)	55,000 (3792)	66,000 (4550)	55,000 (3792)	66,000 (4550)
*Max Output Volume GPM (LPM)	0.9 (3.4)	0.7 (2.6)	1.6 (6)	1.3 (5.2)
Physical Dimensions (L x W x H) (m)	63" (1.6) x 23" (0.6) x 43" (1.1)		67" (1.7) x 35" (0.9) x 39" (1.0)	
Weight Lbs (Kg)	1160 (525)		2240 (1020)	
Max Noise Level	68 dBA		70 dBA	
*Power Requirements	3 PH 380-480 VAC, 50-60 Hz, 60 Amp		3 PH 380-480 VAC, 50-60 Hz, 80 Amp	
Cooling Water Requirement	1.2 GPM (5 LPM) @ 68F (20C)		2 GPM (7.5 LPM) @ 68F (20C)	

** Output Volume Based On 460 VAC Electrical Supply*

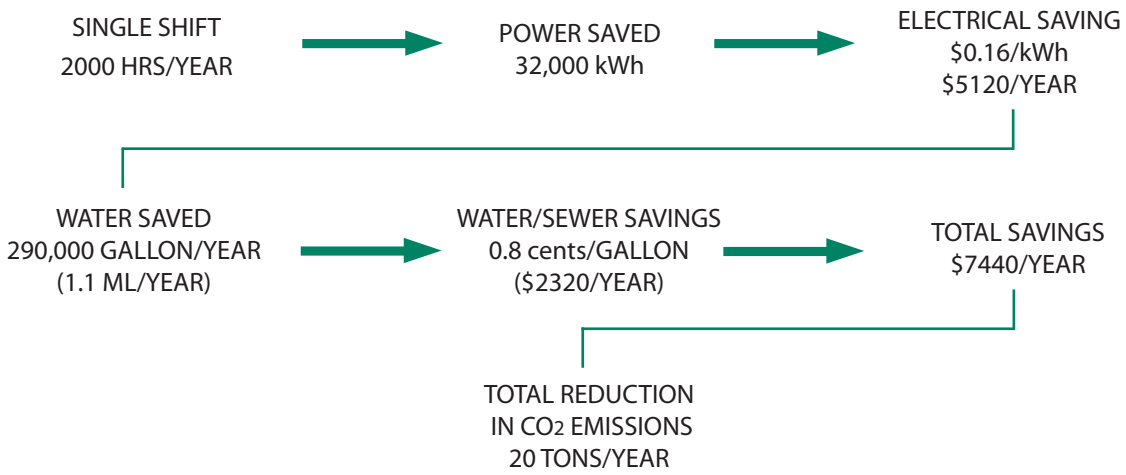
**Due to Constant Endeavour to improve the machine, the specification may be changed without prior notice*

"Reducing The Carbon Footprint With TECHNI Waterjet™ Quantum ESP™"

The TECHNI Waterjet™ Quantum ESP™ is the most environmentally friendly, has the least affect on global warming, and has the smallest carbon footprint of any waterjet cutting pump available on the market.

The high level of efficiency achieved by the Quantum ESP™ dramatically reduces the energy consumed and the water required. For example, a typical company running a single head waterjet cutting machine with the Quantum ESP™, for a single shift for a year, will save approximately 32,000 kW hrs, saving around $5,120/year in electricity charges, and reducing harmful CO_2 green house gases by a staggering 20 tons/yr. There are also considerable water consumption savings as a result of the increased efficiency. For the same example, savings of approximately 290,000 gallons/yr can be achieved, resulting in savings of around $2320/year.

*Figures are based on a comparison with a typical 50 hp intensifier pump running at 60% duty cycle.



*Note: If a recycling water chiller is used, the water savings will be $0, however the power savings would increase from $5120 to $7360, as only a 3 kW chiller is required for the TECHNI Quantum ESP™.

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