



Waterjet cutting has been a specialty technology used in a wide variety of industries from mining to food processing since around the early 1950's. In the 1980's, a high pressure water jet stream was mixed with an abrasive material and a new revolution in shape cutting was born, Abrasive Waterjet Machining. This discovery of added abrasive to the high pressure jet stream literally grinds through any material it comes in contact with. The jet stream acts like a bandsaw blade with the abrasive acting like the teeth on the blade. Over the next decade the process was honed into a precision cutting technology for not only sheet metal but literally any material at all. Using Garnet Abrasive and water the effective waste stream is a non-hazardous silty like mud water peppered with finely ground shavings of the cut material. Waterjet can process many materials like steel, aluminum, plastics, wood, carpet, foam, tiles, stone and literally anything you can touch.



The environmental friendliness and ease of operation of a water jet cutting system also make them very appealing to the novice and expert shops alike. Typically the only information required for a waterjet is the shape file in DXF format then the operator inputs the type, thickness and precision of cut desired. Because of the simplicity and flexibility there are now many companies replacing or complementing their existing methods of operation with water jet cutting methods as this is an accurate method for cutting that produces no hazardous fumes or waste and is NOT a thermal process so heat sensitive parts like plastics are not damaged or destroyed in the machining process. Today waterjet technology is capable of producing cutting pressures in excess of 90,000 PSI (90kpsi).

Waterjets are defined by three major factors; table/travel size, pressure and horsepower. A typical waterjet system will have a table travel of 5' X 10' or 6' X 12' an operating pressure of 55-60,000 psi (60 KPSI). Pump pressure and the volume of water produced at that pressure can have a major impact on not only the performance of the machine but also on the operating costs. As an example, a pump operating at the pressure of 40 KPSI may be a few less dollars to run per hour but can literally take twice as long to cut the same part to the same quality as that very same machine operating at 60 KPSI, thus doubling the manufacturing cost. In another example a pump producing 60 KPSI utilizing a 30hp Intensifier Style Pump will produce .6 gallons perminute (or gpm) of pressurized water. The same machine operating at the same pressure (60 KPSI) but utilizing a 60HP pump will produce 1.2 gpm of pressurized cutting water which will allow the operator to increase the speeds of the very same part, to the very same tolerances by 40%.

## Pump Types

There are two major pump types available for purchase or replacement on a water jet system. By far Intensifier Pumps have been more popular due to the increased cutting speeds and Pressure Consistency but Direct Drive Techniology has come a very long way and many users prefer the Direct Drive (or Crankshaft Style) over the intensifier pumps. Below is a description of the types of pumps available for straight water and abrasive water cutting applications.

## Direct Drive

Typically 3 plungers are driven by an electric (or gasoline/diesel) motor turning a crankshaft producing up to 55kpsi.

## **Advantages of Direct-Drive:**

The major advantages to this type of pump is that there is no cooling water required and the volume of high pressure water created is higher than that of an intensifier style pump.

## **Disadvantages of Direct-Drive:**

The disadvantages to this style is that the pressure gradually decline from the moment the pump is turned on as the seals and internal pump components wear thus affecting cutting speed and finish. Therefore typically an operator runs this pump at lower pressure and controls pressure with RPM of the motor increasing RPM as Pressure begins to decrease. This pump also has more internal wear components requiring slightly higher maintenance downtime and cost.

## Intensifier

In this pump an electric (or gasoline/diesel) motor produces hydraulic oil pressure of (typically) 3kpsi or greater this pressurized oil is then transferred to a cylinder which drives a piston back and forth. The piston is connected to a plunger that is 20X smaller than the piston. High pressure seals separate the oil in the pistons chamber from the water in the plungers chamber. The different ratios in diameter between the piston and plunger create the effect of intensification and thus the 3kpsi of hydraulic oil pressure will create 60kpsi of water pressure.

## **Advantages of the Intensifier Style Pump:**

The major advantages to this style of pump is that the pressure is greater (55KPSI to 100KPSI) and remains consistent allowing for increased cutting speeds and reliable cutting surface finishes.

## **Disadvantages of the Intensifier Style Pump:**

The disadvantage is that this style pump requires cooling water for the hydraulic oil, runs hotter and although bearable, is significantly louder and overall less electrically efficient.

Either type of high pressure pump can be employed to cut using Straight Water or Abrasive Water Jet. Any Abrasive Waterjet Machine can be utilized as a Straight Water machine simply by eliminating the abrasive mixture, however machines designed for Straight Water cutting operations may require significant modification to utilize abrasive machining methods. Typical applications for each are listed below:

Straight Water: Used for applications that can be cut with a knife or scissors such as food processing, paper, carpet, foam, fiberglass insulation, gaskets etc.

Abrasive Jet Machining: Metals, plastics, tile, stone, granites and any other materials that are not easily cut.

Materials Processed with this method include, but are not limited to:

- Steel
- Copper
- Foam
- Carpet
- Stone

- Aluminum
- Brass
- Gaskets
- Glass
- Wood

- Stainless
- Plastics
- Insulation
- Tile

Popular Waterjet Manufacturer's include, but are not limited to:

- American Waterjet
- Flow

Hydra Jet

- Bystronic
- Omax

Romeo Engineering

- Calypso
- Jet Edge
- Wardjet

Esab

Ward Jet

Techni Intech i612-G2 Waterjet Cutting System







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