Water Jet Cutting
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The Water Jet Cutting Company

Water Jet Cutting is a division of Gee Graphite Ltd, a company founded in 1989 to offer a range of industrial gasket and sealing products based on expanded flexible graphite. It was through the difficulties posed by composite graphite materials that a more radical and innovative approach had to be considered. This led to the installation in 1991 of the UK’s first Water Jet Cutting system.

Gee Graphite realised the capabilities and potential of water jet cutting and a separate division offering customers a sub-contract service was set up.

Since then Water Jet Cutting has grown substantially and now operates from a 62000 Sq.ft site in Ravensthorpe, Dewsbury, West Yorkshire offering both Abrasive and Pure Water Cutting from our 10 machines single and multi-head, giving us the largest capacity in the UK.

What is Water Jet Cutting?

There are two options to the process.

**Pure Water**
Take tap water, pressurise it to 60,000 psi (4,000 bar) then force it through a very small hole, or orifice. This creates a tremendous amount of energy concentrated in a thin beam of water, travelling at close to the speed of sound. The result is an extremely powerful and a precise ‘Pure Water’ cutting tool.

**Abrasive Cutting**
An ‘Abrasive’ water system employs the same methods as ‘Pure Water’ however; the addition of an abrasive garnet mixed into the stream increases the cutting forces significantly. When the high-velocity water exits the orifice it creates a vacuum within the mixing chamber. The vacuum pulls abrasive from the abrasive line into the chamber where it is mixed with the water jet stream. The resulting mixture is then realigned in a focusing tube before exiting the cutting head nozzle. At this point the accelerated abrasive particles are now travelling at speeds fast enough to cut through the hardest of materials, all this is achieved by a water jet that is little more than 0.8mm in diameter.
What can we cut?

With over 20 years of experience we have successfully profile cut a vast range of materials from low density foams to wear resistant steels. The only requirement is that the material is ‘flat’ and can be positioned on one of our 10 machine beds.

- **Metals** – Aluminium, Brass, Bronze, Copper, Lead, Mild Steel, Nickel Alloys, Stainless Steel, Titanium.
- **Non Metals** – Carbon Fibre, Ceramics, Glass, Granite, Laminates, Plastics, PTFE, Tufnol, Wood.
- **Soft Materials** – Cork, Foams, Foam Rubbers, Graphite, Neoprene Rubber.

We are restricted by material thickness more than material property. This is not because the water jet cannot cut thicker materials. The limiting factor is the distance from the cutting head to machine bed. In general, to cover materials including metals we state a maximum cutting thickness of approximately 150mm. There are machines available that claim the ability to cut steel over 150mm, but we believe it serves as more of a talking point than a competitive method of cutting. Cutting steel above 150mm is a very slow process and expensive. If there is any doubt as to whether a new material should be pure water or abrasive cut, samples can be produced to determine the optimum process. This also gives us machine data from which accurate quotations can be made.
Advantages of Water Jet Cutting

The versatility and flexibility of water jet profile cutting as a tool has seen its popularity grow rapidly since its introduction in the mid 1990’s. Some key advantages are:-

No heat affected zone (HAZ) - One of the biggest advantages is water jet’s inherent cold cutting quality. This allows materials to be cut that would be burned, melted or cracked by other cutting methods. It also guarantees that no structural change or metallurgical deformation is placed onto the materials being processed.

Environmentally friendly - The process is clean and does not create dust, fumes or hazardous gases. Cutting oils or coolants are not required.

Narrow kerf - The amount of material removed by the water jet stream is typically about 0.5-1.0 mm wide, meaning that very little material is removed. When you are working with expensive material (such as titanium) or hazardous material (such as lead), water jets small kerf, or cut width optimizes material use, increasing cost effectiveness.

Nesting - Combine state-of-the-art CAD software with our multi cutting head machinery and you have the ability to nest and cut hundreds of different parts together in one process. This gives us the ability to dramatically reduce the amount of material required, while at the same time reducing the component processing time dramatically.

Set up - All our programming is carried out offline in a designated CAD office. This allows a quick and relatively easy set up at the machine, enabling Rapid Prototyping right through to volume production batches.

Large components - Water Jet Cutting can meet the demands of most customer enquiries and cut the largest of profiles. With a maximum cutting bed size of 6000mm by 3000mm and an overhead crane with a 9 tonne lifting capacity, there are few components we cannot accommodate.

Other advantages to Water Jet Cutting

• High Speeds for Various Materials
• Minimal Fixturing Required
• High Repeat Accuracy
• No Crushing of Material
• No Tool Sharpening
• Just-in-time Manufacturing Ability
• Eliminates Post Machining in Most Cases
The water jet cutting process is employed worldwide in many different industry sectors, some of which are listed below:

- AEROSPACE
- AGRICULTURAL
- ARCHITECTURAL
- AUTOMOTIVE & MOTORSPORT
- CERAMICS AND MARBLES
- COMPOSITE
- CONSTRUCTION
- MARINE
- MOD
- OFFSHORE
- OIL AND GAS
- PRECISION ENGINEERING
- SCIENCE AND MEDICAL
- SIGNAGE

Water Jet Cutting supplied all the aluminium plates and balcony brackets to this central London office block. Each piece was supplied fully machined, naturally anodised and included all fixing materials and grilles.
Our Water Jet Machines

With five ‘Pure Water’ and five ‘Abrasive’ machines and a combined total of forty six cutting heads, we have capacity to meet the most exacting customer demands. With ten machines of various configurations, we are in a strong position to select the optimum bed size and head configuration for a particular job. With so many machines available to us we are in the fortunate position to ensure our capacity is never stretched and can always meet a customer’s demands. Where other water jet companies might fail to meet tight lead times due to breakdowns and machine maintenance, we can simply move a job from one machine to another without delaying the customer’s delivery date.

**Pure Water Only**
Our five ‘Pure Water’ machines have a range of bed sizes and number of cutting heads. Our largest machine has a 3000mm by 1500mm bed size and has been modified to incorporate twelve cutting heads. This facility provides customers with a competitive alternative to many batch production methods including oscillating knife cutting and even traditional frame cutting with costly tooling. Furthermore, because the water jet is only 0.1mm in diameter we can produce intricate items, like flooring displays and decorative panels, with virtually no material removal.

**With Abrasive**
Our five ‘Abrasive’ machines also have a range in bed size and number of cutting heads. Our largest machines are 6000mm by 3000mm and 4000mm by 2000mm, with each incorporating four cutting heads. In addition, two of our machines are equipped with drilling facilities to aid cutting some of the more fragile laminate materials.
Cutting Qualities

Water Jet Cutting offer three distinct cut qualities for most materials – smooth, medium and rough. Each quality is visibly different and the pros and cons of each can be discussed in detail with customers at enquiry stage. Each quality is visibly different and are offered to ensure our customers get the cut they require at a price that is right.

Fine Cut – This is our smoothest quality, likened to a shot blast finish and is typically used by customers who want their components to have a very smooth profile with the minimum of edge striation and tapering. Similar to Ra 1.6μm. Typical Kerf Deviation on 15mm thick Stainless = +/-0.20mm per side or 0.7°*

Standard Cut – This is our standard cut quality and is most widely used by our customers. A clean cut with moderate lower edge striations, suitable for almost any application. Similar to Ra 6.3μm. Typical Kerf Deviation on 15mm Stainless = +/- 0.25mm per side or 1°*

Coarse Cut – This cut quality is suitable if the cut part is not visible or if a post machining operation is to be carried out. Having Deep Edge Striations. Similar to Ra 50μm. Typical Kerf Deviation on 15mm thick Stainless = +/-0.35mm per side or 1.3°*

*kerf deviation will vary depending on material type and thickness

Kerf Deviation or Tapering
The Kerf Deviation and edge finish are directly related to speed. The greater the speed, the more Kerf deviation and the coarser the edge finish. As the water jet slows down a better finish can be achieved meaning an increase in time ...and price.

Cutting Tolerances
Abrasive jet cutting width = 0.8/1.0mm
Pure water jet cutting width = 0.1/0.25mm
Programming accuracy = 0.05mm

![Diagram of Kerf Deviation and Tapering](image)
Innovation and Investment

**CAD Software**
In 2012 the company invested in a new, industry focused CAD package that is designed specifically with water jet cutting as its primary user. Its installation has brought about dramatic changes, all of which have a direct positive impact on what we offer our customers. Chief among these improvements are faster cutting times, superior quality and better utilisation of material.

The software also has its own inbuilt estimating package which is linked directly to each of our water jet machines. As a result, we are able to upload CAD profiles and attain true machine cutting times which are accurate to the second. Add to that a material utilisation module that nests the maximum number of parts in the best possible way and you have a very precise and efficient estimating tool. When combined these factors ensure the customer gets as many parts as possible at the best price, every time.

**Virtek Laser**
The Virtek LaserQC is a scanning facility with the ability to produce 1st Article Inspection data on any flat part. It can also instantly store this data in the preferred geometry-based DXF format used by all of our water jet cutting machines. In the event that drawings are not available and customers can supply sample parts, a geometry file or DXF can be produced that is compatible with any of our ten water jet machines.

The inspection features provided by the LaserQC are accomplished by simply comparing the scanned part to the CAD generated DXF or drawing that was used to create the part. The state-of-the-art software instantly defines and highlights any part deviations right on the computer screen. This process provides our inspector with the instant ability to view and compare the part to the original geometry from which it was developed. It is these automated shop floor level features that allow us to rapidly complete the inspection process, while increasing productivity.
Abrasive Recycling System

Running costs are an ongoing concern for any business wishing to succeed in today’s climate and it is no different here at Water Jet Cutting. That is why we are always looking to improve our manufacturing efficiency and minimise costs wherever possible. As a result, in late 2013 we continued our innovative tradition and took the bold step of installing the first UK based Ward Pro Abrasive Recycling System.

The System recycles more than 50% of the used abrasive helping to reduce our processing costs and enabling us to offer customers competitive pricing. As an ISO 14001 accredited company, recycling has a direct and positive impact on reducing abrasive waste sent to landfill.
Quality

It is the policy of Water Jet Cutting to provide an integrated management system and quality management structure.

Water Jet Cutting operate a company-wide assurance system conforming to the ISOQAR - ISO 9001: 2000 Standard. The quality assurance system ensures the inspection and recording of incoming materials against purchase orders and customer specifics.

Water Jet Cutting realise the value of achieving and demonstrating sound environmental performance. This commitment has been formally recognised with the registration to BS EN ISO 14001, The Environmental Management Standard.

To achieve the above objectives, the company operates a Quality System that carries out regular reviews of its processes and customer needs and has set in place quantifiable objectives and has established procedures to ensure that these are reviewed and are continuously reassessed.

All operations conform to the company’s procedures and disciplines as described in the Quality Manual, Operating Procedures and Work Instructions etc. The participation of all personnel is mandatory.

Mission Statement

To remain a successful, quality focused supplier of Waterjet Cutting Services. We aim to be forward looking and dedicated to our stakeholders.

The company and its employees will achieve this by:

- Being passionate about what we do
- Being innovative in our approach
- Exceeding customer expectations
Sub-Contract Work

Experience has shown us that some customers would prefer a full turnkey solution when placing orders for water jet cut parts. Water Jet Cutting has developed its own sub contract service network which include the following processes:

- Anodising
- Bending
- Chemical Blacking
- Counterboring & Countersinking
- Drilling & Tapping
- Electroplating
- Laser cutting
- Metal Polishing
- Milling
- Shot Blasting
- Skimming
Founded in 1989, Gee Graphite Ltd specialises in the manufacture and supply of gaskets and associated products based on expanded flexible graphite. A wide range of flexible graphite based products are manufactured and supplied to the valve, process equipment, chemical / petrochemical and power generation markets.

With a history of solving application based problems from cryogenic to elevated temperatures and vacuum to high pressures, Gee Graphite continue to supply high quality products based on this unique material to customers globally.

The Geegraf Energised System (Live Loading) is a full range of products designed to eliminate costly plant leakage problems on valves, pumps and flange connections.

Geegraf Energised offer a gland unpacking, inspection and repacking service using a high pressure water jet, this system uses micro bursts of a focused water jet at extremely high pressure to remove valve stem/pump packing materials of all kinds.

This is backed by technical staff with over two decades of specialist experience in the power, chemical /petrochemical industry.

Gee Graphite – Gee Valve Seals have unrivalled experience in the manufacture and supply of triple offset butterfly valve seals.

With our expertise in flexible graphite and precision water jet cutting, we can assist valve designers in producing laminated valve seals to suit specific applications.

The critical technical requirements of the sealing face are fully understood and achieved through precision clamping, compression and machining of the laminate.

Solid seals, disc/body seats and clamp rings are supplied fully machined to customer drawings. Capability to machining both interior and exterior surfaces.