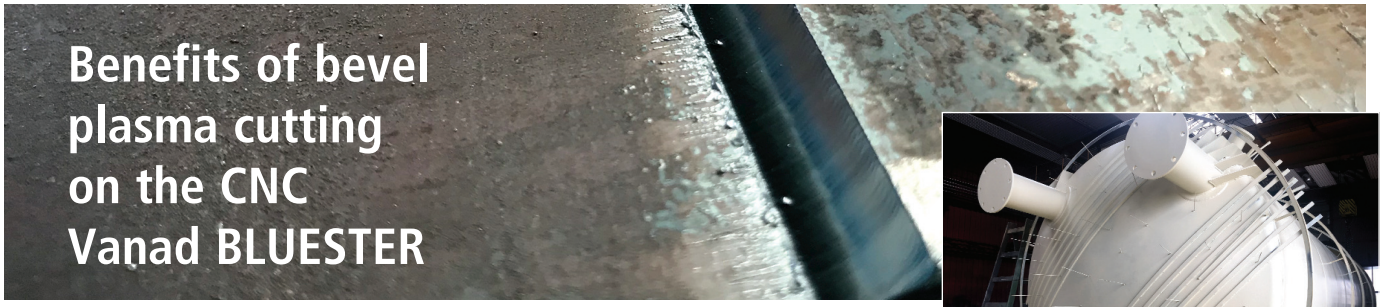
The Art of Bevel

CNC 3D Plasma Cutting as an optimization of the manufacturing process



Why a bevel?

Bevel – ie, bevelled cuts of the required dimensions are most often used in industrial sectors where machines for maximum loading operation are produced, such as construction or agricultural machinery, mining, shipping, forestry equipment.

For manufacturers of such devices bevelled components are part of the preparation process for subsequent welding. Thanks to the bevelling, stronger and more durable welds can be achieved.

Beveled cut parts can also serve other purposes – construction, lightening, design, etc. A complete list of usage options would be considerably larger, of course, as it depends on the production needs and requirements of each particular user.

The dimensions and shape of the bevels produced are determined in particular by the thickness of the material being processed.

Bevelers? Yes and no.

There are many ways to bevel the pieces. Every manufacturer prefers something else. Manual bevels are the most flexible ones, they work with sufficient precision, but they have a limited notch, and the process needs to be repeated to achieve a larger bevel.

The thickness of the material is a limiting factor for the machine bevellers, due to the tension they are unable to process small pieces or parts with more complex contours. Another option is bevelling with the help of oxy-fuel technology, both by manual burners, bevelling machines or robotically. For small operations, this is obviously the most accurate but non-economic method. The disadvantage of the oxy-fuel method is the limited range of materials that can be machined. Using a 3D plasma head on a thermal cutting machine as an additional equipment seems to be the best option.

Beveling on CNC cutting machines

Regardless of how simple or complex cutting of bevels on CNC cutting machines is, to achieve the desired result, three major factors should be considered, equally important: proper hardware, sophisticated software, and erudite operators. Sometimes it takes hours to get quality beveled cut parts, it is tricky, lots of attempts and mistakes. The basis for success is a good data preparation and a suitable CNC cutting machine.

2D against 3D

What is the difference between 3D and traditional 2D cutting? With 3D cutting, four important variables come into play: the feed rate, the angle of the slope, the cutting kerf, and the arc voltage. Combining all these factors can sometimes be a tough nut for senior programmers. The maximum length of the bevel made is limited by the plasma source performance and by the technical possibilities of the given CNC cutting machine. Other factors that can influence the quality of the bevel: used plasma and shield gas, material quality, the

original and regularly changed consumables, maintenance of the CNC cutting machine, its regular inspection and calibration. A production environment also has a surprisingly significant effect on the result of beveling. For example, if beveling is done on a conventional or underwater table.

CNC Vanad BLUESTER

Vanad 2000 a.s., a Czech manufacturer of oxy-fuel, plasma and laser cutting machines, has developed its own 3D Plasma Cutting Head which can be mounted on the Vanad BLUESTER machine designed for heavy operations. The 3D plasma head allows to make bevels up to 50°, allowing the machine to adjust head slope even up to 55°. One of the manufacturing plants where this type of plasma cutting head is used is the Czech company BAEST Machines & Structures, a.s. in Benešov. František Kulovaný, MBA, Director General and Chairman of the Board of Directors, summarizes the reasons for purchasing the Vanad BLUESTER CNC cutting machine with 3D plasma cutting technology in 2015: *„We are a purely Czech medium-sized manufacturing company. We are especially proud to focus mainly on sales abroad, we export to ten countries all around the world. Our products are also often re-exported. They are well rated mainly for high quality and reliability. Customers appreciate a wide range of manufactured products and, in particular, a comprehensive supply from one supplier. The customers appreciate a wide range of manufactured products and in particular, the comprehensive supply from one supplier. We focus on all sorts of containers such as silos, containers for liquid storage, products for the chemical and petrochemical industry, containers for heating plants and power engineering, weldings for various types of machines, eg hydroelectric power plants. In 2015, we decided to optimize our production process and logistics. We wanted to increase our productivity and decided to buy a Vanad two-gantry cutting machine with a 3D head and a Kjellberg HiFocus 280i neo plasma source, two Kjellberg marking units and a drilling unit. The second gantry is equipped with two oxy-fuel units. Previously, we used two cutting machines from Vanad, plasma machine for 2D and an oxy-fuel cutting machine. So we have a good long experience with Vanad. There is lots of welding works to make our containers and steel constructions. Some components are bevelled on a mobile beveler, such as large regular pieces where it is not necessary to cut the material, just to make a bevel. In such cases, a mobile beveler is sufficient, plasma beveling would be non-economic from the operational and logistical point of view. We try to make the most of the cutting machine, using both technologies simultaneously in two-shift production, with the oxy-fuel on the one gantry, and the 3D plasma head on the other, otherwise they are used separately."*

3D Vanad Plasma head

The 3D Vanad plasma head is fully robotic, rotating in the axis of the torch, making it less demanding both for the plasma leads and the plasma torch itself. With the robotic B&R software, the 3D Vanad plasma head can fully adjust the angles, kerf correction, recalculation of plasma arc length and height control. The cutting plan can be automatically generated from the CAD/CAM system. Two harmonic planetary gears are used in the construction of the head in rotate axes which excel with high precision, rigidity, loadability and compact dimensions. B&R's top-of-the-line servo drives deliver the precision and dynamic movement of the head.

Plasma source Kjellberg HiFocus 280i neo

An important factor is the performance and quality of the selected plasma source. For bevel cutting, it is also selected according to the pierce capacity. The maximum bevel length is 1.5 times the thickness of the material. Due to the fact that bevel cutting is slower and more demanding for cooling, it is recommended to choose one class more efficient plasma source. *„I do not buy individual machines but technology,"* says Frantisek Kulovaný, Director of BAEST Benešov, and adds: *„The cutting quality and the flexibility of the production process are important first of all."* With the High-End HiFocus 280i Plasma Source from Kjellberg Finsterwalde (Germany) along with the new Vanad CNC cutting machine BAEST from Benešov also gained a package of Contour Cut, Contour Cut Speed and Hi- Finox – Plasma Cutting Technologies specially developed for mild steel and stainless steel as well. Kjellberg plasma sources allow multi-gas cutting of conductive metal materials and other materials with thicknesses from 0.5 to 160 mm. There is almost no angular deviation while vertical cutting. Even while cutting bevels up to 50° high-quality cut parts and precise preparation of welding surfaces for automated manufacturing processes can be achieved. Cutting parts are suitable for any subsequent machining. *„The excellent quality of bevels when using the HiFocus 280i neo plasma on the Vanad BLUESTER was one of the reasons for buying Kjellberg technology in our production,"* adds Kulovaný. *„Our steel vessels often come under*

high loading, good preparation of parts before welding is essential for us, combined with the Kjellberg FineMarker unit, the cutting machine is even more efficient. With the help of the FineMarker plasma, areas for subsequent manufacturing operations are marked." Kjellberg Plasma Cutting Technology, especially the HiFocus neo line, is popular for superior cutting performance and high cutting quality. Plasma burners with swirl gas technology for cutting current from 5 A to 600 A allow for 100% loading while continuous operation and provide high efficiency in everyday operation. Thanks to this, cutting of pipes, beams, containers, and arched bottoms, as well as other 3D constructions, is high quality and flexible. Kjellberg plasma cutting systems can be used on all available cutting machines and in robotics, both for 2D and 3D, as well as for plasma under water cutting (UWP).

Vanad 2000 a.s.

The company has its headquarters in Golčův Jeníkov and is a traditional Czech manufacturer of high-performance CNC machines for precise oxy-fuel cutting, state-of-the-art plasma technologies, and fiber lasers. Thanks to continuous research and development, Vanad brings comprehensive innovative solutions for cutting workstation to domestic and foreign markets. The premises of the company in Golčův Jeníkov is one of the largest permanent demonstration center for thermal cutting in the Czech Republic. Those interested can explore Vanad CNC cutting machines, get to know their technological possibilities and, in cooperation with the company's technicians, choose the most suitable machine and technology for the given production program.

BAEST Machines & Structures, a.s.

A Czech company purely continuing in the tradition of engineering production in Benešov for over 25 years. It is a subsidiary of BAEST Machinery Holding, a.s. and is focused on the heavier engineering production. The company shows off a wide-ranging production program including large-volume tanks, pressure vessels, devices, silos, storage tanks, technological complexes for bituminous packaging plants, steel tanks and components for the energy and environmental industries. BAEST products are not only aimed at EU countries but also in other countries such as Ukraine, USA, Korea, and others. The company also participated in the supply of parts for machines and equipment used in the construction of the largest water construction in China, the „Three Gorges", the production of assembly platforms for the most modern Airbus manufacturing plant in Toulouse or technological tanks for the new emerging Jaguar automobile factory in Slovakia.

Kjellberg Finsterwalde

As a pioneer in the field of thermal cutting and joining, Kjellberg Finsterwalde offers technology and products for industry and craftsmanship. Whether it is steel constructions, piping and tank manufacturing, automotive, foundry or chemical industry, Kjellberg Finsterwalde creates system solutions, power supplies, consumables and many more for all metalworking industries and engineering. As the oldest manufacturer of plasma cutting technology in the market, Kjellberg Finsterwalde offers its customers plasma and laser cutting technologies for a wide range of applications in automated, mechanized or manual cutting – with a guarantee of quality – made in Germany.

B&R

A supplier of innovative automation based in Austria with network branches all over the world. As a global leader in industrial automation, B&R offers the state-of-the-art technology to provide customers with virtually every industry-complex solution for machine and manufacturing automation, motion control, HMI and integrated functional safety. B&R continuously defines trends in industrial automation through the use of communication standards such as POWERLINK and openSAFETY, as well as the powerful Automation Studio development environment. The innovative spirit that B&R maintains at the forefront of industrial automation is driven by a commitment to streamlining processes and overcoming customer expectations.

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