



Product Description

RPC 1200 - Beam Profiler



RPC 1200 - Beam Profiler - MK3

Introduction

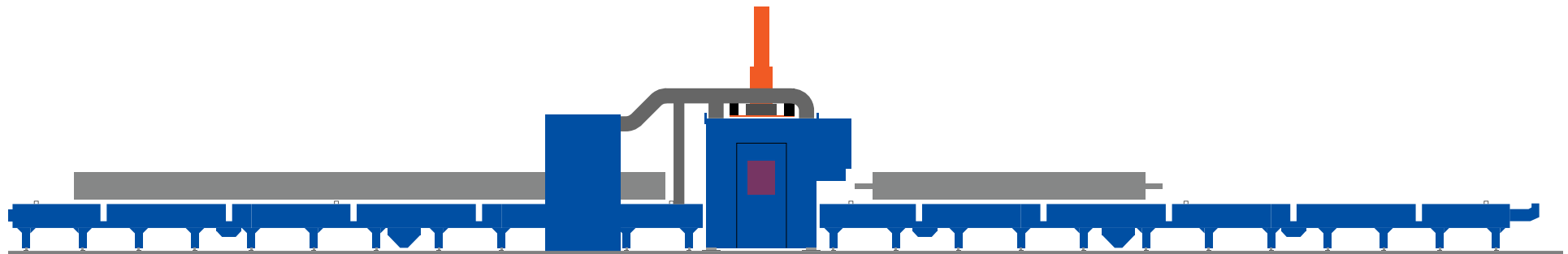
- The production process
- RPC Process description

Hardware

- RPC infeed and outfeed
- Defining longitudinal material position
- Cutting cell
- Industrial robot
- Material displacement and distortion compensation
- Plasma cutting
- HGG's cutting compensation and intelligence
- Box section cutting (optional)
- Marking
- Extraction and filtration (optional)
- Health and safety

Software

- ProCAM Suite
- ProGRAM
- ProCAD: CAD/CAM Interface (if applicable)



The production process

HGG's primary focus is the supply of production automation for the heavy steel industry. Thermal cutting machinery provides beams with highly accurate 3D weld preparations for significant savings on fitting and welding time and costs. HGG is fully aware that the cutting machine forms only a small part of an entire manufacturing process so it is essential that the machine fits perfectly within the entire production process, from design and work preparation upstream, to the cutting, fitting and welding of parts downstream.

Integration into the process

Although it is the actual cutting that is carried out by the machines, the smooth integration of the machine into the production system is achieved by an advanced software framework called ProCAM. By connecting with an extensive range of CAD/CAM applications, features for design check, perfect integration with the machine, managing your stock or automatic nesting, ProCAM saves time and money in the complete process. The continuous development of special cutting routines, outfitting functionality and weld volume calculations optimizes

the subsequent 'fitting and welding' stages of production, increases productivity and saves time and materials.

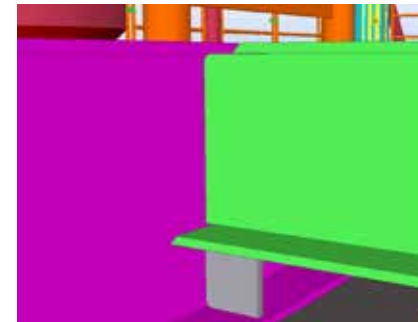
Design

HGG developed CAD/CAM connections for several CAD applications. Reprogramming of complex designs is no longer necessary due to imports of various file formats that save time and greatly reduce error sensitivity. In case there is no CAD package available, HGG's ProGRAM offers complete parametric part design and macro application to all compatible profiles.

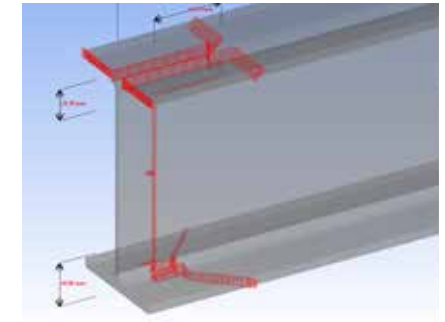
Work preparation

HGG's ProGRAM module, part of the ProCAM suite, can be installed on an independent office workstation and connected to the database providing a direct link to the cutting machine (in the absence of a database, cutting files can be copied to a USB stick which can then be read by the cutting machine). If there is no input from CAD, individual

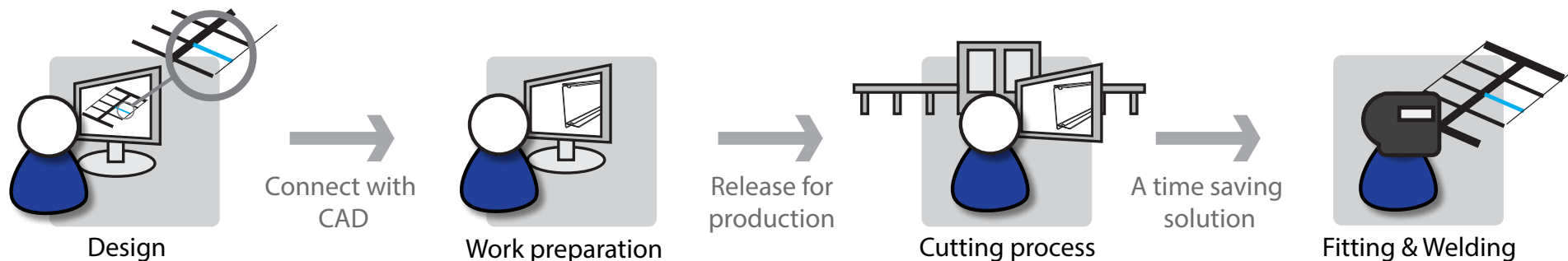
parts can be programmed using the manual programming tool. One of the unique features of the module is the 3D Viewer allowing validation and review of all programmed parts. The Optimized Nesting tool distributes the programmed parts in the available raw materials in the most efficient way. This reduces waste and handling time and greatly improves planning efficiency.



Tekla Structures CAD model



HGG's part design module



Cutting process

In this part of the process all HGG's software intelligence congregates and results in a perfectly cut shape including weld preparation. These high quality cuts are the result of smart machine design and the advanced motion control of the robotic arm. To achieve the most

accurate cuts HGG's cutting machines have software based cutting compensations for the cutting process like kerf width and the teardrop shape of the plasma beam. Due to this machine intelligence, it's possible to achieve a minimum usage of consumables and high cutting speeds without compromising on quality.



Fitting and welding in detail



Fitting, bolting or welding

When cutting manually or with a less accurate machine, grinding is a costly, time-consuming and labour-intensive job. The excellent quality and accuracy of HGG profiling machines reduce grinding to a minimum resulting in shorter fitting time of bolted connections. These factors apply similarly to welded connections. A larger weld volume increases the welding

time and costs. Consistent, accurate bevels reduce welding time, keeps consumables running longer and have the additional benefit of increasing the quality and strength of a structure. HGG is constantly developing and supplying new cutting and marking routines to further eliminate the need for grinding and reduce welding times and volumes even more.

RPC Process description

The RPC can be configured to your needs and the materials that you want to cut. The logistics can be mirrored or extended in various ways. The process of the RPC is explained with the layout below as a reference.

1 Infeed storage chains

The infeed storage chains provide storage for multiple raw profiles by crane or forklift and transport profiles onto the infeed conveyor.

2 Infeed conveyor

The infeed conveyor supports and transports raw profiles towards the cutting cell.

3 Defining length and position

The end of the profile is conveyed into the cutting cell. The longitudinal position is measured by rollers placed against the flanges and a laser measurement system.

4 Material measurement

In the cutting cell, the raw profile is guided by rollers which measure distortion of the lower part of the profile. This measurement and a triangulation scan of the profile section enables the machine to define the actual positional displacement, torsion and section distortion of the raw material to compensate the theoretical cutting paths.

5 Marking

Marking is performed as a separate action and can be integrated in the cutting process to decrease the material movement time.

6 Cutting

Once the raw profile is in position, the industrial robot moves the plasma cutting torch to the starting position and instantly begins the cutting process.

After a cut is made, the scrap piece will fall into the scrap trolley leaving only the cut part on the outfeed conveyor. Depending on material type and profiling shape the operator needs to remove cut out web and flanges between cuts.

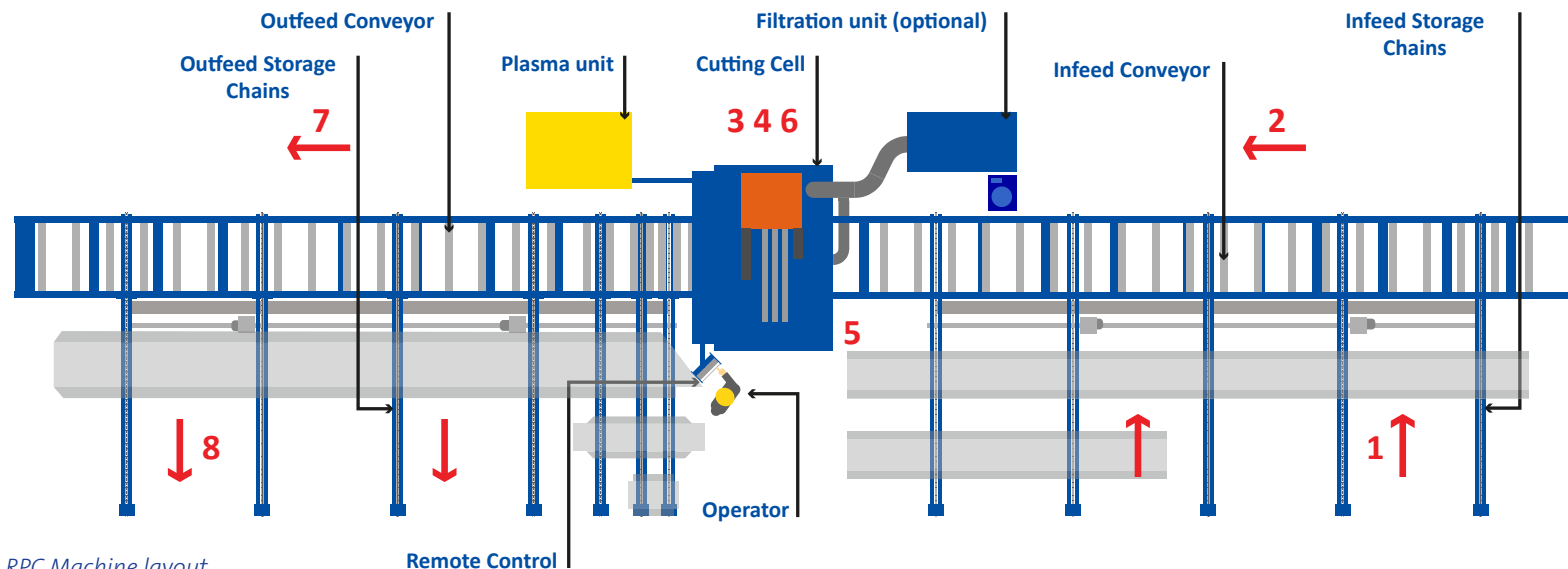
7 Outfeed conveyor

The outfeed conveyor transports processed parts until detected by a sensor

after which the roller conveyor stops automatically.

8 Outfeed storage chains

The outfeed storage chains can store and buffer multiple profiles which can be transported to other logistic systems or unloaded by a crane or forklift. After receiving a signal that a processed part is in position to be unloaded, the hydraulic lifter underneath the storage chains lifts the part. The storage chains automatically space the parts at a set distance.



RPC Machine layout

RPC infeed and outfeed

The infeed and outfeed conveyors for the cutting cell can be loaded directly by crane or by optional storage chains onto which material can be loaded and unloaded by a crane or forklift.

Components

Infeed storage chains

The infeed storage chains load raw profiles in preparation for cutting. The profiles are transported on the chains towards the infeed conveyor. Sensors detect the material and the chains are raised lifting the material, and lowered again placing the material on the rollers of the infeed conveyor.

Infeed conveyor

All cylindrical rollers are powered and transport profiles to and from the cutting cell. The infeed conveyor transports profiles until detected by a light sensor after which the infeed conveyor stops. The spacing of the rollers is optimized to cut both long and short parts (see technical data for sizes).



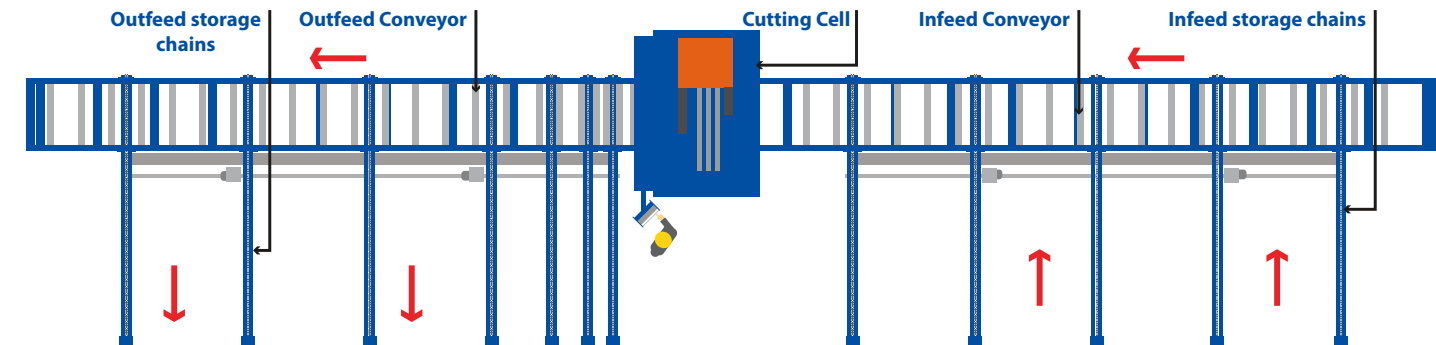
Outfeed conveyor



Storage chains



Infeed storage chains and infeed conveyor



Logistics of a typical configuration

Outfeed conveyor

Finished parts are transported from the cutting cell to the outfeed conveyor. Sensors on the conveyors detect the position and stop the parts.

Outfeed storage chains

The outfeed storage chains can store and buffer multiple parts which can be transported to other logistic systems or unloaded by a crane or forklift. After receiving a signal that a processed part is in position to be unloaded, the hydraulic lifter underneath the storage chains lifts the part. The storage chains automatically space parts at a set distance.

Defining longitudinal material position

To prevent length deviations of cut parts the RPC is equipped with an ingenious longitudinal laser measurement system. This laser system fits perfectly into the character of this machine, namely fast and accurate.

Material initialization point

The infeed conveyor will start conveying the profile into the cutting cell after it is loaded by the infeed storage chains. At this moment the machine doesn't know the length and longitudinal position of the profile. Once the profile enters the cutting cell the initialization point can be defined on the profile end. This is the reference point of all cutting paths calculated for this profile. If the first part cut from the profile is irregular, the initialization point can be displaced easily. The initialization point of the material is now defined, but the length and longitudinal position is still unknown.

Material end-point

The end-point of the material is measured by a laser measurement system that defines its longitudinal position. With the initialization point as reference the exact length of the profile is calculated. The infeed conveyor will transport the profile

and its defined initialization point into the cutting area of the cell. This area is within reach of the robotic arm. The positioning of the material is done by a motor in the rollers of the conveyor. Due to possible slip during transport, the actual longitudinal position is uncertain, but corrected by measuring the end-point again after all transport actions are performed.

Accurate torch approach

The actual initialization point of the cutting path is known to the machine and the robotic arm moves to this point in a split second.

Ease of use

Due to optical measurement, calibration is not necessary. There is no risk of losing the calibration and without moving parts, the measurement system is less error and maintenance sensitive.



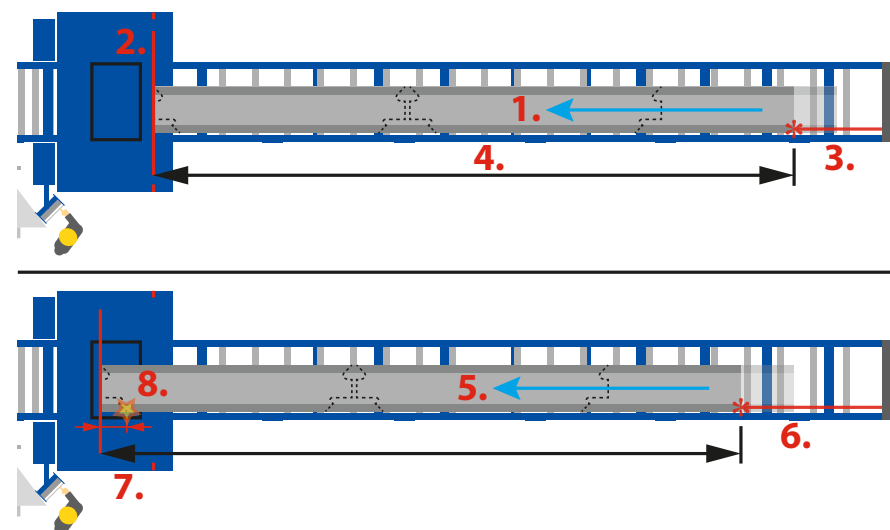
Length measurement laser on profile.



Length measurement system position.

Process of accurate longitudinal positioning:

1. Infeed material;
2. Defining initialization point on material;
3. Defining material end-point with laser measurement system;
4. Calculation of all cutting paths in reference to the initialization point;
5. Infeed of material to cutting area (actual position uncertain because of slip during conveyor transport);
6. Defining actual longitudinal material end-point position after conveyor transport;
7. Calculation of actual longitudinal position of cutting path start-point referred to the material initialization point;
8. Approach of the robotic arm and torch to the actual cutting path start-point.



Process of accurate longitudinal positioning.

Cutting Cell

The multifunctional cutting cell is the heart of robotic profiling machine. The industrial Stäubli robotic arm manipulates the cutting torch to cut profiles. The laser scanners in the cell provide accurate measurements that are absolutely crucial for positioning of the cutting torch and provide high quality and precise cuts. Additionally, the cutting cell incorporates a fume extraction system.

The base for accuracy

Rapid robot movements and accurate positioning needs a rigid base to prevent vibrations and deviations. The cutting cell is engineered to last and enables accurate cutting.

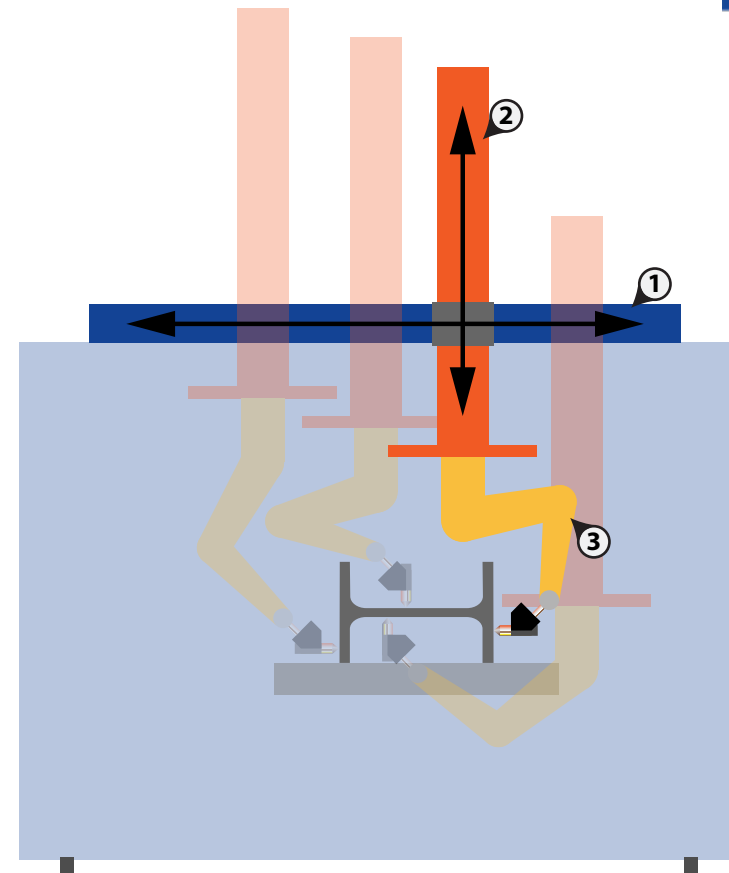
Rapid and accurate material measurement

To measure and compensate the distortions and deviations of profiles, the RPC is equipped with multiple

measurement positions. The scanner scans material before cutting after which one or multiple cutting routines can be performed. The scans can be reviewed, giving the operator a reference of what has actually been measured. The alignment of the material is verified to see if the profile is off-centre in the cutting cell (this usually means the profile is bow shaped, bent or twisted).



The robot hanging inside the cutting cell



Side view of the cutting cell with the 1. Transversal axis, 2. Height axis and 3. Stäubli robot with 6 axes.

Freedom of robot movement

A transversal axis and a height axis are responsible for the gross industrial robot positioning needed for cutting and marking 360 degrees around the material. The industrial robot will perform the fine movements necessary for accurate

torch positioning and bevelling. The combination of the gross robot positioning and the use of a short industrial robot arm for fine positioning results in accurate cuts and rapid torch positioning.

Intuitive operator interface

HGG's software engineers developed a GUI inspired by the input of RPC users all over the world. The result is an intuitive and easy to use interface which requires only a few days of operator training for full machine operation.

Effective fume extraction

Plasma gasses are toxic by definition. Therefore it is very important to extract

these gasses properly. By use of a fume extraction system, the operator maintains a clear view through the cutting cell window without smoke blocking his view.

Noise reduction

The double walls of the cutting cell create a barrier for the loud noises that plasma cutting can generate.



Operator using the GUI



Operator GUI optimized for a touch screen. This screen is used during the cutting process.



The inside of the cutting cell

Industrial Robot

In regards to plasma cutting and robot compatibility, considerations must be made with high temperatures and particle emissions in mind. HGG has been using Stäubli robots with custom software for over a decade and these robots have proven their worth. There is a wide range of different reasons as to why HGG chooses Stäubli robots when it comes to plasma cutting:

- Higher accuracy due to smaller arms;
- Rigid structure allows highly dynamic movement;
- Electronics are closed off from harmful plasma dust;
- Resistance to high temperatures due to fluid oil lubrication.

Components

Robot arm

The robot arm has six axes. The rigid structure used with metal castings results in good dynamic performance and stability. The enclosed structure can be used in a hostile environment with smoke and plasma dust. High accuracy is achieved by Stäubli's patented reduction gear system. This gear system gives the robot arm unrivalled precision, flexibility and speed along with reduced maintenance. Due to HGG's unique application of the robot, high positioning accuracy is achieved. Whereas most machine

fabricators quote the repeatability accuracy of their robot applications, the HGG system distinguishes itself by the rapid and accurate measurements to immediately correct the theoretical cutting path. This makes the machine up to one and a half times as productive without compromising on accuracy.

Torch holder

The torch bracket is milled out of a solid block of aluminium, enhancing the rigidity of the total assembly resulting in higher accuracy during cutting.



Industrial robot that is used in the RPC 1200

Optical scanner

The torch holder has a built-in optical scanner to detect material distortions and deviations. The measurements are necessary to define the actual material position and shape and recalculate the theoretical cutting paths. To protect the optical scanner from plasma light and sparks, an automatic shutter is added that closes after scanning.

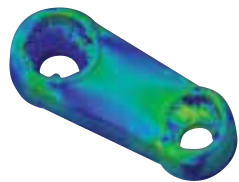
torch and material, the torch is released, preventing damage to the robot arm. This is an additional safety feature, because the measurements of the material prevents collision of the torch.

Robot calibration

The operator can use a wizard in the machine software to calibrate the robot in the blink of an eye. The wizard moves the robot to a few positions and asks the operator to enter a few measured distances. The software compensates the robot positions if the measurements deviate. Robot calibration secures accurate cuts.

Shock sensor

The shock sensor is mounted between the robot arm and torch holder and is connected to a quick-release mechanism. In the unlikely event of an impact between



Rigid Structure



Enclosed Structure



Unmatched precision

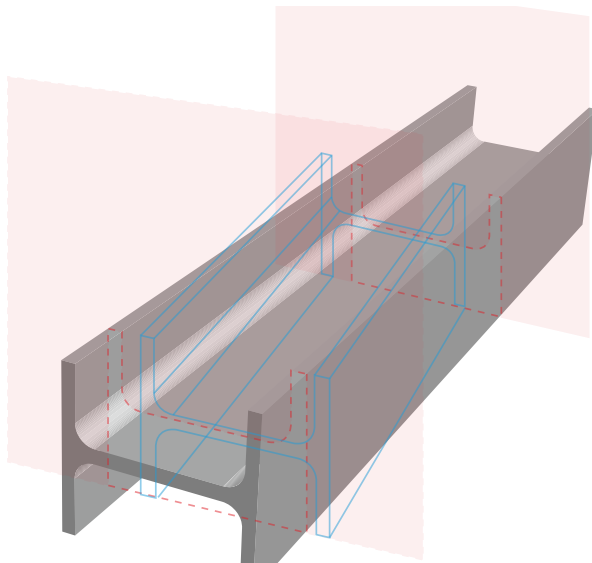
Material displacement and distortion compensation

The theoretical and actual position and shape of raw material differs. To achieve an accurate cut and to prevent collisions during cutting, the material has to be measured. HGG has succeeded in developing an accurate and rapid 3D measuring system which contributes to creating a highly productive and accurate cutting machine.

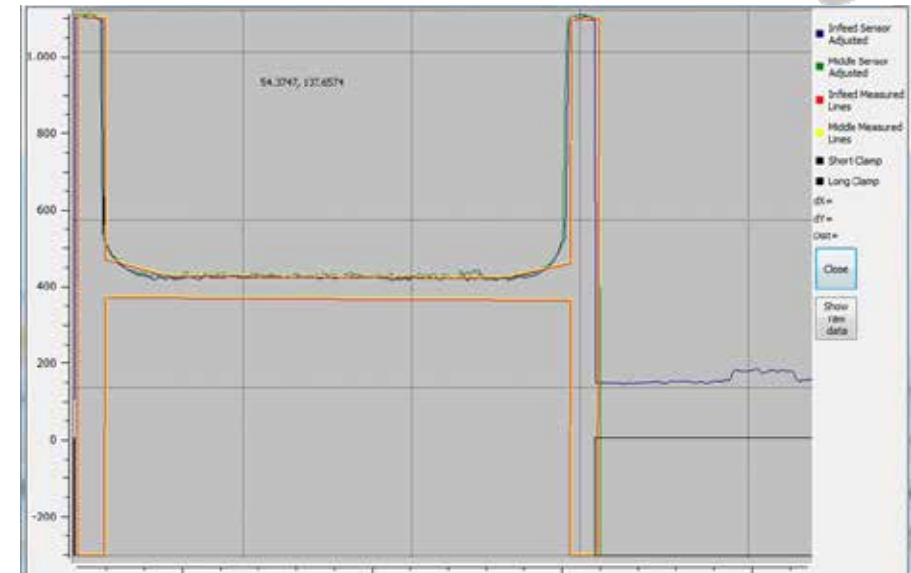
Measurement system

The RPC is equipped with a measurement system to detect displacement of the material. The measuring system consists of a triangulation laser scanner that measures a section. This section measurement takes place at two positions on the material inside the cutting area. The scans of both sections are performed in one continuous cycle and can define distortions in position, torsion and flange or web angles between the two sections. Since the RPC can cut end cuts of two parts

at once, by interlinking cuts, only one 3D scan per profile is required after the initial scan. This saves time making the machine more productive. The laser is enclosed in a case for protection during cutting. The 3D scans can be viewed, giving the operator a reference of what has actually been measured and compares this data with the theoretical model. In a matter of seconds a cutting sequence can be initiated with the alternative cutting path based on the measurement of the actual material rather than the theoretical profile shape.



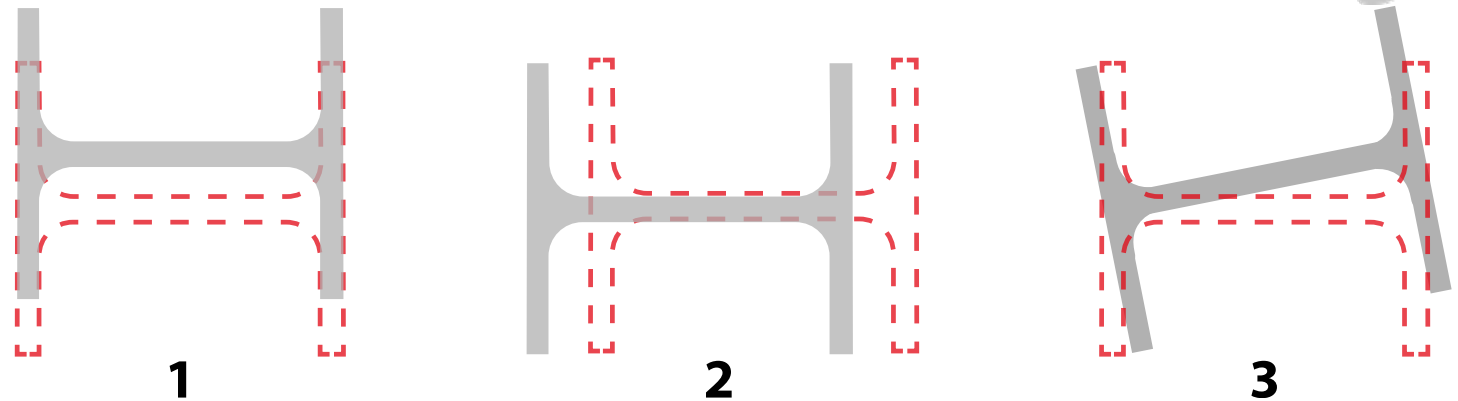
Section measurement compared at 2 positions.



Comparison of theoretical model and scanned results

Positional displacement and torsion

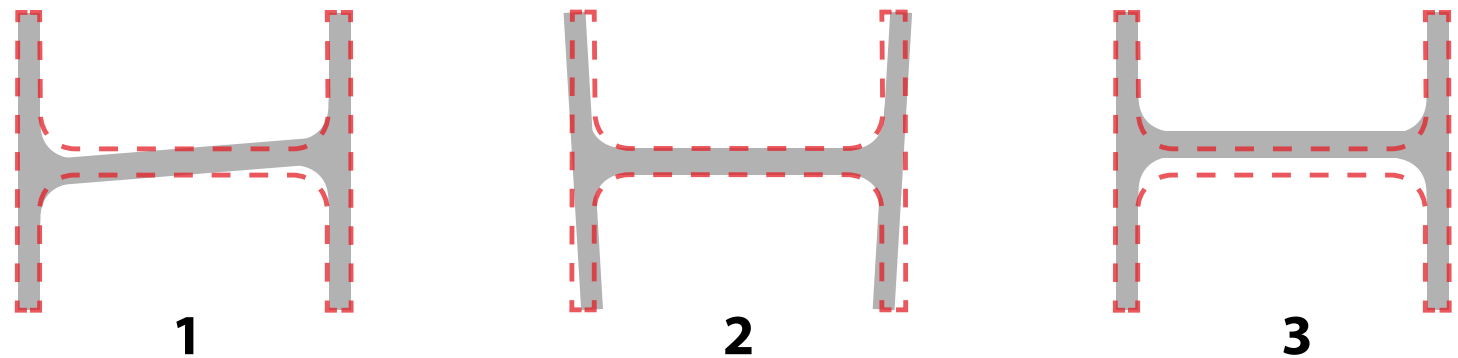
To achieve the most accurate cuts, the actual position of the beam will be measured in order to recalculate the cutting path of the profiling shape. The beam is measured at two positions to detect misalignment. The RPC measures offsets and torsion using both positions.



Compensation of positional displacement and torsion. 1. Sagittal offset, 2. Transversal offset, 3. Torsion.

Section distortions

The section of a beam often has some kind of distortions compared with the theoretical section. To correct for these differences, the beam section will be measured to recalculate the defined cutting path.



Compensation of section distortions. 1. Web not perpendicular, 2. Trapezium flange, 3. Off-centre web.

Plasma Cutting

HGG has distinguished itself as a pioneer in CNC plasma cutting. Since 1994, HGG has supplied over 500 3D profiling machines with plasma cutting technology worldwide and keeps innovating with plasma cutting technology to stay on top of the latest developments.

The basics

An electric beam of superheated, electrically ionized gas, also called plasma, cuts through electrically conductive material (e.g. mild steel, stainless steel, various alloys). The plasma beam follows the electric arc from the cutting torch to the earthed work piece. The electric arc ionizes compressed gas (air, oxygen, hydrogen, nitrogen or argon) blown through a directed nozzle at high speed and

the ionized gas is converted into a beam of plasma. This plasma beam vaporizes the surface of the metal. The plasma and compressed gas blow the molten metal away to cut through the work piece. High definition plasma equipment has a special torch design that swirls a protective gas (air or nitrogen, depending on the material to be cut) around the plasma beam to improve cutting quality.



A plasma torch cutting through the web of a beam profile.

Characteristics

Versatile

Plasma cuts through any electrically conductive material, allowing the cutting of a wide range of materials from mild steel to exotic alloys.

Fast

In the wall thickness range up to 25 mm, plasma cutting outperforms oxyfuel cutting. The exothermal process of oxyfuel cutting limits the cutting speed to between 350 and 800 mm/min. whereas plasma cutting can reach speeds of up to 3000 mm/min. Because plasma cutting requires no pre-heating before piercing, more time is saved on each individual cut.

Plasma costs

Initial investment costs of plasma are higher than for oxyfuel. This is because, apart from the plasma source, a complete extraction system with filtering unit is required. The cost of monthly consumables is also more expensive than oxyfuel but

this is compensated by the higher cutting speed which increases production.

High quality

Plasma cutting delivers a superior surface result over oxyfuel. Plasma also has a smaller heat-affected zone resulting in less distortion of the material's microstructure.

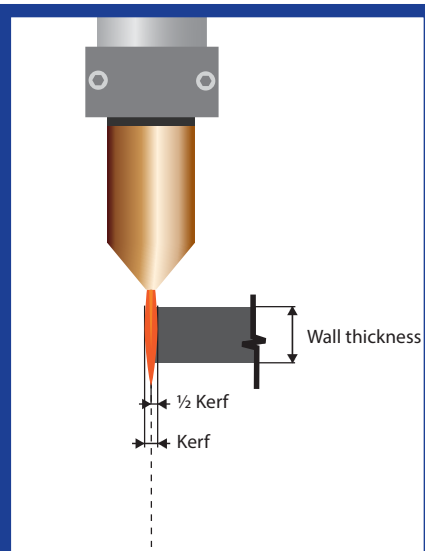
HGG's unique plasma features

HGG's machines and software allows for the following compensations of plasma characteristics which are unique to the industry and only available with HGG's machinery, made possible due to the fact that all software is developed internally by HGG.

Extended consumable lifetime

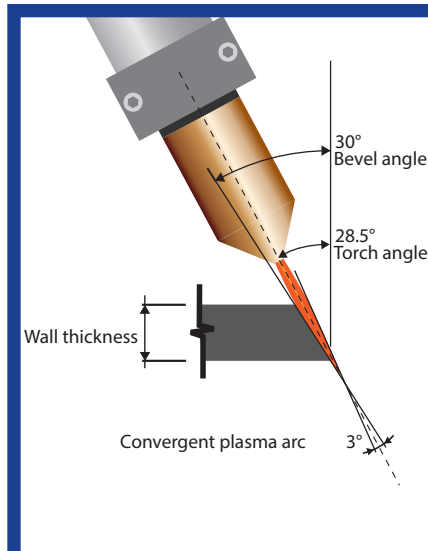
HGG developed interlinked cutting which connects several cuts to drastically decrease the amount of approaches and ignitions. A longer consumable lifetime is achieved in combination with the optimized pierce sequence.

HGG's Cutting Compensation



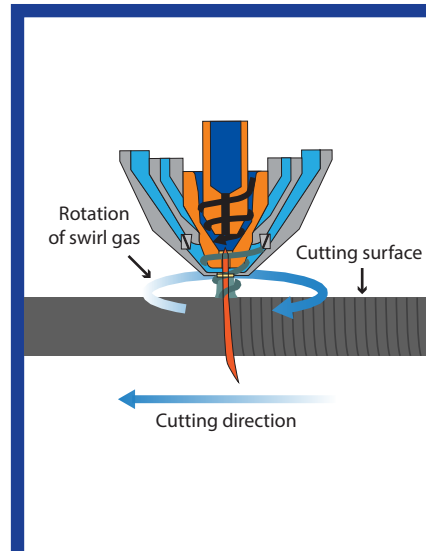
Kerf Compensation

The beam width or kerf depends on the plasma cutting system. The kerf is compensated by software corrections to ensure accuracy. This compensation is typically half of the kerf.



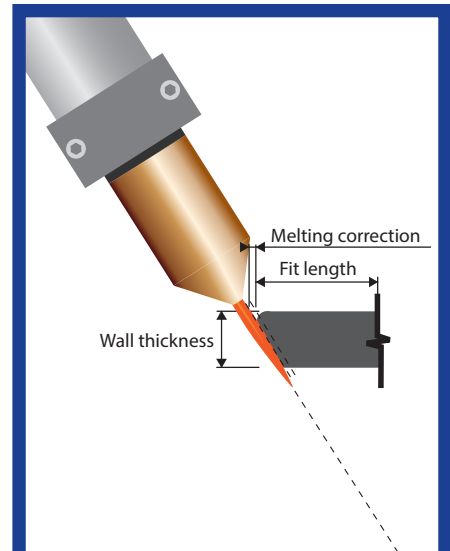
Arc Shape Compensation

In most cutting conditions the plasma arc cuts a convergent kerf; this convergence can vary depending on the torch, nozzle and set height. To make sure the cut bevel angle is accurate, the convergence is compensated by a parameter in the machine software. If the convergence of the kerf is 3 degrees with a required bevel of 30 degrees, the cutting angle is corrected to 1.5 degrees. Consequently, the torch angle will be 28.5 degrees to compensate for the convergence.



Optimized Cutting Direction

Plasma cutting uses a swirl to focus, stabilise and protect the arc. The swirl creates a 'good' and a 'bad' side in the kerf. In order to get a straight cut the torch must travel in the proper direction to have the 'good' side on the part and the bad side on the remnant material. The good side is on the right relative to the movement direction of the torch. HGG uses this knowledge and adapts the cutting routines to maintain the most accurate cut.



Melting Compensation

Especially when cutting a negative bevel the melting away and rounding of the corners occurs on the fit line. Within HGG's software this melting can be compensated with a numeric variable (in mm). This parameter corrects the (local) fit line easing the fitting and welding of the final product.

Cutting Intelligence

Cutting a beam end needs a sequence of cuts covering both flanges and the web. Every shape is different and needs a unique sequence of cuts and combination of cutting techniques. Automatic determination of these combinations and techniques is called cutting intelligence. The machine determines the correct sequence and necessary techniques.

Bolt hole cutting

The RPC is capable of cutting accurate bolt holes rapidly.

PerfectHole™ technology

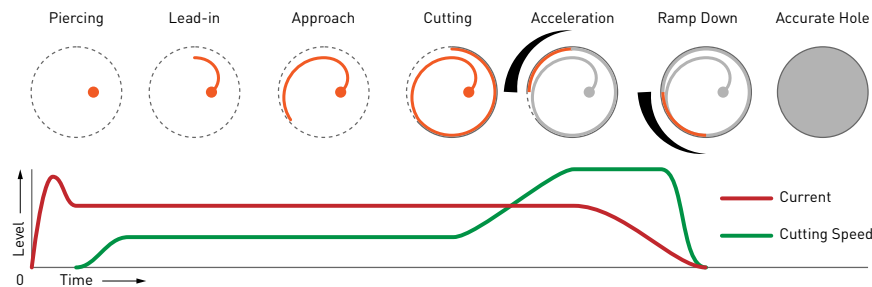
A combination of cutting techniques is selected to cut holes perfectly. Kerf width compensation, arc shape compensation, optimized cutting direction and a special lead-in and lead-out are the base of this technology. The PerfectHole™ process compensates the arc shape behavior during cutting. The applied lead-out technique prevents increasing of the arc length which enables a non-gouging arc ramp down for a longer consumable lifetime and a gouge free bolt hole.

Saw cutting

The RPC is an all-in-one machine and offers a high speed alternative for band saws. Saw cuts can be performed in high speed because the cutting paths do not contain complex shapes and copes.

Combine saw cuts

Thermal cutting usually has a part side and a scrap side. Save scrap length by combining the saw cuts of two parts. All cutting paths of a saw cut are located in one plane. A small gouge at the start point of each cut is the only small disadvantage. The big advantages are superior cutting speeds with only three cuts for each part and material savings by zero scrap length.



Current and speed during the perfect hole process

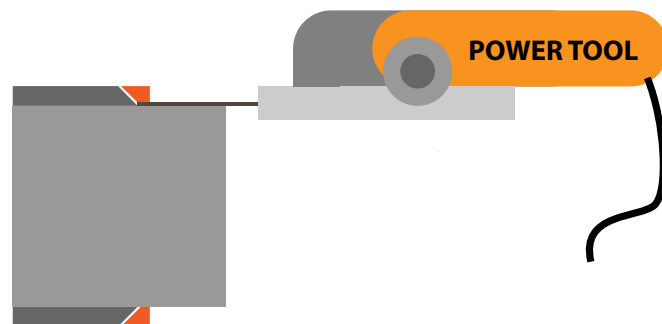
Grind reduction technology

One of the biggest challenges during beam cutting are the transition areas from web to flange. HGG developed cutting sequences based on the plasma cutting process to cut away scrap material and minimise rework. This results in a perfect fit and weld preparation.

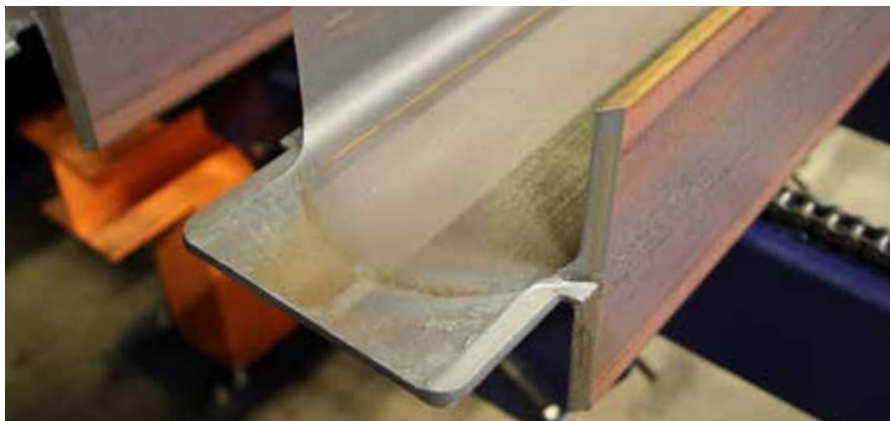
Final flange cut

A coped end-cut profiled with the 'final flange' cutting sequence minimizes rework. Coped end cuts do have an underlying web compared to non-coped end cuts. Traditionally the flange cut is divided into two to avoid the underlying web. This unique sequence cuts the flange

in one single movement without damaging the underlying web and leaves a smooth continuous welding surface without interruptions. A small scrap piece remains if ratholes are not required which is easy to remove by a power tool with cutting disc.



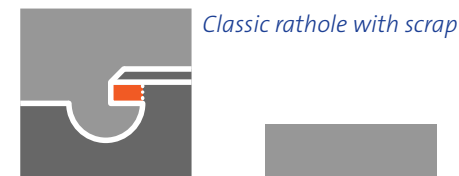
Manual removal of small scrap piece



Near flange cutting

The most commonly used rathole in the industry leaves a small scrap piece next to the flange. Some material can't be cut due to the plasma torch size. It requires manual grinding to cut away the material without damaging the underlying flange. HGG developed a special rathole to skip

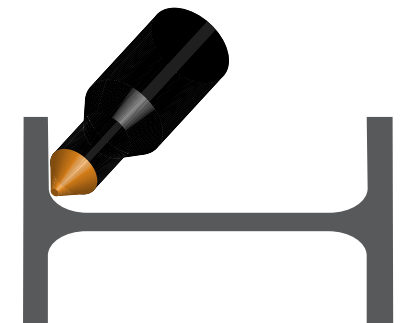
grinding altogether. The unique cutting technique compensates the torch height position and tilts the torch backwards during rathole cutting once the torch approaches the section radius and flange. This prevents torch collision and creates a tapered rathole shape.



Classic rathole with scrap



Rathole 6 without scrap



Position and rotation of torch



Box Section Cutting

The box section is a complex profile to cut. The torch needs to pass four sides and corners to apply an end cut. Most end cuts need weld preparation which makes the profiling even more complex. HGG developed technologies for accurate box section cutting and fast throughput on the logistically optimized RPC.

Measurement system

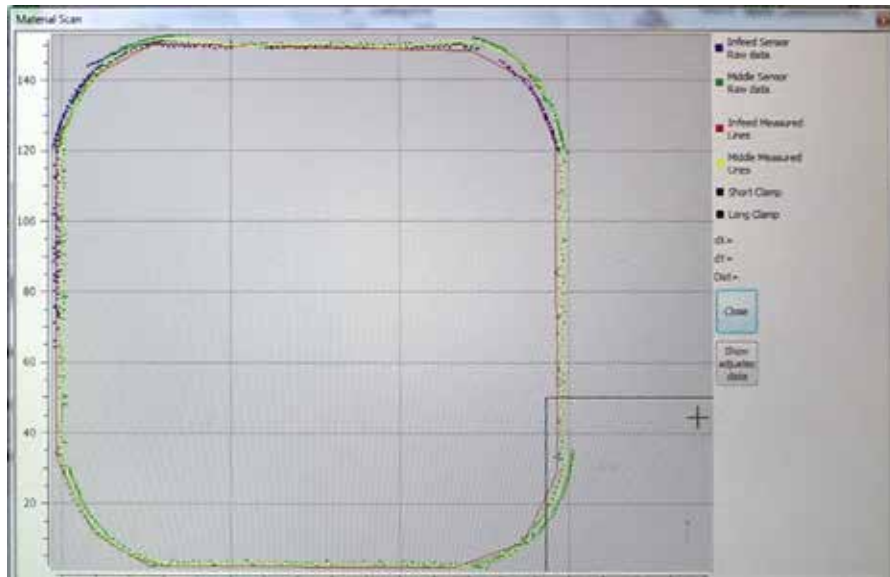
The actual shape of box section sides and corners can differ compared to the theoretical model. The machine starts a laser measurement routine after loading the cutting data to deal with these differences. Positional displacement of the material, torsion and sectional distortions are measured. The theoretical material position and cutting paths will be recalculated and are visible to the operator on the interface where both the measurement and the theoretical model are visible.

Interlinked cutting

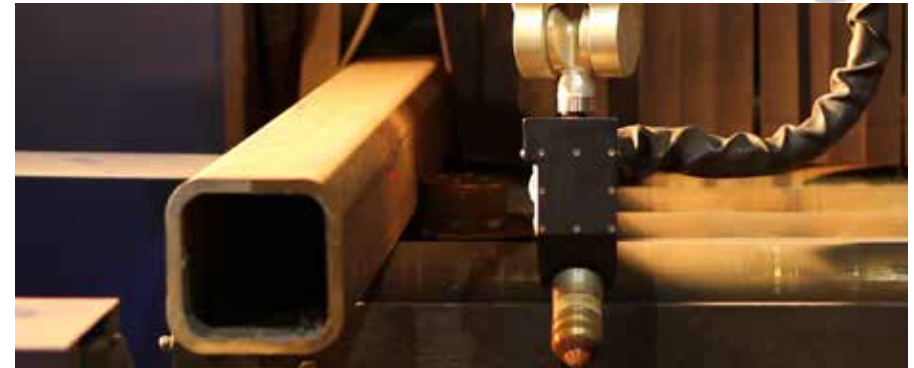
Cuts that cover multiple sides of the box section will be interlinked automatically. Long linked cutting sequences speed up the machine throughput due to a high burner-on time.

Easy fitting and welding

Box section end cuts are often applied and very difficult to cut by hand. The saddle shaped end cut can only be made by 3D profiling and guarantees easy fitting and welding with a minimum amount of welding volume.



Interface with a comparison of a scan and the theoretical model.



Laser measurement routine



3D coping over the box-section corners



Box section saddle connection

Fume Extraction and Filtration

Plasma gasses can cause serious health problems and the fine particles can decrease the life span of the machine and its components. That is why all plasma cutting machines require a fume extraction and filtration system. HGG uses a fume extraction system that extracts from different positions which results in improved health, safety, operator visibility and technical life expectancy.

Fume extraction

Two extraction points in the top of the cutting cell create an upwards airflow inside the cutting cell. The air from the infeed and outfeed opening flows to the extraction points preventing fumes from escaping. Tunnels on both the infeed and outfeed side of the cutting cell create an even bigger barrier for fumes to escape. Fume extraction has 3 distinct advantages:

- A clean working environment for the operator;
- Due to the optimized airflow the operator maintains a clear view through the cutting cell window of the cutting in operation without clouds of smoke blocking his view;
- Extending lifespan. Plasma dust and high temperatures in the cutting cell are restricted to a minimum to prevent negative influences on the technical life expectancy of machine parts such as the clamping sensors and the robot.



Fume extraction channels inside the cutting cell.



Fume extraction unit and particle filter

Filtration

HGG recommends a dedicated filtration unit for each line to ensure the air flow is kept constant and prevent fumes and gasses from escaping.

Smoke and fumes

The plasma cutting process can result in the release of hazardous substances, especially when cutting stainless steel

or aluminium. The fume extraction and dust collection system removes smoke and fumes from the immediate cutting area. However, these units filter particles, they do not purify or filter the gasses. The extracted gasses from the dust collector must be extracted and removed from the area according to local health and safety regulations. HGG recommends that these gasses are always released to the exterior.

Plasma Marking

Cutting machines produce a collection of individual parts ready for assembly. The fitter has to assemble all parts based on drawings. It is necessary to distinguish between parts and know their distance and orientation relative to each other. HGG offers several marking solutions for identification. Text marking can be used to identify parts or material. Some CAD packages can generate and include markings for layout in the cutting file.

Text marking features

Text marking

Some CAD systems can apply text to a part. For instance, Tekla Structures can add the text marking data to the NC1 file which can be imported by HGG's ProCAM for further processing.

Miscellaneous text marking for MDI

For marking of miscellaneous text like member names, projects, job numbers, etc., That are not member specific (e.g. 'This way up', weight or storage information). This feature is available as Manual Data Input.

Text marking by scripting (on request)

The unique 'ID name' used in CAD drawings can be marked on the member by a customer specific script. Additional information can also be marked if required (e.g. project title, job number, etc).

Permanent & non-permanent marking

HGG supports permanent plasma marking for part identification that needs to persist after conservation. Non-permanent marking is also available.

Layout marking

Some CAD systems such as Tekla Structures support the export of layout marking data. HGG supports several kinds of layout marking data from CAD which can be applied to the part by plasma marking.

Secondary contour marking

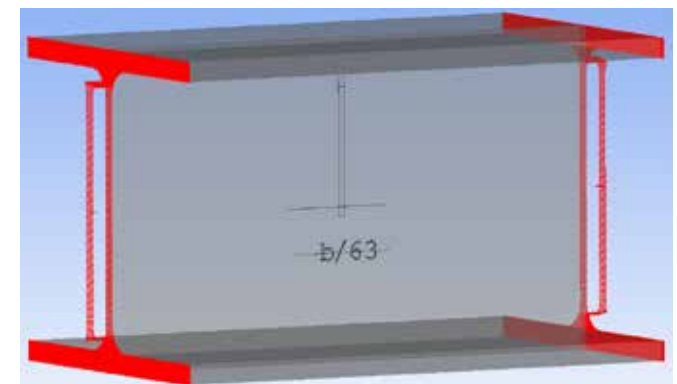
This marking indicates the footprint of a connecting secondary member on a main member for easy fitting. The footprint is also used to locate the surface to clean before welding.

Secondary name marking

ID marking of a secondary member on a main member fitting location. Preferably used together with secondary contour marking and text marking for marking of the member name.

Four sided marking

For H, I, U beams and box sections all four sides of the profile can be marked.



3D view of imported marking data in HGG's ProCAM.

Health and Safety

Working with high voltages and heavy steel means that safety precautions are an absolute necessity. All HGG's profiling machines are designed without compromise on operator safety to ensure perfectly safe machine usage.

Remote control

The machine is operated from a remote control with touch screen and industrial keyboard. The intuitive machine software is easy to use.

Cutting cell

The machine is equipped with a cell that surrounds the cutting process to prevent sparks and plasma glare from reaching the operator. Additionally, the cell protects the operator from movements of profiles and the robotic arm. The robot immediately stops cutting when the cell door opens. Operators can safely monitor the cutting process through the windows with UV protection.

Fume extraction system

The cell protects the operator and surrounding people against the toxic plasma fumes. A filtration unit is connected to extract fumes from inside the cutting cell.

Intelligent ergonomics

The operation interface of the machine is designed with a focus on safety and user friendliness. The height of the control panel, the remote control and the emergency stop buttons are easily accessible to the operator. Despite the aforementioned built-in safety precautions, machine operators are

advised (or required, depending on local laws) to always wear protective clothing, protective footwear, safety goggles and ear protection.

Emergency stops

The machine is equipped with several 'Emergency stop' buttons. Pressing one will stop all machine activity. These buttons are located on the remote control below the touch screen and on the control panel for the storage chains.

Software safety locks

Specific buttons are blocked during operation for safety precautions. Certain actions can damage the machine or harm personnel. Software locks alert operators of potential risks. By requiring the operator to manually overrule the safety lock the risk of accidents is greatly reduced.

European Conformity (EC)

All machines are built in accordance with EU regulations following relevant EC directives and relevant provisions of the NEN harmonised standards, every machine is supplied with an EC declaration according to:

- Machinery Directive 2006/42/EG;
- ElectroMagnetic Compatibility (EMC) Directive 2004/108/EG.



Operator in front of the closed of cutting cell and outfeed conveyor.

ProCAM Suite

HGG has designed an extensive software suite that enables users to quickly and efficiently prepare jobs for HGG 3D profiling machines. The user can create and modify parts, review parts, set up the most efficient way to cut those parts from stock and automatically generate machine CNC data. The suite can also import project files generated with CAD packages.

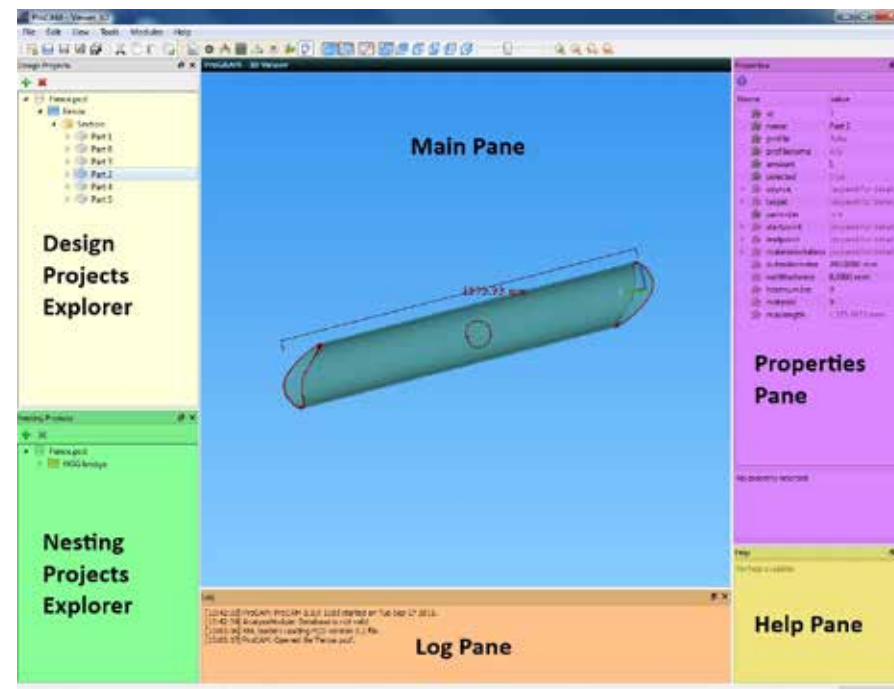
The Suite

ProCAM is a constantly expanding and evolving suite that incorporates advances in technology and effectively responds to user needs and wishes. The latest additions provide vital information to optimize processes and enable various analysis options. Together these features lead to an optimal efficiency and substantial savings in materials and time as well as providing an excellent framework with effective calculation, estimation, planning and quality control. In combination with the Manual Data Input, Nesting and 3D Viewer modules for all aspects of structural design and preparation of materials for the cutting machines this suite provides an all-in-one solution.

ProCAD: CAD/CAM Interfaces

HGG provides interfaces that convert entire structures modelled in various

CAD packages into CNC data files for the cutting machine without the need for further processing. HGG is proud to be a leading player to enrichment information through standardization of all aspects of the industry from design to production and create greater collaboration within the industry. The various interfaces link the existing CAD package to ProCAM providing unique functionality and editing capabilities, vital for the generation of the necessary cutting data. Tekla is the most commonly used CAD program to design structures. With only a few mouse clicks, you can transfer design data from Tekla to ProCAM. It's also possible to interface with solid modelling packages like Inventor and SolidWorks. Using the 3D viewer users are able to check cuts and parts before cutting data is generated.



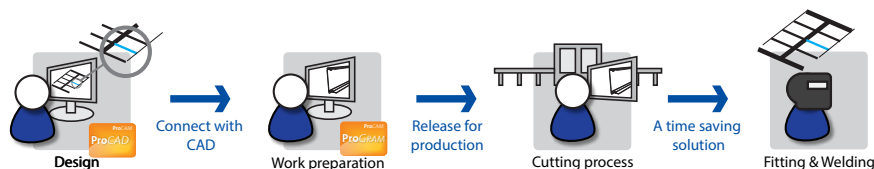
User interface of ProCAM with the 3D Viewer visible.

ProGRAM

With this comprehensive package it is possible to design parts by manually entering data and program profiling information (MDI), view all the designed parts (3D Viewer) and divide them efficiently into the available raw materials (Nesting).

ProCAM offers you:

- Familiar, intuitive user interface;
- CAD/CAM interfaces to remove re-programming and errors;
- Manual programming interface with extensive profiling shapes library;
- 3D viewing of parts, cuts and nesting stock;
- Efficient nesting for fast cutting and material savings.



ProGRAM

ProGRAM is the standard set of software included with the cutting machine. With this comprehensive package it is possible to design parts by manually entering data and program cutting information (MDI), view all the designed parts (3D Viewer) and divide them efficiently into the available raw materials (Nesting).

Manual Data Input (MDI)

Program individual parts with all necessary parameters. The intuitive interface makes the programming of profiling shapes for welding and fastening simple and accurate.

Material types and sizes

The MDI module can define default shapes and dimensions, speeding up the whole design process. If materials with specific dimensions are regularly used you can define them as standards for fast and easy part creation.

Profiling shapes

HGG has extensive library set of profiling shapes which are offered in a customized selection including the software. Profiling shapes are pre-defined software based tools to calculate cutting paths necessary for profiling. Profiling shapes contain a set of parameters to adjust the final cutting path. Each profiling shape has a help image that explains the parametric measurements. Invalid parts display a warning with an explanation of the problem for fast and efficient corrections.

3D Viewer

Generated with cutting data, this viewer provides three dimensional representation including welding preparations. Invalid parts are not displayed in the viewer. The

3D viewer can rotated move and magnify for close examination of the cutting path.

3D Viewer

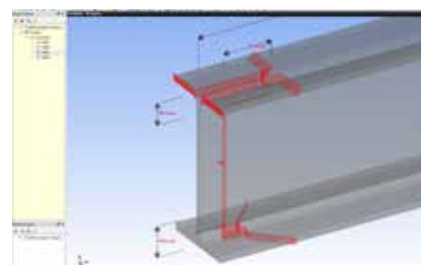
The ProGRAM 3D Viewer visualizes the entered data by displaying a three dimensional part and the specified cutting paths. A full check can be performed before nesting and creation of the cutting data.

Nesting module

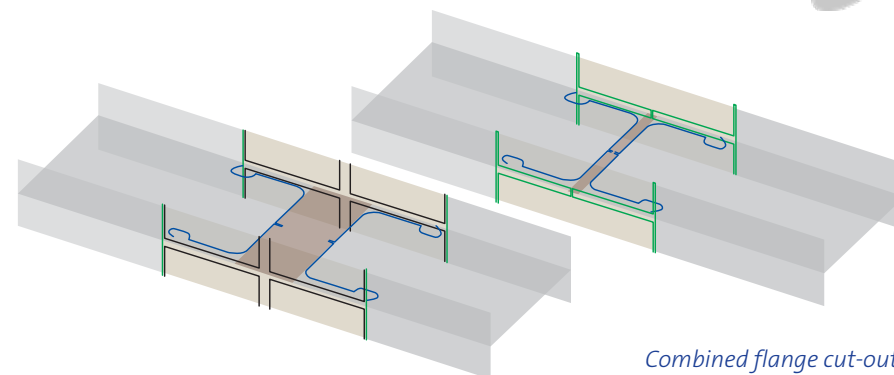
Optimized nesting places parts in their most cost-effective way in profiles to reduce waste and increase efficiency.

Combine flange cut-outs

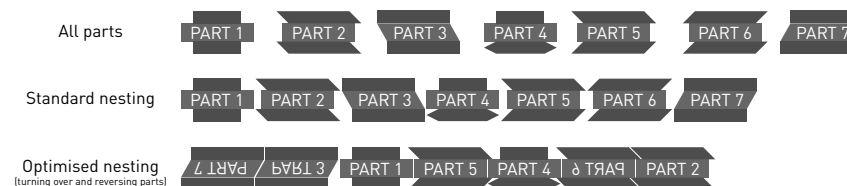
The left nest in the figure above shows the black lined flange cut-outs required to make room for the torch to perform



Parametrically defined profiling shape



Combined flange cut-outs



Optimized nesting according to reverse and turnover algorithm

the web cut without collisions. The HGG technique 'combine flange cut-outs' combines the left and the right cut-out to one as viewed in the right nest above. This results in minimized scrap length represented by the brown colored surface. The interlinked cutting technique speeds up cutting by bundling required flange cuts into single cuts.

Reverse and turnover algorithm

Sloped or skewed end-cuts with complex copes can be very material consuming. The 'Reverse and Turnover' algorithm can nest parts by reversing and turning over parts

in a different order to reduce scrap to a minimum.

Stitch cutting

Sometimes it's difficult to handle and store parts of different sizes and lengths efficiently. Keeping parts stitched together with a custom cutting routine can lower the crane or fork lifting need because profiles keep their original length. Handling will not interfere with the machine throughput nor become a bottleneck. Another benefit is easy processing of extremely short parts. Some rework (cutting the stitches through) is necessary to separate the parts.

Reports

ProGRAM provides access to a range of reports that provide detailed information about the project. These can be used to keep records of the production, to monitor the machine or as a management/planning tool to optimize production:

- Nest report: Shows nesting of the parts in the stock items;
- Batch report: Details about nest jobs once it is divided into stages;
- Group report: Details about nest jobs for post production purposes;
- Rest length report: Overview of the remaining stock after cutting;
- Cutting list: All the necessary information for part cutting and quality control.

ProGRAM offers you:

- Manual Data Input with a wide variety of profiling shapes and detailed parameter drawings;
- Unique visualization with the 3D Viewer giving exact representations of parts;
- Easy to use Nesting Module increasing efficiency and reducing scrap and production time;
- Reporting for detailed information about the nest project.





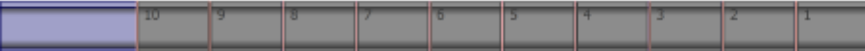
specialists
in 3D profiling

Nest report di 8 december 2015, 11:07:48

Project: Nest Project
Job: Nest Job

Profile properties

Type: H-Beam	Material: S235JR	Profile name: HE300A
Web length: 290,00 mm	Web thickness: 8,50 mm	Flange length: 300,00 mm
Flange thickness: 14,00 mm	Radius: 27,00 mm	Number of stock items: 1
Number of parts: 10		



Auto Stock, length: 12.000,00 mm, rest length: 1.878,00 mm, clamping length: 0,00 mm, heatnr: X

1. b-5(10)	5. b-5(6)	9. b-5(2)
2. b-5(9)	6. b-5(5)	10. b-5(1)
3. b-5(8)	7. b-5(4)	
4. b-5(7)	8. b-5(3)	

Nest report from ProCAM

Plate cutting

In addition to 3D profiles, plates are often used in heavy steel industries as supporting brackets or beam stiffeners. To support plate cutting on a beam profiling machine and save costs on a plate cutter, the RPC 1200 has a plate cutting bed that can be used to cut plates.

Plate cutting with the RPC

Factories where floor space is precious or low quantities of plates are processed can greatly benefit from plate cutting with the RPC. It requires the placement of a cutting bed on the conveyor for each cycle, after which the machine can cut a full plate by itself. By utilizing the RPC conveyors and a separate cutting bed, plate cutting is done inside the cutting cell, utilizing all the benefits (e.g., fume extraction, closed compartment cutting, sound reduction, laser measurement) of the RPC and having one machine to cut plates, beams and bars.

The cutting bed

A separate cutting bed is loaded from its hoist rings onto the sideways loading chains or the infeed conveyor and can be transported over compatible conveyors (see technical data for compatible conveyors). The cutting bed supports the plate, has consumable ribs that can be cut with plate cutting (rib drawings are included), a closed bottom side with smoke channels to the rear of the cell and makes use of the distance laser measurement of the RPC 1200 to determine position.



Plate cutting as seen from within the cell



Plate cutting with cutting preview on the remote control.

Software

Cutting files for plate cutting are drawn using CAD/CAM software with .DXF export functionality. There are no macro's for plate cutting on the RPC 1200. External software can be used to nest multiple shapes into a single file. The .DXF format is imported into HGG's ProCAM to create a cutting file. The generated cutting file does not have separately selectable contours.

Cutting

The plate is grounded through the cutting bed and the conveyor. All closed contour shapes can be cut, including holes and

slots. Parts are automatically cut with the good side of plasma and have kerf correction to deliver high quality cut time and time again. Arc voltage control is used for optimal plasma distance. Bevel cutting functionality is not possible.

Advantages of HGG plate cutting

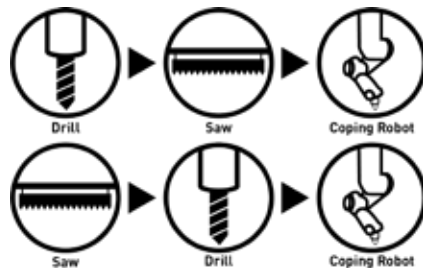
- Cut plates with the same machine that cuts beams and bars and save space in your factory
- High quality cuts with arc voltage control and torch measurement laser
- Automatic cutting cycle

Prefabricated single part processing

To process prefabricated single parts, the RPC coping robot requires a part that is already cut to length by a saw. The prefabricated part may also be drilled and/or marked. The prefabricated single part is required to have a clean non-mitered sawed edge on both the leading and trailing side.

Process description

Prefabricated single part processing is a functionality that makes it possible to connect drills, saws and/or marking equipment with the RPC coping robot to process single parts, optimized for production speed and scrap reduction. The RPC coping robot should be positioned behind these machines in the workflow as visible in the examples below.



Examples of workflow with prefabricated single part processing.

Single parts

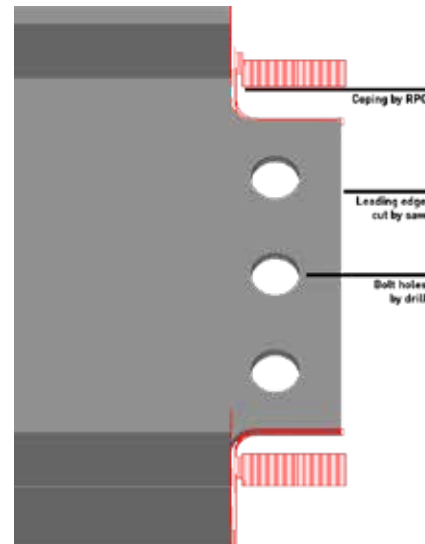
A single part is described by a DSTV file as a part which has a leading and trailing edge and will not be split into further sections by either the saw or coping robot. With prefabricated single part processing, parts are never nested.

Screenshot from HGG ProCAM, showing the cutting path of the RPC coping robot in red.

Process description

The process of prefabricated single part processing is described as:

1. The part is designed with existing software tools (WinSteel, VoCAM, Tekla, Manual Data Input, Routing software, etc.)
2. Existing software tools export a DSTV file of the complete shape of the part for the RPC coping robot.
3. Material is positioned at the start of the machine line and the parts are processed by the saw and/or drill with existing tools and data. The saw and drill process the part into sawed-



to-length and drilled parts that only require further coping and/or marking. The saw creates the trailing and leading edge. The drill creates all bolt holes up to a limit specified in the settings.

4. Parts are processed on the RPC coping robot based on the generated DSTV files. The RPC coping robot processes amongst others; copes, mitres, weld preparations, and line and text markings if necessary. The machine detects the same leading or trailing edge as the drill line and uses this as a reference point to finish the part.

5. After the part is processed by the RPC coping robot it can be transferred to the next step in the fabrication process (e.g., welding, painting, assembly, transport) and a new single part can be processed as soon as the first machine is ready to process it.

Benefits

Prefabricated single part processing has a faster production speed by selecting the quickest machine for the job. Scrap is also minimized by utilizing the most appropriate way of processing for each step. Standard DSTV files can be processed as long as they are not nested.

Technical notes

- It is only possible to process pre-drilled single parts that are sawed-to-length.
- It is only possible to process non-mitered saw cuts.
- RPC coping is referenced to saw-cuts; the final cope tolerance is the sum of the RPC tolerance and saw tolerance.
- An external program will generate the necessary DSTV files (WinSteel, VoCAM, Tekla, Manual Data Input, Routing software etc.).
- Minimum length of parts using the coping sequence is determined by the minimum infeed length of the RPC.
- It is not possible to combine prefabricated single part processing with ERP/ERM systems.
- Drill-holes that should or should not be cut can be filtered using a single threshold based on diameter.
- The material on the RPC Coping robot can only cope with the correct profile orientation as shown in figure "Profile orientation RPC". For asymmetric profiles such as T profile, unequal angle, bulb and channel it is important that the top flange of the profile is on the datum side as depicted below.



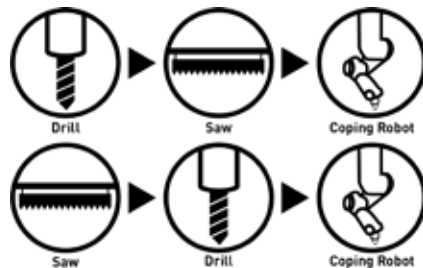
Profile orientation RPC (Black lines represent the top flange of profiles).

Prefabricated multi part processing

To process prefabricated multi parts, the RPC coping robot requires one or more parts that are cut to length by a saw. The prefabricated parts may also be drilled and/or marked. The prefabricated parts are required to have a clean non-mitered sawed edge on both the leading and trailing side.

Process description

Prefabricated multi part processing is a functionality that makes it possible to connect drills, saws and/or marking equipment with the RPC coping robot to process parts, optimized for production speed, scrap reduction and optimized nesting. The RPC coping robot should be positioned behind these machines in the workflow as visible in the examples below.



Examples of workflow with prefabricated single part processing.

Multi parts

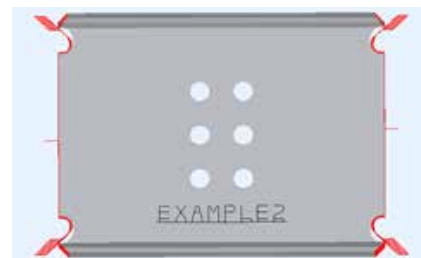
Multi parts are described by a DSTV(+) file with leading and trailing edges and can be split into multiple smaller sections by either the saw or coping robot. With prefabricated multi part processing, parts can be nested, and cut with miters by the coping robot.

Screenshots from single parts imported into HGG ProCAM with cuts, drill holes and marks.

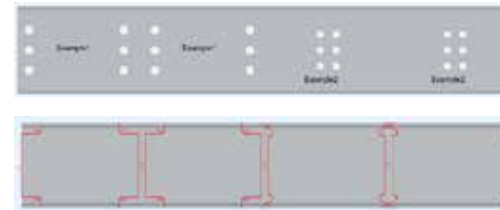
Process description

The process of prefabricated multi part processing is described as:

1. The part is designed with existing software tools (WinSteel, VoCAM, Tekla, Manual Data Input, Routing software, ProCAM etc.)
2. Existing software tools export one or multiple DSTV files into ProCAM with all coping, drill and marking information (see images below).
3. Nesting is performed in HGG ProCAM with the leading and trailing edge aligned to the edges of the multipart.



4. Upon release for production, the following data files are created:
 - 1) Regular single DSTV with multiple holes (and optionally; marking) in relation to the leading or trailing edge (see image with drill holes).
 - 2) The part file used by the RPC for the remaining copes (see image with red lines).
5. The regular single DSTV with holes is imported into the drill-line operating software to be processed.
6. After the drill is finished the part moves towards the RPC coping robot, the part file is loaded. The RPC coping robot processes amongst others; copes, mitres, weld preparations, and line and text markings if necessary.
7. After the part is processed by the RPC coping robot it can be transferred to the next step in the fabrication process (e.g., welding, painting, assembly, transport).



Benefits

Prefabricated multi part processing has a faster production speed by selecting the quickest machine for the job. Scrap is minimized by utilizing the most appropriate way of processing for each step and optimizing the nesting. DSTV(+) files can be processed.

Technical notes

- It is only possible to process non-mitered saw cuts.
- ProCAM will generate the NC files for the saw and drill line
- RPC coping is referenced to saw-cuts and their leading edge expect for the last part where the RPC will use the trailing edge; the final cope tolerance is the sum of the RPC tolerance and saw tolerance.
- There are possibilities to combine prefabricated multi part processing with ERP/ERM systems, requiring additional hours to develop physical and software connections.
- Drill-holes that should or should not be cut can be filtered using a single threshold based on diameter or using a table with currently available drills in the drill line.
- The material on the RPC Coping robot can only cope with the correct profile orientation as shown in figure "Profile orientation RPC". For asymmetric profiles such as T profile, unequal angle, bulb and channel it is important that the top flange of the profile is on the datum side as depicted below.



Profile orientation RPC (Black lines represent the top flange of profiles).

Comparison between prefabricated single and multi part processing

Prefabricated single and multi part processing have some things in comparison, but differ in key functionality, sometimes difficult to explain completely. To show the differences side by side, a comparison is provided for key insights into prefabricated single and multi part processing with the RPC 1200.

	Single part processing		Multi part processing
What the integration can process	Preprocessed single parts sawed-to-length		Preprocessed multi parts sawed-to-length
Type of cuts that can be processed	Non-mitered saw cuts	Equal	Non-mitered saw cuts
Coping reference	Leading edge except for cuts close to the trailing edge		Leading edge except for cuts close to the trailing edge of the last part
Tolerance	Coping robot tolerance and saw tolerance	Equal	Coping robot tolerance and saw tolerance
File creation	DSTV by external program or ProCAM		DSTV by external program processed by ProCAM for the saw or the drill
Minimum length	The minimum infeed length of the RPC		No limit
ERP Connection	There is no nesting, ERP connections don't make sense in this workflow		Limited, request for options
Drill hole filtering	Diameter threshold		Diameter threshold or table with available drills
Profile orientation	According to figure: "profile orientation RPC"	Equal	According to figure: "profile orientation RPC"
Costs	Lower (the saw process can be cheaper too)		Higher
Automation capabilities	Minimal		Extensive
Integration	Only parts that need to be processed by the RPC will go through the RPC		Options to choose material flow
Profile orientation	Channels, Angles and T-bars might need to be flipped	Equal	Channels, Angles and T-bars might need to be flipped



Profile orientation RPC (Black lines represent the top flange of profiles and need to be aligned with the datum line).