Pipe Profiling Machine

Operators Manual

Original manual for the Pipe Profiling Machine

SPC 500-1200

MAINTENANCE CALIBRATION MESSAGES RESTORE QUALITY TERMINOLOGY

HGG specialists in 3D profiling

Operators Manual - Pipe profiling machine

This is the pipe profiling machine operator's manual. For any questions or comments please contact:

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Service

Spare parts and consumables are available and can be ordered from the HGG service department. Questions or information can be sent to the service department by e-mail or fax 24 hours a day. During local office hours your questions will be handled with dedication and care.

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Preface

This is the operators manual providing information regarding the operation and safe use of the pipe profiling machines. The machine types SPC (stationary pipe cutter) 500-1200 are covered by this manual. This manual is part of a set of manuals supplied with the pipe profiling machines.

Manual sets

Operators Manual	This manual describes the operating procedure of the pipe profiling machine. This manual also contains important information regarding safe use of the machine. In the appendices you will find the periodic maintenance and grease schedule, the calibration procedure for the cutting head and instructions for cutting test pieces. Also included in the appendices is the procedure for restoring the software and a list of error codes in numerical order. For reference purposes you will also find definitions of the terminology used in this manual and a quick guide to the oxyfuel cutting process.
Technical Manual	This manual contains an installation checklist for the assembly and installation of the machine, a list of spare parts and wear and tear parts for the machine configuration. Also included in the technical manual are the main assembly drawings, electrical diagrams and connection lists and pneumatic and hydraulic diagrams. Detailed technical specifications and sub-assembly and individual part drawings form part of the technical dossier which is stored at HGG.
Software Manual	In this manual you will find instructions for using the ProCAM software for online and offline programming of the profiles that can be cut on the machine. This manual also describes the nesting of parts in raw materials and all the other features of ProCAM. There is also a course book which includes exercises providing a step for step guide to using the software. Manuals for the optional ProCAD connections for AutoCAD and Tekla will also be included if applicable.
Options	In the options you will find manuals for any other optional features delivered with the machine, such as a plasma unit, dust collector, marking unit etc.

For safe operation and to ensure the reliability of the pipe profiling machine it is important that all the above manuals are available to all the people who work with the machine and to those who are involved with the machine such as supervisors, maintenance engineers, service engineers and work preparation personnel.

Safety

It is important that everybody who works with the profiling machine is aware of the safety notes as described in the chapter 'Safety' in the operator's manual. Use the machine only after you have read and completely understood the contents of this manual. Operators and everybody involved with the machine must always keep safety in mind.

Maintenance

For reliability and safe operation of the machine it is necessary that the maintenance is carried out as described in the Appendix A: Maintenance & Grease Schedule.

Special notations

There are four levels of special notation used in this manual.

WARNING!
A warning statement will typically describe the potential hazard, it's possible effect and the measures that must be taken to reduce the hazard.

CAUTION!
Damage to the equipment or products could result if the specified action is not complied with.

ATTENTION!
Provides extra information to notify the user of potential problems.

NOTE!
Provides information or gives a tip for easier operation.

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Introduction

Intended use of the machine

This machine is a thermal profiling machine and should be used for profiling steel pipes with an oxygas cutting process (oxyfuel) or plasma cutting process. For the explanation of these two processes, see the 'Terminology' appendix. The machine should be used for industrial applications only. The machine is suitable for cutting the pipe range as described in the technical specifications or the nameplate. An overview of the pipe ranges is shown in the table below.

A nameplate like the one shown in Figure 1 is located on the side of the main drive unit. A nameplate like the one shown in Figure 2 is located on the front side of each pipe trolley. You should always keep these nameplates clean and legible.

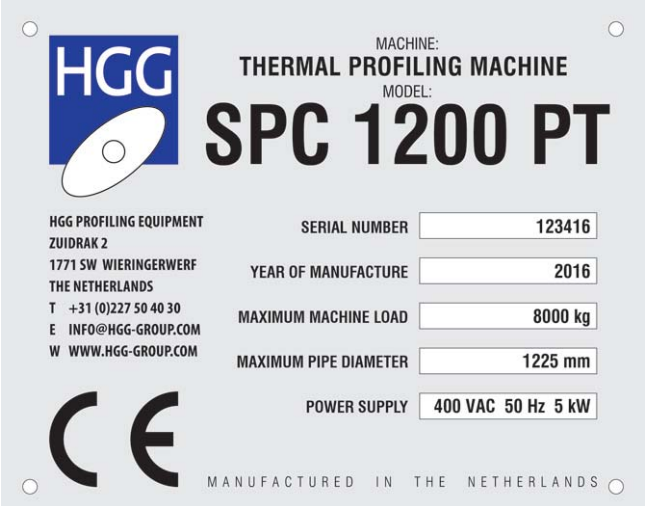


Figure 1: Nameplate pipe profiling machine

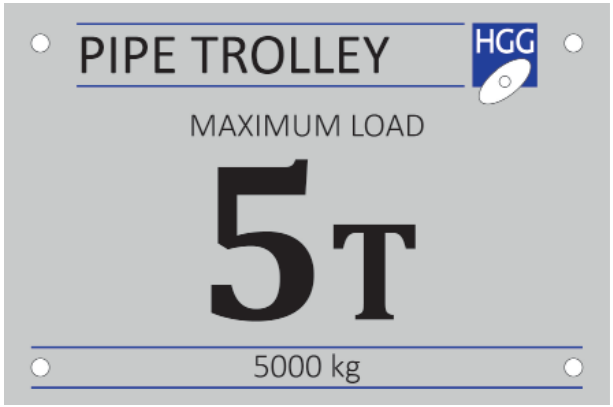


Figure 2: Nameplate pipe trolley

Pipe range SPC 500 - 1200

Profile	Machine	Minimum and maximum outer diameter		Maximum weight	Minimum length	Maximum length
CHS (Circular Hollow Section)	SPC 500	48 mm	510 mm	4000 kg	300 mm	6000 mm
	SPC 600	48 mm	610 mm	4000 kg	300 mm	6000 mm
	SPC 800	60 mm	815 mm	6000 kg	300 mm	6000 mm
	SPC 1000	75 mm	1020 mm	8000 kg	300 mm	8000 mm
	SPC 1200	75 mm	1225 mm	8000 kg	300 mm	12000 mm
	SPC 1200	75 mm	1225 mm	12000 kg	300 mm	12000 mm

Cutting process	Minimum wall thickness	Maximum wall thickness	Cutting angle range
Oxyfuel	3 mm	150 mm	-70° tot 70 °
Plasma	3 mm	38 mm (30 mm quality cut)	-45° to 45°

Conditions for use and installation

The SPC 500 - 1200 range is suitable for installation and use in an environment with the following specifications:

- ventilated, wind- and rainproof environment;
- admissible ambient temperature of 0º C to +45º C;
- maximum atmospheric humidity of 95% non-condensing;
- minimum illumination intensity of 500 lux.

WARNING!
Due to the plasma cutting process hazardous substances may be created. Consult the instruction manual of the plasma unit for more information.

Non-intended use of the machine

The SPC 500 - 1200 range should not be used for clamping or cutting pressurized cylinders, hermetically sealed containers or objects other than described in chapter 1.1. The machine should not be used for cutting flammable or explosive material. Do not use tools other than those specified in this manual in combination with the machine.

Non-intended use of the machine can:

- cause injury to personnel;
- damage the machine or other equipment;
- reduce the machine reliability and the machine performance.

WARNING!
The plasma cutting process generates high temperatures and sparks. The machine should never be used in a flammable or explosive environment!

Noise emissions

There are no harmful noise emissions when profiling using the oxyfuel cutting process, the noise emissions are less than 70 dB(A). The plasma cutting process causes higher noise emissions which increase slightly with higher currents. Please refer to the plasma instruction manual for details. The tables below gives a general indication of the expected noise emissions for commonly used plasma units. Ear protection must be worn when using the plasma cutting process.

Smart Focus

Cutting current	Material thickness	Maximum noise level at a distance of:			Cutting pressure
		1 meter	3 meters	6 meters	
90 Amps	6 mm	96 dB(A)	86 dB(A)	83 dB(A)	9.9 bar
130 Amps	6 mm	100 dB(A)	91 dB(A)	86 dB(A)	9.9 bar
160 Amps	25 mm	105 dB(A)	93 dB(A)	91 dB(A)	9.9 bar
280 Amps	20 mm	104 dB(A)	98 dB(A)	93 dB(A)	5.5 bar
360 Amps	25 mm	104 dB(A)	95 dB(A)	91 dB(A)	7.0 bar
400 Amps	40 mm	112 dB(A)	99 dB(A)	96 dB(A)	7.0 bar

High Focus 440i

Cutting current	Material thickness	Maximum noise level at a distance of:			Cutting pressure
		1 meter	3 meters	6 meters	
90 Amps	6 mm	96 dB(A)	86 dB(A)	83 dB(A)	9.9 bar
130 Amps	6 mm	100 dB(A)	91 dB(A)	86 dB(A)	9.9 bar
280 Amps	20 mm	104 dB(A)	98 dB(A)	93 dB(A)	5.5 bar
400 Amps	40 mm	112 dB(A)	99 dB(A)	96 dB(A)	7.0 bar

Source: Kjellberg-Finsterwalde Plasma Instruction Manuals.

Hypertherm HPR400XD

Cutting current	Material thickness	Distance from source	Distance above arc	MaxP*	Lav5**
130 Amps	25.4 mm	3000 mm	340 mm	111.0	97.7
260 Amps	38.1 mm			118.4	103.8
400 Amps	50.8 mm			123.4	107.8

Source: Hypertherm HPR 400XD Acoustic Noise Level Measurements (16-12-2004).
** MaxP = peak C-weighted instantaneous sound pressure (LpCpeak in dB).*
*** Lav5 = A-weighted sound pressure (LpA in dB).*

WARNING!
The plasma cutting process generates noise emissions above 70 dB (A), ear protection must be worn at all times.

Gas supplies

- The cylinders must always be placed upright and in a secured position.
- Do not use damaged cylinders, pressure reducers or armatures.
- Use pressure reducers only for the gas for which they are intended.
- Do not lubricate pressure reducers with grease or oil.
- All parts coming into contact with oxygen must be protected from grease and oil.

The following gas supplies must be available where the machine is installed:

Oxyfuel

- Compressed air. Non-greased, non-condensed, filtered for particles <5 µm. Pressure 6-8 bar.
- Acetylene. Non-greased, non-condensed, filtered for particles <5 µm. Pressure 1.2-1.5 bar.
- Propane. Non-greased, non-condensed, filtered for particles <5 µm. Pressure 1.5-1.8 bar.
- Oxygen. Non-greased, non-condensed, purity 99.8%, filtered for particles <5 µm. Pressure 8-10 bar.

Plasma Kjellberg Smart Focus

- Compressed air. Non-greased, non-condensed, filtered for particles according to ISO 8573-1 Class 1.4.1. Pressure 10 bar.
- Argon. Purity 99.996%. Pressure 10 bar.
- Hydrogen. Purity 99.95%. Pressure 12 bar.
- Nitrogen. Purity 99.9%. Pressure 10 bar.
- Oxygen. Non-condensed, purity 99.5%, filtered for particles <5 µm. Pressure 10 bar.

Plasma Kjellberg High Focus

- Compressed air. Non-greased, non-condensed, filtered for particles <40 µm. Pressure 12 bar.
- Argon. Non-greased, non-condensed, filtered for particles <5 µm. Pressure 12 bar.
- Hydrogen. Non-greased, non-condensed, filtered for particles <5 µm. Pressure 12 bar.
- Nitrogen. Non-greased, non-condensed, filtered for particles <5 µm. Pressure 12 bar.
- Oxygen. Non-greased, non-condensed, purity 99.5%, filtered for particles <5 µm. Pressure 12 bar.

Plasma Hypertherm

- Compressed air. Non-greased, non-condensed, filtered for particles according to ISO 8573-1 Class 1.4.2. Pressure 8 bar.
- Argon. 99.990% pure. Non-greased, non-condensed. Pressure 8 bar.
- H35 (65% Argon 35% Hydrogen). 99.995% pure.Non-greased, non-condensed. Pressure 8 bar.
- Nitrogen. 99.990% pure. Non-greased, non-condensed. Pressure 8 bar.
- Oxygen. 99.500% pure. Non-greased, non-condensed. Pressure 8 bar.

Heat, smoke and fumes

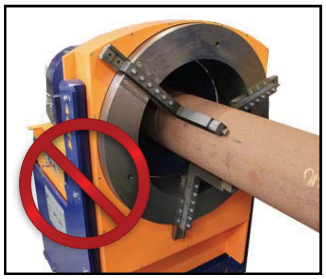
The exhaust system creates an air flow which removes smoke and fumes from the cutting area and also cools the cutting trolley which can reach high temperatures during the cutting process. It is essential that the exhaust system is switched on and active during cutting. Failure to do so could result in damage to the machine and in extreme cases melting of components. The plasma cutting process may also result in the release of hazardous substances, especially when cutting stainless steel and aluminium. The fume extraction and dust collection system removes smoke and fumes from the immediate cutting area. However, these units filter particles from the exhaust, they do not purify or filter the gases. The exhaust gases from the dust collector must be extracted and removed from the area according to local health and safety regulations. HGG recommends that these gases are always released to the exterior

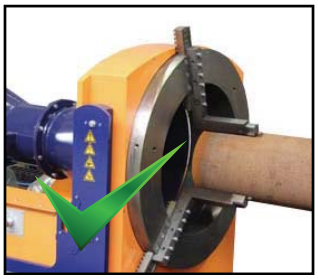
WARNING!
The exhaust gases from the fume extraction and dust collection systems must be removed from the work floor according to local health and safety regulations. HGG recommends these gases be released to the exterior. When cutting stainless steel HGG STRONGLY advises that fumes are ALWAYS released outside.*

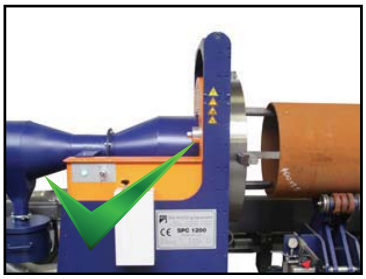
* HGG's advice is based on international research and European Health and Safety Regulations.

Fire risk when clamping pipes

The main drive is equipped with a spark arrestor and dust bin behind the chuck. This is connected to the extraction or exhaust system, extracting fumes and sparks through the pipe. Because of this air flow through the spark arrestor, caution must be taken when clamping the pipe to minimise the risk of fire caused by sparks and residue being sucked through into the dust collector. Do not clamp pipes through the chuck and into the main drive. This will cause greater suction and higher temperatures and increase the risk of fire. Larger pipes can be clamped right up to the face of the chuck because in the larger area inside the pipe the temperature does not reach dangerous levels and the flow rate is lower. However, to further minimise the risk, operators must always check that the inside of all pipes are clean and free from dust, cardboard, wood, paper and any other residue that could increase the risk of fire.







WARNING!
Clamping pipes through the chuck and up against the spark arrestor will increase the risk of fire in the dust collector. All pipes should be checked for residue and cleaned if necessary before starting to cut.

Definitions of qualification of personnel

User
A user is a person or organization who is responsible for the machine.

Authorized person
An authorized person is someone who is authorized by the user to carry out certain activities on the machine.

Skilled person
Skilled persons have technical knowledge or sufficient experience to enable them to avoid the dangers which electricity, pneumatics, hydraulics and mechanics may create (engineers and technicians).

Instructed person
Instructed persons are adequately advised or supervised by skilled persons to enable them to avoid the dangers which electricity, pneumatics, hydraulics and mechanics may create (operating, cleaning and maintenance staff).

Operator
Operators are instructed persons who are adequately advised to avoid the dangers this machine may create. Instruction should include instructions in operation under normal conditions and emergency situations. Operators are persons who start, stop, load, unload, program and clean the machine.

Mechanic
Mechanics have technical knowledge or sufficient experience to enable them to avoid the dangers which electricity, pneumatics, hydraulics and mechanics may create. Mechanics are persons who maintain and clean the machine.

Safety

Machine safety

The machine is designed to be controlled by a single operator. The location of the control elements ensures that the person controlling the machine is not exposed to hazards generated by machine movements or the cutting process. The touch screen interface is also designed with safety in mind. Many machine actions require operator confirmation in order to continue. This guarantees that the operator is in position at the remote control and ensures that he is aware of what is about to happen. Dangerous situations can arise if more than one person is working on the machine at the same time!

WARNING!
The machine is designed to be operated by a single operator. There is a danger of unexpected movement, crushing, wedging or drawing in if more than one person is working on the machine at the same time.

The machine can ONLY be operated by instructed operators and mechanics.

Risks can especially be caused when the machine:

- is operated, maintained or cleaned by inexperienced or non-instructed personnel.
- is operated, cleaned or maintained insufficiently.
- is used for purposes other than described in chapter 1 'Introduction'.

Operators and mechanics must:

- read and understand chapter 2 of this manual 'Safety'.
- have sufficient knowledge to carry out the activities on the machine.
- have knowledge of the location and working of the emergency stop mechanism of the machine.
- have knowledge of the presence and working of all other safety facilities of the machine.
- have knowledge of their specific tasks and authorizations.
- avoid all activities that could be dangerous to the health.
- avoid all activities that could cause damage to the machine and the products of the machine.

Operators and mechanics have to make sure that:

- the area surrounding the machine is clean and free of persons, tools and other (flammable) objects or liquids.
- the machine is only operated when the machine is in good condition.
- the machine is only operated when the protective covers are correctly installed at the correct locations.

CAUTION!
Before operating the machine check that there is no oil leakage from the pipe trolleys or main drive, this may cause a slipping hazard. Remove all materials from the vicinity of the machine that could cause a tripping hazard.

Personal safety instructions

An operator has to keep the following safety instructions in mind:

- Do not use the machine without following the instructions in the manuals.
- Read and understand the Operators Manual and all safety labels before operating or maintaining this machine.
- Read and understand the 'Plasma Unit Instruction Manual' when plasma cutting is used.
- Read and understand the dust collector 'Installation and Operation Manual', when a dust collector is used.
- Keep these manuals at hand at all times and read it as many times as necessary for a complete understanding.
- Only instructed operators are permitted to operate this machine. Instruction should include instructions for operation under normal conditions and emergency situations.

Before starting this machine, the operator must check that:

- All persons are clear of the machine.
- No maintenance work is being performed on the machine.
- All guards are in place.
- The machine is free of jams and other obstacles.
- The machine has not been stopped in such a way that another worker can start the machine while you are working on it.

To avoid injury the operator should:

- Never reach into the machine for any reason unless the machine is at a complete stop.
- Never change or disable the function of electrical interlocks or other machine shutdown switches.
- Never modify the machinery in any way.
- Never exceed the maximum pipe load.
- Never approach the pipe trolley wheel units, pipe trolley rails, cutting trolley track when the machine is in operation or when maintenance is being carried out due to the risk of crushing.
- Never approach the cutting torch, flames from the torch will burn skin! Always maintain a safe distance.
- Never look directly into the flame, the bright light could damage your eyesight. Always use safety glasses and make sure the glass UV protection shield supplied with the cutting device on the machine is in place before any cutting is done.

For safety reasons operators have to wear the following protective equipment:

- Safety shoes.
- Flame proof overalls or flame proof clothing.
- Flame proof gloves.
- Safety helmet.
- Ear protection.
- Safety glasses.

ATTENTION!
Consult the plasma unit instruction manual for more information about risks and endangerments of the plasma unit and its accessories.

Residual risks

The pipe profiling machine is designed to be safe. Despite all risk reduction measures, care must always be taken when operating the machine. Some risks cannot be entirely eliminated, the greatest potential residual risks of the SPC 500-1200 range are:

- Wedging/crushing
- Burning (skin injury)
- Falling material

Operators should pay special attention to the following residual risks:

WARNING! Main drive
The chuck rotates and the jaws may stick out. Keep your body and hands away from the chuck when it is rotating, you could get wedged or hit by moving parts.

WARNING! Pipe trolleys
The pipe trolley wheels provide support for the pipe. Keep your hands and body away from the pipe trolleys when the pipe is rotating, you could wedged between the pipe and wheels!

WARNING! Cutting trolley and torch
Flames from the torch will burn skin! The cutting arm and torch can be hot during the cutting process! Always wear flame proof gloves when replacing the tip.

WARNING! Pipes and scrap pieces
Pipe and scrap pieces can be hot due to the cutting process! Always wear flame proof gloves and clothes and wait until the machine has stopped before cleaning or removing pieces. Beware of pipes and scrap pieces falling after cutting, wear safety boots to avoid injury.

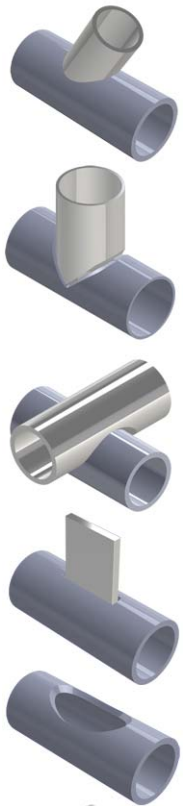
Safety labels

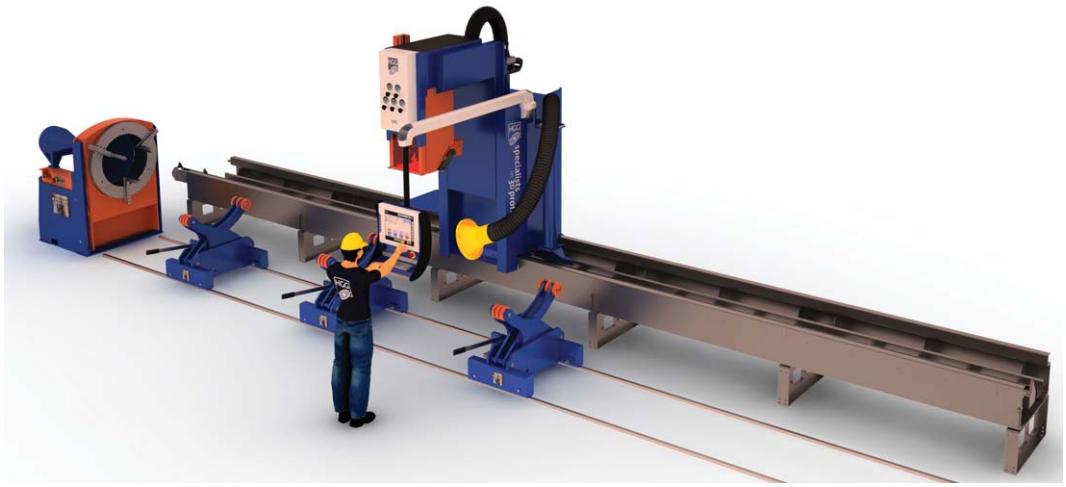
The residual risks of the SPC are expressed by safety labels. The following safety labels can be found on the machine:

Label	Description	Location
	Fire, naked flame and smoking prohibited.	Front side of the remote control. Front side of the main drive.
	Wear flame proof clothing.	Front side of the remote control. Front side of the main drive.
	Wear flame proof safety gloves.	Front side of the remote control. Front side of the main drive.
	Wear safety shoes.	Front side of the remote control. Front side of the main drive.
	Wear head, eye and ear protection.	Front side of the remote control. Front side of the main drive.
	Read and understand the operator's manual before operating the machine.	Front side of the remote control. Front side of the main drive.
	Warning! Hot surfaces.	Right and left sides of the cutting trolley.
	Warning! Laser.	Right and left sides of the cutting trolley.
	Warning! Hazardous substances.	Right and left sides of the cutting trolley.
	Warning! Suffocation hazard.	Right and left sides of the cutting trolley.
	Warning! Moving parts.	Right and left sides of the cutting trolley. Front side of the main drive. Front side of the pipe trolleys. Next to the marking unit (optional).
	Warning! Electric shock hazard.	Right and left sides of the cutting trolley. Back side of the remote control. Front side of the main drive. Side of the control unit cabinet. Next to the marking unit (optional). Front of the exhaust unit (optional).

Machine Description

Introduction





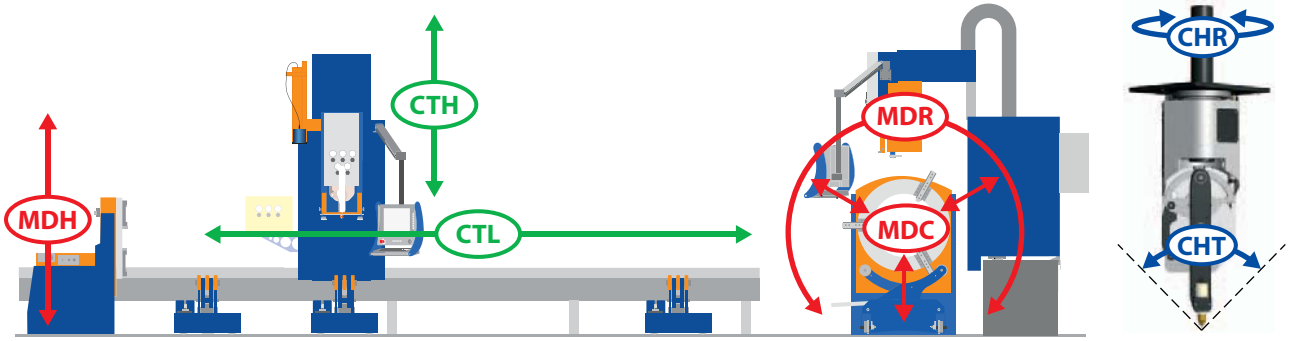
The SPC machines are thermal profiling machines designed to cut connections on steel and stainless steel pipes, with constant welding preparations over the entire profile length. Pipes are clamped in the main drive and supported by pipe trolleys. The machines are capable of cutting with oxyfuel and plasma (optional). The cutting trolley moves along the length of the profile and the bi-axial cutting head can rotate and tilt. Pipes are rotated by the main drive. This flexibilty of movement combined with computer numeric control of the axes produces a versatile machine capable of high precision profiling. The SPC machines can be used for applications from a variety of industries.

The SPC machine range is capable of profiling the following connections and shapes:

- Chamfer
- Saddle
- Hole set in
- Hole set on
- Mitre saddle
- Mitre hole
- Saddle set in
- Oblong hole
- PJP chamfer (offshore)
- PJP saddle (offshore)

A range of additional profiles including offshore profiles and other industry specific profiles is also available, for more details or further information please contact HGG.

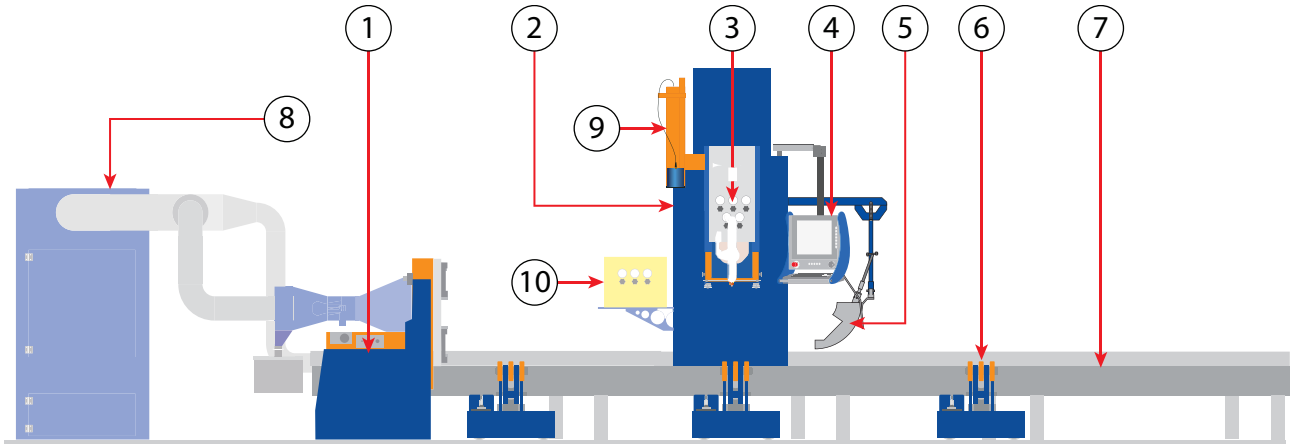
Axis definition



- **MDR Main drive rotation**
- **MDH Main drive height**
- **MDC Main drive clamping**
- **CTL Cutting trolley longitudinal**
- **CTH Cutting trolley height**
- **CHT Cutting head tilt**
- **CHR Cutting head rotation**

Lay out

The SPC stands for Stationary Pipe Cutting machine. This type of machine is anchored to a foundation frame which is embedded in the concrete flooring.



1	Main drive	3	Gas controls	5	Spark reversal kit	7	Rear frame	9	Marking unit*
2	Cutting trolley	4	Remote control	6	Pipe trolley	8	Dust collector*	10	Plasma unit*

** optional*

SPC 500 - 1200 main components

Machine frame

The foundation frame is essential for proper and accurate functioning and has a simple construction of H-beams and is constructed by the client. After ordering an SPC machine, the foundation will be designed in consultation with the client. A set of drawings will be provided by HGG Profiling Equipment B.V. The foundation frame can be placed in concrete or a transportable foundation frame can be constructed which can be mounted on a concrete floor. To guarantee proper function, geometrical accuracy, accuracy of positioning and consistency, installation on a steel frame embedded in concrete is advised. The transportable version is also designed to fit a 40 foot container. Rails for the pipe trolleys are welded on the frame during installation under supervision of a technician from HGG Profiling Equipment B.V. The rear frame is a heavy duty construction and

consists of a rectangular tube to ensure stable movement of the cutting trolley at high speed (20 m/min.). To guarantee perfect and smooth movement, high precision hardened linear guides are used. As the foundation frame is solidly constructed in a concrete floor, vibrations caused by the movement of the cutting trolley, will not affect the rest of the machine.

Main drive

The main drive is equipped with a solid, self-centering 3-jaw chuck. The chuck is rotated by a high performance, brushless DC servo motor. Clamping is done hydraulically and can be operated from the remote control. The main drive is also equipped with a pressure gauge and knob to manually adjust the clamping force of the chuck. The SPC 500-1200 range is equipped with a height adjustable main drive as standard. This means the centreline of the pipes can be positioned on different levels allowing the machine to reach a wide range of pipe diameters or to be equipped with fixed height conveyor systems.

Pipes can also be clamped in the middle allowing profiling at the front and back

of the main drive reducing scrap due to over length clamping. Due to HGG's patented cutting head, the clamping length in front of the chuck is only 300 mm (11.8") and in combination with long jaws only 50 mm (2").

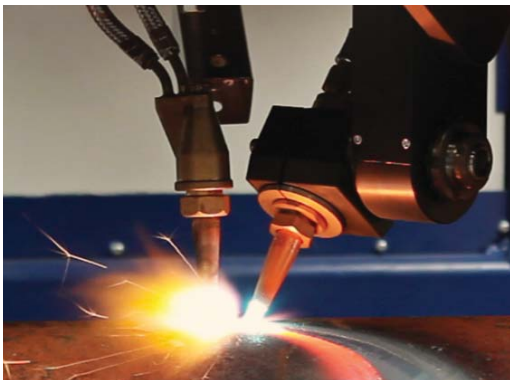
Cutting trolley

The cutting trolley is suspended from a heavy duty machine frame. It is CNC-controlled and runs over the high precision, hardened linear guides along the pipe length. The cutting trolley integrates height movement (for pipe diameter reach) and linear movement (for pipe length reach). The cutting trolley also contains a biaxial cutting head and is equipped with a remote control. Every cutting trolley has an initialization laser pointer equipped as standard allowing the cutting trolley to be accurately positioned at the begin point of each profile.

The height movement is controlled by a servo motor. Two heavy duty rollerball arms at each side of the cutting torch apply pressure to the pipe in its support with a pre-set weight of ± 250 N. The pre-set weight is adjusted by a spring load system. This height control system is quick and direct. The servo controlled height allows height of the torch to be fixed for floating cutting. This also provides the possibility to cut closer to the main drive, reducing scrap length.

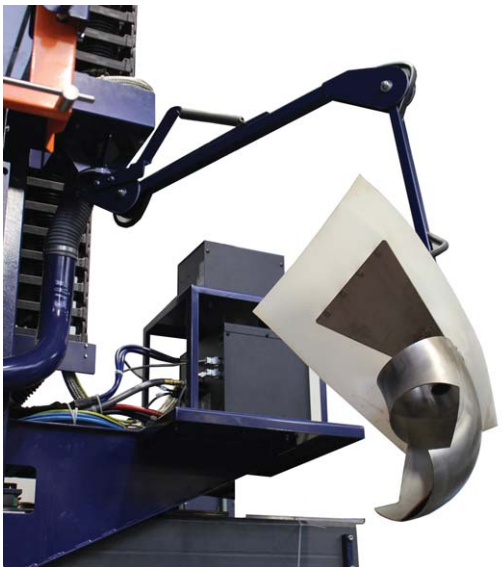
Cutting head

The patented, biaxial cutting head with its torch is installed on the height adjustable part of the cutting trolley which runs on linear guides. The height adjustment allows coverage of the entire diameter range of pipes. The torch can rotate more than a complete revolution and can tilt from -70° to +70°. The machine can be equipped with either oxyfuel cutting or plasma cutting.



Spark and fume reversal kit

The spark and fume reversal kit is attached to the side of the cutting trolley on a flexible arm. The sparks and fumes generated during the cutting process are deflected back into the pipe being cut. Compressed air is passed through a nozzle creating a Venturi effect, increasing the air flow. This channels the remaining smoke and fumes through the reverser and back into the pipe. The fume extraction tube is mounted on the back of the main drive drawing sparks and fumes back through the main drive to be removed by the existing fume extraction system.

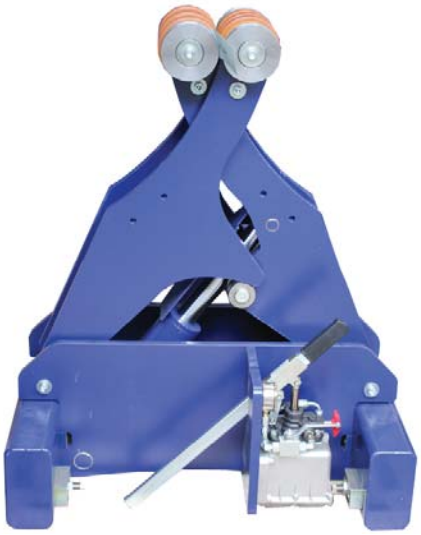


Remote control

The remote control is mounted on an arm on the cutting trolley so that the operator is always close to the profiling position. The entire machine can be controlled from this point. The intuitive graphic interface can be operated using the touch screen. The most common actions can also be controlled using stainless steel buttons on the right and bottom of the remote control, these buttons are for ease of use and correspond to the equivalent adjacent buttons on the touch screen. The remote control is also equipped with a stainless steel keyboard and tracker ball.

Pipe support: pipe trolleys

Standard the machine comes with height adjustable pipe trolleys. There are three sizes of pipe trolley capable of carrying a maximum load of 3000, 5000 and 10.000 kg. The wheels are coated with polyurethane to ensure smooth rotation of the pipes. The height adjustment is hydraulic for easy operation under full load and allows easy levelling of a loaded pipe. For stability six support wheels are present on each trolley. This type of trolley allows you to change the middle position of a pipe trolley when a pipe is loaded and supported by 2 other trolleys.



Pipe support: rollerball gutter

An alternative pipe support system is the rollerball gutter. Because the gutter is at a fixed height, this system can only be used in combination with a height adjustable main drive. The advantages offered by the rollerball gutter support are that the pipe does not have to be levelled and that the machine is easy to integrate with in-feed and out-feed conveyors. Handling of the profiled pipes is much easier since the pieces stay on the machine and do not drop to the floor.

Fume extraction (optional)

Fumes can be drained through a fume exhaust point integrated within the main drive unit. It exists of a spark collector connected to a dust tray which allows easy collection and emptying. The spark collector should be connected to a separate fume extraction system on site. A ventilator can be connected to the spark collector for oxy-fuel cutting or together with a filter unit for plasma cutting. It's highly advisable to have a filter unit when using plasma cutting.

Marking unit (optional)

The SPC 500 - 1200 machine range can be outfitted with a ink jet printer, plasma fine marker or punch marking unit. The marking unit is mounted on the side of the cutting trolley and can be used to mark lines and/or text on the pipes. It is also possible to mark 'footprints' showing the exact position of a cut pipe on the fit pipe or simply to mark all profiles to be cut as an extra control of the shapes and relative positions of the profiles. On the right an inkjet printer on an SPC 1200 and far right, a punch marker on an SPC 1000.

The controls

Main drive

The key switch for the power is located on the main drive. The hydraulic clamping force of the chuck can be adjusted using the knob and pressure gauge on the main drive. The machine can be controlled by using the remote control with keyboard, trackball and touch screen at the cutting trolley.

Power key switch

The key switch can be used to turn the machine on and off.

Clamping pressure

The knob to the left of the key switch can be used to adjust the clamping pressure of the chuck.

NOTE

When the main power switch is set to 0 the climate control in the control unit at the cutting trolley is also turned off. HGG advises to keep the main power set to 1 and to shut the machine down by using the key switch. By using the reset and/or emergency stop no dangerous situations will occur because all machine axes keep their actual position. The machine resets the CTH (cutting trolley height) axis.

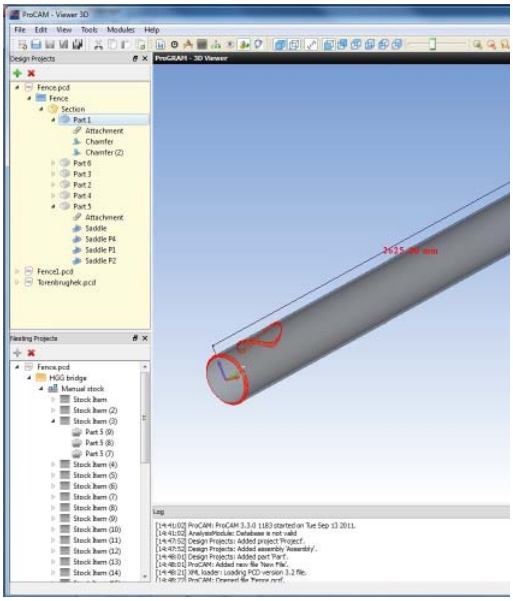
Remote control

The remote control is the interface between the operator and machine. The entire machine can be controlled from this interface.

Manual Data Input (MDI) with ProCAM

The button on the top left of the screen (next to the on/off button) starts the ProCAM software. In ProCAM multiple macros (cuts) can be programmed in order to create a production piece. The parts can be nested into raw materials and data files generated which can then be directly opened and profiled on the machine. A 3D viewer is also available to view parts before nesting and creating the cutting files.

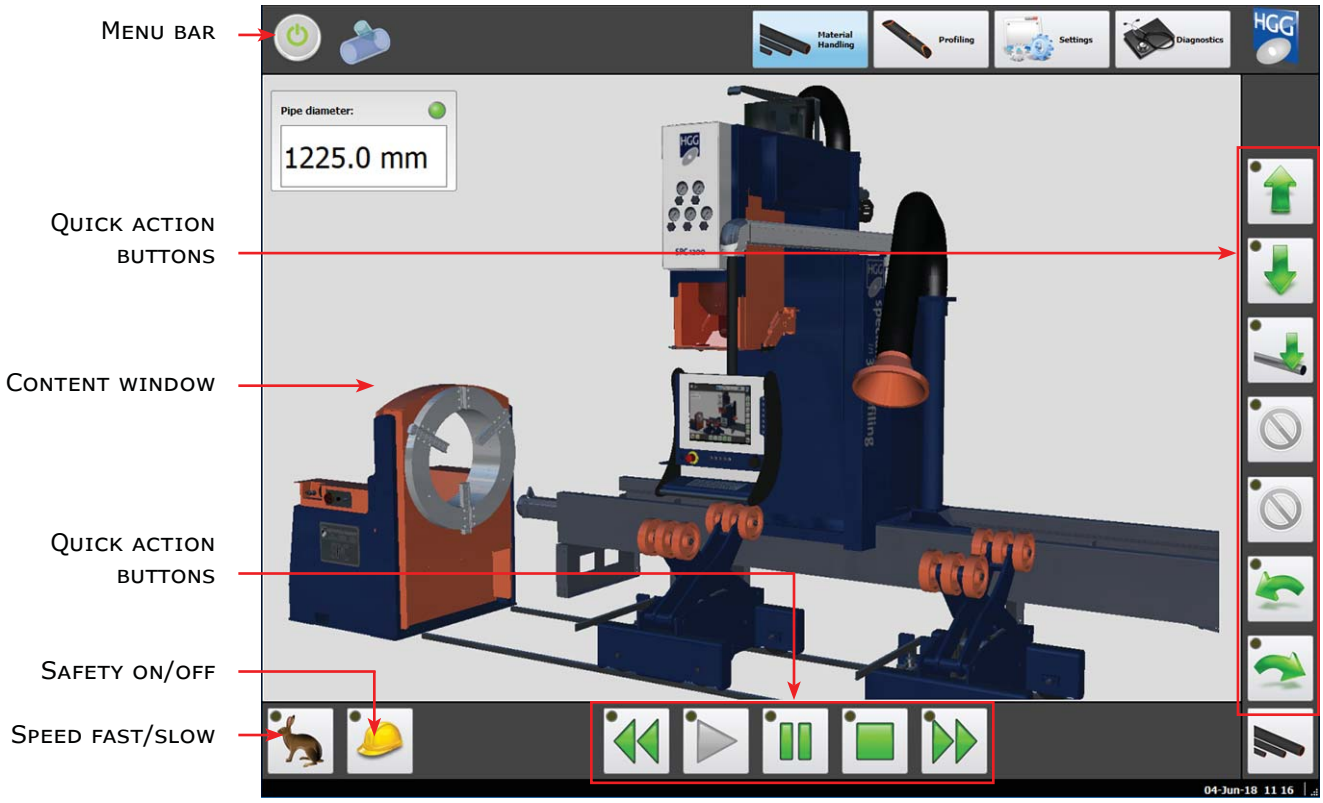
For details of all the possibilities available in ProCAM please consult the ProCAM User's Manual and Course Book provided with the machine.



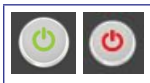
Using the remote control

The remote control is used to operate the machine. The remote control consists of an USB connection, emergency stop, manual control buttons, keyboard with trackball and a touch screen.

The display



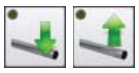
The menu bar

	The on and off buttons for starting or stopping the machine.
	ProCAM: start the ProCAM software program for on-line creation of parts.
	The material handling screen prepares the machine and material for profiling.
	When the emergency stop button is pushed this button appears in the menu bar. Pull the emergency stop button on the remote control out and press here to reset.

	The profiling screen is for opening data files and starting the profiling process.
	The settings screen is for entering choices and preferences. Also for machine settings and offsets.
	The diagnostics screen shows all tools equipped on the machine and also the machine status.
	The 'Mode selection' button allows the operator to choose which action buttons are activated on the right hand side bar.

The quick action buttons

To the right of the content window are a set of larger control buttons for ease of use with the touchscreen. These correspond to controls in the material handling content window and represent the most commonly used controls. Some of these buttons may change depending on the current position of the machine or the action being carried out (see the tables below for more details). Underneath the content window you will also find a set of 5 large buttons for ease of use. In the bottom left hand corner of the screen you will find the toggle buttons to turn the safety on and off and to change the speed from fast to slow. At the bottom right of the screen you will find the 'Mode selection' button.

	Move the cutting trolley up.
	Move the cutting trolley down.
	Left: move cutting trolley to pipe. If it is on the pipe you will see: Right: float above pipe.
	Rotate the chuck counter clockwise.
	Rotate the chuck clockwise.
	Toggle safety on and off. When safety is on, slow movement is forced.

	Move the cutting trolley in the negative direction (see axis definition).
	Play: proceed with current (or next) action.
	Pause the current action.
	Stop cutting.
	Move the cutting trolley in the positive direction.
	Toggle between slow and fast movement of the machine.

The 'Mode selection' button

The 'Mode selection' button at the bottom right of the screen toggles between 'Material handling' and 'Profiling' modes. The quick action buttons in the side bar on the right of your screen will change depending on the selected mode. If your machine is equipped with automatic functions, the 'Automatic' mode button will also be available here giving access to the 'Home all axes', 'Automatic infeed', 'Automatic outfeed' and '(Semi)Automatic profiling' buttons.

Material handling mode

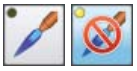
Using this mode during profiling allows the operator to carry out movement functions from within the 'Profiling' screen avoiding the need to switch between screens during the cutting process. Some extra buttons will appear which are only available during profiling, these buttons are described below.

	Reverse. When cutting is paused holding this button in will move back in the cut (left disabled, right: enabled). Releasing the button will stop the movement.
	Skip. If the 'Material length measurement' option is available on the machine, the 'Skip' button will appear with the 'Measurement' action progress box. Press 'play' to measure, press 'Skip' to continue without measuring. When a set is approached in the data file, this button will also appear. Press 'Play' to move to pipe, press 'Skip' to cancel (for example to select a different set or to activate 'Dry run'.
	Displace. If the pipe is rotated or the cutting trolley moved while profiling is paused, this button resumes from the new position (pressing play will resume from where profiling was paused).

Profiling mode

The 'Profiling' option is activated when a data file is loaded. In profiling mode the buttons change to allow adjustment of cutting speed and plasma power and other controls relating to the profiling process. See below for more details.

	During profiling the cutting speed buttons will appear. Left: increase profiling speed, right: decrease profiling speed.
	This button disables the cutting tool allowing its movement to be checked before cutting (left: dry run off, right dry run on, cutting tool disabled).
	If the pipe is rotated while profiling is paused, this button resumes from the new position (pressing play will resume from where profiling was paused).

	When profiling using plasma, these buttons allow the operator to manually increase or decrease the plasma power.
	The 'Dry run' button. When profiling with oxyfuel these buttons enable and disable the 'Dry run' mode (see description on the left for plasma).
	When profiling using oxyfuel this button toggles between preheat enabled and disabled.

Automatic mode

If 'Automatic' mode is available on your machine this button will also appear in the 'Mode selection' window. This will add the four buttons shown below to the side bar. When 'Automatic profiling' is enabled the top four buttons of the side bar will change to those shown in the bottom table on this page. The 'Mode selection' button will be disabled during 'Automatic profiling'.

	Home all axes. The main drive, cutting trolley and cutting head axes move to their 'Home' positions.
	Enable/disable automatic profiling.

	Start/continue automatic infeed.
	Start/continue automatic outfeed.

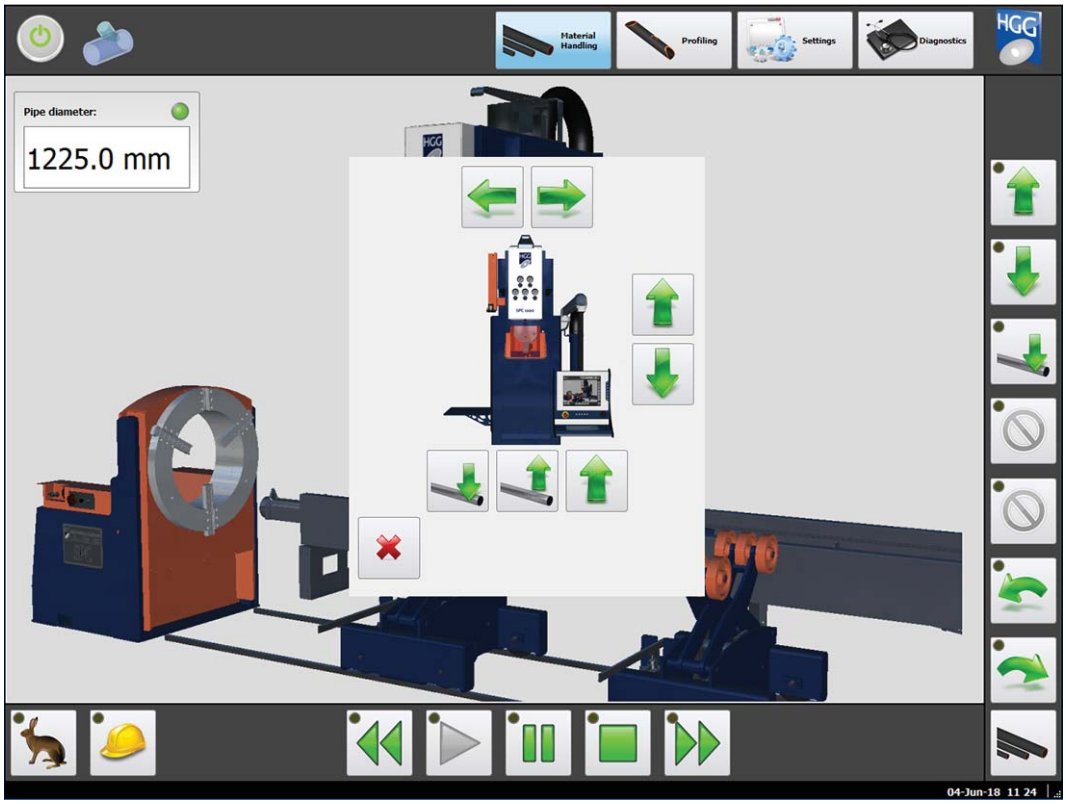
During automatic profiling thes buttons appear in the top four positions:

	Increase cutting speed.
	Decrease cutting speed.

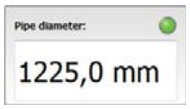
	Increase plasma power.
	Decrease plasma power.

Material Handling screen

The 'Material Handling' screen is used to prepare material and the machine for profiling. When the machine is started up, a view of the machine is shown in the content window. Touching a part of the machine will open the control window for the selected machine part allowing the operator to manually control all parts of the machine except the cutting head (the cutting head can be calibrated, homed, rotated and tilted in the Diagnostics screen). The main drive and the cutting trolley can both be manually controlled from here.



The material handling screen: clicking on a machine part will open the control box.



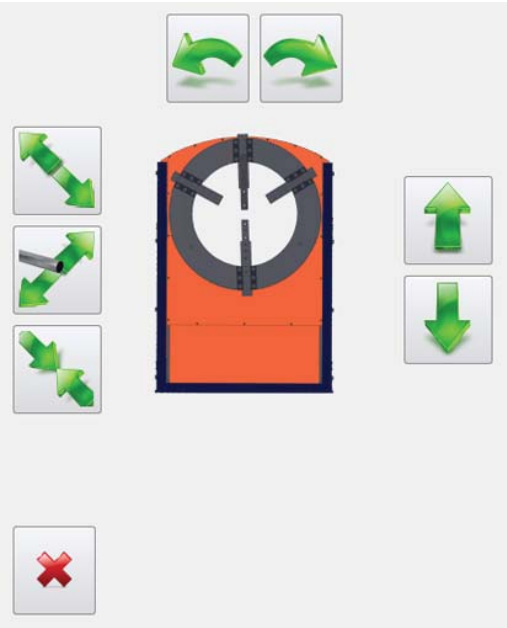
The pipe diameter can be entered in this field, the speeds of some of the machine parts are directly related to the diameter of the pipe. To enter the diameter, touch the field on the touch screen to open the numeric keypad. Enter the correct diameter and press enter. If the entered diameter is larger or smaller than the range of the machine the set diameter will automatically change to the maximum (if larger) or minimum (if smaller). This keypad enables input via the touch screen, it can be disabled in the settings if desired. When a data file is opened in the 'Profiling' screen the pipe diameter of the programmed parts will automatically appear in this field.

The cutting trolley

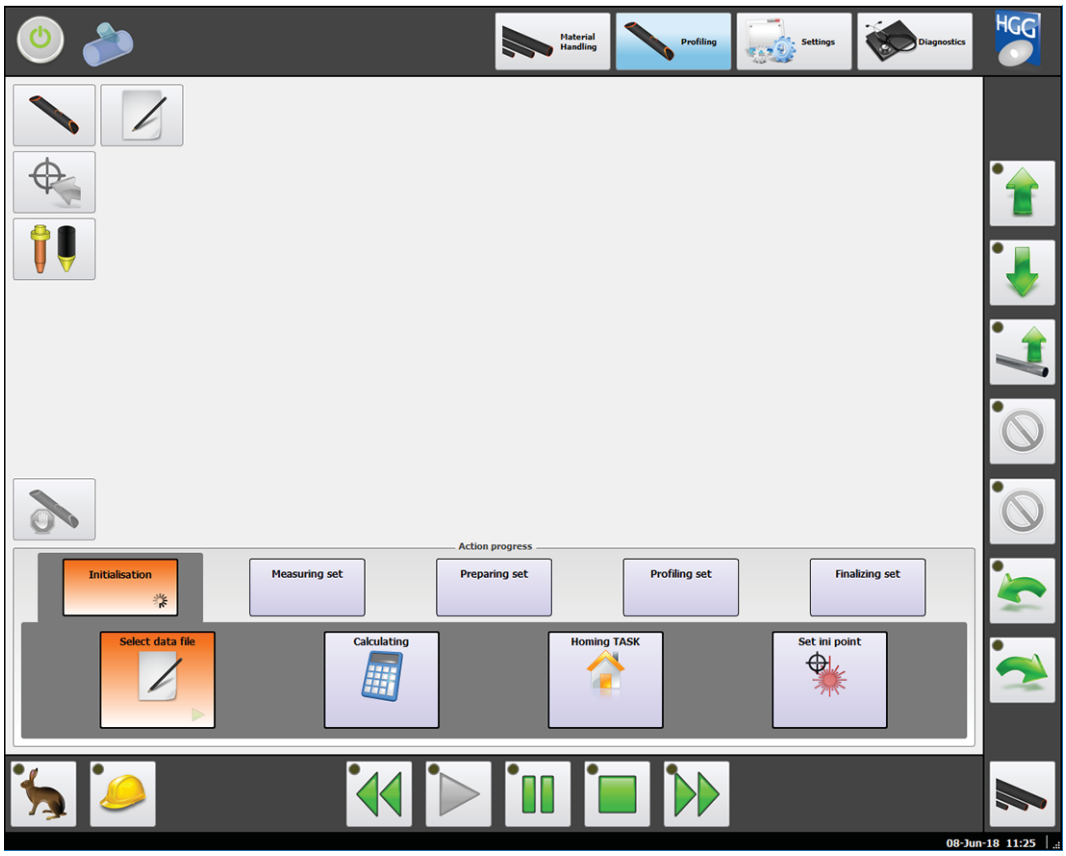
Button	Action	Position
	Move cutting trolley left.	Left
	Move cutting trolley right.	Left
	Move cutting trolley up.	Right
	Move cutting trolley down.	Right
	Move cutting trolley to 'Pipe'.	Bottom
	Move cutting trolley to 'Float'.	Bottom
	Move cutting trolley to 'Top'.	Bottom
	Close window.	Bottom

The main drive

Button	Action	Position
	Rotate the chuck counter clockwise.	Top
	Rotate the chuck clockwise.	Top
	Move The jaws of the chuck outwards.	Left
	Move the jaws of the chuck inwards.	Left
	Toggle between clamping on the inside or the outside of the pipe.	Left
	Raise the chuck.	Right
	Lower the chuck.	Right
	Close window.	Bottom



Profiling screen

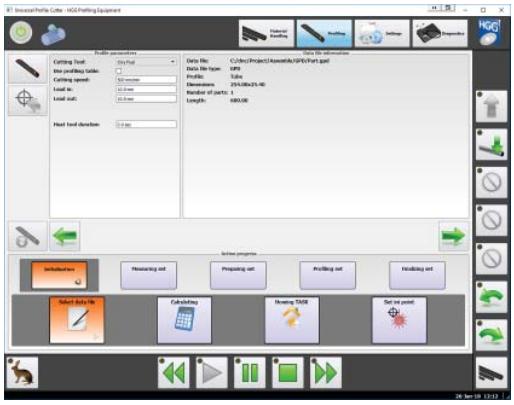


	Select data file. Choose a data file to profile
	Profiling list screen. A list of all the 'sets' in the current data file
	Open advanced profiling screen. This screen has extra control options for the operator

	Profiling information screen. Includes data file information and profile parameters.
	Select 'set'. This button appears when the profiling list is open. Select a 'set' and press this button to profile the chosen set.
	Stop profiling. This ends profiling of the current data file.

The 'Profiling' screen is for loading profiling files and selecting the 'sets' to be profiled. The top half of the content window shows details of the loaded data file and settings for profiling. Once the cutting process and options have been chosen the following screen is accessed using the green arrow at the bottom of the window, this window shows information about the stock item (raw material) that is selected for the profiling job, the profile type and dimensions of the material to be cut, the selected profiling speed (and the actual profiling speed) as well as the name of the currently selected part and set. The target button on the left hand side of the screen can be used to view all the sets in a file, use the hand to select a specific set with which to begin.

Depending on the profiling process selected (plasma or oxyfuel) the appearance of the screen will change. In the example below oxyfuel cutting has been selected, the quick action buttons

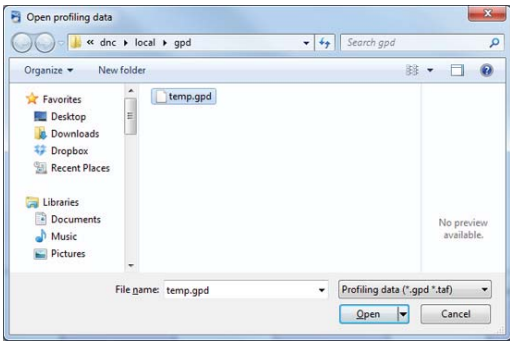


on the right of the screen include the oxyfuel dry run button and the preheat enable/disable toggle button. The boxes in the action progress section at the bottom of the screen also vary according to the cutting process (for example: when using plasma, piercing occurs automatically whereas with oxyfuel the play button must be pressed again when the cutting head is in position to pierce the material). Whenever operator action is needed to continue, the green arrow in the bottom right hand corner of the box will be flashing. The yellow light in the top right hand corner of the 'Play' button will also be flashing, press 'Play' to continue.

The bottom part of the profiling screen shows the action progress. The boxes here will be coloured orange when active (light blue = pending, dark blue = done). The larger boxes at the bottom show a green, blinking arrow to inform the operator of the next step in the process. Press 'Play' to continue or 'Skip' to omit.

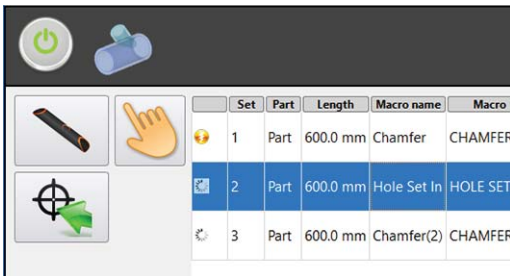
Selecting a data file or set

When the screen is first opened, select a data file for profiling. To select a file, click on the 'Select data file' button at the top left of the content screen and browse to the file you wish to open. Click on 'Open'. Once a file has been selected, check the box to use the profiling table (the profiling tables can be viewed in the settings screen). Values have been entered for different materials and different wall thicknesses. If the box is not checked the operator can enter the profile parameters (cutting speed, lead in and lead out).



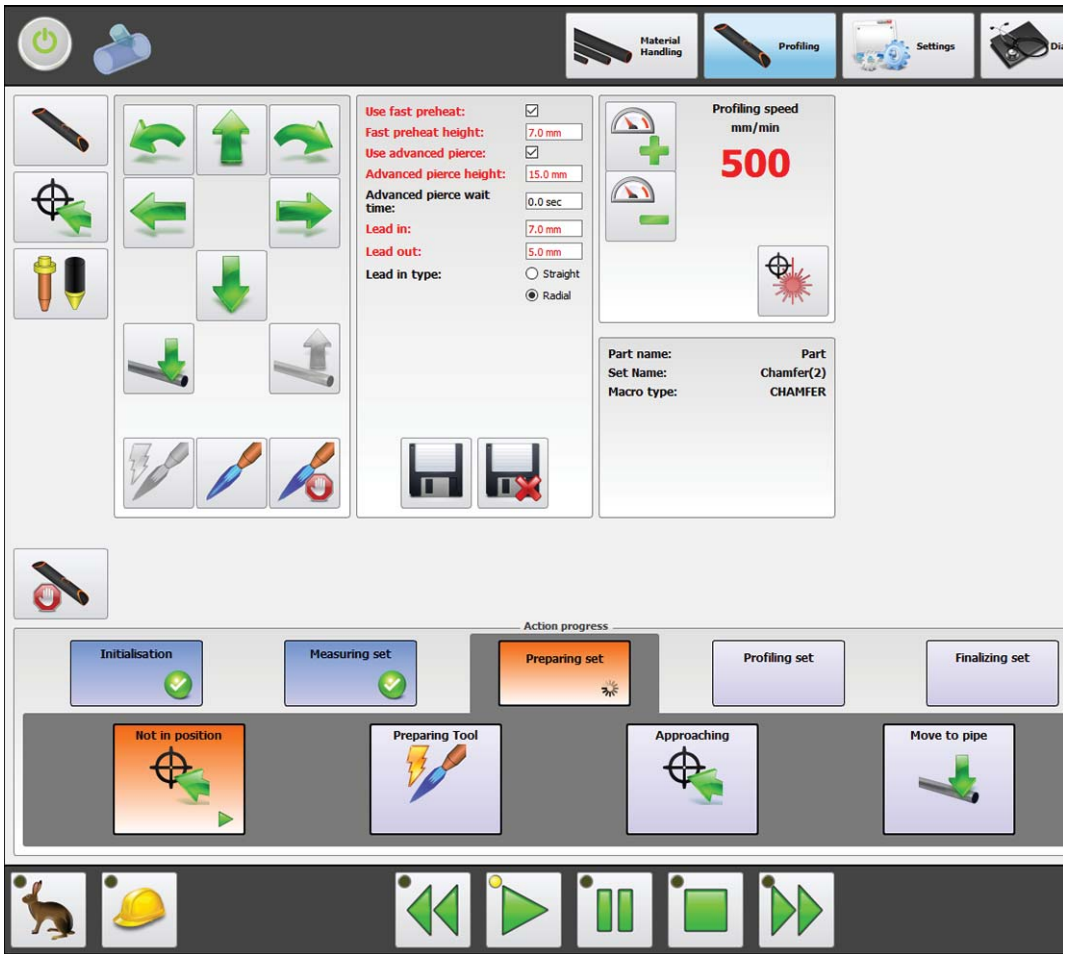
A single data file may contain several parts, each with two or more macros to be profiled. The 'Select set' button shows a list of all the sets in the data

file providing the operator the option to choose which set will be profiled first or to skip one or more sets in the data file. Once a data file has been selected all the information will be displayed in the window above the action progress window.



The profiling process can be stopped by pressing the 'Stop profiling button or the 'Stop' button at the bottom of the screen (quick action buttons).

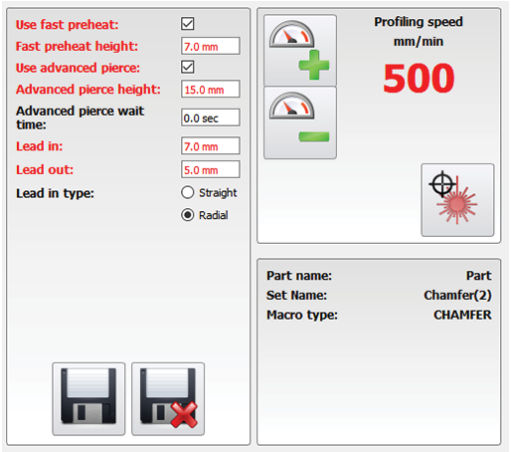
Advanced profiling screen



The advanced profiling screen gives the operator extra control over the profiling process. This is particularly useful for large pipes and especially thick-walled pipes. The first column of this screen gives the operator access to the most commonly used movement buttons and the oxyfuel ignition buttons so that the cutting flame can easily be adjusted and movements can be made without leaving the profiling screen.

The second column allows adjustments to be made to suit the material, thick-walled pipes often need fast preheating and/or advanced piercing. Fast preheat prepares

thicker walls for cutting. Advanced piercing helps to protect the nozzle during piercing. The torch is raised higher than usual to begin and, after a short delay, is lowered again to the optimal cutting height. The lead-in and lead-out can also be adjusted here. Any changes are shown in red until the changes have been saved or discarded using the buttons at the bottom of the column.



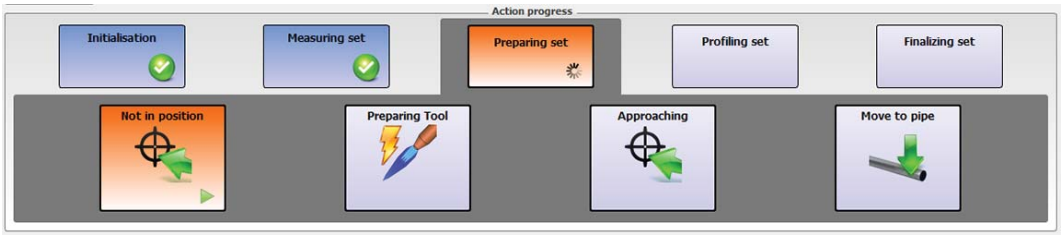
The final column shows the current cutting speed in large, red, bold figures and allows the operator to increase or decrease the speed before, or even during profiling.

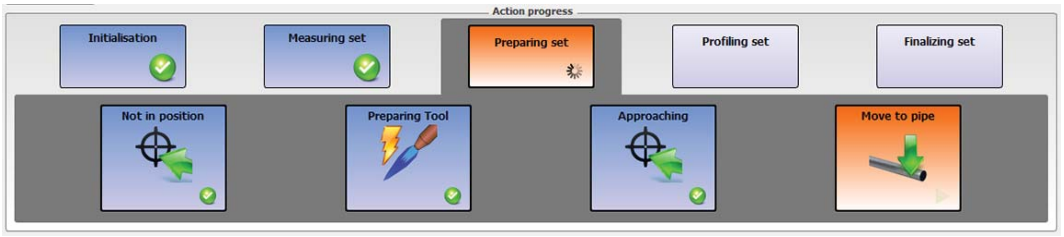
The 'Displace Lead-In Position' button allows the operator to manually choose a new starting point for piercing and the run-in to the cut. Particularly with thick walled pipes and oxyfuel cutting it can be difficult to pierce the material. If piercing is unsuccessful it can be very difficult to start again from the same position because the surface of the pipe will already be cratered. To displace the lead-in position, move the torch to a new position where it has a clear run-in to the starting point. Attention: the starting point will not change! Press the button to set the new point as the start of the lead-in.

Action progress

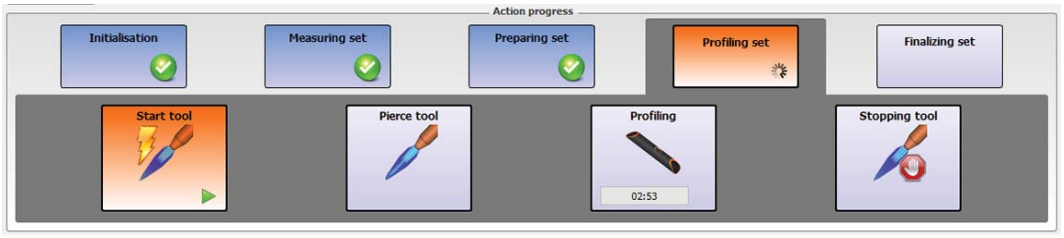
Once an action has been successfully completed, the box will change colour to blue. When a data file has been selected the machine will automatically calculate the cutting parameters and home the cutting head (TASK). The operator will now be prompted to set the initialisation point for the cut. If your machine is equipped with the optional 'Material length measurement' press 'Play' to detect the end of the profile now. Press 'Skip' to proceed without measuring. If you do not have this option the box will be absent. The green 'Play' arrow in the quick action buttons at the bottom of the screen will now be blinking. Click on 'Play' to set the initialisation point for the cut.

The 'Not in position' box will now be flashing, press 'Play'. The cutting tool is prepared for profiling and the cutting trolley moves into position (if the cutting trolley is already in position the action progress will continue automatically). When the torch is in position the last box will be flashing. Press 'Play' again and the torch will move to the profile, now you are ready to begin profiling.

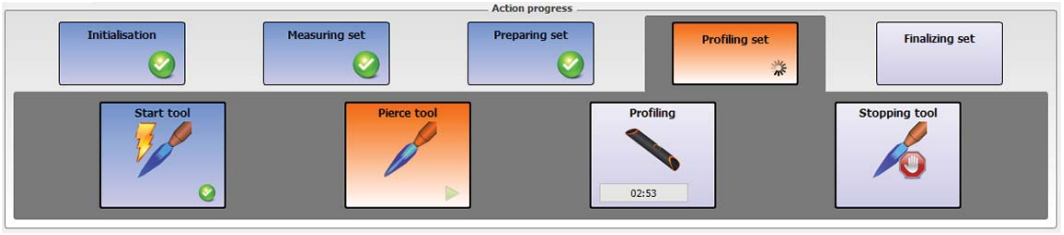


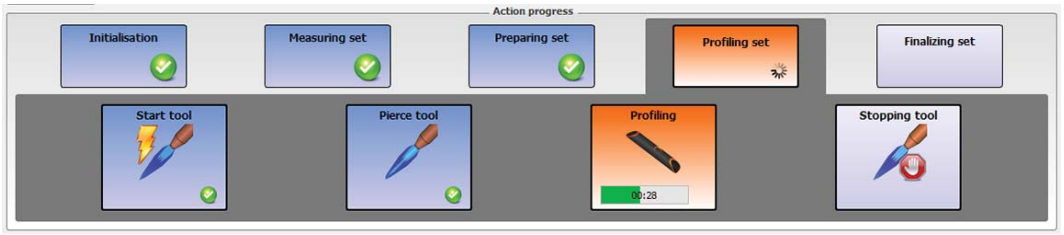


The green arrow in the 'Start tool' box will now be blinking. Click on 'Play' and the machine will start the cutting tool (oxyfuel in the example shown).



In the case of oxyfuel cutting the material must be pierced before profiling begins. The operator must press 'Play' again to start the pierce tool (this occurs automatically with plasma cutting). When piercing is complete profiling begins automatically. The progress bar in the 'Profiling' box shows the progress.

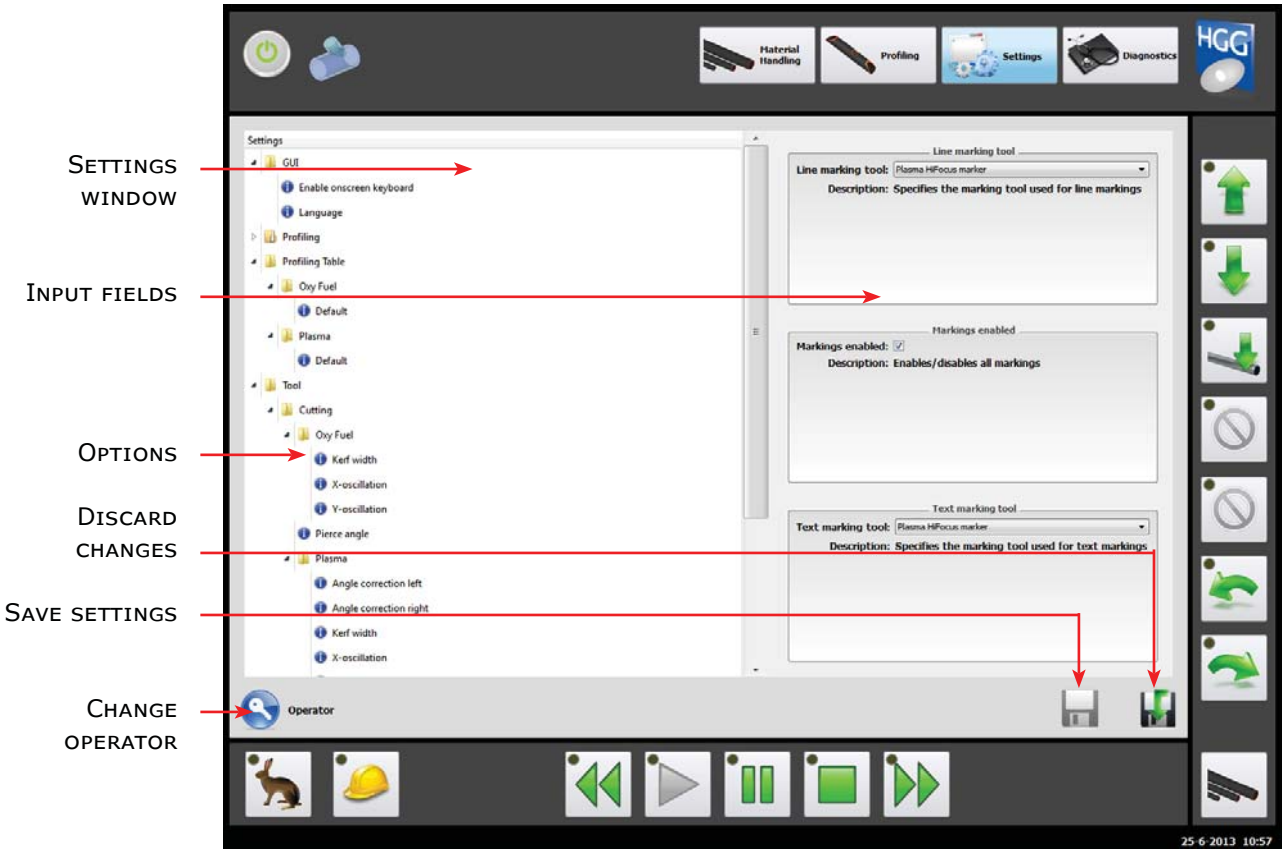




When the machine has finished profiling the selected set, the action progress will prompt the operator to begin the next set. Press 'Play' to continue. The procedure is repeated until all the sets in the data file have been cut. If you wish to proceed to the next data file, pressing the 'Stop' button will end the cutting process. A new data file can now be opened.

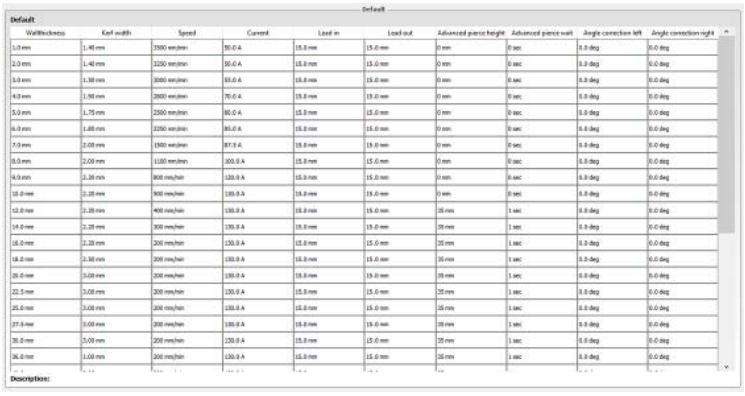
Settings screen

In the 'Settings' screen it is possible to select preferences, enter values and calibration offsets to ensure maximum accuracy and efficient cutting. On the left hand side of the content window a familiar tree directory structure shows all the options available. On the right hand side the value fields are shown for the selected option, all preferences and values can be entered here. Selecting a folder on the left will display all value fields on the right. Individual options can also be selected on the left and only the selected field will then be shown on the right. For more information and details of the settings see the table in this chapter.



Touch control	Description
	This button changes access to the controls, a window will open asking the new operator to enter a password. There are three levels of access to the settings. The options available in level 1: Operator are described in this chapter. Level 2: Maintenance can be accessed with a password supplied by HGG. Level 3: Software is only accessible to HGG's software engineers.
	Changes to the settings can be saved (left), or discarded (right). Once the required settings and options have all been entered don't forget to save them! It is also advisable to make a back-up. This can been done in the 'Diagnostic' screen under the 'Support' tab, see the following chapter.

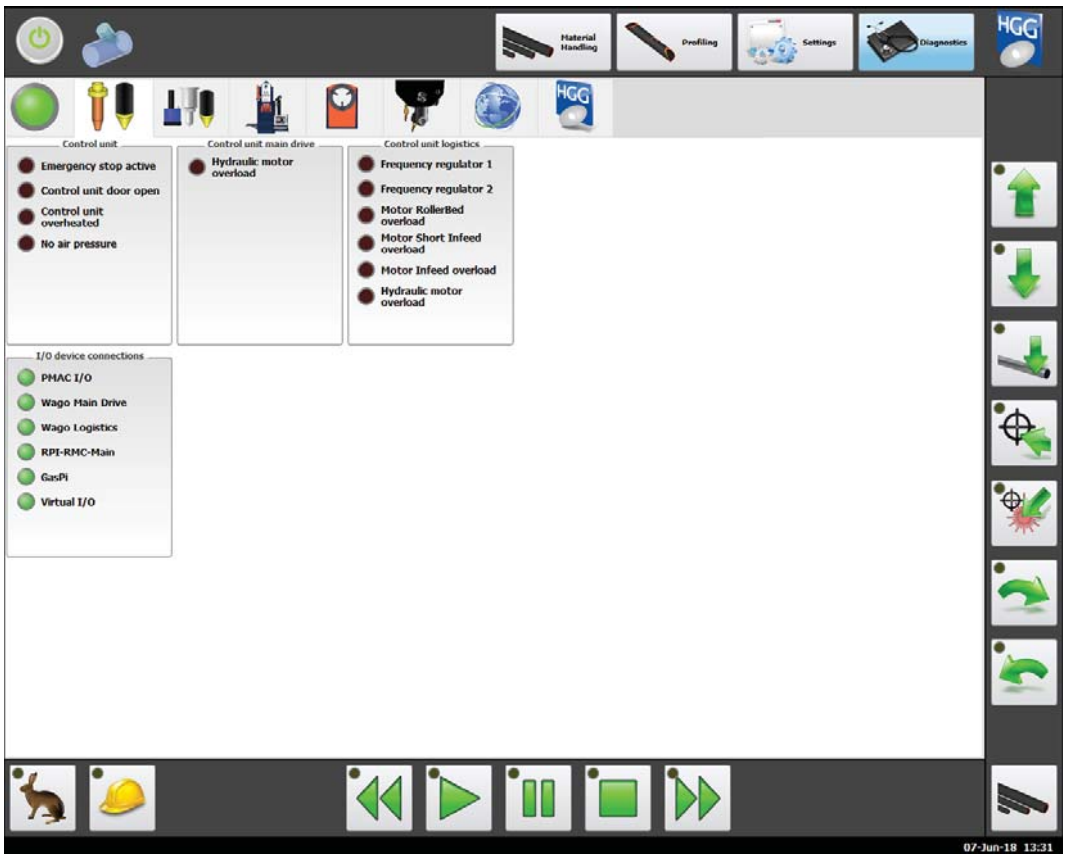
Settings

Setting	Options	Description
GUI Graphic User Interface	Display angle units	Choose display units: degrees or radians.
	Display length units	Choose display units: millimetres or inches.
	Display mass units	Choose display units: kilograms or pounds.
	Display speed units	Choose display units: millimetres or inches per second.
	Languages	Choose the display language for the interface.
	Enable onscreen keyboard	Check this box to enable the onscreen keyboard to allow easy input on the touch screen. If the keyboard is disabled, values must be entered using the keyboard on the remote control.
Profiling Calculation	Combined cutting	Combine multiple end cuts on one side of a part.
	Connect end cuts	Check box to continue cutting from the end of one cut to the beginning of the next.
	Lead in type	Cutting begins a small distance away to prevent damage or inaccuracy to the profile during start up. This is called the lead in. Choose between 'Straight' or 'Radial' (see Appendix F: Terminology).
	Lead in speed reduction	This setting applies only to tubes created in ProCAM's MDI module. This is useful for thin walled tubes and machines with a fast moving cutting head. Reducing the lead in speed will reduce vibration in the cutting trolley. It can also help to solve 'following errors' during the lead in. The default value is '0%', no speed reduction. Entering a value of 50% will half the lead in speed.
	Sort mode	This provides the option to sort the order of the profiling process. When disabled the cuts will be executed in the order they were programmed. 'Sort by distance per part': After each cut the nearest following cut will be done first. 'Sort by distance, markings first': all markings on all parts will be done first, then the parts will be cut as above. 'Sort by distance, markings first per part': for each part the markings will be done first and then the cuts as above.
	Stitch min. diam.	Stitches are portions of a profile left uncut to prevent large pieces falling from or into the pipe. Enter the minimum diameter here above which stitches will be used.
	Stitch no.	Number of stitches to be used.
	Stitch width	The width of each stitch in millimetres.
Profiling Ini Laser	Ini pointer	Choose which initialisation pointer to use cutting torch or initialisation laser.
Profiling table Oxyfuel/Plasma	There are default profiling tables available for oxyfuel and plasma cutting. These tables can be selected and used for cutting when opening a data file. They can also be edited as required. Don't forget to save the settings if changes are	

Setting	Options	Description
Tool Cutting	Pierce angle	The angle of the cutting torch in degrees for piercing material.
	Virtual burner height	Height in millimetres used for calibrating the height of the cutting torch (see Appendix B: Calibration).
Tool Cutting Oxyfuel	Kerf width	Width of the cutting beam, used for width compensation during cutting. The start point will be offset by half the kerf width to ensure accurate cutting.
	X-oscillation	Offset values to compensate for the cutting torch being off-centre on the MDR and CTL axes (see axis definition).
	Y-oscillation	
Tool Cutting Oxyfuel Preheat	Shift angle	The minimum angle the cutting tool must have to shift the preheat tool (see page 30 for more information).
	Tilt angle	The minimum angle of the cutting tool to tilt the preheat tool.
Tool Cutting Plasma	Angle correction left	Angle in degrees entered to compensate for the divergence of the plasma beam when cutting bevels.
	Angle correction right	
	Kerf width	Width of the plasma beam, used for width compensation during cutting. The start point will be offset by half the kerf width to ensure accurate cutting.
	X-oscillation	Offset values to compensate for the cutting torch being off-centre on the MDR and CTL axes (see axis definition).
	Y-oscillation	
Tool Marking	Markings enabled	Check the box to enable all marking. If the box is not checked no marking will be done (see page 50 Marking).
Tool Marking HiFocus plasma REA ink jet or Punch marker	Line marking tool	If you have more than one marking unit equipped, choose which one will be used for line marking.
	Text marking tool	If you have more than one marking unit equipped, choose which one will be used for text marking.
HiFocus only	Marking current	For the HiFocus plasma marker choose the plasma current.
REA inkjet only	Enable printer	Check the box to enable the REA inkjet printer.
	Printer height	The distance between dot 1 and dot 16 on the printer determines the height of the characters to be printed. The maximum height is when the printer head is perpendicular to the pipe and is equal to 67 mm. By rotating the printer head the height of the characters can be reduced. To measure the height, rotate the printer head to approximately the correct height. Place a piece of paper (or pipe) under the printer. In the diagnostics screen, under the marking unit tab, press the 'Test' button in the inkjet marker control box. You can now measure the vertical distance between dot 1 and dot 16. For plasma marking and punch marking the height of the characters can be programmed in ProCAM.
Plasma unit Hypertherm	Plasma table for cutting	Enter the correct cutting record (or marking record) for the cutting process, material and plasma current. A complete list of the cutting and marking records can be found in the HGG Hypertherm Guide.
	Plasma table for marking	

Diagnostics screen

In the 'Diagnostics' screen you will find tabs representing the machine status, tools and HGG Service. The remaining tabs represent additional equipment present on the machine. Selecting one of the tabs at the top of the content screen will display the associated information in the window below.



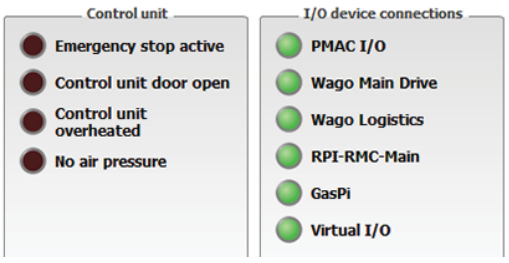
Tab bar

Status | Cutting tools | Marking unit | Cutting trolley | Main drive | Cutting head | Support | HGG

In the tab bar above all options are shown, for example usually the marking option is either inkjet, punch or plasma marking although it is possible to have more than one system on the machine. All machines are equipped for oxyfuel cutting, if plasma is also equipped the plasma tab will be shown here.

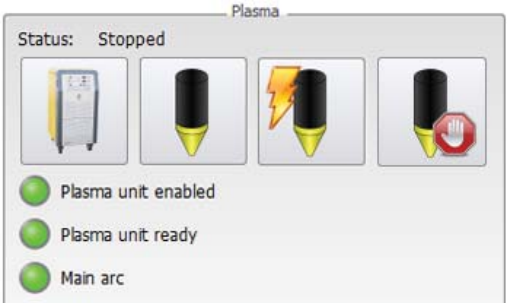
Machine status

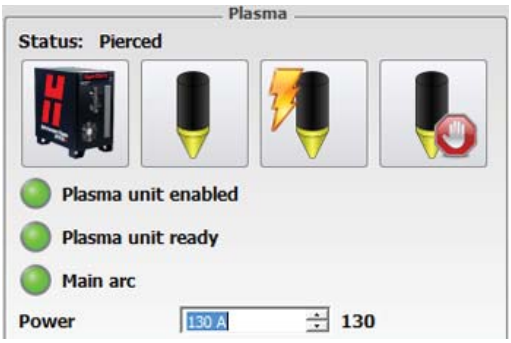
This gives a quick diagnostic check when there is a problem with the machine. The operator can see at a glance if there is a problem. The green lights show the device connections, assisting remote assistance and diagnostics by HGG.



Cutting tools

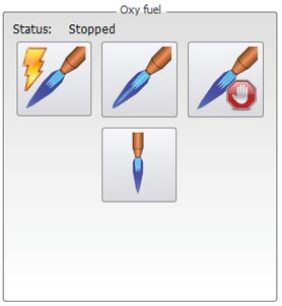
Each tool will have one or more control boxes. The plasma window consists of four buttons and three indicator lights. The first button shows an image of the plasma unit. This button enables (or disables) the plasma unit, when enabled the indicator light will come on. The second button prepares the plasma torch for cutting, the indicator light comes on when the unit is ready. The third button ignites the plasma torch, once ignited, the 'main arc' indicator light comes on. The last button stops the plasma tool, the 'main arc' indicator light goes out (the plasma unit is still enabled and ready). This window can be used to do a control check on the plasma unit.

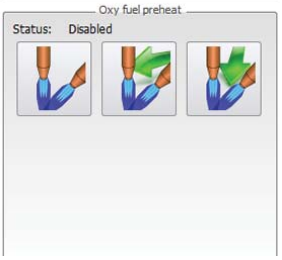




The plasma service counter is an additional optional feature to keep track of the wear and tear of plasma consumables. In the settings, the number of ignitions to replacement (or inspection) is set. This will vary for the different torch parts. The buttons on the right of the window reset the counter after the part has been replaced (or inspected).

For oxyfuel cutting there are two control boxes. One for the cutting torch and one for the preheat. In the oxyfuel control box, the first button ignites the torch. After a few seconds the second button will light up. This is a toggle switch to turn the cutting gas on or off. This can be used to check the cutting flame and make adjustments as necessary. The third button stops the tool. The button underneath is used to enable or disable the 'fast preheat' option.





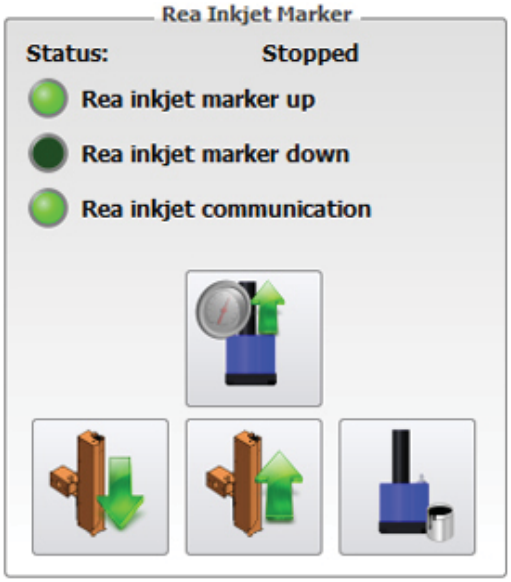
In the preheat control box the first button is a toggle switch to turn the automatic preheat shift/tilt on or off. If the automatic shift is disabled the other two buttons can be used to force the shift and/or tilt respectively. When cutting thick walled pipes or when the cutting torch is at an angle of more than 30° preheat will be necessary.

Shift moves the preheat torch forward to the position of the cut. Tilt angles the preheat torch when the angle is less than -1°. It may sometimes be necessary to adjust the shift or tilt manually to ensure correct preheating or to avoid damage to the cutting torch.

MARKING

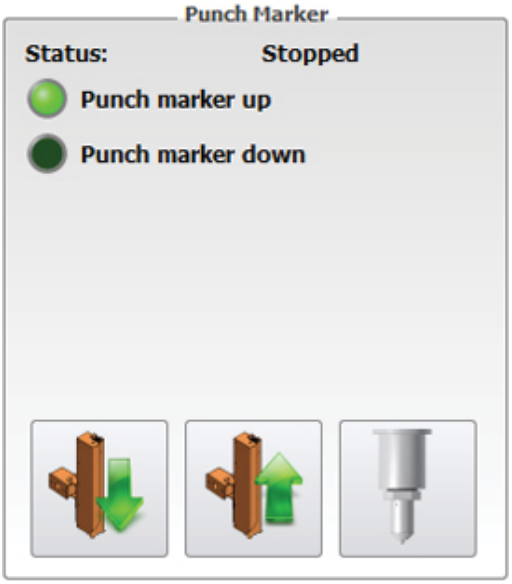
REA ink jet printer

Enabling marking in the settings will activate the marking unit. The control box in the diagnostics screen allows manual movement of the marking unit as a control check. The indicator lights show the current position of the marking unit, if neither light is lit the marking unit is between the top and bottom positions. The bottom light indicates that the printer is connected and communicating with the software. The right hand button is the 'Test' button. This is used to test the printer and clean the nozzle and should be done regularly. For more information regarding the maintenance and operation of the REA ink jet printer, please refer to the 'Marking unit' manual.



Punch marker

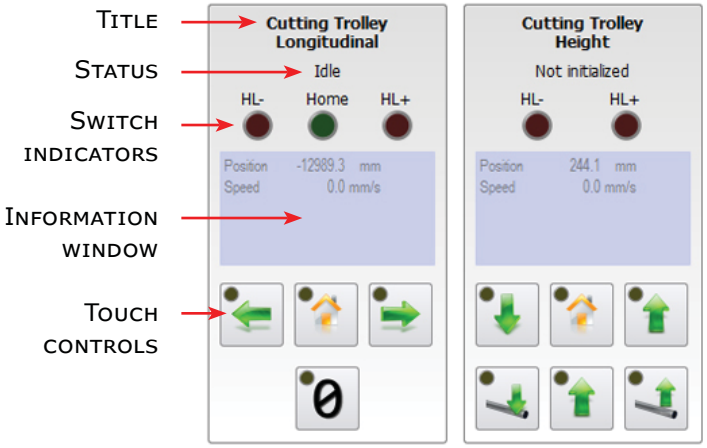
The punch marker and fine marker have a similar dialog in the diagnostics screen. The punch marker uses a pneumatic punch to mark the pipe and the fine marker uses plasma. The 'Test' button is used to check that the marking unit is functioning correctly.



Cutting trolley

Under this tab you will find the control boxes for the cutting trolley's longitudinal movement and height.

The control boxes



Each box contains a title with the part of the machine it relates to and the action that can be carried out. The status changes depending on the action being carried out, you can find a list of actions and their explanations in the tables following. The switch indicators show the hardware limits (end switches) these will light up (red) when an end switch is reached. The home light will be lit up (green) until the home switch is reached. The information window shows data relevant to the action being carried out, usually the position (in millimetres/ inches or degrees/radians) and the speed are shown. In the bottom of the box you will find the touch controls, some of these have a larger corresponding button in the 'quick action' buttons.

The cutting trolley controls

Cutting trolley longitudinal

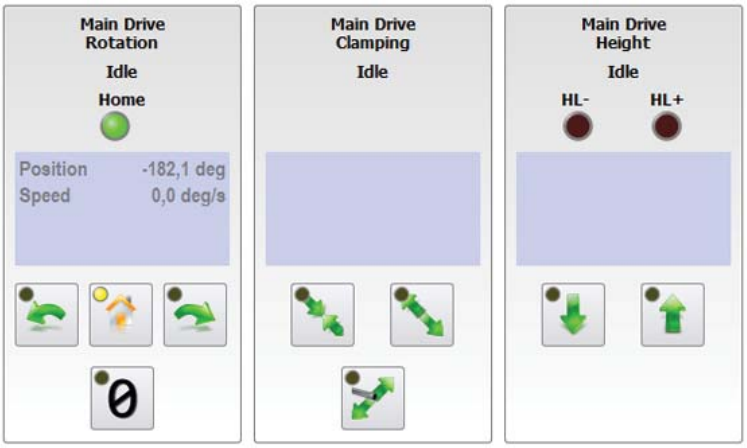
Touch control	Description
	These buttons move the cutting trolley in positive and negative directions along the length of the pipe (the CTL axis – see axis definition). While pressed the light comes on and the status will change from 'idle' to 'jogging' (manual movement).
	When the home button is pressed the cutting trolley will move to the 'home' position. The light will be red while the chuck is jogging and will turn yellow when the home position is reached. The status will change from 'idle' to 'homing'.
	The zero button will change the position value in the information window to zero. This is purely for the operator's convenience, for example to establish a reference point, the actual position does not change.

Cutting trolley height

Touch control	Description
	These buttons move the cutting trolley up and down (CTH axis – see axis definition). The 'home' button moves the cutting trolley to the height 'home' position.
	The first button moves the cutting trolley to the 'pipe' position (on the pipe). The second moves the cutting trolley to the 'top' position. The third to the 'float' position, for definitions of these terms please refer to Appendix F: Terminology.

Main drive

Under this tab you will find the three control boxes for the main drive unit. The controls for rotating the chuck clockwise and counter clockwise can also be found in the 'quick action' buttons on the right of the screen. A description of the touch controls and their actions can be found in the tables following.



Rotation

Touch control	Description
	These buttons rotate the chuck clockwise and counter clockwise (the MDR axis – see axis definition). While pressed the light comes on and the status will change from 'idle' to 'jogging' (manual movement).
	When the home button is pressed the main drive will rotate to the 'home' position. The light will be red while the chuck is rotating and will turn yellow when the home position is reached. The status will change from 'idle' to 'homing'.
	The zero button will change the position value in the information window to zero. This is purely for the operator's convenience, for example to establish a reference point, the actual position does not change.

Clamping

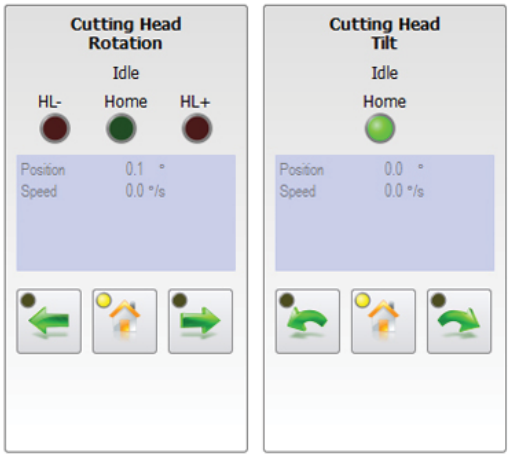
Touch control	Description
	These buttons open and close the jaws of the chuck.
	This button switches between clamping the inside or outside of the pipe (to reach the maximum range of the chuck, larger pipes may be clamped on the inside of the pipe). The clamping force is then limited to the force entered in the settings (see the following chapter).

Height

Touch control	Description
	These buttons raise and lower the chuck (MDH axis – see axis definition). While pressed the light comes on and the status will change from 'idle' to 'jogging'.

Cutting Head

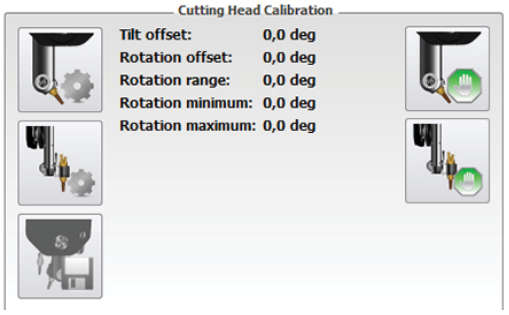
The control boxes for the cutting head control the (manual) rotation and tilt. The green indicator light in the top of the control boxes refers to the home switch and not the 'home' position of the cutting head which is indicated by the light next to the middle button at the bottom of the box. The information window shows the position of the cutting head in degrees and the movement speed. The controls are explained in the table below. The remaining tools under this tab are used for calibration of the cutting head.



Touch control	Description
	TILT - These buttons manually tilt the cutting head. The 'Home' button homes the cutting head and the yellow light will come on.
	ROTATION - These buttons manually rotate the cutting head to the left and right. The 'Home' button homes the cutting head and the yellow light will come on.

Calibrating the cutting head

The cutting head calibration and storage of the offsets can be done here. The procedure is explained in detail in chapter 8: Calibration.



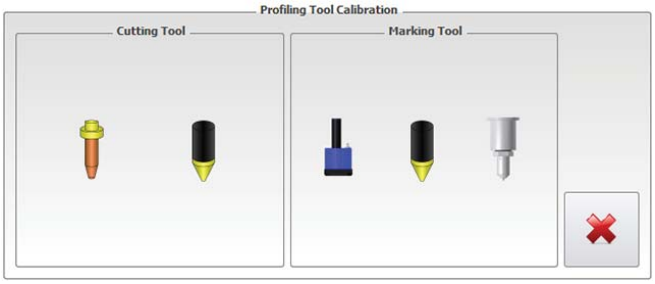
Profiling tool calibration

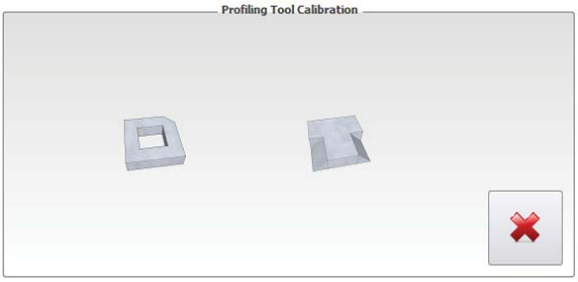
To the right of the calibration dialog you will find the Profiling Tool Calibration dialog for cutting test pieces. This dialog is used to cut (or mark) test pieces to automatically calculate the cutting head oscillation and to store the calculated oscillation offsets for both plasma and oxyfuel cutting. The second test piece is cut to determine the virtual burner height (OXYFUEL ONLY!). Here the measurements can be entered and the virtual burner height is calculated and stored. Detailed instructions on how to use the dialog can be found in chapter 8: Calibration.

Button	Action
	Calibrate tilt.
	Calibrate rotation.
	Store offsets.
	Free tilt axis. This allows manual tilting of the cutting head.
	Free rotation axis. This allows manual rotation of the cutting head.

It is advisable to cut test pieces regularly to ensure the accuracy of the machine. The results of the test pieces are measured using a pair of calipers and entered in the fields provided. The offsets are calculated automatically and can

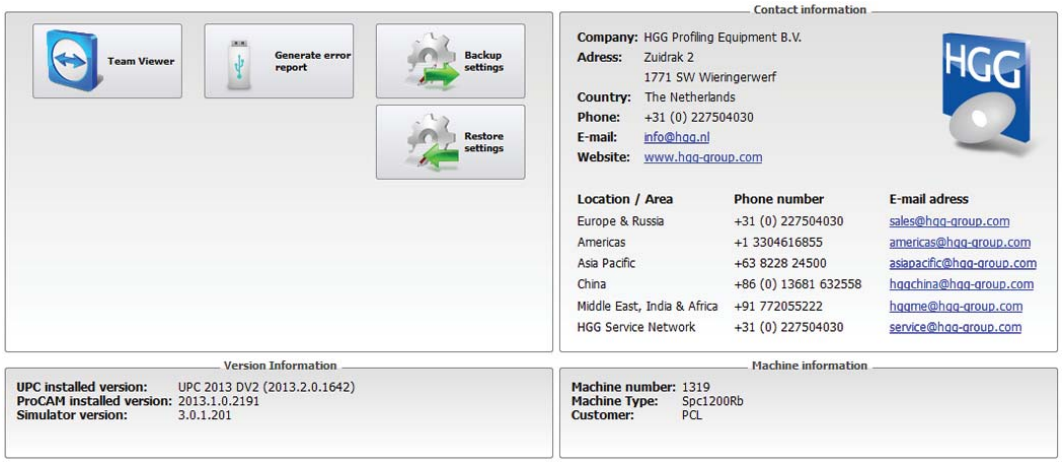
be stored here. Above you can see the sequence, first select the tool you will be using then select the test piece you wish to profile. When using the plasma torch only the first test piece will be visible. The process for angled cutting is described in the calibration appendix. When calibrating the marking tool, you will be asked to choose a cutting process, the centre of the piece is marked and then the piece is cut free from the material for measuring.





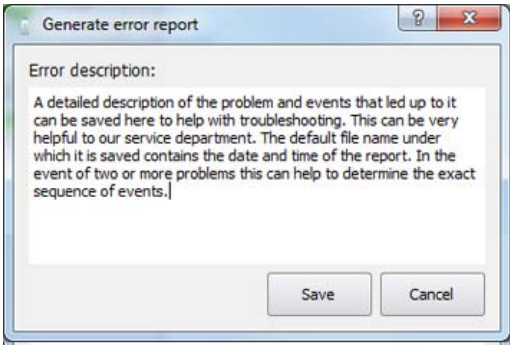
Support

This feature allows direct contact with the HGG Service department for diagnostics and troubleshooting. The 'Service' tab has 4 buttons. The settings buttons provide the opportunity to make a copy of the settings. It is advisable to do this once all the settings have been entered. If any changes are made or if other settings are used a new backup can be made with a different name (or date) avoiding the necessity to enter all the settings each time the cutting process changes. In the unlikely event of a computer crash, the software will have to be re-installed. All settings will then be returned to the defaults, if a back-up has been made the last known settings can be reloaded with one click of the button. You will also find contact information for HGG head office and sales areas and the details and version numbers of the machine and installed software.



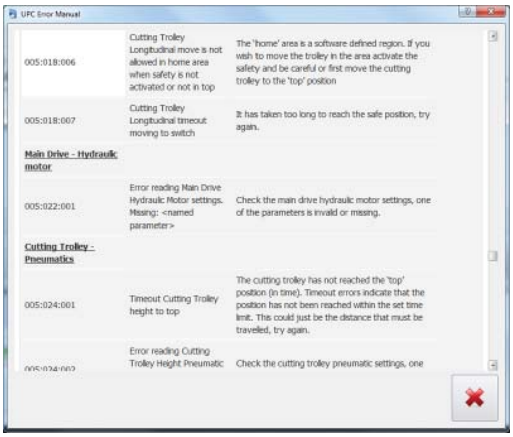
Generate error report

The 'Generate error report' button can be used in the event of a problem with the machine. A separate window will open allowing the operator to enter a description of the problem. It is very important to enter as many details as possible about the problem and the events immediately before the problem occurred. The report can then be sent to the HGG Service department for analysis. This helps to quickly find problems and provide speedy solutions.

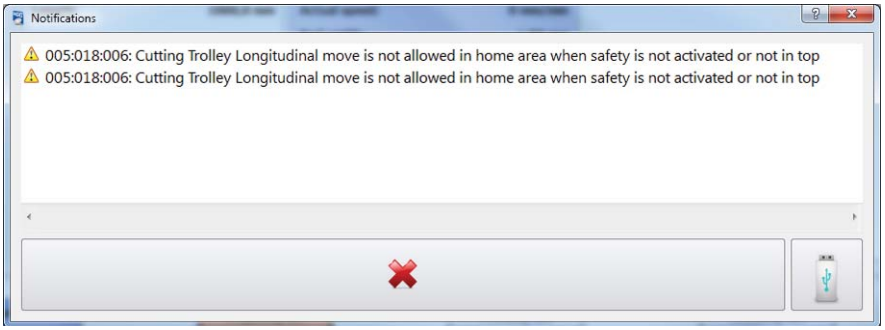


Team viewer

The Team Viewer button allows the HGG Service department access to the computer to help with troubleshooting in the event of a problem with the machine. An internet connection is necessary to use this function. Problems on the machine can be diagnosed 'live' and our staff will be able to help you easier if questions can be asked directly during diagnosis. For optimal use of this service it is important that both parties use the same version, you can find the current HGG version at this location:
https://get.teamviewer.com/hggservice
Below this set of service buttons is a screen showing the versions of the machine software as well as the design software.



Should an error occur during machine operation a notification or warning will appear on the touch screen (see example below) Clicking on the error (or touching it) will open a window with the relevant part of the error manual with an explanation and suggested solution or referral. In the bottom right of this window you can also open the 'Generate error report' window.



HGG

This tab is for HGG personnel and is password protected. During installation, default settings and specific machine settings are entered here. In the event of problems with the machine this button provides troubleshooting and diagnostic features for HGG engineers. In many cases problems can be solved or settings restored via an internet connection to minimise machine down-time.

Operating the machine

Control elements

The following control elements are present on the SPC 500 - 1200 range:

1 The main power switch to turn the machine on is located on the control unit cabinet.

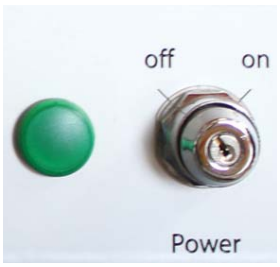
2 The key switch is located on the control panel on the main drive unit.

3 The gas and oxygen valves are controlled by the 5 knobs located on the front right hand side of the cutting trolley.

4 Next to the control panel on the main drive is a pressure gauge and a knob to manually adjust the clamping force of the chuck.

5 The remote control is used to control the SPC 500 - 1200 range. The remote control consists of a: touch screen, manual control buttons, a keyboard with trackball and an 'emergency stop' button. The machine can either be controlled by the touch screen or the control buttons.

6 In case of an emergency situation, the emergency stop button must be pressed. The emergency stop buttons are located on the left side of the remote control and on the control panel on the main drive unit.

<table>
<tr><td> 
</td><td> 
</td><td>  </td></tr>
<tr><td>1 Main power</td><td>2 Key switch</td><td>3 Gas controls</td></tr>
<tr><td>  </td><td>  </td><td> 
</td></tr>
<tr><td>4 Clamping force</td><td>5 Remote control</td><td>6 Emergency stop</td></tr>
</table>

ATTENTION!
Consult the plasma unit instruction manual for more information about the control elements of the plasma unit and its accessories.

Before starting the machine

- Make sure the machine and the area surrounding the machine is clean and free of tools and other obstacles.
- Make sure you wear the correct personal protection equipment (PPE) as described in chapter 2: Safety.
- Make sure all gasses for the cutting process are available and connected to the machine in the right order.

To start the machine

- Open the gas, oxygen and compressed air valves at the source (if not already open).
- Start the dust collector according to the dust collector manual (option).
- Start the plasma unit according to the instruction manual of plasma unit (option).
- On the main drive control panel, turn the main power switch to the ON or 1 position (the first time you start the machine, usually this switch is left on and the machine is turned on and off using the key switch. However if the machine is inactive for any amount of time it may have been switched off at the main power switch).

- On the main drive control panel, turn the power key-switch to the ON or 1 position.
- Use the remote control to log on. Logon as operator (default password: operator).
- The HGG logon is intended for HGG mechanics only.
- It may take a little while before the machine user-interface appears.

To home the machine

Before the operator starts profiling, the machine axes of the components need to be 'homed'. This establishes the reference positions from which all subsequent calculations are made. The cutting trolley height (CTH), the main drive rotation (MDR) and the cutting head tilt and rotation (CHT & CHR) must be homed. It is advisable to home the cutting trolley longitudinal axis as well (CTL).

On the remote control:

- In the material handling screen use the mode selector switch to select 'Automatic mode'.
- At the top of the side bar, press the 'Home all axes' button.
- The cutting head is homed automatically after selecting a data file for profiling.

The machine is now in the 'Home' position (for more information refer to Appendix F: Terminology).

To stop the machine

- Abort all profiling jobs.
- Shut down the plasma unit as directed in the plasma unit manual (option).
- Shut down the dust collector as directed in the dust collector manual (option).
- On the top left of the touch screen, press the on/off button to shut down the machine.
- On the main drive control panel, turn the power key-switch to the 'OFF' or '0' position.
- Close the gas, oxygen and compressed air valves at the source.

Using the main drive

The main drive height, rotation and clamping can be controlled from the remote control material handling screen or the diagnostics screen under the main drive tab. In the diagnostics screen you will also find the home button for the main drive rotation. The clamping can be set to the inside or outside of the pipe and the jaws of the chuck can be opened or closed.

Clamping a pipe in the chuck

To clamp a pipe in the chuck follow the steps below:

- Make sure the cutting trolley height is in the top position ('home').
- Check whether clamping is set to the inside or outside of the pipe and check that the jaws are correctly mounted for the selected clamping (to turn the jaws see the description below).
- Move the main drive to a suitable height to clamp the pipe and position the jaws according to the diameter of the pipe.
- Adjust the height of the pipe trolleys so that the centreline of the pipe is aligned with the centre of the chuck.
- Using an overhead crane or other lifting device, place the pipe on the pipe trolleys (small pipes can be manually loaded onto the pipe trolleys).
- Move the pipe towards the main drive so that the end can be clamped by the jaws of the chuck.
- Use the main drive clamping controls on the material handling screen or diagnostics screen to move the jaws of the chuck in or out (depending on the clamping style) so that they will fit inside or outside the pipe for clamping.
- Carefully adjust the height of the main drive until the jaws are inside (or outside) the pipe and the centre of the chuck is aligned with the centre of the pipe.
- Use the clamping controls to clamp the pipe.

To turn the jaws of the chuck

Loosen the bolts on the jaws. Turn the jaws 180° and retighten the bolts. Don't forget to select the inner/outer clamping direction in the material handling screen or the diagnostics screen.

To adjust the clamping force of the chuck

Before adjusting the clamping force of the chuck you need to know whether clamping is set to the inside or outside of the pipe. When clamping a pipe approximately 80% of the set clamping force is used to clamp the pipe, 100% of the clamping force is used to release the pipe. If the wrong clamping style has been set, the pipe will be clamped with 100% force making it difficult (if not impossible) to release the pipe again.

The hydraulic clamp force of the SPC 500 - 1200 range can be adjusted manually by using the valve knob next to the main drive control panel. The clamping force can be read from the pressure gauge. The set clamping force is an average value, discretion should always be used when clamping pipes, thin walled pipes and certain materials (e.g. copper) will require a lower clamping force to avoid damage or distortion of the pipe.

Using the spark and fume reverser

Fumes (and sparks) from the cutting process are deflected back into the pipe by this component. The fume extractor connected to the back of the main drive sucks the fumes through the pipe and into the dust collector or extraction system creating a continuous flow. When cutting positive bevels on the end of the pipe this component also deflects sparks back into the pipe to minimise the risk of injury to the operator and damage to other components or cables and hoses.

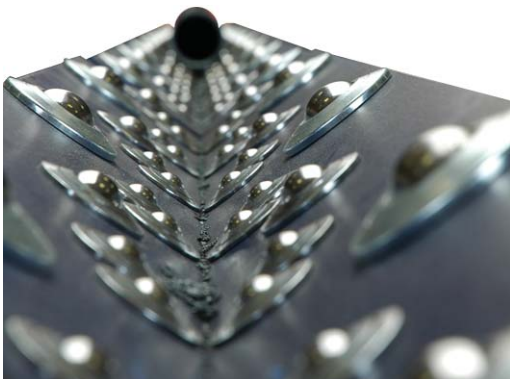
Positioning the spark and fume reverser

Move the reverser well out of the way when loading a pipe onto the machine to ensure it is not damaged. Load the pipe onto the machine and move the cutting trolley into position for the first cut. Determine the initialisation point for the cutting sequence. Now swing the spark and fume reverser into position at the end of the pipe. Position the curved section in the centre of the pipe with the end just inside the pipe opening.

The machine can cut a range of pipe diameters so the reverser must always be positioned manually. Open the compressed air tap to create an air flow into the pipe. When cutting starts, manually adjust the position so that the spark stream is deflected back into the pipe. Use a stiff brush to remove the dust and residue from the spark and fume reverser once the cut is completed.

Roller ball gutter

Instead of (or as well as) pipe trolleys the SPC machines can be equipped with a roller ball gutter. A roller ball gutter has the same function as the pipe trolleys and is especially useful when many relatively short positions have to be cut from a pipe length. The roller ball gutter can be installed on the pipe trolley rails and is suitable for pipes up to a maximum outer diameter of 610 mm.

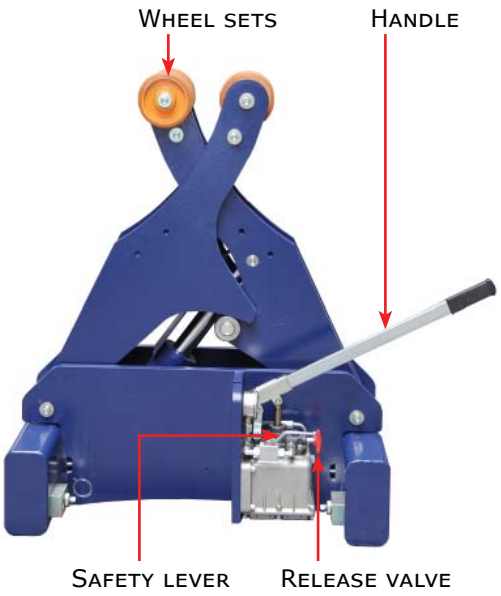


Using the pipe support

Pipe trolley

The pipe trolleys support the pipe during profiling. This system places the centreline of the pipe in line with the machine centreline. The distance between the wheel units has to be set according to the diameter of the pipe. The pipe trolleys can be manually transported over the rail. Depending on the type of machine the maximum load of the pipe trolley varies. The wheel distance can be set using the handle.

Always make sure a pipe trolley is close to area where profiling will be done to ensure that the pipe is adequately supported after profiling.

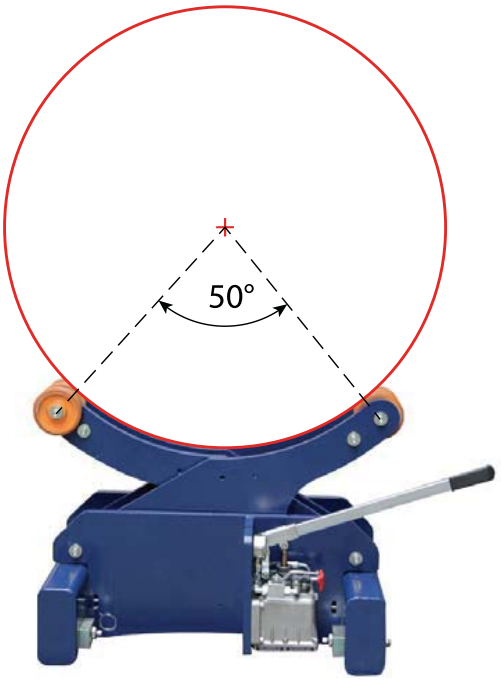


CAUTION!
Flames from the torch can cause damage to the equipment! To prevent damage to the wheel units, make sure to position the pipe trolleys in such a manner that programmed cuts do not run over the wheel units!

Adjusting the wheel distance

The distance between each wheel unit is important in order to handle the complete diameter range. The correct distance between the wheel units is when the angle between the wheels is at least 50°.

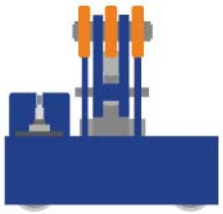
- Make sure the release valve (red knob) is closed by turning it clockwise.
- Pump the handle up and down to raise the wheel units until the wheel distance is correct.
- Pull the safety lever to close the hydraulic circuit.
- To lower the wheel units, push the safety lever, then turn the release valve slowly counter-clockwise until the wheel units come down.



WARNING!
The wheel distance must have an angle of at least 50°! The material could roll of the pipe trolley wheels and damage people or equipment if this warning is not complied with!

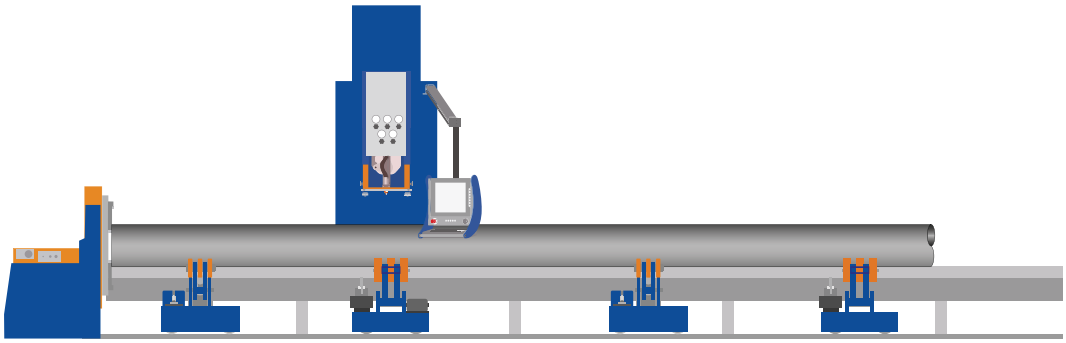
Pipe trolley positioning

The maximum weight capacity of the pipe trolleys is shown in the table below. It is important to ensure that there are enough pipe trolleys in place to support the weight of the raw material to be loaded. The pipe trolleys can also be used to compensate for distortions in the shape of the pipe. The positioning of the pipe trolleys may vary depending on factors such as the length of the raw material, the size of the parts to be cut and the type of cut.

			
Capacity	**5 ton**	**10 ton**	**10 ton**
Type	**Non-driven**	**Non-driven**	**Driven**

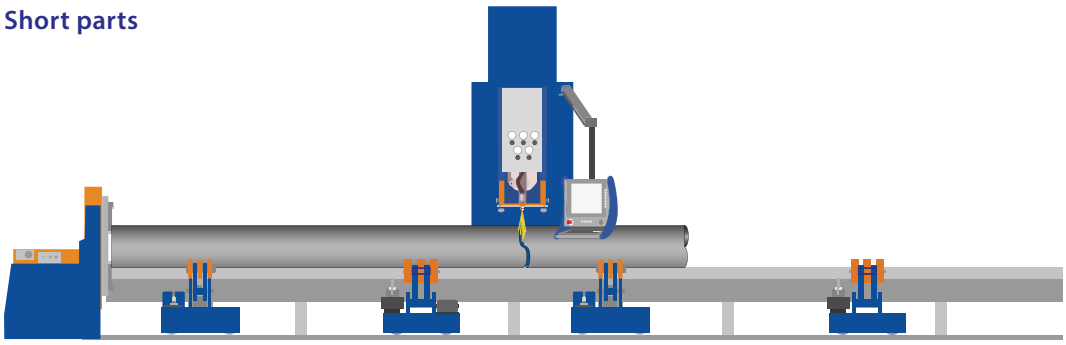
Normal use

In normal use distribute the available pipe trolleys evenly over the length of the pipe. In the example below three different pipe trolleys are present (5 tons, 10 tons & 10 tons driven). The diagram shows the optimal positioning of the trolleys and the most efficient order in which to place them.



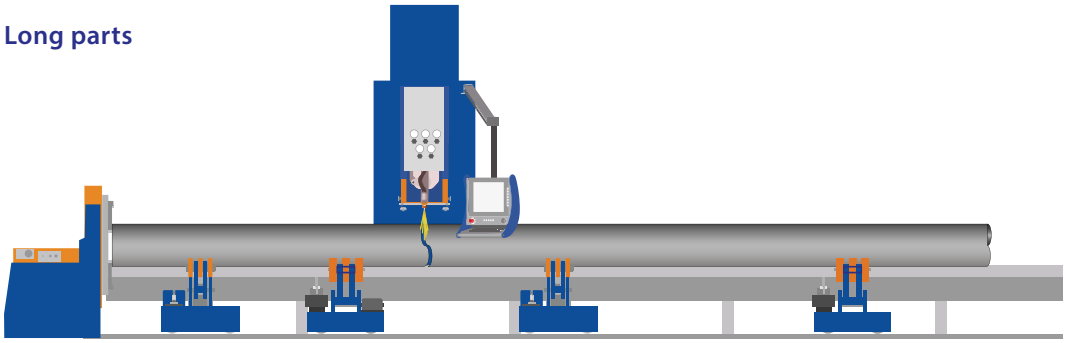
Note: a smaller trolley is placed next to the main drive to allow positioning as close as possible. The motorised trolley is placed in one of the middle positions so that the pipe can be moved along the rails. A larger trolley is placed furthest from the main drive to provide adequate support for longer, heavier pipes.

Short parts



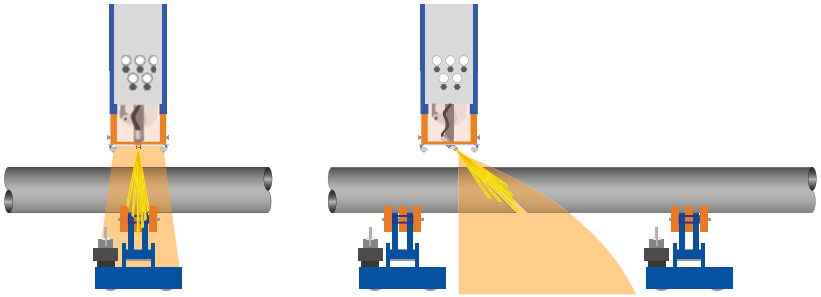
When cutting short parts make sure there are sufficient pipe trolleys present to support the pipe remaining in the chuck. It may not always be possible to support the cut part. If the part is long enough, use two pipe trolleys. If not, place one pipe trolley as close to the centre of the cut part as possible. If the part is so short that there will be a risk of damaging the pipe trolley during cutting, do not use a pipe trolley. The part will then fall to the floor after cutting. To soften the impact and prevent damage you can place some pieces of wood between the pipe trolley rails before cutting.

Long parts



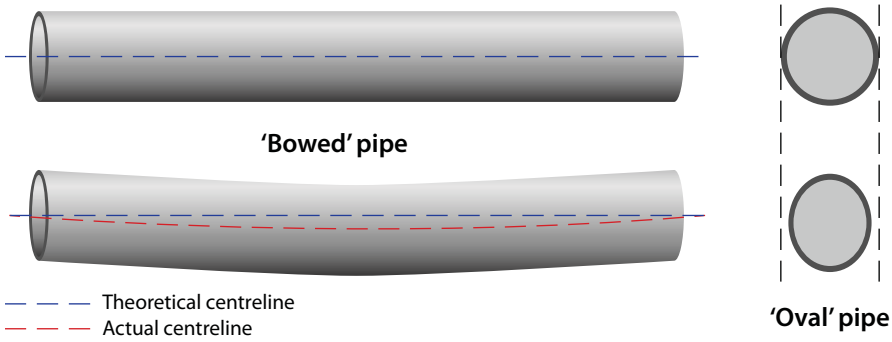
When cutting longer parts always make sure that the cut part has sufficient support (see diagram). Remember that the pipe trolleys have a maximum weight capacity, for longer parts cut from large pipes it may be necessary to use a third pipe trolley. Take care not to place the pipe trolleys too close to the cutting area.

Heat and spatter

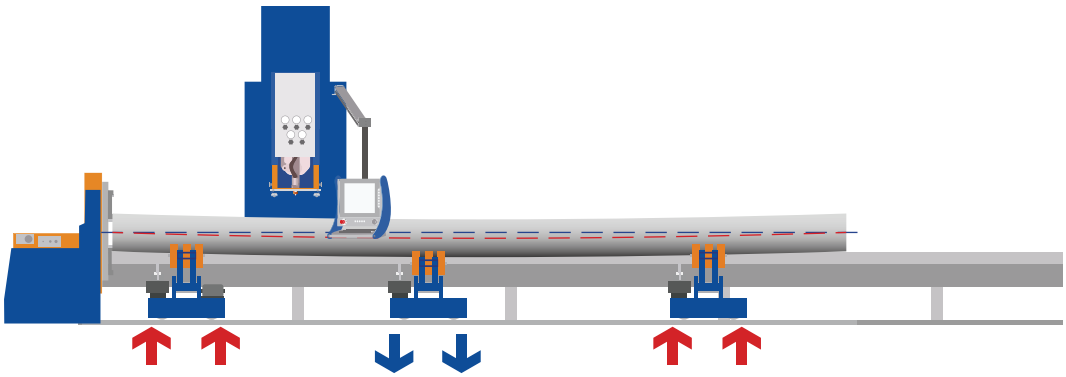


During the cutting process, the area around the cut will become very hot. Avoid placing pipe trolleys in the heat zone, the extreme temperature may melt the coating on the pipe trolley wheels. There will also be a spray of sparks or some spatter of molten metal around the area of the cut. If you see that spatter is falling on the pipe trolley, brush it away as soon as possible or stop cutting, move the pipe trolley, then continue.

Distorted pipes



In practice, no pipe is perfectly round or perfectly straight. If a pipe is 'bowed' (when the middle is higher/lower than the ends), this can cause the end of the pipe move too much during rotation. This can be compensated by placing the pipe trolleys at the ends of the pipe and not in the middle. In the diagram above the middle pipe trolley has been lowered so that the pipe is supported using only the left and right pipe trolleys. Make sure that there are enough pipe trolleys to support the weight of the pipe!



Loading and unloading pipes

Loading pipes on to the machine

To avoid injuries or damage to the equipment, make sure that before loading:

- the main drive is in the home position.
- the cutting trolley is in the home position.
- the jaws of the chuck are correctly positioned to handle the pipe diameter.
- the machine is not being operated.
- no people or objects are located near the machine.
- the pipe trolleys are positioned in such a manner that loaded material cannot collapse by force of gravity.
- the wheel distance of the pipe trolleys are correctly adjusted as described earlier in this chapter.

An overhead crane or other lifting device can be used to slowly load the material on to the pipe trolleys. When the material is loaded, it can be pushed to the jaws of the chuck.

- Adjust the height/wheel distance of the pipe trolleys until the pipe is level.
- On the remote control use the 'Clamp in' or 'Clamp out' button to clamp the pipe, then check that the pipe is correctly clamped. Adjust if necessary.

WARNING!
Serious injuries could occur when loading or unloading pipes from the machine. People can get hit or wedged. Make sure no people or objects are located on or near the machine before and during loading or unloading of pipes from the machine. Always keep safety in mind! Cut parts may be hot due to the cutting process, always wear flame proof gloves when loading and unloading. Cut parts may fall to the floor, always wear protective footwear when unloading the machine.

Unloading pipes from the machine

To avoid injuries or damage to the equipment, make sure that before unloading:

- the cutting trolley is in its home position.
- the machine is not being operated.
- no people or objects are located near the machine.
- all the loose scrap pieces are removed from the material.

Use the remote control to release the pipe by opening (or closing in the case of inside clamping) the jaws of the chuck. The material can now be pushed out of the jaws. Make sure you unload the material slowly and carefully from the pipe trolleys (or roller ball gutter), an overhead crane or other lifting device can be used to unload the material from the pipe support.

Profiling

To begin profiling go to the 'Profiling' screen on the remote control, you will be prompted to select a data file. When a file has been selected the cutting head is homed automatically and the pipe diameter will appear on the top left of the material handling screen. The arrow in the 'Set ini' box will be flashing, prompting the operator to set the initialisation point for the data file. In the settings you can choose either the laser or the torch to set the initialisation point. Move the cutting trolley in longitudinal direction to the starting point either using the diagnostics control box or the quick action buttons under the screen. If necessary rotate the pipe to the desired position using either the main drive rotation control box or the quick action buttons to the right of the screen. Move the laser pointer (or torch) to the location where you wish to begin the first set of the data file. When in position, press 'Play'. The arrow in the 'Start tool' box will now be flashing. Press 'Play' to begin profiling.

Cutting speed

A good quality cut is the result of a correct cutting flame and the right cutting speed. Selection of the cutting speed depends on material qualities like wall thickness and temperature. For a thicker walls and lower material temperatures a lower cutting speed is recommended. Smudged or coated material can also reduce the cutting speed. During the cutting process you can adjust the cutting speed by pressing the plus (+) or minus (-) buttons at the bottom of the right hand quick action buttons.

The table below shows the tip number with the associated cutting speed in mm/min.

Tip nr.*	00	0	1	2	3	4	5	6
Cutting speed	480	440	380	335	275	245	215	150

**Koike 102D7*

NOTE!
The above mentioned cutting speeds are indicative. In practice the speed may slightly differ. Please refer to the manufacturers guide to find the cutting speed associated with the tip number you are using.

The preheat flame

Adjustment of the preheat flame depends on the tip used. Set the pressure of the gas to the pressure associated with the tip number using the knob located at the top left on the front of the cutting trolley. Set the pressure of the oxygen to the pressure associated with the tip number using the knob located at the top right on the front of the cutting trolley.

Enable preheat using the quick action button on the right of the touch screen. The flame should look similar to the one shown in the photo in the margin on the left. If necessary, adjust the oxygen pressure until the flame is bluish white with a bright inner cone surrounded by a flame envelope of a darker hue.

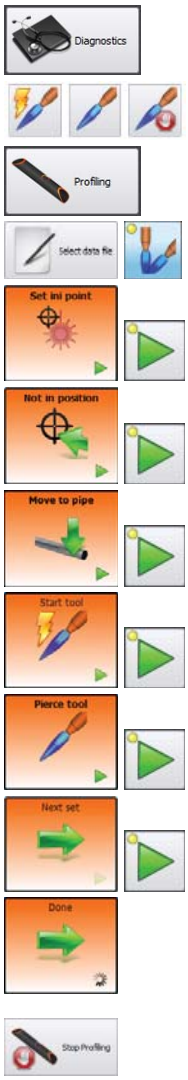
The cutting flame

A perfect cutting flame has very distinct colours. The inner cone is bluish white, the intermediate cone is white and the outer flame envelope is light blue. The feather at the tip of the inner cone is greenish blue. The length of the cutting flame depends on the tip being used. To adjust the cutting flame, fully open the cutting oxygen valve using the middle knob at the bottom on the front of the cutting trolley. In the diagnostics screen, tools tab, activate the oxygen flow by pressing the second button. The flame should now be similar to the one shown on the right. If necessary, re-adjust the oxygen flow until the flame looks like the photo. Press the third (stop) button in the diagnostics screen to extinguish the flame.

GAS CONTROLS

1 Preheat Oxygen
2 Preheat Gas
3 Burner Oxygen
4 Cutting Oxygen
5 Burner Gas

To start profiling



Oxyfuel

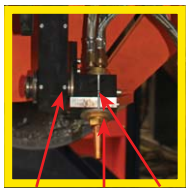
1 Make sure the correct tip is installed.
2 In the diagnostics screen, tool tab, press the first button in the Oxyfuel control box to ignite the torch.
3 Use the pressure controls on the front of the cutting trolley to adjust the heating flame.
4 After a few seconds the second button will light up, press this to enable the cutting gas. Use the pressure controls to adjust the cutting flame.
5 When you are happy with the flame, press the button again to disable the cutting oxygen.
6 On the remote control in the profiling screen, select a data file.
7 Choose oxyfuel cutting tool. Use the profiling table for default cutting speed for the wall thickness of the pipe. If you wish to change the cutting speed, disable the profiling table and enter the required cutting speed, lead in and lead out. The options for 'Extra preheat' and 'Mark all profiles' can also be enabled here.
8 Select 'Profiling' mode with the mode selection button. Use the right hand action button to toggle the preheat tool 'on' if required.
9 Set the initialisation point for the file (the point where profiling will begin) and press 'Play'.
10 Measuring is only applicable to roller bed machines and will be automatically skipped. Press 'Play' again to move the cutting trolley into position (if not already in position).
11 The tool will be prepared and the cutting trolley will approach the position. Press 'Play' to move the torch to the pipe.
12 In the action progress section of the profiling screen the arrow in the 'Start tool' prompt will be flashing. Press 'Play' to start.
13 After a few seconds the 'Pierce tool' prompt will be flashing, press 'Play' again to begin profiling.
14 When the set has been profiled, the arrow in the 'Go to next set' prompt will be flashing. Press 'Play' to begin profiling the next set.
15 When the cutting trolley is in position, repeat steps 11 to 13.
16 When all the sets have been profiled, you will see the profiling is 'Done' box. Press the 'Stop profiling' button. Select a new data file if required.

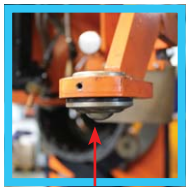
Plasma

1 Make sure the correct nozzle is installed.
2 Make sure the correct current and cutting speed is set for the plasma unit (refer to the plasma manuals) or use the profiling table.
3 On the remote control in the profiling screen, select a data file.
4 Choose plasma cutting tool. Use the profiling table for default cutting speed and plasma current. If you wish to change the cutting speed and current, disable the profiling table and enter the required cutting speed, lead in, lead out and plasma current (this depends on the material to be cut, refer to the plasma manuals for the correct speed and current for the material you are cutting). The options for 'Advanced piercing' and 'Mark all profiles' can also be found here. When you are finished setting the profiling parameters, click on 'OK'.
5 Set the initialisation point for the file (the point where profiling will begin) and press 'Play'.
6 Measuring is only applicable to roller bed machines and will be automatically skipped. Press 'Play' again to move the cutting trolley into position (if not already in position).
7 The tool will be prepared, the cutting trolley will approach the profiling position. The arrow in the 'Move to pipe' box will be flashing. Press 'Play' to move the torch to the pipe.
8 In the next action progress set you will see the green arrow in the 'Start tool' is flashing. The yellow light in the 'Play' button is also flashing. Press 'Play' to begin profiling. The progress is shown in the profiling box.
9 When the set has been profiled, the 'Next set' box will appear. Press 'Play' to move to the next set.
10 When the cutting head is in position, repeat steps 6 and 7.
11 When all the sets in the data file have been profiled the action progress will show that the profiling is 'Done'. Press the 'Stop profiling' button and select the next data file if required.

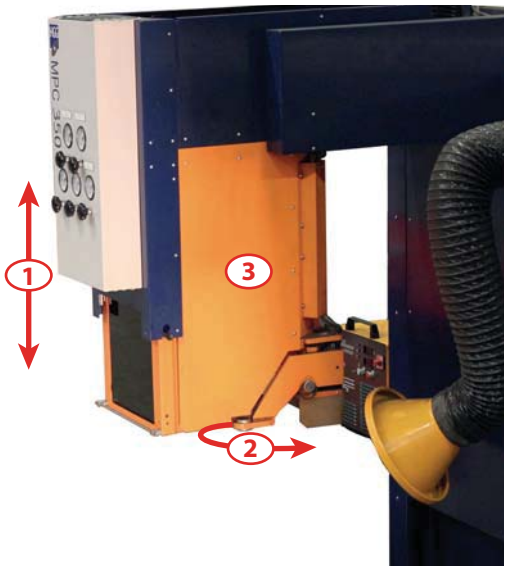
Switching from oxyfuel to plasma

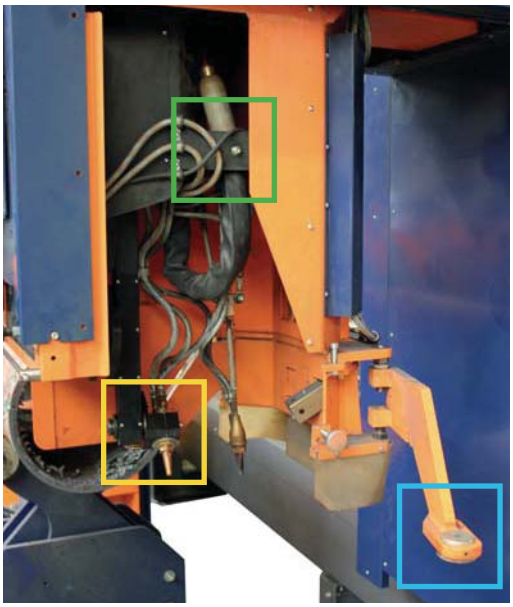
The following procedure explains how to remove the oxyfuel torch and mount the plasma torch.



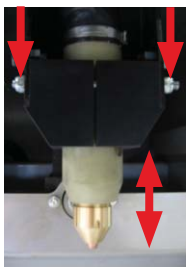


1 Use the remote control to position the cutting head at a convenient height.
2 Swing the arm holding the rollerball unit away from the cutting head.
3 Remove the cover from the cutting head to gain access to the torches.
4 Loosen the bolts on the cap holding the torch and remove the oxy-fuel torch.
5 The plasma torch is secured to the cutting head by a bracket on the top of the cutting head. Release the plasma torch from the bracket and carefully allow it to hang vertically.
6 Place the oxyfuel torch in the bracket and close the bracket.
7 Place the plasma torch in the holder so that the nozzle is just showing and replace the cap securely but not too tightly.
8 With a tube clamped in the machine, lower the cutting head to the pipe by pressing the 'pipe' button on the remote control.
9 The rollerball will rest on the pipe. Place a 6mm Allen key on the pipe under the torch.
10 Loosen the cap and lower the torch until the nozzle rests on the Allen key.
11 Carefully tighten the cap making sure that the gap remains the same on both sides.



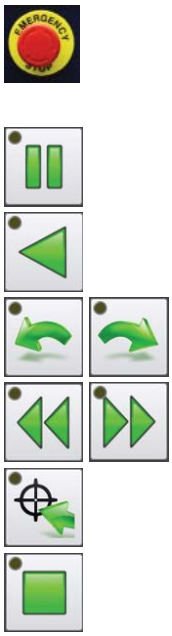


Adjusting the height of the plasma torch



- Use a spanner to loosen the nuts of the torch holder as indicated on the left.
- Adjust the height of the plasma torch as described above.
- When the height of the plasma torch is correct, tighten the nuts on the torch holder. Make sure the gap is the same on both sides.

To stop profiling



It may sometimes be necessary to stop profiling. For example if a portion of the data file has not been (correctly) profiled, the cutting flame is lost, the pipe is damaged or other problems. In the case of a serious problem the emergency stop should be used. For more information regarding the emergency stop buttons, see below.

Pause

Pressing the quick action 'Pause' button at the bottom of the screen will interrupt the profiling, the cutting head remains in place and other options become available. In the right hand quick action buttons the 'Reverse' button becomes active, see below for a description of reversing the profiling direction. The bottom two quick action buttons on the right allow rotation of the main drive and it is also possible to move the cutting trolley along the pipe with the 'Fast forward' and 'Rewind' quick action buttons at the bottom of the screen.

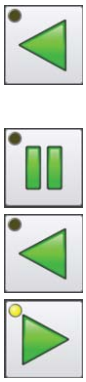
Displace profile

Using any of these buttons will move the cutting head to a new position. This will automatically activate the 'Displace profile' button in the right quick action buttons, see below for a description of cutting from a new position.

Stop

The quick action 'Stop' button at the bottom of the screen acts in the same way as the 'Pause' button but if a logistic system is being used for infeed and outfeed this will also be stopped, the pause button has no effect on the logistic system.

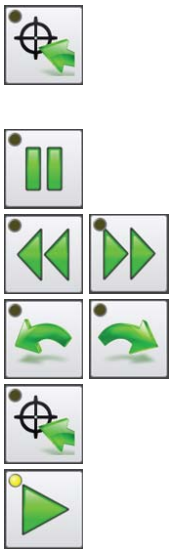
The 'Reverse' button - moving back in the cut



Pressing the 'Pause' button during profiling will stop the machine, the cutting head will remain in position. The 'Reverse' action button will now be available in the right hand quick action buttons. Pressing the 'Reverse' button will move the cutting head back along the profile, release the button to stop moving. The progress can be seen in the profiling box. This can be very useful if the machine missed a cut because of wrong settings and a particular part needs to be done over again. Pressing 'Play' again will resume cutting from the new position.

1. On the remote control, press the 'Pause' button to interrupt the cutting process.
2. Keep the 'Reverse' button pressed to move back in the cut, release the button when the desired position is reached.
3. Press the 'Play' button to resume profiling from the new position.

The 'Displace profile' button – continuing from a new position



Pressing the 'Rewind' or 'Fast forward' buttons or rotating the main drive when the machine is paused will move the cutting trolley along the pipe (CTL axis) or rotate the pipe (MDR axis). This automatically activates the 'Displace profile' button in the right hand quick action buttons.

The action progress section at the bottom of the profiling screen will show the 'Not in position' prompt. Pressing the 'Displace profile' button will move the cutting head to the new position and the action progress will show the 'Start tool' prompt. Press 'Play' to continue from the new position. Instead of pressing the 'Displace profile' button, press the 'Play' button again to return to the position where the machine was paused.

1 On the remote control, press the 'Pause' button to interrupt the cutting process.
2 Move the cutting head or rotate the pipe to the new position with the quick action buttons.
3 Press the 'Displace profile' button to continue from the new position.
4 Press the 'Play' button to resume profiling.

WARNING!
Changing the cutting position will affect the whole job! All remaining profiles are calculated from the new position!

To cut near the main drive

When the cutting trolley comes close to the main drive a warning will appear on the screen. This safety feature is to prevent damage from a possible collision with the main drive. When the safety area is reached the cutting trolley will stop. It is possible to continue by de-activating the safety using the toggle button at the bottom right of the screen. When the safety is de-activated the 'Fast/slow' toggle button is automatically set to 'Slow' and the button is disabled (it is not possible to return to 'Fast' while not in safety mode). It is now possible to continue, slowly. When the safety mode is re-activated the speed remains set to 'Slow' but the 'Fast/slow' button will once again become active and the speed can be changed back to 'Fast' when and if required. When the machine is set to slow, the cutting trolley moves at one fifth of the speed.

CAUTION!
When the safety is disabled and the machine moves at slow speeds, it is still possible to run the cutting head into the main drive. This can and probably will cause damage to the cutting head! Operators must always keep safety in mind!

To cut behind the main drive (option)

To gain cutting length and to reduce scrap, it is possible for some machines to cut behind the main drive. Material can be positioned through the centre of the main drive. The conditions are that the foundation frame and rear beam must be extended at the backside of the main drive. To transport the cutting trolley over the main drive, the main drive must be in home position and the cutting trolley must be in the most upper position ('Top'). In the case of machines with fume extraction, the extractor will have to be moved from the back of the main drive. There are two handles to facilitate the removal, lift the connector counter clockwise, then lift the funnel clockwise. This means that when cutting behind the main drive the fume extraction is no longer functional.

Using the preheat (option)

To increase cutting speed or to cut at steeper angles, a preheat torch can be used to help preheating the material. Activate the preheat option using the quick action button on the right of the profiling screen.

Emergency stop

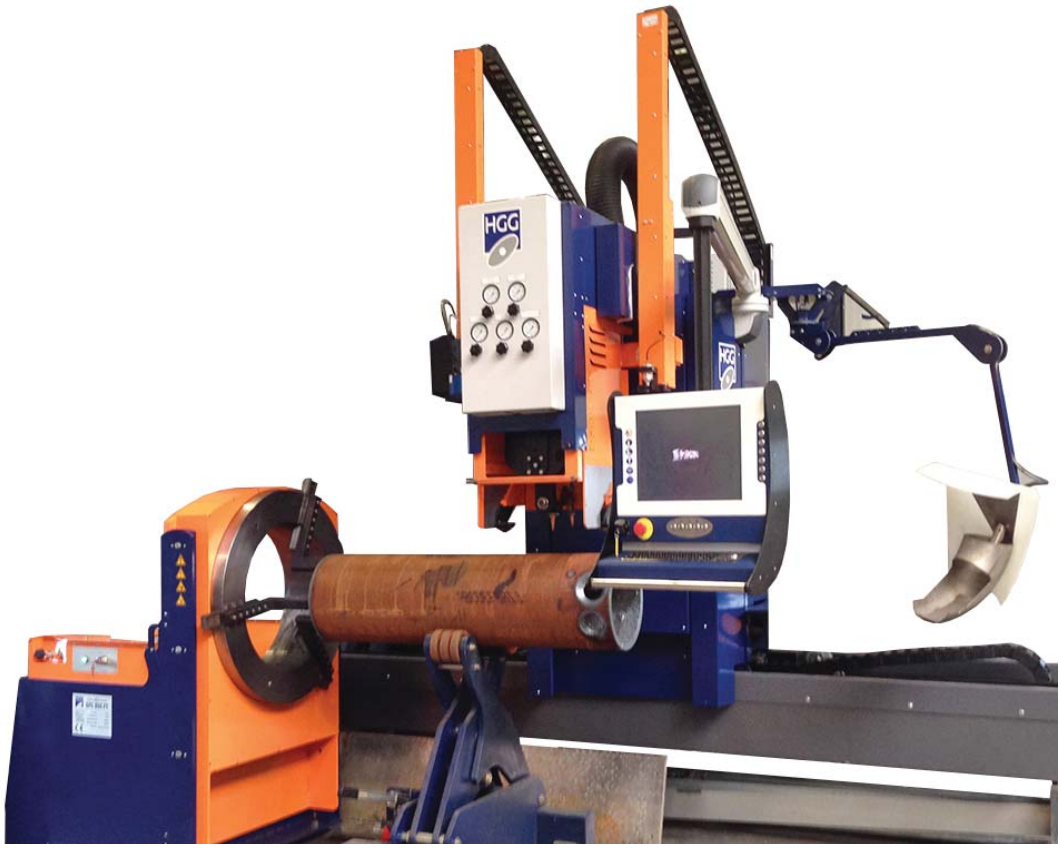
In case of an emergency situation the emergency switch must be operated. An emergency stop will cause all machine movements to stop immediately. A notification window appears on the screen with the text: 'Emergency stop active'. At the top left of the screen you will see the emergency stop button appear. Press this button (or the 'Reset' button on the main drive control panel) to continue. Follow the internal procedures of your company or organization for an emergency situation.

ATTENTION!
When the machine is in the emergency mode the machine cannot be operated until the machine is reset. The emergency stops are located on the main drive control panel and the remote control.

To reset from emergency mode

Pull the emergency stop out to reset the emergency-stop button. On the remote control, press the emergency stop button in the menu bar at the top of the screen (or use the reset button on the main drive control panel) to continue.

Marking options



An SPC equipped with an ink jet printer (left) and a punch marker (right)

Marking information on the parts cut on the machine adds an extra dimension to the production process. Marking can take many forms and can be applied to the pipe in a variety of ways. The machine can mark the pipe with relevant information such as the part name/number, assembly group, quality information, track and trace codes etc. Marking is also often used as a reference to fit parts together during the assembly stage. Reference lines on both main pipe and branch pipe are marked while the pipe is being cut on the machine and later aligned to ensure easy and accurate fitting. Footprints are shapes marked on the pipe showing the exact contour of the branch pipe at the connection point, an invaluable aid for complex connections.

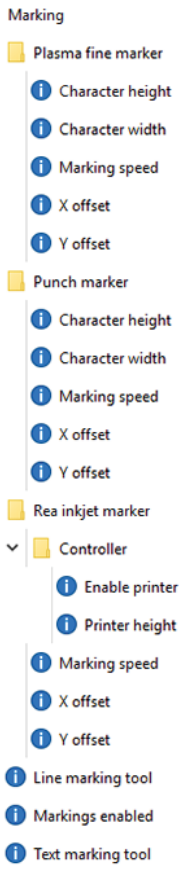
The SPC 1200 can be equipped with an ink jet printer, a plasma fine marker or a punch marking unit. The marking unit is mounted on the side of the cutting trolley and can be used to mark lines, text or footprints on the pipe. Most machines that are equipped with a plasma unit can mark using the same unit, a dedicated plasma marker is not necessary but may still be equipped for convenience.

Ink: reference lines and footprints

Ink: alphanumeric

Punch: alphanumeric

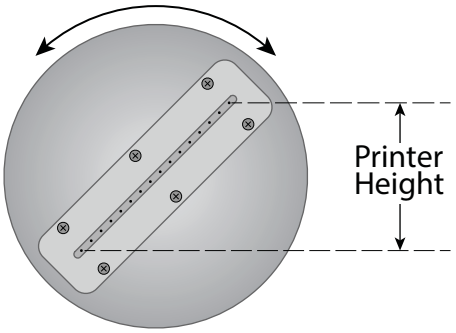
Using the marking option



To use the marking option make sure that marking is enabled in the settings screen (Tool>Marking). All markings in a data file will be marked on the pipe. If marking is disabled all markings will be skipped. In the settings you will only find the type of marking unit that has been installed on the machine, a punch marker, plasma marker or an ink jet printer. It is possible to have more than one unit installed on the machine, in this case you can choose which unit to use for text and which to use for line marking. If you only have one marking unit it will be the only available option in both fields.

Ink jet printer

The REA 16-dots ink jet printer is ideal for non-permanent marking of reference lines, text and footprints on the surface of the pipe. The text character size is adjustable by rotating the print plate on the printer head, the vertical distance between the first and sixteenth dots determines the height. The maximum height, with the dots in a vertical line perpendicular to the centreline of the machine, is 67 mm.

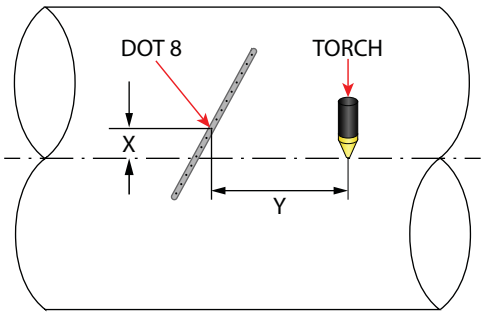


Rotate the printer head to achieve the desired result. **ATTENTION!** The actual height must correspond to the height value entered in the settings, otherwise the text will be slanted. Measure the vertical distance and enter the value in the 'Tool>Marking>REA inkjet>Controller>Printer height' setting.

A tilde sign (~) between two lines of text will activate the double line function, the text after the tilde sign will be printed below the text before the sign. **Please note: the text will then only be half of the entered printer height!** The tilde sign itself is never printed.

Printer offsets

The printer is mounted on the side of the cutting trolley. For line marking dot number 8 is used, this dot is aligned as closely as possible to the centreline of the machine. For the marking to be placed in the correct position the software must know how far the printer head is from the torch tip. The printer head can be offset in two directions, the 'y' direction, along the length of the pipe (CTL axis) and the 'x' direction, the direction of the rotation of the pipe (MDR axis). Measure these distances and enter the offsets in the settings, the software will now compensate for the offsets when marking.



These offsets apply to all marking units that are mounted on the side of the cutting trolley. Generally speaking, text marking is less critical than reference lines or footprints. If the text fits completely on the pipe and is legible, the exact position is not important. Reference lines and footprints mark the position of other pipes that will later be connected to this pipe, it is essential that these markings are positioned exactly.

Marking speed

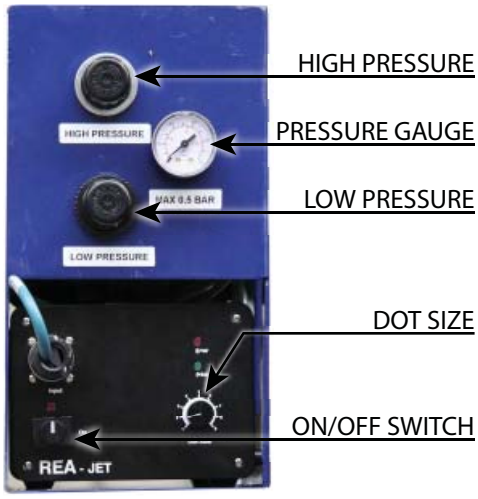
The default marking speed for the ink jet printer is 2000 mm/min. The quality of the marking depends on the speed and air pressure. If the speed is too high, the marking will be fainter, if the speed is too low, too much ink will be used and the chances of the nozzles clogging up will be increased. The speed can be adjusted in the settings. Faint markings could also be due to other causes such as insufficient ink, insufficient pressure or blocked nozzles. More information about checking and maintaining the systems follows.

The REA ink jet printer controller and reservoir

Hardware settings

The hardware consists of a printer head, a controller and an ink reservoir. There are two pressure systems, the software controls which pressure is used for which function. The default settings are shown in the table below:

Printer function	Pressure system
Mark line	Low pressure system
Footprint	Low pressure system
Mark text	High pressure system



Turn the knobs to adjust the low and high pressure to between 0.2 and 0.5 bar, read the actual working pressure from the gauge. Increase or decrease the dot size to achieve the desired printing result.

Always check the ink level in the reservoir before printing. Always keep the level between the minimum and maximum level markers, never overfill the reservoir.

Cleaning and maintenance

Always make sure the printer head is clean before starting to print. Wipe the nozzle plate with a lint-free cloth soaked in the cleaning fluid that was supplied with the machine (CL-TKDK). Check the reservoir, is there enough ink to complete the job? Check that the nozzles are not clogged. Pass a piece of paper under the printer head and push the purge button on the top of the printer head. The dots should all be the same size. If some are smaller or missing altogether, then these nozzles are probably clogged and will need cleaning. Take the printer head out and turn it upside down, so that the nozzles are facing upwards. Spray cleaner on the clogged nozzles and allow it time to react. Wipe clean and try testing again. If there is no improvement the nozzle plate will have to be cleaned, the procedure is explained later in this chapter. If the top nozzles do not print, there may be air in the system, the procedure for venting the system is also explained in this chapter.

Cleaning the nozzle plate

Safety first! Both the ink and the cleaning fluid can be dangerous. Both substances are highly flammable. Avoid using in temperatures above 45°C or in direct sunlight. In case of fire use alcohol-resistant foam, carbon dioxide, dry powder or water fog/spray. Do not use a water jet.

The cleaning fluid will irritate skin, eyes and the respiratory system if it comes in contact with them. When working with these substances wear impermeable gloves (butyl rubber), safety glasses with side shields and long-sleeved, flame-resistant overalls. Do not inhale the fumes, always use in a well ventilated area.

1 Turn off the ink supply and allow the pressure to escape!
2 Disconnect the tubing from the printer head.
3 Turn the head upside down, unscrew the screws and remove the nozzle plate.

4 Place the nozzle plate in a container filled with cleaning fluid.

Flushing the ink chamber

1 Turn off the ink supply and allow the pressure to escape!
2 Disconnect the tubing from the printer head.
3 Empty the ink out of the chamber into a basin.

4 Fill the chamber with cleaning fluid and let it work in for a while, then empty out the cleaning fluid.
5 Refill the chamber with fresh cleaning fluid. Continue to repeat the process until the chamber is clean.
6 If the nozzles are still clogged after cleaning the nozzle plate and ink chamber, remove the nozzle plate and place the head, nozzles down, in a basin of cleaner so the fluid can work directly on the nozzles.

7 When everything is clean, screw the nozzle plate back on and vent the system.

Venting the system

The system needs venting after the ink chamber has been cleaned (or if air has gotten into the system). Turn the printer head upside down so the nozzles plate is facing upwards. Now remove the excess air by pushing the purge button on the top of the printer head. **Do not hold the purge button in for more than 60 seconds!** Test the nozzles by passing a piece of paper under the head and pushing the purge button. When the uppermost dot is clearly printed, the system is vented.

Whenever the top dots are missing or becoming faint, venting the system can solve the problem without cleaning the whole system. The tube connecting the ink reservoir to the printer head is equipped with a filter. This helps to prevent the nozzles from clogging. If the problem continues even after cleaning and venting, check the filter, it may be necessary to replace it.

Punch marker

The punch marker is used to apply permanent markings to a pipe, usually a pipe that is later to be painted or coated. By punching the lines or text into the pipe they can still be read after coating. Depending on the treatment the markings can be etched deeper into the pipe by decreasing the speed or increasing the air pressure.

The punch marker uses a pneumatic needle to punch the marking onto the pipe. The marking speed and character height and width can be adjusted in the settings (diagnostic screen; marking tab). The default speed is 2000 mm/min. and the default pressure is 3 bar. Increasing the speed or pressure will increase the wear and tear on the needle and may even lead to breakage.

Replacing the marking needle

To replace the needle, remove the printing head and unscrew the stylus. Remove the old needle, leave the spring in place. Place the new needle and screw the stylus back into the printer head. When the punch marker is not in use, replace the plastic cap to protect the needle. Don't forget to remove it again before marking!

MARKING NEEDLE

04.06.189

SPRING & STYLUS

04.06.241

Line marking options

Simple line marking on the pipe can be programmed in ProCAM's MDI module (Manual Data Input) which is explained in detail later in this chapter. There are also several other 'automatic' line marking options available. If one or more of these options is available on your machine, you will find extra settings under the marking tool in the machine settings.

Chamfer mark line: when enabled two reference lines are automatically marked on chamfer cuts, with a rotation of 90° between them. Two corresponding lines can be marked on the plate or profile to which the chamfer is to be connected. Aligning these lines on both profiles guarantees easy and precise fitting.

Saddle mark line: this is similar to the chamfer mark line, two lines are marked on the saddle cut, rotated 90° from each other. Two corresponding lines will be marked on the pipe to which the saddle is to be connected showing the position and angle of the connection.

Hole line: automatically marks two reference lines, 90° apart, at the edges of a hole cut in the pipe. The connecting 'saddle set in' (connection of a fit pipe to the inner wall of the cut pipe) will also be marked with two reference lines.

Reference line: these are also used for alignment during fitting. When enabled a minimum of one, up to a maximum of four lines are marked at selected points at 0°, 90°, 180° and 270°.

Text marking options

One or two lines of text can be programmed and positioned on the pipe in ProCAM's MDI module, details follow later in this chapter. There are several other 'automatic' text marking options available on the machine for track and trace, quality assurance, ease of fitting etc. The settings can be found under the marking tool settings if the option is activated for your machine.

Heat number: the heat number is a quality assurance measure, each batch of steel has a unique heat number which gaurantees that all steel from the same batch will have exactly the same properties. Heat number marking records the heat number on each part cut from the same batch. It is also possible to automatically mark the heat number on rest material, the stock material remaining when all parts have been cut.

Hole text or slot text: when a hole or slot (oblong hole) is cut from a pipe this option marks the name of the connecting part/profile next to the hole or slot.

Part name: automatically marks the part name on each part.

Text enable: automatically marks the connecting part name next to each cut.

Footprints

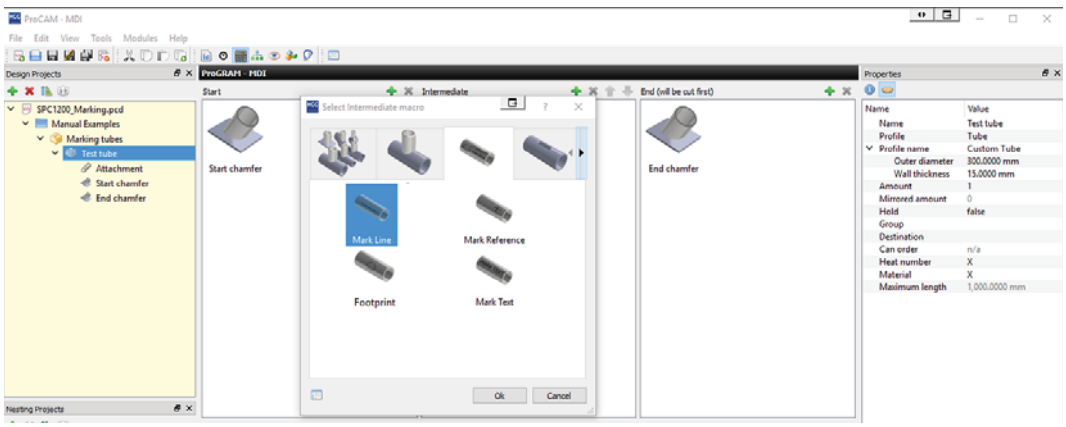
A footprint is a contour of the shape the connection will make at the location on the cut pipe where the branch pipe is to be positioned. Footprints can also be programmed in ProCAM's MDI module.

Mark all profiles

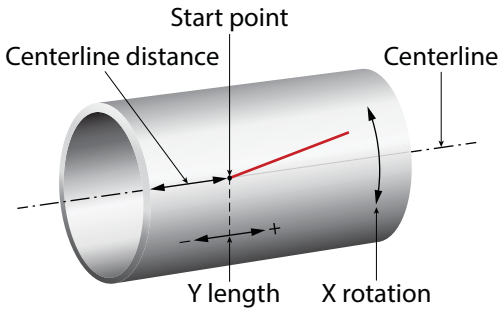
There is one more option to activate marking on the machine. When a data file is loaded, one of the profiling parameters on the profiling is the option to 'Mark all profiles'. When enabled, all cuts and marking will be marked on the pipe *BEFORE* profiling begins. This can be used to check the positions of the cuts or marking to ensure that is correct before the pipe is cut. Any marking that has been programmed or marking option that has been enabled will be marked twice if this box is checked.

Programming marking in ProCAM

1 Open ProCAM by clicking on the icon on the top left of your screen.
2 Select a tube profile and enter the dimensions of the tube to be marked.
3 Select the 'MDI' module, add chamfers to the ends, add an intermediate macro, for example 'Mark line', 'Mark text' or 'Footprint'.

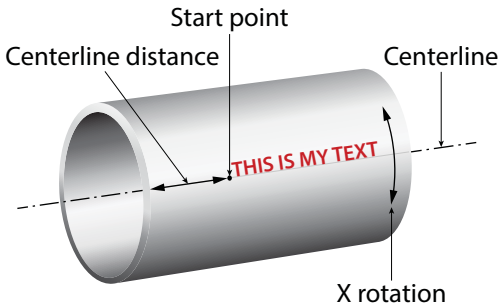


Line



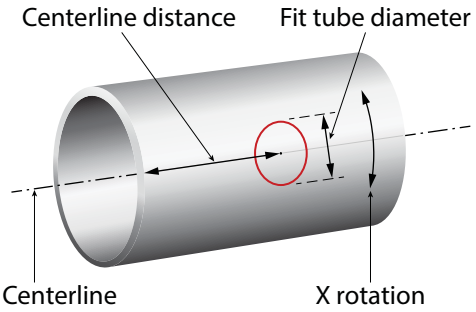
- The 'Centerline distance' parameter gives the start point for marking along the Y axis (CTL) in millimeters.
- The 'Centerline turn' parameter gives the rotation about the X axis (MDR) of the start point in degrees.
- The 'X rotation' parameter gives the rotation about the X axis of the end of the line relative to the start point.
- The 'Y length' parameter gives the length along the Y axis (CTL) between the start point and the end of the line (note: this is NOT the length of the line unless the 'X rotation' is set to zero.

Text



- The 'Centerline distance' parameter gives the start point for the text along the Y axis (CTL) in millimeters.
- The 'Centerline turn' parameter gives the rotation about the X axis (MDR) of the start point of the text in degrees.
- The 'Rotation' parameter gives the angle of the text from the centerline.
- The 'Height' parameter gives the height of the text characters.
- The 'Text' parameter is the field in which to type your text. Remember, for two lines of text enter a tilde sign (~) at the end of the first line. If you choose two lines of text, each line of text will be half the height entered in the 'Height' parameter.

Footprint



- The 'Centerline distance' parameter gives the centre of the footprint along the Y axis (CTL).
- The 'Centerline turn' parameter gives the rotation about the X axis (MDR) of the centre of the footprint.
- The 'Fit tube diameter' parameter is the outer diameter of the tube to be connected at this point.
- The 'Slope' diameter is the angle between the centerlines of the fit tube and the marked tube.
- The 'Eccentricity' parameter is the off-centre distance of the centre of the footprint from the centerline of the marked tube.

For more detailed information about centerline programming and working with ProCAM's MDI module, please refer to the ProCAM User's Guide delivered with this machine.

Appendix A

Maintenance and Grease Schedule

Maintenance on the Pipe Profiling Machine

This appendix contains details of the maintenance of the pipe profiling machine. Periodic maintenance is necessary to ensure the reliability and safe operation of the machine. It is very important to keep the pipe profiling machine in perfect condition for the following reasons:

- To maintain the high quality of the cutting work
- To have a minimum of down time
- To work safely with the machine

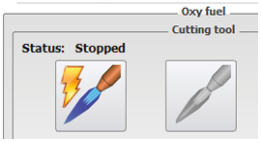
Safety

Turn the power "off" when maintenance is being carried out so that nobody can get clamped between moving machine parts. When the power has to be on during maintenance work, pay attention to the following points:

- A person may be clamped between the frame and the moving components.
- A person could be hit by the moving cutting head.
- A person could be injured by a rotating pipe.
- A person could get an electric shock.

CAUTION!
Always be careful when carrying out maintenance on the machine!

Replacing the cutting torch nozzle



Always make sure the cutting process has been stopped before beginning work. Check the status on the diagnostics screen under the 'Tool' tab. While the operator is changing the nozzle no one is allowed to use the remote control. This could lead to dangerous situations such as unexpected movement of components or unintentional ignition of the torch. When the cutting process is stopped the gas valves are automatically closed. However, some gas will remain in the hose between the valve and the torch. When the old tip is removed this gas can escape. If you smell gas, wait until the smell has gone before starting work. There should only ever be one operator working on the machine so it is impossible to change the nozzle and press 'Ignite' at the same time.

WARNING!
The torch and the tip can be hot due to the cutting process! Allow the torch and the tip to cool down. Always wear flame proof gloves and flame proof clothing when replacing the tip. Never ignite the torch without a nozzle securely in place. Never press 'Ignite' while someone is working on the torch. This button ignites the pilot flame and opens the gas valves!

The following procedure can be used for replacing the nozzle of the cutting torch and preheat torch.

- Use a wrench and a counter wrench to remove the nut from the torch, remove the nozzle.
- Select the replacement nozzle according to the thickness of the steel pipe and attach it to the torch.
- Use a wrench to tighten the nut. Do not over tighten the nut, it will be heated during cutting and become tighter, making it difficult to remove.

Preventive Maintenance

The machine has to be cleaned and greased according the periodic schedule, in the case of intensive operation according to the number of operating hours.

Weekly maintenance

This is a weekly check-up to maintain essential parts of the machine to ensure optimal running of the machine and quality of cutting.

- Greasing and cleaning must be carried out according the grease schedule.

Other weekly maintenance:

CUTTING HEAD

- Make sure the cutting head arm is vertical at the front and the side of the arm.
- Cut a test piece with the option "Design" from the main menu. Choose the profile type "Task check". Cut and evaluate this. See Appendix B: Calibration for more information. If necessary adjust the cutting head.

CONTROL UNIT

- Remove the ventilator cover of the air conditioning unit and clean the filters with compressed air.

Three-monthly maintenance

ATTENTION!
First carry out the weekly maintenance before proceeding with the three monthly maintenance.

- Greasing and cleaning must be carried out according the greasing schedule.

Other three monthly maintenance:

CUTTING HEAD

Remove the side and front cover at the housing, the cutting head and check the hoses for wear, if damaged or in a bad condition change them. It is good practice to replace all hoses after a period of 2-3 years. The rubber of the hoses will dry out with the risk of leakage!

For further information please contact HGG (service@hgg.nl)

Grease types

On the following pages you will find the greasing schedule of the pipe profiling machine. The following grease types will be used:

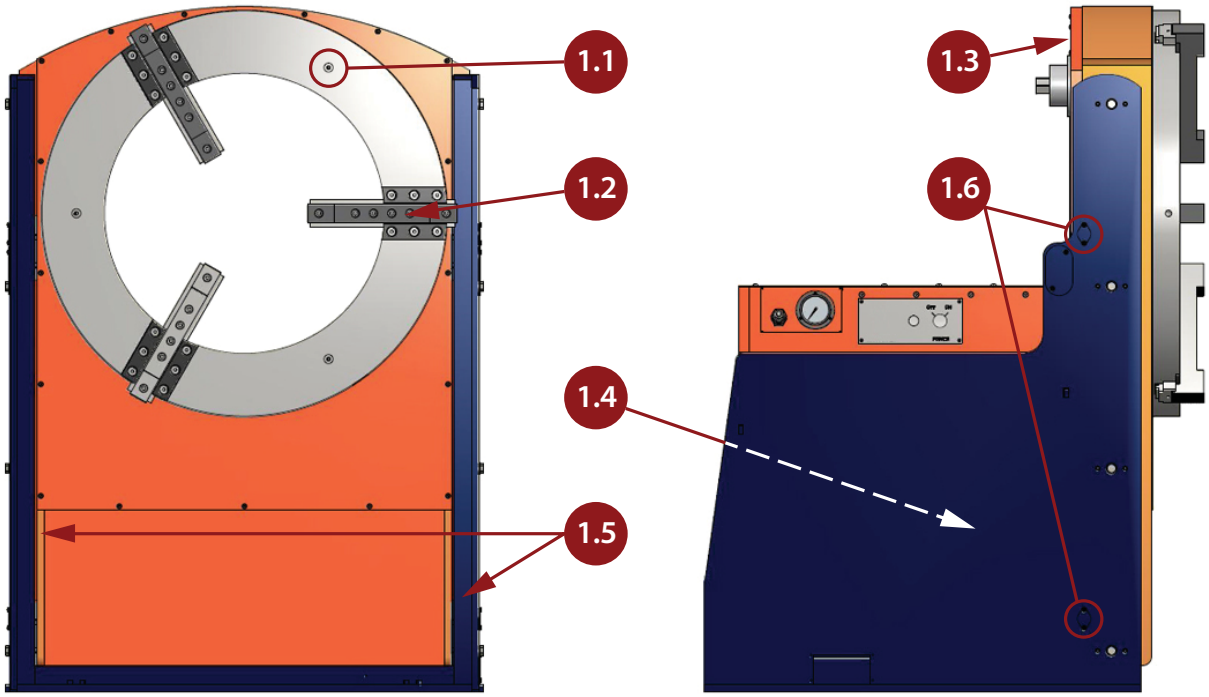
Grease / lubrification type	Number	HGG part number
Unil Protect SEE NT (5 litre) protection oil	I	08.00.021
Total Ceran XM100 400 gr	II	08.00.009
Total Altis SH 2 400gr	III	08.00.008
Hydraulic oil HV-A 32 (5 litre)	IV	08.00.020
Total Carter SG 680 (5 litre)	V	08.00.013

Cleaning fluid	Number	HGG part number
Cleaner TKDK	VI	01.08.206

Plasma coolant	HGG part number
Kjellfrost -20°C (20 litres)	07.04.024

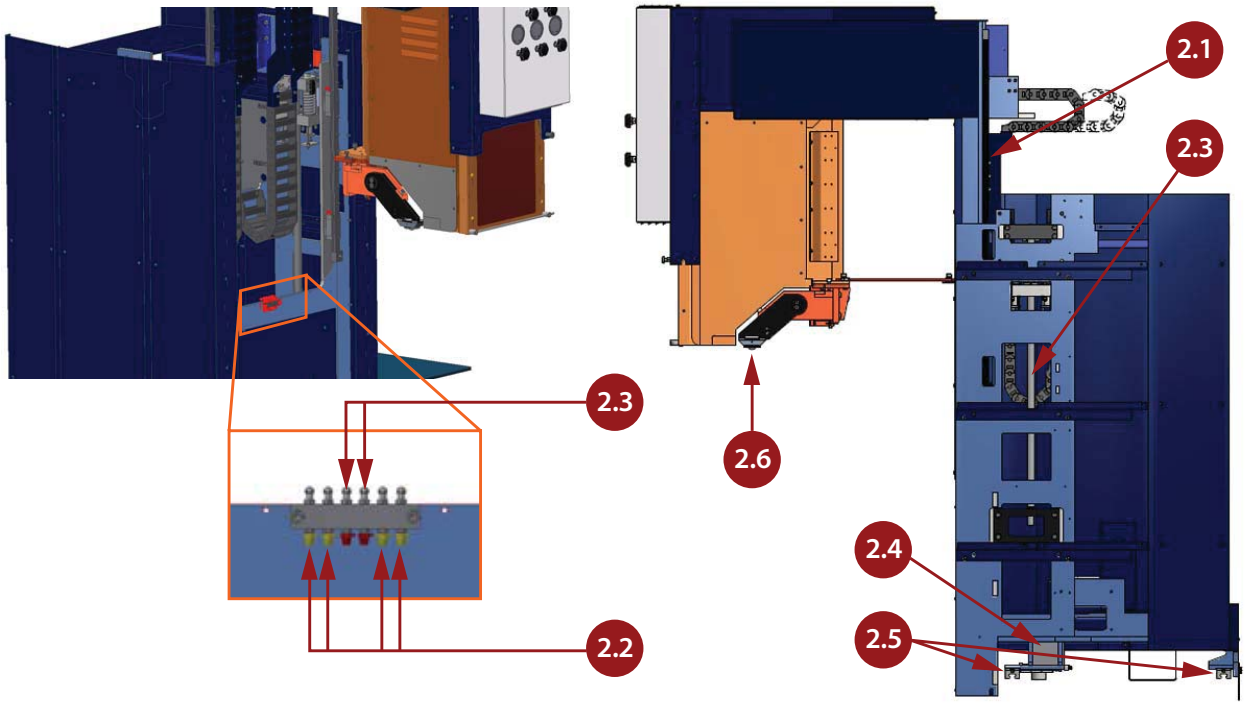
These products are especially chosen for the maintenance of the pipe profiling machine. It is not recommended that these are replaced by other products. Please contact HGG Profiling Equipment BV if you have problems in ordering the products that are described above (service@hgg.nl).

1 Main drive unit



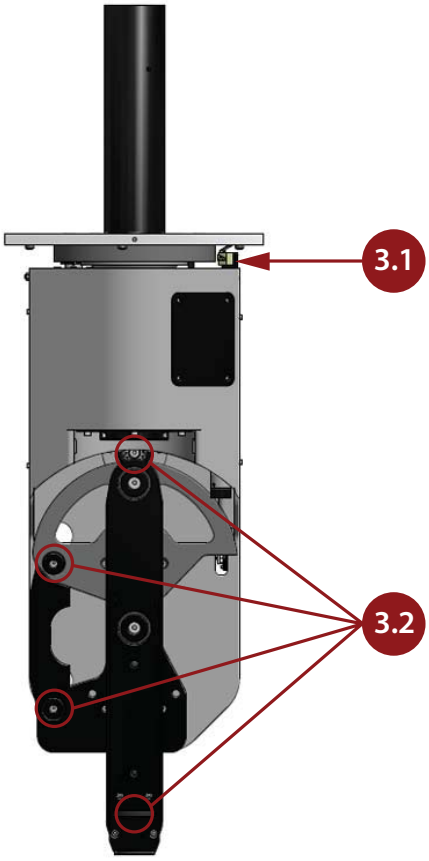
Grease point	Description	No.	Type	Operating hours	Maint. schedule
1.1	Pump new grease into the 3 nipples at the front of the chuck to grease the spiral plate. Rotate the chuck a few times in both directions to spread the grease. Rotate until the nipples are in a different position (±40°) and repeat. Rotate again and repeat. It is important that the grease is spread over the whole surface to prevent friction and vibration.	3	III	500	3 months
1.2	Open the jaws fully, clean and apply new grease. Close the jaws and clean and grease the remaining parts.	3	III	500	3 months
1.3	Open the cover and apply new grease to the pinion and teeth of the slewing bearing.	1	III	1000	6 months
1.4	Change the oil of the main drive unit gearbox.	1	V	8000	4 years
1.5	Clean the vertical rails.	2	--	50	1 week
1.6	Pump a small amount of new grease (± 0.5 cc) into the vertical linear bearings.	4	II	1000	6 months

2 Cutting trolley



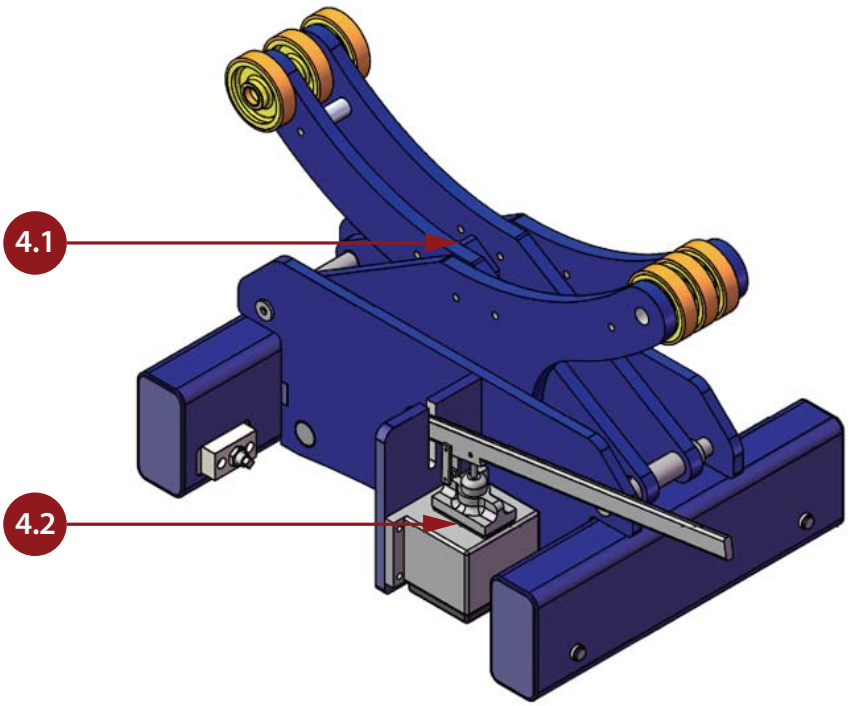
Grease point	Description	No.	Type	Operating hours	Maint. schedule
2.1	Move the cutting trolley to the top position, clean the vertical rails.	2	--	50	1 week
2.2	Pump a small amount of new grease (± 0.5 cc) into the nipples of the vertical sliders (colour coded yellow).	4	II	1000	6 months
2.3	Clean the vertical spindle and nut. Pump a small amount of new grease into the grease nipples (colour coded red, the middle position).	1	III	1000	6 months
2.4	Pump a small amount of new grease into the sliding system of the mounting plate gearbox.	4	II	1000	6 months
2.5	Pump a small amount of new grease (± 0.5 cc) into the horizontal sliders.	4	II	2000	1 year
2.6	Clean and grease the roller balls on the arms.	2	II	50	1 week

3 Cutting head



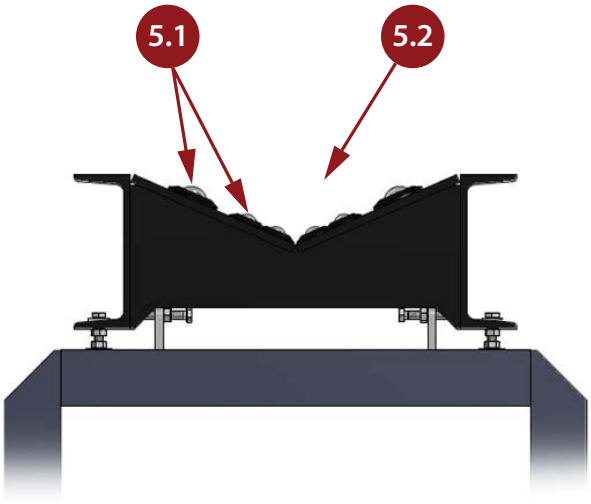
Grease point	Description	No.	Type	Operating hours	Maint. schedule
3.1	Clean the rotation gear.	2	--	500	3 months
3.2	Remove excess dirt and grease from the tilting system.	4	--	500	3 months

4 Pipe trolley



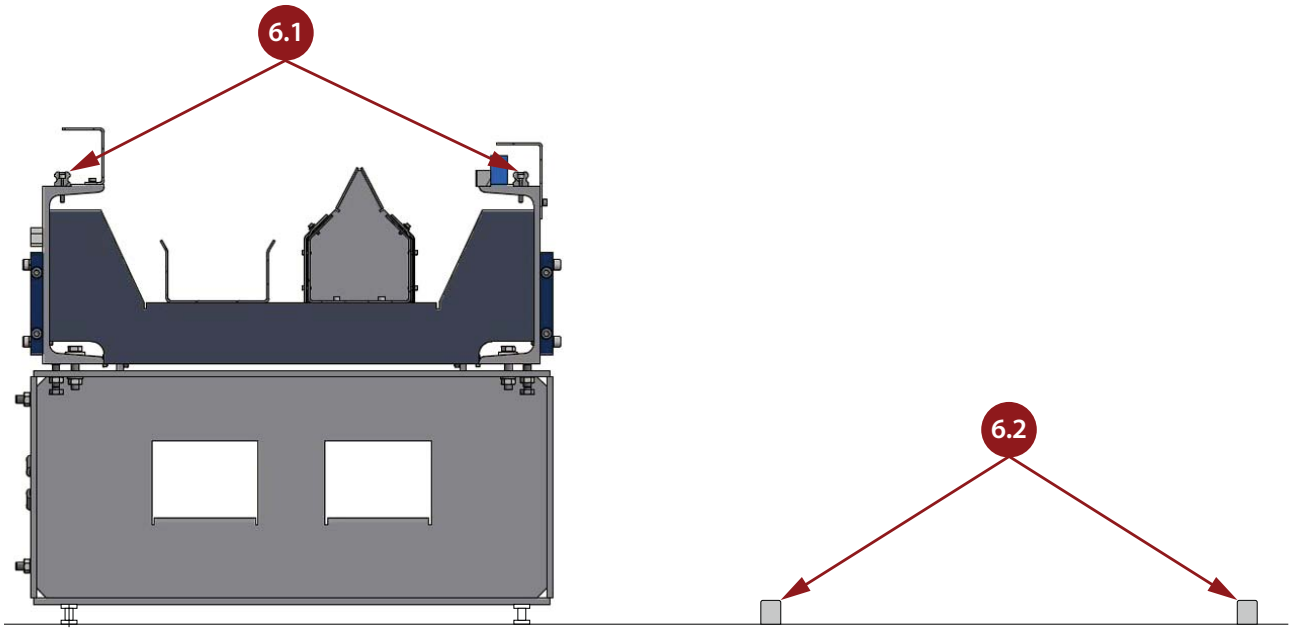
Grease point	Description	No.	Type	Operating hours	Maint. schedule
4.1	Set the pipe trolley to the top position, clean and lubricate the vertical guide system.	2	I	200	1 month
4.2	Set the pipe trolley to the bottom position, check the oil level in the pump. Top up if necessary.	1	IV	1000	6 months

5 Rollerball gutter



Grease point	Description	No.	Type	Operating hours	Maint. schedule
5.1	Clean and grease the roller balls in the gutter.		II	50	1 week
5.2	Remove any excess dirt and/or residue from the gutter.		--	50	1 week

6 Machine frame



Grease point	Description	No.	Type	Operating hours	Maint. schedule
6.1	Clean the horizontal rails and the tooth gears.	2	--	10	1 day
6.2	Clean the pipe trolley rails.	2	--	10	1 day

Appendix B

Calibration and Cutting Test Pieces

Calibration and alignment

During installation of the machine the foundation frame, rear frame and pipe trolley rails are all aligned to within +/- 0.5 mm tolerance. This is vital to the accuracy of the machine. The main drive, the cutting trolley, the cutting head, the pipe trolleys and (if present) the roller ball gutter are all moving parts and their alignment should be checked regularly to ensure accuracy. In this appendix you will find instructions for the mechanical alignment of the machine parts.

Cutting test pieces

Once the mechanical calibration has been carried out, one or more test pieces can be cut to calculate the software offsets. The 'Task check' macro in ProCAM is designed especially for this purpose. The procedure for cutting and evaluating test pieces is also included in the calibration appendix. It is recommended that these test pieces are cut at least once a week.

Safety

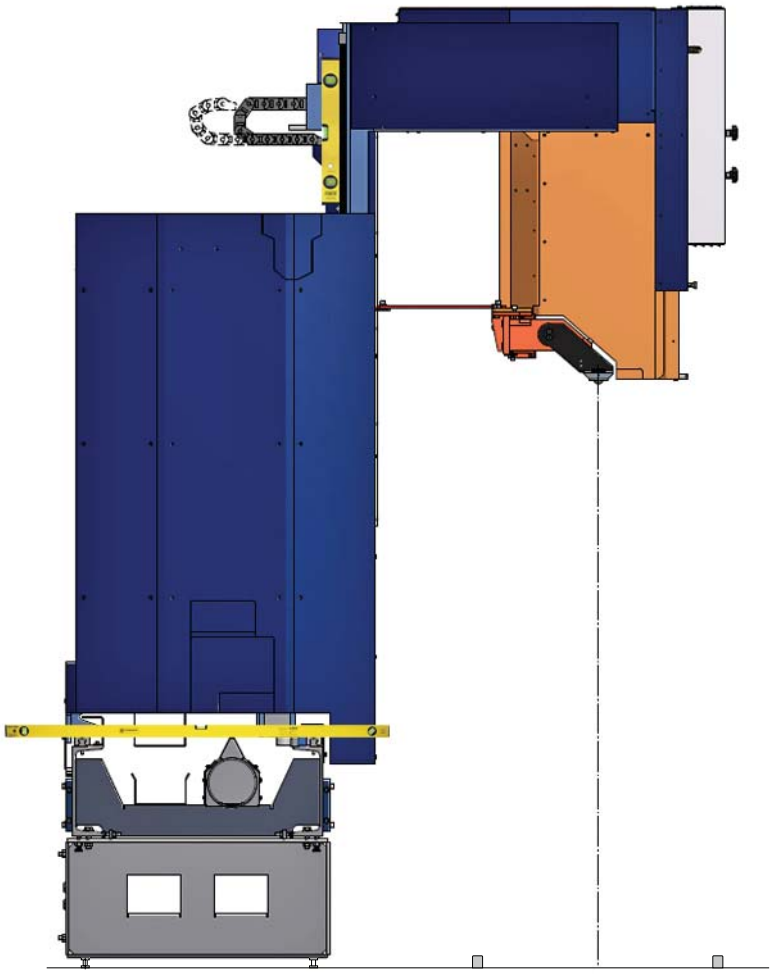
Always take great care when calibrating the machine. Follow the safety instructions as outlined in chapter 2 of this manual and always wear the recommended personal safety equipment. Turn the machine off before carrying out calibration and alignment unless the instructions specifically require the machine to be turned on.

When cutting test pieces remember that the pieces will be hot. Wear protective overalls and gloves. Pieces may fall into the pipe or onto the floor, always wear protective footwear.

CAUTION!
Always be careful when calibrating the machine! There is a risk of an electric shock. A person could get wedged between parts of the machine. Some parts of the machine may move unexpectedly.

WARNING!
Test pieces will be hot due to the cutting process! Always wear flame proof gloves and flame proof clothing when cutting test pieces. Do not handle the test pieces until they have cooled down or been immersed in water.

Alignment of the rear frame



Horizontal

Check that the rear frame is horizontally level by laying a large spirit level across the frame.

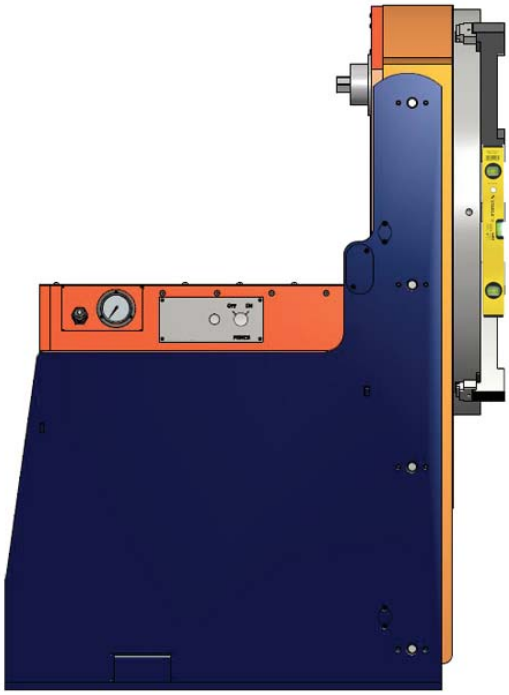
Vertical

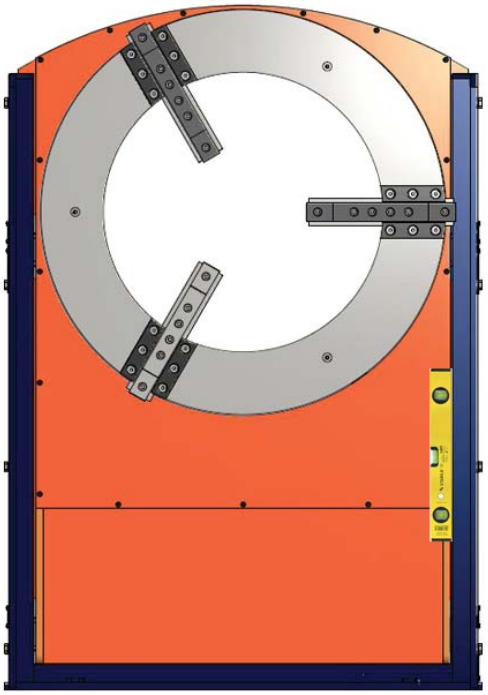
- Move the cutting trolley to its top position.
- Unbolt the gearbox for the longitudinal movement and push the pinion out of the rack so the cutting trolley can move freely along the frame.
- Set up a vertical rotating laser (or other levelling instrument) on the machine centreline (centre of the pipe trolley rails).
- Hang a plumb line from the torch holder.
- Use a spirit level on the vertical rails of the cutting trolley to check the vertical alignment.
- Move the cutting trolley along the rear frame to the next pole.
- Check the that the rear frame is horizontally level and the cutting trolley is vertically level. The plumb line should always be above the centreline.
- Adjust the rear frame as necessary, always ensure that it remains horizontally level.
- Repeat these steps until the cutting trolley is positioned within 0.5mm tolerance.
- Secure all bolts on the rear frame.
- Reattach the gearbox.
- Move the cutting trolley from the top to the bottom position and check that the plumb line remains above the centreline during this vertical movement.
- Repeat several times along the length of the frame.

Alignment of the main drive

The main drive unit must be aligned in 3 directions:

1 The vertical rails must be vertically level.
2 The front side of the chuck must be perpendicular to the machine centreline.
3 The centre of the chuck must be aligned to the machine centreline.

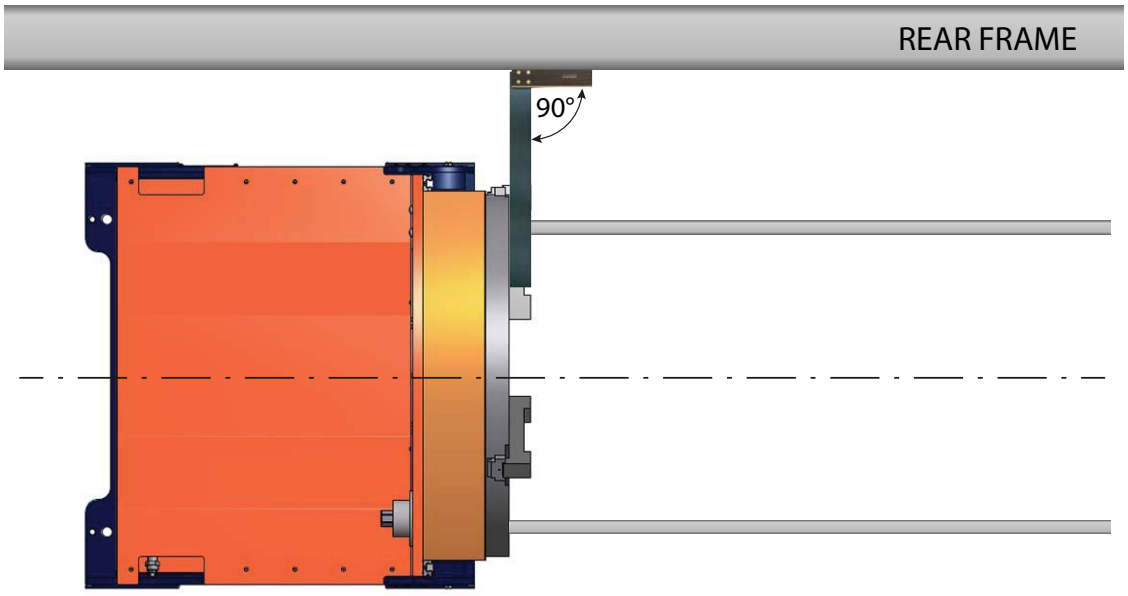




Vertical

- For the vertical alignment use a spirit level on the vertical rails of the main drive and also on the front side of the chuck face.
- Adjust the bolts at the base of the main drive as necessary.

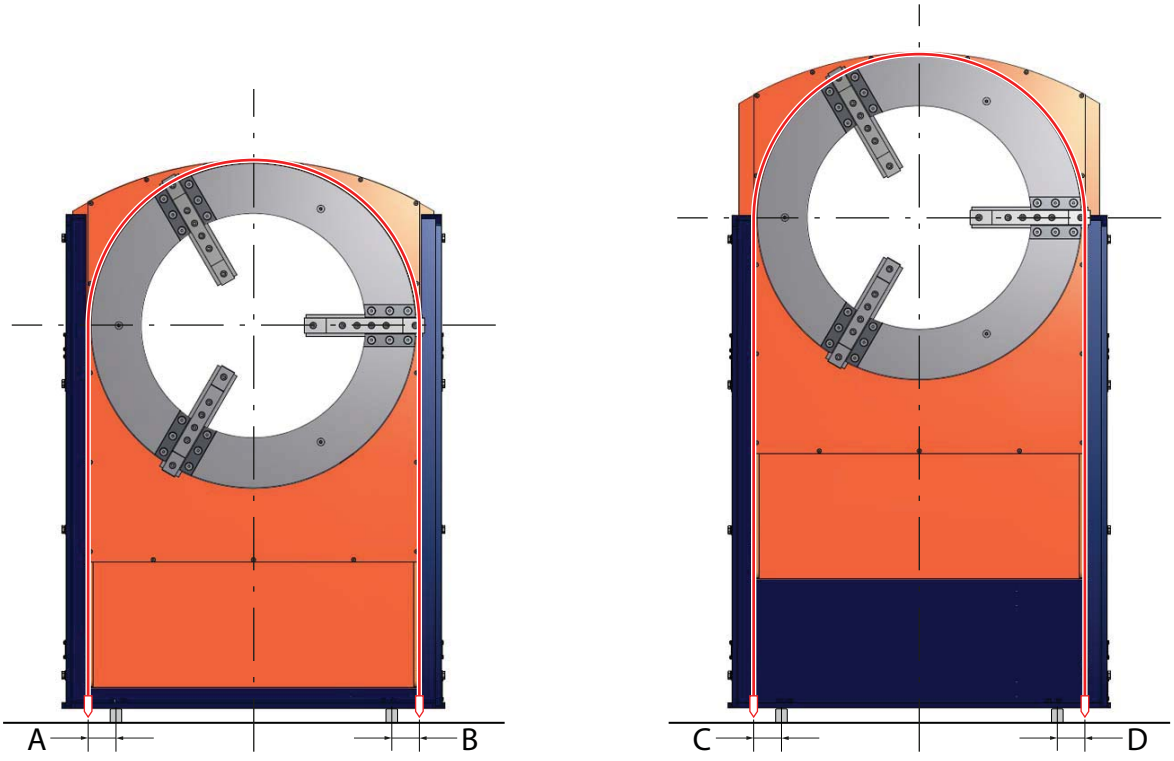
Alignment of the main drive



Top view main drive

Perpendicular

- Use a large set square on the rear frame and the front side of the chuck to ensure that the main drive is perpendicular to the rear frame.

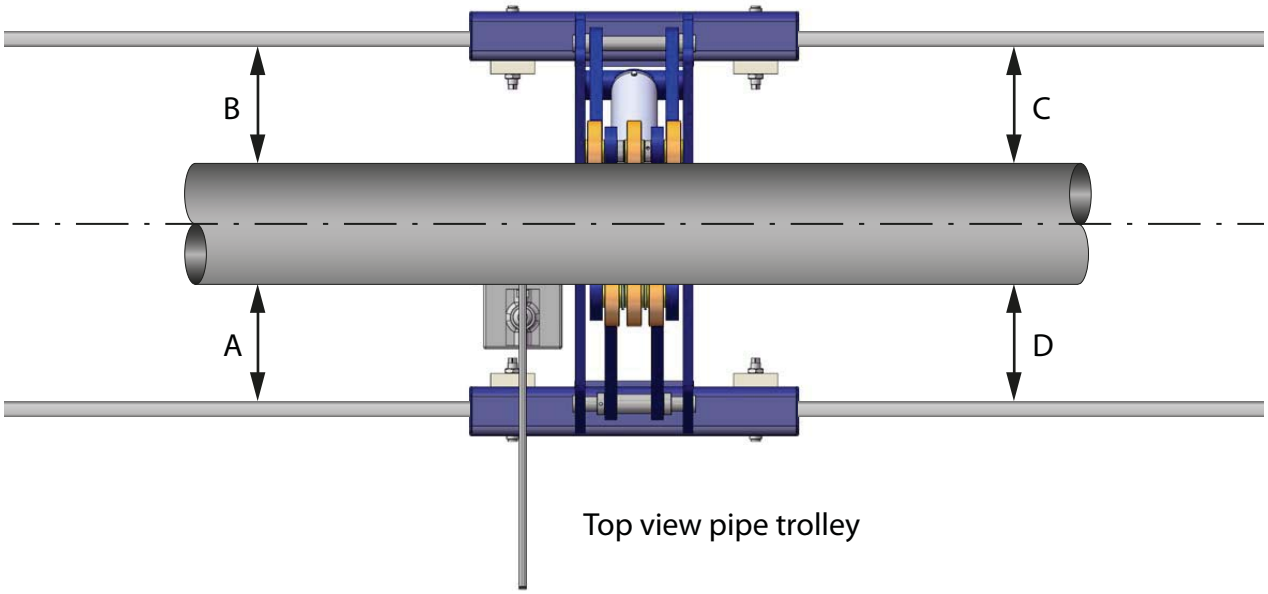


Centreline

- For the alignment of the centre of the chuck, hang a plumb line over the chuck and measure the distance to the pipe trolley rails.
- Move the chuck to its bottom position and measure again (A & B).
- Move the chuck to its top position and measure again (C & D).
- When the main drive is aligned to within 0.5 mm tolerance, tighten all the bolts.

Pipe trolley adjustment

The centre of the pipe trolley must be aligned with the centreline of the machine. There should be no more than 0.5 mm play between the pipe trolleys wheels and the rails.

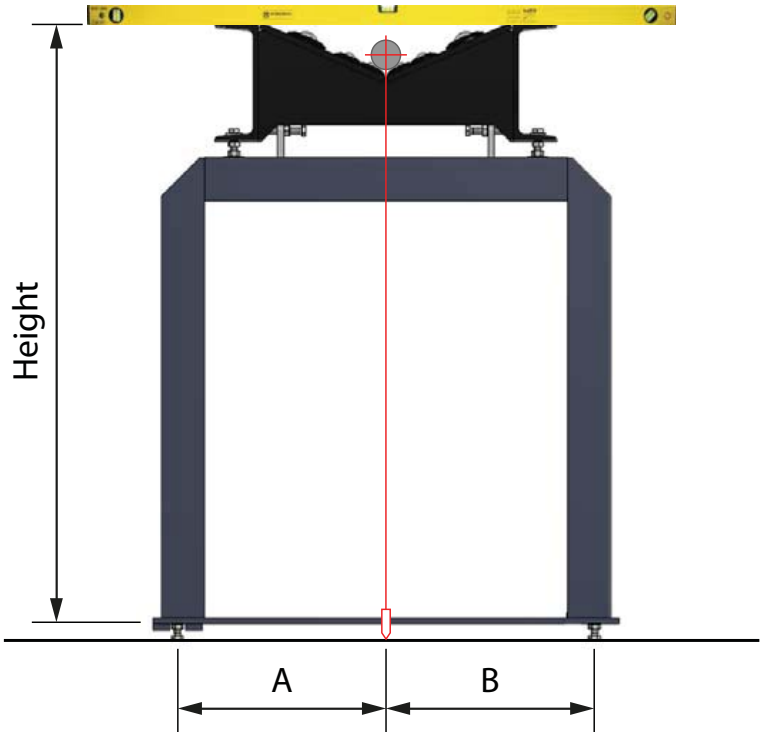


Top view pipe trolley

- Place a bar or pipe on the pipe trolley which you know is absolutely straight. For accurate measurements it should be at least 1 metre long.
- Measure the distance between the bar (or pipe) and the rails at the 4 points as shown in the diagram.
- Adjust the wheels until the bar is in the centre to within 1 mm (the 4 measurements should have the same value).
- Repeat the procedure for all of the pipe trolleys.

Roller ball gutter adjustment

On the roller ball gutter the roller ball units must be horizontally level and all at the same height. The centre of the roller ball units should be aligned with the machine centreline.



Horizontal

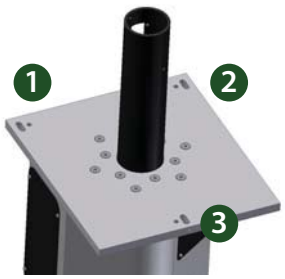
- Use a large spirit level at each roller ball unit, working from left to right. Make sure the units are level.
- Measure the distance between the top of the pipe trolley rails and the bottom of the spirit level to check the height of the roller ball gutter. The height must be the same at each unit to ensure that the gutter is horizontally aligned along its length.

Centreline

- Place a bar with a diameter of at least 50 mm and a length of at least 500 mm on the roller ball gutter.
- Mark the centre of the bar.
- Use a plumb line to align the centre of the bar with the centreline of the machine.
- Begin close to the main drive and work away from it.

Mechanical alignment of the cutting head

The cutting head is mounted to the cutting arm with 3 pull bolts. 3 push bolts at the top of the cutting arm are used to exactly position the cutting head.



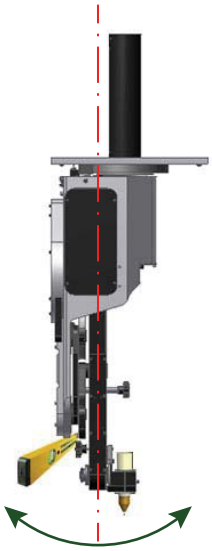
When adjusting the bolts it is important to make sure there are a few millimetres play for adjustment, if not there is a danger of distorting the plate when tightening:

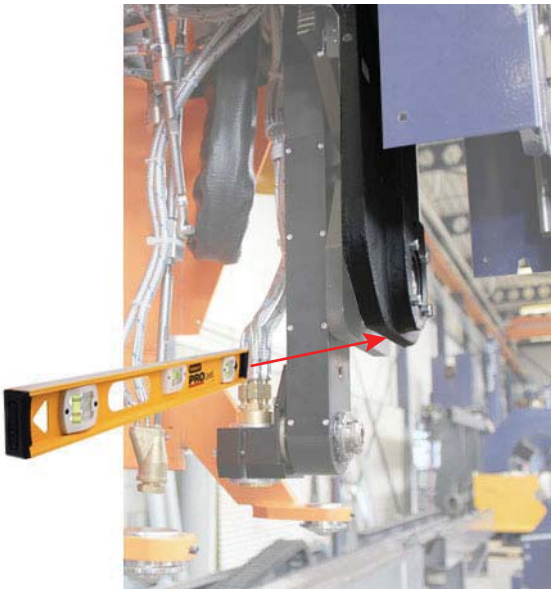
- Always partly unscrew the pull bolts before adjusting the push bolts.
- Make sure the tension on all 3 push bolts is about the same.
- Secure the 3 pull bolts with about the same tension.

Vertical

Set the cutting head to vertical by using a spirit level to align the cutting head in two directions. Measure at the machined surface at the back of the cutting head to check that the plate is level (±0.5mm/m), see diagrams and photo for exact location.


FRONT VIEW


SIDE VIEW

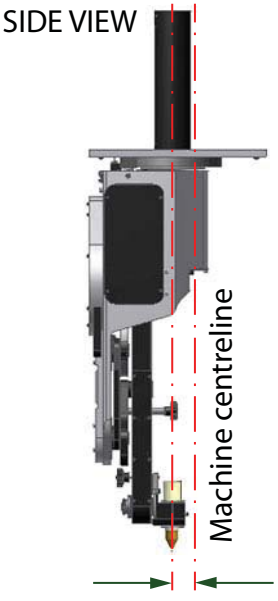


Centreline

Set the cutting head in the centre of the machine by aligning the torch with the centreline of the machine. To do this, clamp a pipe in the machine and use the roller balls to mark the centreline along the top of the pipe. Turn the machine off before aligning the cutting head.

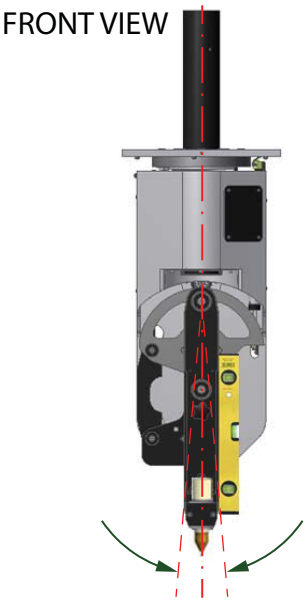
- Push the cutting head smoothly by hand to the zero position (with the calibration pins at the back).
- By slightly unscrewing the 3 pull bolts, you can shift the cutting head along the mounting plate. Place a plumb line in the torch holder and adjust the cutting head until the cutting torch is in in line with the centreline marked on the pipe.
- When you are satisfied with the alignment, tighten the 3 pull bolts.

Alternatively, mark the centreline between the pipe trolley rails and align the plumb line with the centreline as described above.



Rotation

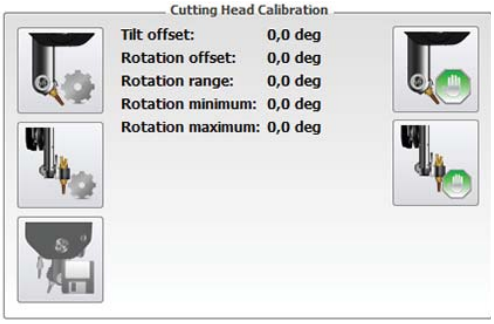
The cutting arm must be positioned vertically level in all directions. The rotation axis was positioned vertically by levelling the mounting plate. The cutting arm should now be parallel to the rotation axis. Check this by placing a small spirit level on the machined edge on the right hand side of the arm. Rotate the arm clockwise in steps of 90°, always taking measurements from the same edge. If for any reason it is not vertical, contact the HGG service department for instructions.



Software calibration of the cutting head

The software calibration of the cutting head can be found on the 'Diagnostics' screen of the remote control. Follow the instructions below to calculate and enter the offsets and complete the software calibration.

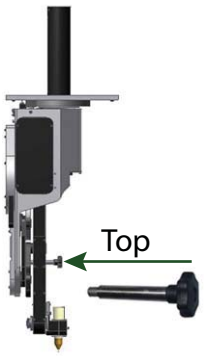
- Remove both side covers to reveal the cutting head.
- On the remote control touch screen select the 'Diagnostics' tab.
- On the 'Diagnostics' screen, select the 'Cutting head' tab.
- At the top left of the screen you will see the 'Cutting head calibration' dialogue. To carry out the calibration you will need a retractable measuring tape.



				
Calibrate tilt	Calibrate rotation	Store offsets	Free tilt axis	Free rotation axis

Tilt offset

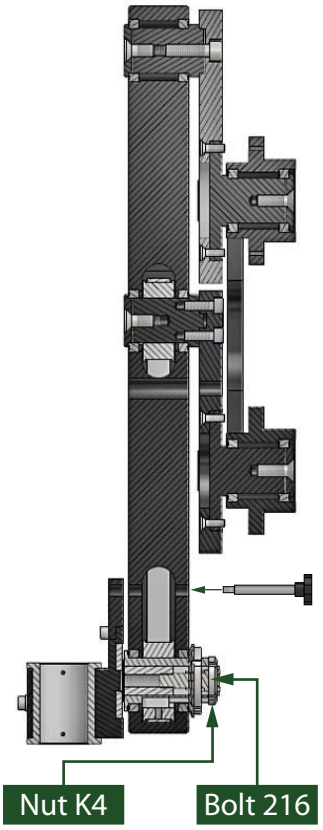
- Press the 'Calibrate tilt' button in the calibration control box. When the cutting arm has stopped moving a notification will appear on screen "Cutting head tilt axis is free. Please position the axis at its 'home' position."
- Manually move the cutting head so that the top calibration pin can be inserted.
- Store the offset by pressing the 'Store offsets' button.



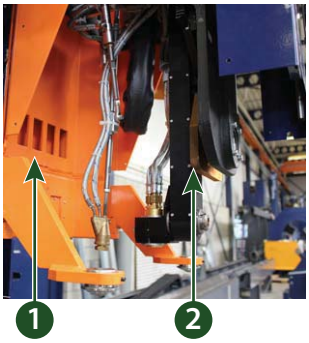
Torch angle

The calibration of the torch angle is done mechanically. The torch angle calibration is included here for convenience because the tilt offset also involves alignment with the calibration pins. The upper calibration pin fits so the torch is in line with the cutting head arm. The torch holder must also be in line with the arm. This can be adjusted as follows:

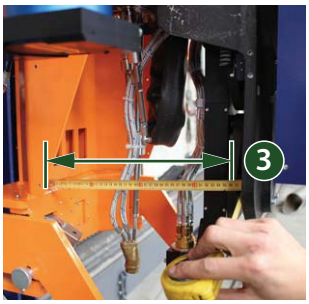
- Make sure the upper calibration pin fits
- Unscrew the bolt "216" at the back of the torch holder and nut type "K4" the torch holder can now be tilted manually
- Rotate the torch holder until the lower calibration pin fits
- Secure the nut "K4" (not too tight)
- Secure the bolt "216" while the calibration pin is inserted
- **Remove both calibration pins before calibrating the rotation offset.**



Rotation offset



- Press the 'Calibrate rotation' button in the calibration box. When the cutting arm stops moving a notification will appear on screen "Cutting head rotation axis is free. Please position the axis at its 'home' position".
- Manually rotate the cutting head counter clockwise until the flat side is facing the operator (approximately 180°).
- Measure the distance from the back of the housing to the machined surface between the torch holder and the back plate (see the pictures).
- Do the same on the other side, adjust until the measurements on both sides are exactly the same.
- When you are satisfied, press the 'Store offsets' button. This completes the calibration.



Measure from the back of the housing, under the slots, above the weld seam (see photo point 1).
Measure to the machined surface between the torch holder and back plate (photo point 2).
Repeat on the other side. When both measurements are the same, press 'Store offsets'.

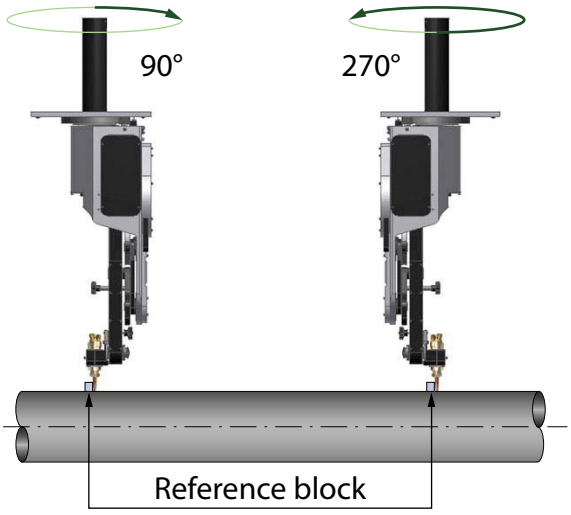
The two buttons on the right of the calibration box free the cutting head axes for manual movement.

Setting the torch in the centre of the cutting head

The torch has to be set in the centre of the cutting head. If the cutting head is rotated with both calibration pins inserted, the nozzle should not move, it should only rotate around its own axis. You can check this by placing a small fixed reference block on the pipe, close to the nozzle. As you rotate the cutting head with the rotate buttons, the distance between the nozzle and the reference block should stay the same.

Before you make any changes take note of the following:

- Both calibration pins have to fit as described above.
- You have to use a straight nozzle, a new one is preferred. An old nozzle might be bent due to heat, this will also cause the nozzle to be out-of-centre.
- Rotate the cutting head away from you so will be able to see if the nozzle moves the block.
- Take several measurements before you make any adjustments.



The torch can only be out-of-centre in 1 direction. This is the logical result of the design of the cutting head. This out-of-centre is always in the MDR-direction (main drive rotation, across the width of the pipe).

Adjustment in MDR-direction:

- Set the cutting head to 90º and place a reference block near to the nozzle
- Rotate the cutting head to 270º and check the distance to the reference block
- Rotate the cutting head to 90º and check the distance to the reference block

Repeat the calibration of the cutting head until the out-of-centre in the MDR-direction lies within 0.5 mm.

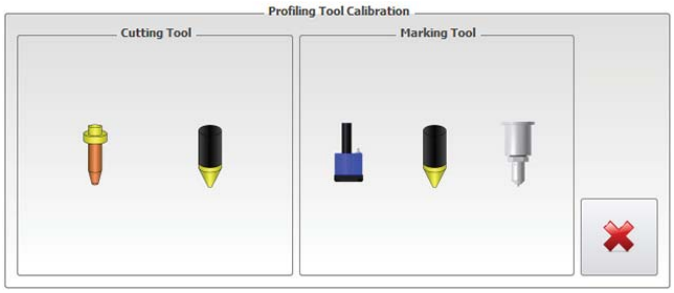
Cutting test pieces

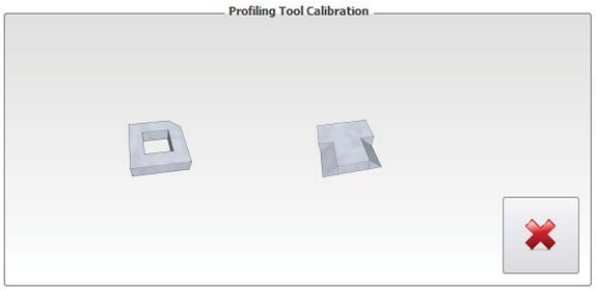
The 'Profiling Tool Calibration' dialog on the 'Diagnostics' screen of the remote control is used to cut small square test pieces from a pipe. By measuring these test pieces you can check the calibration of the cutting head and calibrate the machine to cut accurately. When cutting with oxyfuel, both test pieces can be cut using this dialog. These two test pieces should be cut every week as part of a quality control system to ensure cutting tolerances are within specifications. After making any adjustments to the cutting head, replacing tips or nozzles, you should also cut the two test pieces.

When using the plasma cutting process only the first piece is cut. Instead of the second piece, rings are cut from the pipe for the virtual burner height correction and the plasma angle correction. This procedure is also explained later in this chapter.

Oxyfuel

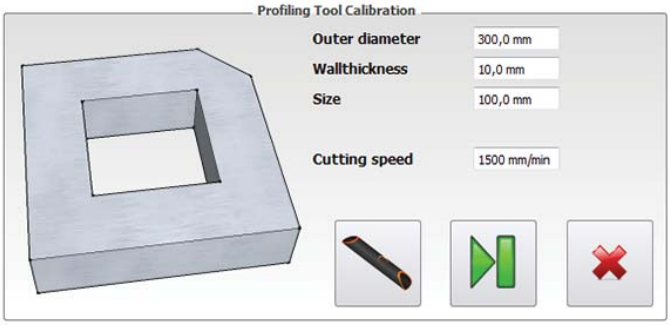
Load a pipe onto the machine from which you wish to cut the test pieces. If possible use a pipe with the same dimensions as the production pieces you will subsequently be cutting. If this is not possible, choose a pipe with a relatively thick wall, this will make measurement easier when evaluating the pieces after cutting. Go to the diagnostics screen on the remote control and select the 'Cutting head' tab. On the top right of your screen you will see the 'Profiling Tool Calibration' dialog.





You will now be asked to choose which cutting process is to be used, in this case choose the oxyfuel tip on the left. If your machine is also equipped with one or more marking units you will also be able to choose the marking unit tool. The procedure for calibrating the marking tool is explained later in this chapter.

The first test piece corrects oscillation of the torch in the x (rotational MDR) and y (longitudinal CTT) directions. Select this piece. In the dialog that appears enter the ACTUAL measured dimensions of the pipe you have loaded for cutting. Programming actual cutting pipe diameter and wall thickness here (not theoretical) is very important because we are going to make adjustments based on errors in the cut test piece. The 'Size' is the square dimension of the test piece (default 100 mm or 4").



Cut the first test piece

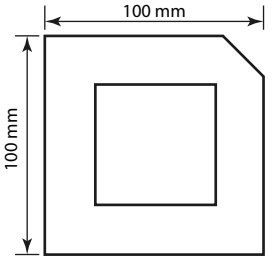
When you have entered the dimensions and cutting speed the 'Profile' button will be activated. If you are not sure which cutting speed to enter, refer to the default profiling table for oxyfuel on the settings screen. Look up the default speed for the entered wall thickness. Position the torch at the point where you wish to begin cutting. Make sure the torch is far enough from the end of the pipe to cut the 100 mm square. Initialise the torch using the laser and press the 'Profile' button. Press the 'Skip' button to continue without cutting.

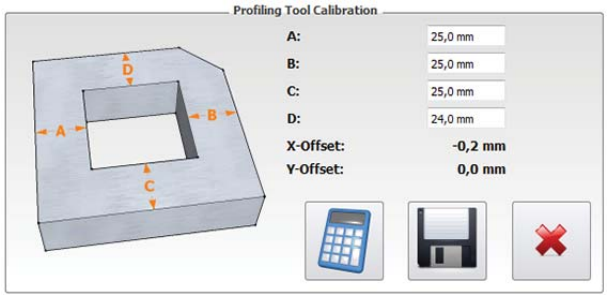
Before you make any changes in the calibration of the cutting head first make sure that:

- the cutting head is mechanically calibrated as described earlier in this appendix.
- the wall thickness of the material is equal over the dimensions of the test piece.
- the programmed wall thickness is the same as the wall thickness of the material to be cut.
- the pipe is horizontally level (use a spirit level).
- you always cut 3 test pieces and check if they have the same error. If not, the error cannot be caused by calibration settings of the cutting head.
- the cut quality of the test piece is correct. The cut sides of the test piece have to be smooth and straight. If they are not refer to the cutting quality appendix in this manual.

Calculating the oscillation offsets

The result of the test piece should be as shown on the right. Now using a pair of callipers, measure the distances from the four sides of the test piece to the square in the centre. Fill in the four measurements according to the diagram shown in the diagnostics screen. The 'Calculate' button will now be activated.

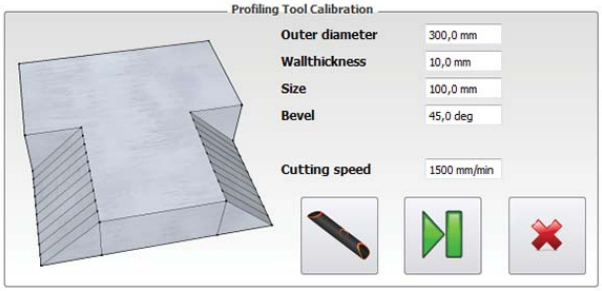




Press the button to calculate the offsets. The new values will be calculated and shown, press the 'Save' button to save the new values.

This completes the oscillation offset calculation. Now the second test piece can be cut.

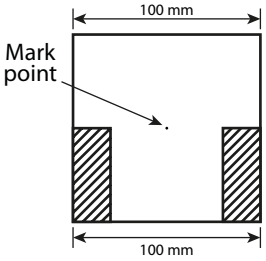
Cutting the second test piece



Return to the diagnostics screen and select 'Pipe', 'Oxyfuel' and the second test piece. Place a mark point on the pipe using a centre punch and move the optical initialisation laser onto it. Enter the outer diameter, wall thickness, size and cutting speed as before. Enter a bevel of 45° and press the 'Profile' button to cut the second test piece.

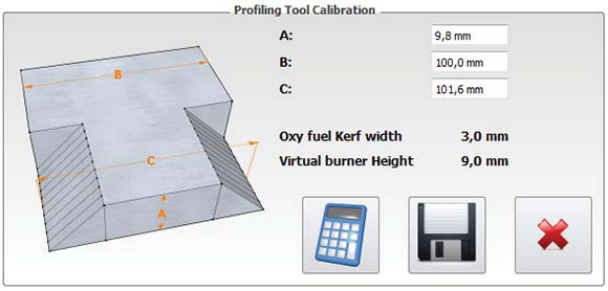
Calculating the virtual burner height

The result of the second test piece should be as shown here on the right. The perfect test piece will be exactly 100 mm square, the hatched sections will have a 45° bevel and the mark point will be in the middle of the test piece.



Setting the kerf width and virtual burner height

Using a pair of callipers, measure the distances as shown in the diagram in the diagnostics screen. Enter the measurements in the respective boxes and press the 'Calculate' button (if it is not lit up, press 'enter' on the keyboard). The kerf width and the virtual burner height are now automatically calculated for you. Press the 'Save' button to store the calculated values.

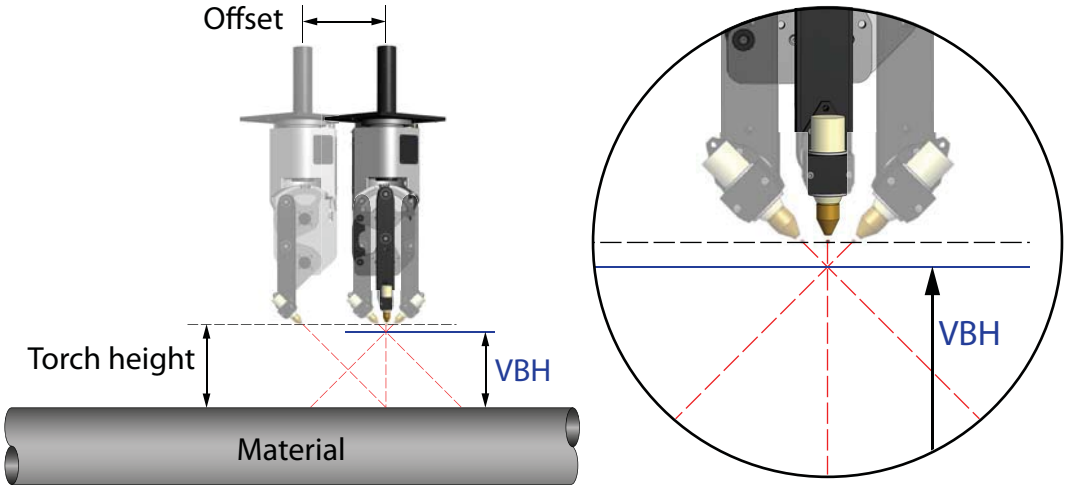


Here follows a short explanation of the terms 'virtual burner height' and 'kerf width' and their influence on the accuracy of the cut.

What is the 'Virtual Burner Height' and the 'Kerf width'?

Virtual Burner Height

The virtual burner height is the distance between the material and a point in space through which the cutting beam always passes. It is not the same as the torch height but a theoretical point below the torch height, this makes it impossible to measure. When the torch is tilted at an angle, the cutting arm moves to the left or right. The more the torch is tilted, the further the arm moves, but the tip of the torch always points directly at the same point in space (see diagram below).

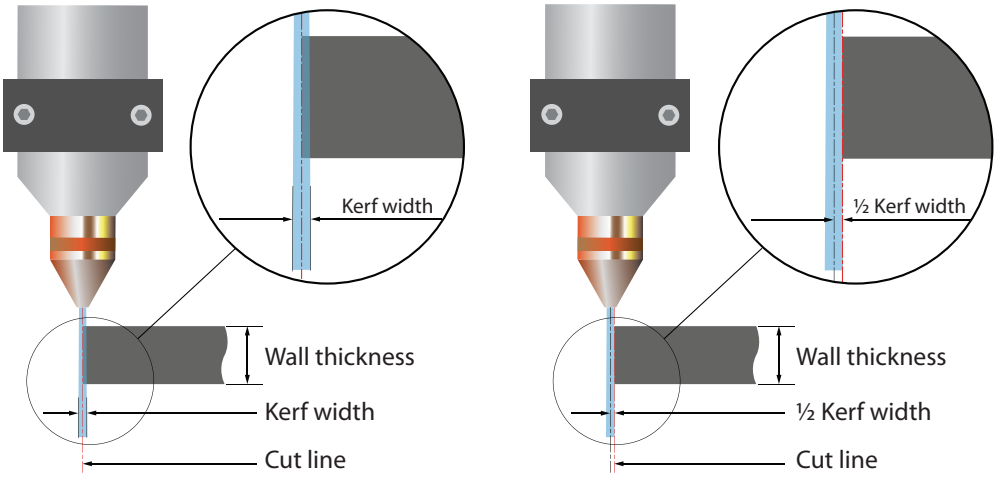


The torch height is the distance from the torch tip to the material. The combination of the torch height, the angle of tilt and the virtual burner height makes it possible to calculate the distance the cutting head must be offset to cut the material at exactly the right point (see diagram above). The position of the torch in the holder and the torch height have no effect on the virtual burner height.

Because it is impossible to measure, the VBH is set to its approximate value and the test piece is cut. The result of the test piece provides the information necessary to calculate the correct value of the virtual burner height. If the value of the VBH is set too low the cutting head will not move far enough and the test piece will be too big. If the value of the VBH is too high the torch will move too far and the test piece will be too small. By entering the measurements of the test piece in the fields provided the VBH will automatically be calculated for you.

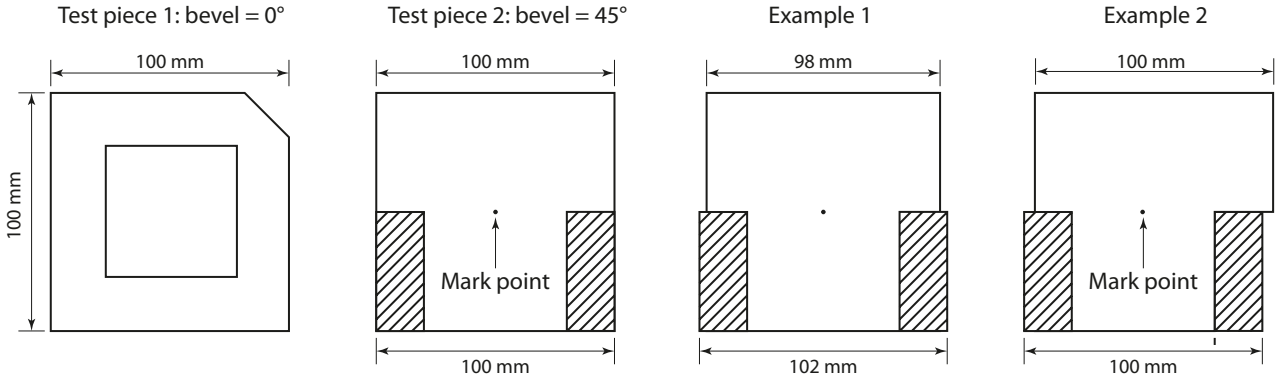
Kerf width

The kerf width is the thickness of the cutting beam. To maximise the accuracy of the cut an offset is calculated which moves the cutting beam a small distance away from the cut line (this is normally half the thickness of the beam). In this way the actual cut is exactly on the cut line (see diagram below).



Evaluating the second test piece

If the side of the test piece without a bevel is too small (by 2 mm in example 1 below), the torch has not compensated enough for width of the beam so the kerf width must be increased (by 2 mm). If the side is too big, the torch has compensated too much, the kerf width must be decreased.



If the side of the test piece with a bevel is too big (by 2 mm in example 1 above), the value of the VBH is too low and must be increased. If the side is too small then the value of the VBH is too high and must be decreased.

If all the mechanical and software calibration has been carried out as described in this appendix, the deviation shown in example 2 above should not happen. If the two halves are out of alignment this can only be caused by the torch being off centre in the cutting head. Either the mechanical calibration described in 'Setting the torch in the centre of the cutting head' has not been carried out (correctly). Or the torch may have collided with another component or the material. In both cases the mechanical calibration must be repeated and new test pieces cut.

WARNING!
Test pieces will be hot due to the cutting process! Always wear flame proof gloves and flame proof clothing when cutting test pieces. Do not handle the test pieces until they have cooled down or been immersed in water.

Plasma cutting

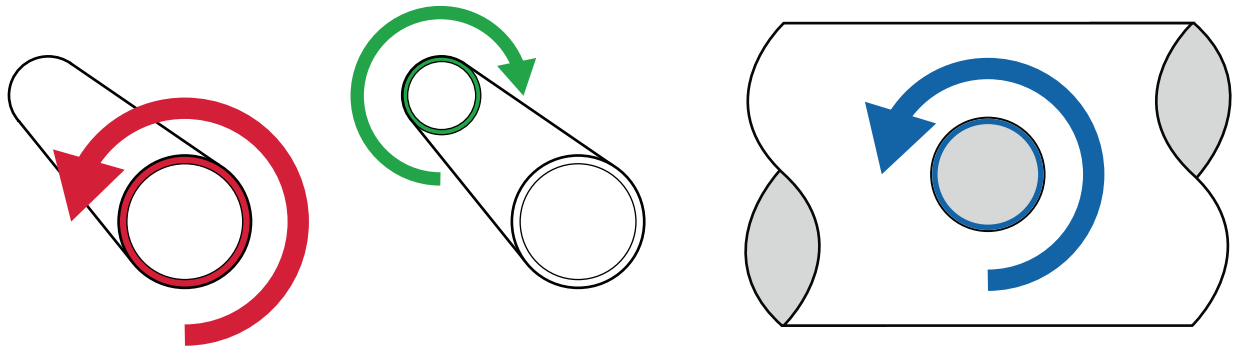
When cutting with plasma the first test piece to correct the oscillation of the torch is exactly the same as described for oxyfuel. Make sure you choose the plasma torch when selecting the cutting process. You will see that there is now only one choice of test piece. Cut the test piece as descibed in the previous section.

The remaining deviations can be evaluated and corrected by cutting a series of rings from the pipe. The ring is formed by cutting two chamfers a small distance apart. The first chamfer will be used to assess the angle of the beam relative to the material. By cutting a chamfer with a default slope (90°), the cut should be perpendicular to the outer wall of the pipe. When cutting with plasma it is important that the side of the plasma beam adjacent to the part is accurate and correct. The opposite side of the beam will be on the scrap or waste side of the cut and is unimportant to the accuracy of the finished part.

It is therefore important to understand the factors that influence and affect the quality of plasma cutting so that the test pieces can be correctly evaluated. This section describes in detail the causes of the deviations that will be corrected by cutting and evaluating the rings that are to be cut from the pipe.

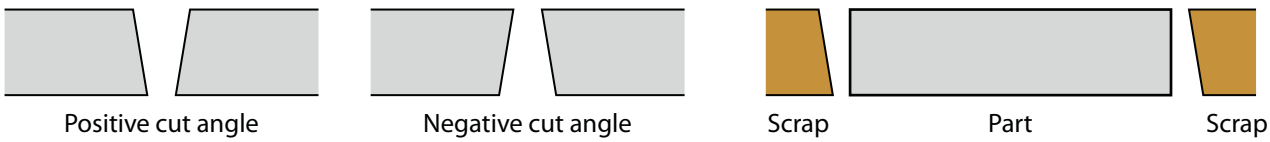
Cutting direction

The cutting direction is important. The right hand side of the cut (relative to the forward motion of the torch) is always the 'good' side. Depending on the cut, this can mean that the cutting direction is clockwise or anti-clockwise. The 'part' should always be on the right hand side of the plasma arc, the 'scrap' always on the left hand side. When cutting holes or slots the 'good' side is always on the outside of the hole, the inside is the the circle being cut out, the scrap side.



Cut angle

This refers to the angularity of the cut itself. A 'positive' cut angle occurs when more material is removed from the top of the cut than the bottom. A 'negative' cut angle occurs when more material is removed from the bottom. Don't forget that the right hand side must be straight, the left hand side (scrap side) will always have a degree of angularity but this is not important to the quality.



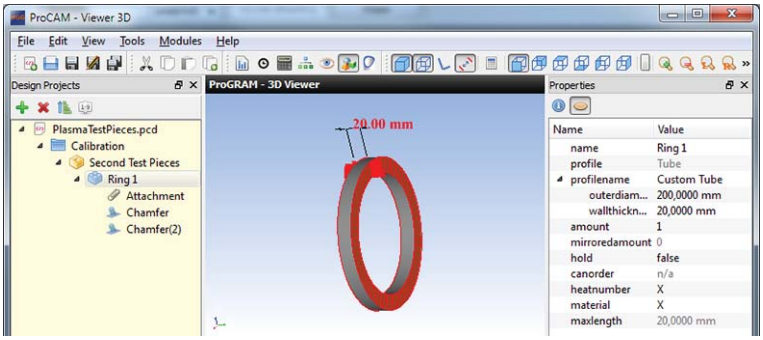
A cut angle problem can also be caused bij misalignment of the torch. To check whether it is the plasma system or a mechanical problem, make a test cut and measure the angles. Rotate the torch 90° in its holder and repeat the cut. Measure the angles again. If the angles are the same on both tests then it is a mechanical alignment problem. If the angles are all positive or all negative it can be corrected with an angle correction in the settings.

Cutting the second test pieces for plasma

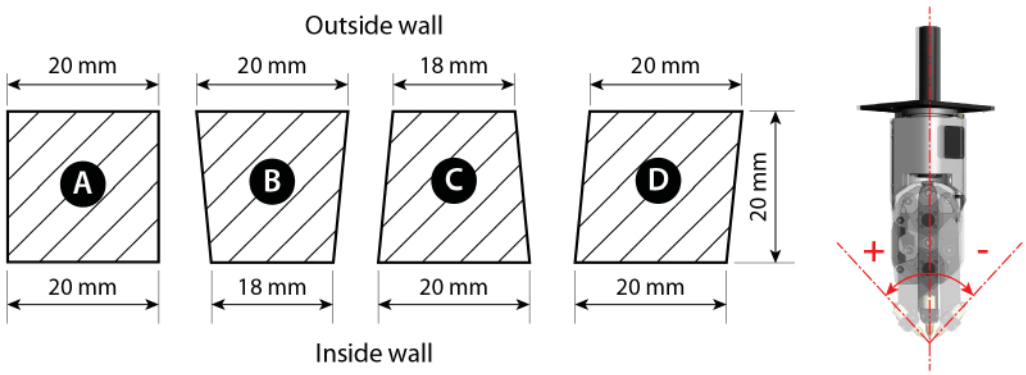
In order to correct deviations caused by the factors mentioned in the previous section you should now cut a series of rings from a pipe with the same (or similar) dimensions to the material from which your parts are to be cut. Whenever you change material or change the consumables in your plasma torch it is advisable to cut these pieces again. The size of the nozzle opening, the cutting current, the wall thickness of the material and the plasma gases used can all have an effect on the width and shape of the plasma beam.

Plasma angle correction

Open ProCAM by clicking on the icon at the top of the touchscreen. Create a new file in ProCAM. Make sure the part has the exact dimensions of the pipe you are using to cut your rings. In the MDI module, program a 'Chamfer' macro on the start and end sides. The value of the bevel should be 0°. The 'clorigin' parameter (centreline origin) determines the length of the part, in this case the width of the ring. Set this value to at least 20 mm on the end side in the MDI module. The default 'Slope' parameter (for a perpendicular cut) is 90°. In ProCAM the part will look like the image below.



When the part has cooled, use a pair of calipers to measure the width of the ring at the outer wall and at the inner wall at several places around the ring. The perfect ring should be 20 mm wide at all locations on both the inner and outer walls. If there is a difference between the width of the inner and outer walls, measure the angle and enter the angle in the settings. Because the pipe will rotate in opposite directions for the two chamfers (see cutting direction) the angles on the left and right side of the ring may differ so it is important that you know which side is which (for example mark the right side of the ring before cutting the left side). In the settings enter the angle corrections for the left and right sides of the ring. See the diagram below showing a section of the wall of the ring to determine whether the correction should be positive or negative. If you have corrected the wrong way the in the next cut you will see that the deviation is twice as bad!

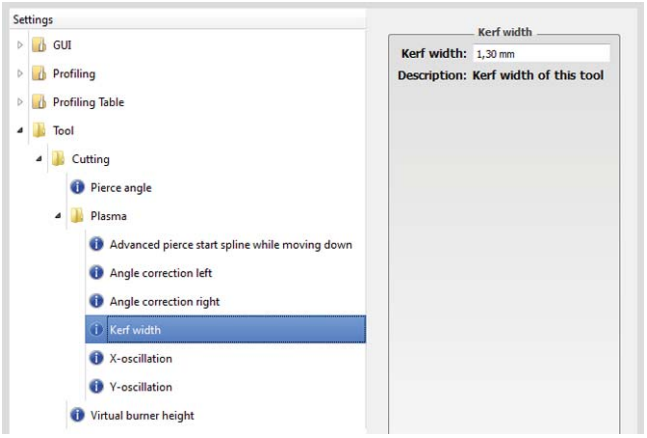


A No corrections
B Angle correction right = positive. Angle correction left = negative.
C Angle correction right = negative. Angle correction left = positive.
D Angle correction right = negative. Angle correction left = negative.

Kerf width correction

For the second ring exactly the same file can be used. Now that the angles corrections have been enterred the kerf width can be accurately measured. Load the same cutting file as you used for the first ring and select an initialisation point. Cut the two chamfers as before. Using a pair of calipers, measure the width of the ring. The width at the inner and outer walls should now be the same, if this is not the case check your angle corrections have been correctly entered in the settings (positive or negative).

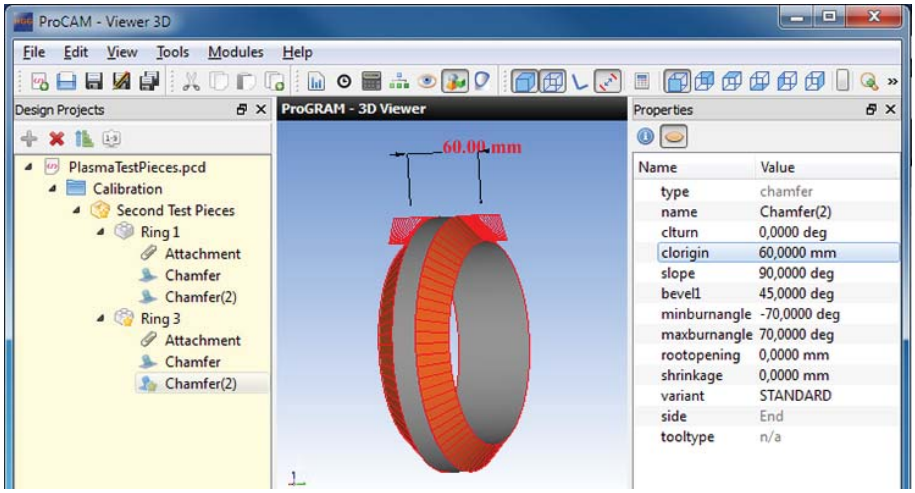
If the ring is too narrow (smaller than 20 mm) the value of the kerf width in the settings must be increased by half the difference. The software has not compensated enough. So if the width is 18 mm, the difference is 2 mm, increase the kerf width value by 1 mm. If the ring is too wide (more than 20 mm) the value of the kerf width must be decreased. The software has over compensated. So if the width is 22 mm, the difference is 2 mm, decrease the kerf width in the settings by 1 mm.



Virtual Burner Height correction

When cutting a bevelled chamfer, the cutting head will move to the side to compensate for the angle so that the inside wall of the pipe is on the cut line. The distance that the cutting head moves depends on the angle of the bevel and the virtual burner height (see the VBH diagram earlier in this chapter). To evaluate the offset you can now cut a third ring. Because this ring will have bevelled sides, the ring will have to be wider than the first two. Program the third ring in exactly the same way as the first one but with the following values changed:

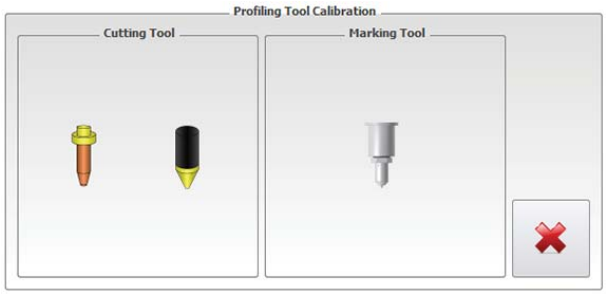
Chamfer - start (will be cut first)	Chamfer (2) - End
clorigin = 0 mm	clorigin = 60 mm
bevel1 = 45°	bevel1 = 45°

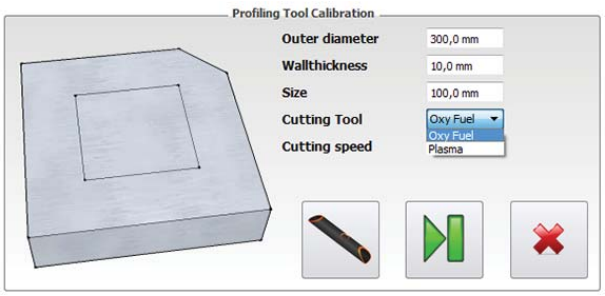


Using a pair of calipers, measure the width of the ring at the inner wall. This should be 60 mm. If the width is greater than 60 mm, the virtual burner height is too low and the value must be increased.
If the width is less than 60 mm, the virtual burner height is too high and the value must be decreased.

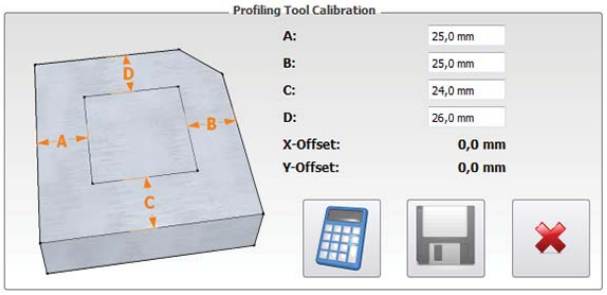
Calibrating the marking tool

To calibrate the marking tool use the same dialog, but choose the marking toolfrom the selection dialog. For marking there will also only be the oscillation test piece available because the kerf width and virtual burner height are not relevant. It is important that the cutting process is entered in the following window because the square will still be cut from the pipe. This time the inner square will be printed or punched by the marking unit. It is also important that the oscillation correction has already been carried out for htis cutting process! If this has not been done, it will affect the measurements!





Mark the inner square. Then cut the outer square. When the piece has cooled down, measure the distance from the edges of the cut piece to the marked square in the centre. Enter the measurements in the fields provided and press the ‘Calculate’ button. The offsets will be calculated automatically for you. When you are finished don’t forget to press the ‘Save’ button to store your offsets. This concludes the marking calibration.



Appendix C

Software Messages, Notifications and Errors

Software messages, notifications and errors

Error number	Error text	Problem/Reference chapter
IO Director – IO device WAGO		
002:001:001:	Could not connect to Wago. Error: <named>	Check the network connection.
002:001:002:	Wago update failure, disconnected. Error: <named>	
002:001:003:	Error checking Wago modules.	Contact HGG.
IO Director – IO device Pmac		
002:004:001	Could not connect to Pmac (IO device: <named>)	Check the network connection.
Pmac (motion controller) brick errors		
003:000:001	Following error on motor <named>	The named motor did not reach the programmed position or could not keep up with the programmed speed/acceleration. See chapter 2 of this appendix.
003:000:002	Amplifier error on Pmac motor <named>	See chapter 1 of this appendix.
003:000:003	Open loop error on Pmac motor <named>	The motor is not in 'closed loop' mode. The CNC controller is unable to control the motor.
003:000:005	Error resolving Pmac motor error when starting spline	Failed to resolve motor error, check the other errors if this error appears again, contact HGG.
003:000:006	Invalid Pmac motor status received for motor <named>: <named status>	Check the named motor, see chapter 10 of this appendix
003:000:007	Open loop on Pmac motor <named>	These are notifications, see errors 003:000:002 & 003 above.
003:000:008	Amplifier error on Pmac motor <named> See 002	
003:000:009	Invalid Pmac coord status received <named>	These are configuration errors, contact HGG.
003:000:010	Invalid parameter in CalcGears	
003:000:011	Pmac gearing deviation too large <named>	
003:000:012	Could not connect to Pmac (Motion device)	Either the network is unavailable or there is a problem with the cable (connection).
003:000:013	Error initializing Pmac with values from <named>	These errors are problems with the Pmac brick motion controller, if you see these errors contact HGG.
003:000:017	Error downloading Pmac: <named>	
003:000:018	Error initializing Pmac PLC0 program	
003:000:019	Error approaching Pmac	
003:000:020	Invalid Pmac motor status count received <named>	
003:000:021	Error executing Pmac command <named>	
003:000:022	Error opening Pmac download file <named file>	
003:000:023	Invalid Pmac global status count received <named>	

Error number	Error text	Problem/Reference chapter
Pmac (motion controller) brick errors		
003:000:024	Pmac cannot start data gathering while already gathering.	These errors are problems with the Pmac brick motion controller, if you see these errors contact HGG.
003:000:025	Pmac starting data gather failed.	
003:000:026	Pmac stopping data gather failed.	
Pmac (motion controller) brick errors		
003:000:027	Pmac download data gather failed (count data addresses).	These errors are problems with the Pmac brick motion controller, you see these errors contact HGG.
003:000:028	Pmac download data gather failed (count data samples).	
003:000:029	Pmac download data gather failed (list gather).	
003:000:030	Pmac download data gather failed (size mismatch: received <named>; expected: <named>	
003:000:031	Pmac download data gather failed (conversion).	
003:000:032	Pmac download data gather failed (sample time).	
003:000:033	Pmac cannot cannot gather 24 bit addresses, 48 bit address starts with $4 or $C.	
003:000:034	Pmac error aborting gather.	
003:000:035	Invalid Pmac motor speed count received <named>	
003:000:036	Home offset <named> out of bounds (-8388608 - 8388607).	
003:000:037	SendSplinePoints: SplineposSize < 1	
Max Controller		
003:001:001	Open loop: <named>axis	The motor is not in ‘closed loop’ mode. The CNC controller is unable to control the motor.
003:001:002	Following error: <named>	The named motor did not reach the programmed position or could not keep up with the programmed speed/acceleration. See chapter 2 of this appendix.
003:001:003	Amplifier error: <named>	See chapter 1 of this appendix.
003:001:007	Positive hardware limit: <named>	These are ‘end switch’ errors. The motor has reached it’s positive or negative end. The motor can only be moved away from the end switch. See chapter 3 of this appendix.
003:001:008	Negative hardware limit: <named>	
003:001:009	Positive software limit: <named>	These are software movement limits, use the manual jogging to move away from the limit.
003:001:010	Negative software limit: <named>	
003:001:190	Position not reached after move to	The next position has not been reached (in time), try again.

Error number	Error text	Problem/Reference chapter
Max Controller		
003:001:315	Error starting spline (motion controller: <named>).	These are software problems with the Max controller, usually you will have received other error messages prior to one of these. If the problem could not be solved and one of these messages continues, contact HGG.
003:001:316	Error preparing start spline (motion controller: <named>).	
003:001:317	Gearing of axes failed (motion controller: <named>)	
003:001:318	Ungearing of axes failed (motion controller: <named>)	
003:001:319	Geared axes. master: <named>; slave: <named>.	
003:001:320	Ungeared axes. master: <named>; slave: <named>.	
Axes		
003:002:001	Merged softlimits of slave axes <named> and master axis <named>: neg.: <number>, pos.: <number>	This is a software problem caused by overlapping axes in the configuration, contact HGG.
Safety Overrule		
003:003:001	Overrule safety enabled	These are not errors but notifications. If the operator chooses to overrule the safety speed this message will appear.
003:003:002	Overrule safety disabled (manual)	
003:003:003	Overrule safety disabled (automatic)	
Laser Measurement System		
003:017:001	Keyence, settings loaded*	Messages marked with * are notifications, not errors. Messages marked with [1] are connection errors, check the USB stick and connections For the remaining messages, check that the laser is in position and free from blockages or dirt and try again. If the problem persists, contact HGG.
003:017:002	Error reading Keyence settings. Missing: <named parameter>	
003:017:003	Keyence: Error initializing. Device not present?[1]	
003:017:004	Keyence: Error starting data gather.	
003:017:005	Keyence: Error stopping data gather or download gather buffer.	
003:017:006	Keyence: Error loading LkIF dll.	
003:017:007	Keyence: Error setting up communicating with controller.[1]	
003:017:008	Keyence: Error aborting data gather.	
003:017:009	Keyence: Error, no communication with controller.[1]	
003:017:010	Keyence: Lost communication with controller*[1]	
Data collector		
003:025:001	Data Collector returned no result. Data not collected.	The data collector keeps a record of machine activity. Messages marked with * are notifications not errors. For the remaining messages, check the path (file location).
003:025:002	Purging archive ... (older than <number> days)*	
003:025:003	Purged archive*	
003:025:005	Data Collector, settings loaded*	

Error number	Error text	Problem/Reference chapter
Digitax (variable speed drive for servo motors)		
003:029:001	Unable to connect to digitax <named>	Messages marked with * are notifications not errors. The remaining messages all refer to the Digitax servo motor drive, if an error occurs first try: 1 Checking the connections 2 In the case of a trip, reset Digitax 3 In case of a timeout, try again If none of these actions solve the problem, contact HGG.
003:029:002	Unable to resolve trip error on digitax motor <named motor>	
003:029:003	Unable to resolve digitax motor error on motor <named motor>	
003:029:004	Connection lost at <named>	
003:029:005	Connection restored to <named>*	
003:029:006	Successfully connected to <named>*	
003:029:007	Error reading inputs: <named>	
003:029:008	<named> Has tripped	
003:029:009	<named> module slot 1 error SM-Ethernet module error code <code>	
003:029:010	<named> module slot 2 error SM-Universal Encoder Plus module error code <code>	
003:029:011	<named>module slot 3 error SM-EZMotion Module error code <code>	
003:029:012	<named> Following error	
003:029:013	<named> Drive type cannot perform home by falling edge.	
003:029:014	<named> Function not yet implemented.	
003:029:015	<named> Home action took too long.	
003:029:016	<named> Moved too much while trying to home.	
003:029:101	A vital variable is missing from the configuration file: <named file>	
003:029:102	Configuration file not openable for reading <named file>	
003:029:103	Configuration file corrupt, XML error: <named error> at line <number>	
003:029:104	Configuration file corrupt, DigitaxMC element not found	
003:029:105	Config. file corrupt, DigitaxMC name not found	
003:029:106 003:029:107	Configuration file corrupt, error reading general data (var data)	
Plasma Service Counter		
003:031:003	<named> value changed from <value> to <value>	These are notifications, not errors. The values have been changed in the settings.
003:031:004	<named> max changed from <value> to <value>	

Error number	Error text	Problem/Reference chapter
HiFocus Plasma Unit		
003:032:001	HiFocus, settings loaded.	This is a notification not an error.
003:032:002	Error reading HiFocus settings. Missing <named setting>	Check the connection.
003:032:003	HiFocus, cannot open communication: <named>	Check the connection. Try again.
003:032:004	HiFocus, communication error: <named>	
003:032:005	HiFocus, error setting gas parameters: <named>	Check the settings on the plasma unit
003:032:006	HiFocus, plasma unit not enabled	Notification. Enable the plasma unit in the settings and try again.
003:032:007	HiFocus, serial communication not enabled in settings	Notification. Contact HGG, serial communication has not been enabled I n the settings.
REA Inkjet Printer		
003:033:001	ReaDriver. Opening com port <number> failed	Check the connection and try again
003:033:002	ReaDriver. Configuring com port <number> failed	
003:033:003	ReaDriver. Setting flow control of com port <number> failed	
003:033:004	ReaDriver. Setting callback function for data reception on com port <number> failed	These are communication problems between the printer controller and the driver. Turn the printer off, wait a short time. Turn the printer on again. If the problem continues contact HGG
003:033:005	ReaDriver. Wait for ACK: reception of answer data from printer driver took more than 2 seconds	
003:033:006	ReaDriver. Wait for ACK:reception of ACK from printer driver failed; no data was received (returncode sio_read <code>)	
003:033:007	ReaDriver. Wait for ACK: ACK received.	
003:033:008	ReaDriver. Wait for ACK: reception of ACK from printer driver failed; received char was not ACK (0x06) but < code>)	
003:033:009	ReaDriver. RequestToSend: sending ‘request to send’ to printer driver attempt <number> of <total number>	
003:033:010	ReaDriver. RequestToSend: error occurred while sending ‘request to send’ to printer driver (returncode sio_write <code>)	
003:033:011	ReaDriver. Request ToSend: Waiting for ACK	
003:033:012	ReaDriver. SendCommandToPrinter: sending command: <named command>	
003:033:013	ReaDriver. SendCommandToPrinter: transmission of data chars failed (sio_write returned <code>)	

Error number	Error text	Problem/Reference chapter
REA Inkjet Printer		
003:033:014	ReaDriver. SendCommandToPrinter: transmission of data chars failed, not all chars were sent (<number> of <total number>)	These are communication problems between the printer controller and the driver. Turn the printer off, wait a short time. Turn the printer on again. If the problem continues contact HGG
003:033:015	ReaDriver. SendCommandToPrinter: waiting for ACK of REA printer	
003:033:016	ReaDriver. Unknown width: <named>	
003:033:017	ReaDriver. Unknown orientation: <named>	
003:033:018	ReaDriver. Unknown direction: <named>	
003:033:019	ReaDriver. Unknown size: <named>	
003:033:020	ReaDriver. Unknown side: <named>	
003:033:021	ReaDriver. No com port configured	
Default settings		
005:000:001	Setting not found: <named setting>, using default value <named value>	This is a notification, not an error. The named setting was not found and the default value will be used. If another value is desired, make a note if the setting and value named and contact HGG.
005:000:002	Setting not found: <named setting>, default value also not found! Value is undefined!	No default value has been found for this setting. Contact HGG.
General errors		
005:001:001	Timeout homing <named>	Timeout errors indicate that the position has not been reached within the set time limit. This could just be the distance that must be travelled, try again. Pre-home timeouts mean the cutting head have not reached (or are already in) the position required for homing, jog a small distance away and try again.
005:001:002	Timeout pre-homing <named>	
005:001:003	<named> invalid axis configuration	Software error, make a note of which axis is giving problems and contact HGG
005:001:004	Timeout approaching axis <named axis>	See explanation above for errors 005:001:001 and 002
005:001:005	Timeout moving <named axis>	
General notifications		
005:002:001	Starting up...	These are general notifications for the operator (not errors).
005:002:002	Started up	
005:002:003	Shutting down...	
005:002:004	Shut down	

Error number	Error text	Problem/Reference chapter
ProCAM		
005:002:006	Error starting ProCAM	First check the path the try again. The default path is C:\Program Files\HGG\ProCAM
005:002:007	Error reading Host settings. Missing: <named parameter>	Check settings location (only available in maintenance level access), otherwise contact HGG.
005:002:008	License not found	Insert your HASP key (see ProCAM manual for further help)
005:002:009	License lost, shutting down after <number> seconds	Insert key. If the key is inserted, check the connection, remove and replace the key.
005:002:010	License restored	Notification.
Control Unit		
005:003:002	Emergency stop active	Notification. See chapter 6 of this appendix.
005:003:003	Control unit overheated	Check the air conditioning unit.
005:003:004	Motor(s) overheated	See chapter 11 of this appendix.
005:003:005	No air pressure	Notification, check the air pressure.
005:003:006	Control unit door opened	Close the door before continuing.
005:003:007	Error resetting emergency stop	Try again, if the problem persists, contact HGG.
005:003:008	Emergency stop successfully reset	Notification.
Main Drive - Rotation		
005:005:002	Main Drive Rotation is not allowed, profiling is active	The main drive cannot be rotated during profiling.
005:005:003	Main Drive Rotation is not allowed, automatic mode is active	In automatic mode the machine moves automatically to the next position, manual rotation is not allowed in automatic mode.
005:005:004	Main Drive Rotation is not allowed, Clamping cylinder is not in	The pin blocking rotation during clamping is inserted (cylinder out), complete clamping before rotating (this error applies to the SPC 330).
Main Drive – Height hydraulic		
005:009:001	Main Drive Height at top position	These are notifications for the operator (not errors).
005:009:002	Main Drive Height at bottom position	
Main Drive - CNC Clamping (SPC330)		
005:014:001	Main Drive Clamping is not allowed, Main Drive Rotation is not idle	The main drive is rotating, clamping is not allowed.
005:014:002	Main Drive Clamping is not allowed, Profiling is active	Clamping is not allowed during profiling.

Error number	Error text	Problem/Reference chapter
Main Drive - CNC Clamping (SPC330)		
005:014:003	Main Drive Clamping failed, Main Drive Rotation not in position	The pin locking rotation cannot be inserted because the main drive is not correctly aligned. Jog the main drive rotation away and move back to position and try again.
005:014:004	Timeout homing Main Drive Clamping	The main drive has not reached the clamping 'home' position (in time). Try again.
005:014:005	Error reading Main Drive Clamping CNC settings. Missing: <named parameter>	Check the main drive clamping settings, one of the parameters is invalid or missing
005:014:006	Main Drive Clamping is not allowed, automatic mode is active	In automatic mode the machine moves automatically to the next position, manual clamping is not allowed in automatic mode.
005:014:007	Main Drive Clamping failed, Main Drive Rotation is not homed	Home the main drive rotation before clamping. If the main drive does not rotate, try jogging the rotation a small amount, then home the rotation again
005:014:008	Main Drive Clamping CNC axis not found in motion controller	These are software configuration problems which should no longer occur. If they do, contact HGG.
005:014:009	Main Drive Clamping CNC invalid axis configuration	
005:014:010	Main Drive Clamping cylinder out timeout	It has taken too long for the cylinder to push the locking pin into position, check that the main drive is correctly aligned and try again.
005:014:011	Error calculating preopening for Main Drive Clamping	The jaws have not opened to insert the pipe. Calculation error, check the clamping settings (inside/outside) and try again.
005:014:012	Main Drive Clamping cylinder in timeout	It has taken too long for the cylinder to retract the locking pin. Check that the pin is free to move. Try again.
005:014:013	Main Drive Clamping timeout moving to home position	It has taken too long for the jaws to reach the home position. It may just be the distance, try again.
005:014:014	Error calculating parameters for automatic clamping	The pipe diameter or wall thickness is out of the range for this machine.
005:014:015	Main Drive automatic clamping failed to clamp material	Check that the material is present and in position. Check the clamping settings. Check that the jaws are moving freely.
005:014:016	Timeout Main Drive clamping automatic unclamping	It has taken too long for the jaws to release the pipe. Check the clamping settings (inside/outside of pipe). Try again.

Error number	Error text	Problem/Reference chapter
Main Drive – Hydraulic height encoder		
005:016:001	Main drive height at top position	These are not errors but notifications for the operator.
005:016:002	Main drive height at bottom position	
Cutting Trolley		
005:018:002	Cutting Trolley Longitudinal movement is not allowed when Control Unit door is open.	This is a safety precaution. Close the control unit door and try again.
005:018:003	Cutting Trolley Longitudinal home only allowed when Cutting Trolley Height at top.	To avoid collisions or damage to the cutting head, longitudinal movement of the cutting trolley is only allowed when the cutting trolley is in the 'top' position.
005:018:004	Cutting Trolley Longitudinal move is not allowed, Profiling is active	Longitudinal movement is not allowed during profiling.
005:018:005	Cutting Trolley Longitudinal move is not allowed, automatic mode is active	In automatic mode the machine moves automatically to the next position, longitudinal jogging is not allowed in automatic mode.
005:018:006	Cutting Trolley Longitudinal move is not allowed in home area when safety is not activated or not in top	The 'home' area is a software defined region. If you wish to move the trolley in this area, activate the safety and be careful or first move the cutting trolley to the 'top' position
005:018:007	Cutting Trolley Longitudinal timeout moving to switch	It has taken too long to reach the 'home' or 'end' switch. Check the switch and try again.
Main Drive - Hydraulic motor		
005:022:002	Overload of main drive hydraulic motor	Check the motor protection circuit breaker. See also chapter 11 of this appendix.
Cutting Trolley – Height pneumatic (PC600 ProCutter)		
005:024:001	Timeout Cutting Trolley height to top	The cutting trolley has not reached the 'top' position (in time). Timeout errors indicate that the position has not been reached within the set time limit. This could just be the distance that must be travelled, try again.
Cutting Trolley – Height spring loaded (SPC500-1200)		
005:025:001	Timeout Cutting Trolley Height to top	The cutting trolley has not reached the height position (in time). Timeout errors indicate that the position has not been reached within the set time limit. This could just be the distance that must be travelled, try again.
005:025:002	Timeout Cutting Trolley Height to pipe	
005:025:003	Timeout Cutting Trolley Height to float	
005:025:004	Timeout Cutting Trolley Height to free	
005:025:005	Cutting Trolley Height move to top not allowed when axis is not homed	First home the CTH axis (cutting trolley height), then try again.

Error number	Error text	Problem/Reference chapter
Cutting Trolley – Height spring loaded (SPC500-1200)		
005:025:007	Cutting Trolley Height down is not allowed when on pipe	Moving the trolley down when it is in 'pipe' position is not allowed to prevent damage to the torch/cutting head.
005:025:008	Cutting Trolley Height down move is not allowed in home area when safety is not activated	The 'home' area is a software defined region, movement in this area could result in damage or collisions. If you wish to move the trolley in the area activate the safety to slow movement and be careful.
005:025:009	Cutting Trolley Height down is not allowed, Profiling is active	The cutting trolley cannot be moved down during profiling.
005:025:010	Cutting Trolley Height down is not allowed, automatic mode is active	The cutting trolley cannot be moved down in automatic mode.
005:025:011	Cutting trolley height end limit reached when moving to pipe	Check that there is a pipe loaded. Is the pipe too small? Try raising the cutting trolley, raising the main drive and moving to pipe again.
Cutting Trolley – Height sensor (SPC1500-2500; SPC1200RB; RBPC)		
005:026:001	Timeout cutting trolley height to top	The cutting trolley has not reached the height position (in time). Timeout errors indicate that the position has not been reached within the set time limit. This could just be the distance that must be travelled, try again.
005:026:002	Timeout cutting trolley height to pipe	
005:026:003	Timeout cutting trolley height to float	
005:026:004	Timeout cutting trolley height to free	
005:026:005	Cutting trolley height move to top not allowed when axis is not homed (which axis See above 005:025)	First home the CTH axis (cutting trolley height), then try again.
005:026:007	Cutting trolley height down is not allowed when on pipe	Moving the trolley down when it is in 'pipe' position is not allowed to prevent damage to the torch/cutting head.
005:026:008	Cutting trolley height down move is not allowed in home area when safety is not activated	The 'home' area is a software defined region, movement in this area could result in damage or collisions. If you wish to move the trolley in the area activate the safety to slow movement and be careful.
005:026:009	Cutting trolley height down is not allowed, profiling is active	The cutting trolley cannot be moved down during profiling.
Cutting Trolley – Height sensor (SPC1500-2500; SPC1200RB; RBPC)		
005:026:010	Cutting trolley height down is not allowed, automatic mode is active	The cutting trolley cannot be moved down in automatic mode.
005:026:011	Cutting trolley height end limit reached when moving to pipe	Check that there is a pipe loaded. Is the pipe too small? Try raising the cutting trolley, raising the main drive and moving to pipe again.
005:026:012	Initialising cutting trolley height sensor arms, no air pressure available	Check the air pressure and the connections.

Error number	Error text	Problem/Reference chapter
Cutting Trolley – Height sensor (SPC1500-2500; SPC1200RB; RBPC)		
005:026:013	Could not initialise cutting trolley height sensor arms, sensor range is too small	Check the mechanical calibration of the sensor arms and try again
005:026:014	Could not initialise cutting trolley height, timeout sending PLC program to Pmac	Check the connection and try again.
005:026:015	Could not move cutting trolley height to pipe, sensor is not free	Check that the sensors are free (and not already resting on the pipe)
005:026:016	Cutting trolley height end limit reached when moving to free	The cutting trolley cannot move any higher. Lower the cutting trolley and try again
005:026:017	Cutting trolley height encountered end switch during pipe movement	The pipe is too low/too small or there is no pipe present
005:026:018	Cutting trolley height move down is not allowed when sensor is not initialised	This is a safety feature to prevent the torch hitting the pipe. First initialise the height sensor in the diagnostics screen, cutting trolley tab
005:026:019	Cutting trolley height error following pipe contour	A drastic movement has triggered one of these safety warnings (e.g. one or both sensor arm(s) has dropped into a hole in the pipe or rest material on the pipe has caused the sensor arm to jump). Check the pipe and try again
005:026:020	Cutting trolley height error following pipe contour, positive deviation too big	
005:026:021	Cutting trolley height error following pipe contour, negative deviation too big	
005:026:022	Cutting trolley height error following pipe contour, torch has hit pipe	
005:026:023	Cutting trolley height sensor reached during jog movement	Material has triggered the sensor arms, remove material and continue
005:026:024	Cutting trolley height to pipe is not allowed, sensor is not initialised	This is a safety feature to prevent the torch hitting the pipe. First initialise the height sensor in the diagnostics screen, cutting trolley tab
005:026:025	Could not move cutting trolley height to pipe, error setting PLC data	This is a software problem, contact HGG
Gas Cutting		
005:028:001	Timeout moving up for piercing	Timeout errors indicate that the position has not been reached within the set time limit. Try again.
005:028:002	Timeout moving to float after piercing	
005:028:003	Timeout moving to pipe after piercing	
005:028:005	Timeout moving up for preheating	The action took too long, try again.
Plasma Cutting		
005:030:001	Timeout waiting for plasma unit ready	Check the plasma unit.
005:030:002	Plasma pilot arc timeout	
005:030:003	Timeout moving up for piercing	Timeout movement errors indicate that the position has not been reached within the set time limit. Try again.
005:030:004	Timeout moving to float after piercing	
005:030:005	Timeout moving to pipe after piercing	

Error number	Error text	Problem/Reference chapter
Plasma Cutting		
005:030:006	Plasma main arc lost	Enabling the option ‘Resume main arc on lost’ will cause the machine to try to automatically re-ignite.
005:030:007	Stopping plasma tool	These are notifications for the operator.
005:030:008	Restarting plasma tool	
005:030:010	Plasma main arc timeout	Check the plasma unit. Try again.
Software errors		
005:031:001	Construction of IO devices failed	These are software configuration errors, check all connections. If the errors continue to occur contact HGG.
005:031:002	Machine configuration validation failed: <named>	
005:031:003	Error loading machine configuration: <named>	
Fume Extraction Unit		
005:032:001	Fume extraction started	Notifications for the operator.
005:032:002	Fume extraction stopped	
Profiling		
005:033:002	Error calculating data file, file does not exist: <named file>	Could not find data file, check the path (location of file).
005:033:003	Trying to calculate unknown data file type: <named file>	The data file is not in the correct format (or missing) check path, ‘save as’ in the correct format.
005:033:004	Error starting ProCalc2: <named error>	Failed to calculate, check path. If the error persists, contact HGG.
005:033:005	Timeout calculating data file	Check the path, file format and parameters. Try again after correcting.
005:033:006	Calculation result file not found: <named file>	Calculation failed. Check the path, file format and parameters. Try again after correcting.
005:033:007	Error opening calculation result file: <named file>	File not found or corrupted. Check the path, file format and parameters. Try again after correcting.
005:033:008	Calculation result file format incorrect: <named file>	This is a software problem, contact HGG (make a note of the file name).
005:033:009	Calculation error: <named error>	Named error, check file and parameters.
005:033:010	Timeout moving cutting head to laser initialisation point	Check that the initialisation point is set to laser in the settings, try again.
005:033:011	Error loading SET file: <named file>	The part (or data) file is invalid or has not been found. Check the path, check the file.
005:033:012	Error loading GPT file: <named file>	
005:033:013	No valid cutting data loaded	
005:033:014	Error optimizing Main Drive Rotation position	Try manually rotating the main drive a small amount, then try again.

Error number	Error text	Problem/Reference chapter
Profiling		
005:033:015	Timeout moving axes to start position	It has taken longer than the set time limit for all axes to reach the 'start' position, try again.
005:033:016	Data file type <named file type> not available yet!	This is an older cutting file which is not yet supported by this system. Contact HGG for help or advice.
005:033:017	Can't calculate unknown GPD type	This is a new cutting file format, contact HGG for conversion.
005:033:018	Error loading profiling table: <named>	Check the settings in the profiling table.
005:033:019	Wall thickness not found in profiling table	
005:033:020	Cutting Trolley Height to pipe took too long	It has taken too long for the cutting trolley to reach the pipe. Check that the trolley is moving freely, try again.
005:033:021	Error moving Cutting Trolley Height to pipe	Manually move the cutting trolley up a small amount and try again. If the problem persists, contact HGG.
005:033:022	Cutting Trolley Height to free took too long	It took too long to move the cutting trolley a safe distance from the pipe, try again.
005:033:024	Automatic profiling cannot be enabled, machine is not homed	Home the machine axes and try again.
005:033:025	Error calculating data file, diameter <named value> too big, max=<named value>	The diameter of the pipe in the file is too big for the machine. It can't be larger than the named maximum. Check the data file.
005:033:026	Error calculating data file, diameter <named value> too small, min=<named value>	The diameter of the pipe in the file is too small for the machine. It can't be larger than the named minimum. Check the data file.
005:033:027	Error calculating data file, wall thickness <named value> too big, max=<named value>	The wall thickness of the pipe is too thicker than the named maximum thickness. Check the data file.
005:033:028	Error calculating data file, wall thickness <named value> too small, min= <named value>	The wall thickness of the pipe is too thin. It can't be thinner than the named minimum. Check the data file
005:033:029	Error loading profiling tables: <named table>	Check the profiling table in the settings. If it is correct and the problem persists, contact HGG
005:033:030	Profiling table for tool <named tool> is not available	The profiling table for oxyfuel or plasma has not been found. Check the table in the settings. If no table exists, contact HGG.
005:033:031	Profiling table for tool <named tool> and material <named material> is not available	There is no cutting table for this combination of material and cutting tool. Contact HGG.

Error number	Error text	Problem/Reference chapter
Profiling		
005:033:032	Error getting <named value> for wall thickness <named wall thickness> from profiling table <named table>	The value for the wall thickness in the cutting table is missing or invalid. Check the table and edit as necessary.
005:033:033	Generic error from the host system call	Contact HGG
005:033:034	Not all profiles fit within the machine frame, data file cannot be fully profiled	Check the data file, some profiles are too large to fit within the machine frame.
005:033:035	There are profiles that are placed in the main drive area, data file cannot be fully profiled	Some profiles in the data file will be too close to the main drive. Use a longer stock length or deselect some sets of the data file.
005:033:036	ProCam version is incorrect, installed version is <named version>, minimum required version is <named version>	Some features are not present in the installed version of ProCAM. Contact HGG for an upgrade.
005:033:037	Error starting MPCCalc: <named error>	There is a problem with the box section calculation module or an older version of ProCAM has been used for the design. Contact HGG
005:033:038	Error loading angle file: <named file>	
005:033:039	Incompatible angle file version: V<version number>	
005.033.040	Error loading data file information from <named data file>	Check the data file. Try again
005.033.041	License key error <named error>	Make a note of the error and call HGG
005:033:100	TAF file contains invalid part: <named part>	One or more parts nested in the stock is invalid. Check the data file.
005:033:101	TAF file contains file type: <named file>	This is a notification not an error
Cutting Head Rotation (SPC, SPC-RB, RBPC machines)		
005:043:001	Cutting Head Rotation axis is free. Please position the axis at its ‘home’ position	Notification during calibration. Manually rotate the cutting head to its home position.
005:043:002	Cutting Head Rotation axis calibration has been completed	Notification. The calibration has been successfully completed.
005:043:003	Cutting Head Rotation axis calibration has failed. Timeout on range calibration.	Notification. It has taken too long to complete the rotation range check of the cutting head. Try again
Cutting Head Pitch (PC600 ProCutter machines)		
005:044:001	Cutting Head Pitch axis is free. Please position the axis at its home position	Notification for the operator. The cutting head can now be manually moved to its home position.
005:044:002	Cutting Head Pitch axis calibration has been completed	Notification for the operator.

Error number	Error text	Problem/Reference chapter
Cutting Head Tilt (SPC, SPC-RB, RBPC machines)		
005:045:001	Cutting Head Tilt axis is free. Please position the axis at its home position	Notification for the operator. The cutting head can now be manually moved to its home position.
005:045:002	Cutting Head Tilt axis calibration has been completed	Notification for the operator.
Cutting Head Roll (PC600 ProCutter machines)		
05:046:001	Cutting Head Roll axis is free. Please position the axis at its home position	Notification for the operator. The cutting head can now be manually moved to its home position.
05:046:002	Cutting Head Roll axis calibration has been completed	Notification for the operator
Main Drive Longitudinal (SPC-RB machines)		
005:048:002	Main Drive Longitudinal at positive hardware limit	Notification. The main drive has reached its positive limit.
005:048:003	Main Drive Longitudinal at negative hardware limit	Notification. The main drive has reached its negative limit.
005:048:004	Main Drive Longitudinal not at lock position	Notification. The main drive must be in the 'lock' position for auto infeed
Main Drive Transversal (SPC-RB machines)		
005:049:001	Timeout moving <named axis>	Try again
005:049:002	Unable to move < named axis > when infeed end switch found material	Material has been detected by the sensor. Movement has been blocked as a safety precaution to prevent damage to the machine or material. Check that no material is present. Check that the sensor is free from dirt or other obstructions.
005:049:003	Unable to move < named axis >. Conveyor transversal positive end switch found material.	
005:049:004	Unable to move < named axis >. Conveyor transversal negative end switch found material.	
005:049:005	Unable to move < named axis > when profiling bed end switch found material.	
005:049:006	Unable to move < named axis > when profiling.	Main drive transversal movement is not allowed during profiling or during auto mode
005:049:007	Unable to move < named axis > when in auto mode.	
005:049:008	Overrule safety not enabled.	The safety is activated, preventing movement. If you still wish to move the main drive, disable the safety on the bottom right of the touch screen and proceed with caution.
005:049:009	Main drive is in position.	These are notifications for the operator, not errors
005:049:010	Infeed conveyor is in position.	
005:049:011	Main Drive Transversal at positive end limit.	
005:049:012	Main Drive Transversal at negative end limit.	
005:049:013	Conveyor Transversal at positive end limit.	
005:049:014	Conveyor Transversal at negative end limit.	

Error number	Error text	Problem/Reference chapter
Database Errors		
005:051:003	The database connector was unable to close connection to database: <named connection>	Check connections, location and settings. If the problem continues, contact HGG.
Plasma marking		
005:052:001	Timeout waiting for plasma unit ready	Check the plasma unit.
005:052:002	Plasma pilot arc timeout	The material is too far from the torch. Check that there is material present. Check the torch height. Try again
005:052:003	Timeout moving up for piercing	Timeout errors indicate that the position has not been reached within the set time limit. Try again.
005:052:004	Timeout moving to float after piercing	
005:052:005	Timeout moving to pipe after piercing	
005:052:006	Plasma main arc lost	In the plasma settings, enabling the option 'Resume main arc on lost' will cause the machine to try to automatically re-ignite.
005:052:007	Stopping plasma tool	Notifications.
005:052:008	Restarting plasma tool	
005:052:010	Plasma main arc timeout	It took too long to ignite the main arc, try again
005:052:011	Timeout moving to pipe	Try again.
Material Length Measurement		
005:053:002	Theoretical stock item length too short to do material length measurement	The stock item in the data file is too short for a length measurement, use a longer stock item or skip the measurement.
005:053:003	Cutting Trolley Longitudinal not homed	Home the cutting trolley in the longitudinal direction and try again.
005:053:004	Error material length measurement switch not on material	The switch has lost contact with the material. It could be a distorted pipe, rotate 180° and try again. Visually check that the switch remains on the pipe
005:053:005	Timeout on moving Cutting Trolley Height to Top Position	It has taken too long to carry out the action named. It could just be the distance involved, try again.
005:053:006	Timeout on moving Cutting Trolley Longitudinal to measure start position	
005:053:007	Timeout on moving Cutting Trolley Height to Pipe Position	
005:053:008	Timeout for doing material length measurement	
005:053:009	Error maximum measure distance reached	The maximum (longitudinal) distance has been exceeded in searching for the end of the pipe. Check the theoretical length.

Error number	Error text	Problem/Reference chapter
Plasma Fine Marker		
005:055:001	Timeout waiting for plasma unit ready	Check the plasma unit and try again
005:055:002	Plasma pilot arc timeout	Wait until the torch is in position again and retry.
005:055:003	Plasma main arc lost	
005:055:004	Plasma main arc timeout	
005:055:005	Timeout moving plasma fine marker down	It has taken too long for the marking unit to reach its position. Check that it is not blocked, try again
005:055:006	Timeout moving plasma fine marker up	
Punch Marker		
005:056:001	Timeout moving punch marker down	It has taken too long for the marking unit to reach its position. Check that it is not blocked, try again
005:057:002	Timeout moving punch marker up	
Plasma Unit HiFocus		
005:057:001	Timeout moving punch marker down	It has taken too long for the marking unit to reach its position. Check that it is not blocked, try again
005:057:002	Timeout moving punch marker up	
REA inkjet printer		
005:058:001	Timeout moving REA inkjet marker down	It has taken too long for the marking unit to reach its position. Check that it is not blocked, try again
005:058:002	Timeout moving REA inkjet marker up	
Main Drive Clamping (SPC 1500-3000)		
005:059:002	Main Drive Clamping DC amplifier error	See chapter 1 of this appendix.
Control Unit		
005:060:001	Emergency stop active Fuse F21 broken	Replace the fuse
005:060:002	Emergency stop active Fuse F22 broken	
Approach errors (prior to profiling)		
005:061:001	Error approaching current set, Cutting Trolley Longitudinal is not homed	Home the cutting trolley in the longitudinal direction and try again
005:061:002	Error approaching current set, current set is located inside main drive area	Some profiles in the data file will be too close to the main drive. Use a longer stock length or deselect some sets of the data file.
REA inkjet printer controller		
005:062:001	Error communicating with printer on port <numbered port>	Check the printer connection and try again. If the problem continues, contact HGG
005:062:002	Error sending purge command, communication error	
005:062:003	Error sending text to printer	
005:062:004	Error sending line to printer	
Diabolo conveyor		
005:064:001	Overload of diabolo conveyor longitudinal <named> motor	See chapter 11 of this appendix.

Error number	Error text	Problem/Reference chapter
Conveyor Lever Height hydraulics		
005:067:001	Conveyor Lever Height at top position	These are notifications for the operator, not errors.
005:067:002	Conveyor Lever Height at bottom position	
005:067:004	Timeout for moving Conveyor Lever Height to top position	It has taken too long for the levers to reach the desired position. Check that the levers are not blocked (or already in the position). Try again.
005:067:005	Timeout for moving Conveyor Lever Height to bottom position	
005:067:006	Timeout for moving Conveyor Lever Height to level position	
Roller Bed Bogie Height hydraulics		
005:069:001	Roller Bed Bogie <numbered bogie> Height at top position	These are notifications informing the operator that the bogie(s) with the corresponding number(s) are in position
005:069:002	Roller Bed Bogie <numbered bogie> Height at bottom position	
005:069:004	Timeout for moving Roller Bed Bogie <numbered bogie> Height to top position	It has taken too long for the bogie(s) to reach the top or bottom. Check that nothing is obstructing movement and try again.
005:069:005	Timeout for moving Roller Bed Bogie <numbered bogie> Height to bottom position	
Roller Bed hydraulic motor		
005:071:002	Roller Bed hydraulic motor overload	See chapter 11 of this appendix.
Frequency Regulators		
005:072:002	Fault on Frequency Regulator <Frequency Regulator number>	Trigger the emergency stop. Wait at least 20 seconds. Reset the emergency stop
Diameter Check (RBPC machines)		
005:074:001	Timeout moving Main Drive Rotation to start point diameter check	It has taken too long for the named axis to reach the start point. It could be just the distance involved, try again.
005:074:002	Timeout moving Cutting Trolley Longitudinal to start point diameter check	
005:074:003	Timeout moving Cutting Head Rotation to start point diameter check	
005:074:004	Fault during Main Drive Rotation movement to measure point	Try again. If the problem persists, contact HGG
005:074:005	Diameter deviation too big: <value of deviation>	The diameter deviates too much from the expected diameter. Check the diameter of the pipe, check the theoretical diameter
Measurement Tool controller		
005:075:001	No measure control devices found	Notification for the operator.

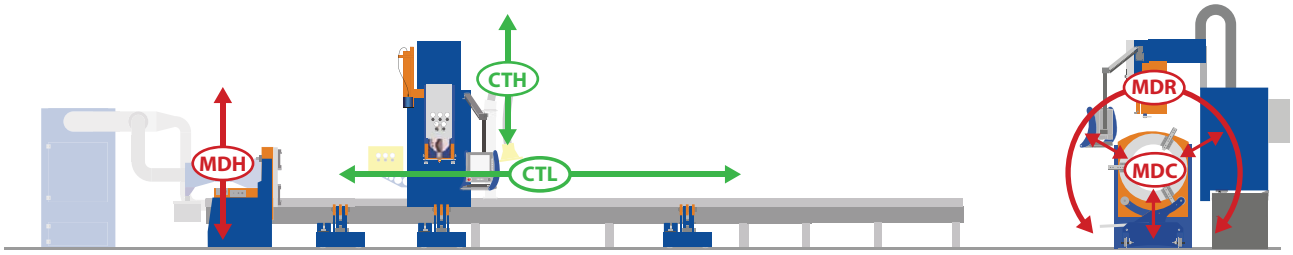
Error number	Error text	Problem/Reference chapter
Diabolo Conveyor controller (SPC-RB machines)		
005:076:002	Diabolo Conveyor is unable to reach target speed. Using maximum speed	Notification for the operator.
005:076:003	Automatic infeed or automatic outfeed, manual movement not allowed	Manual movement is not allowed during automated functions
005:076:004	Diameter for automatic movement not set	Enter the outer diameter of the pipe and try again
005:076:005	Conveyor Lever Height <named conveyor> not at bottom position	Conveyor movement is not possible when the conveyor levers are not in their bottom position
005:076:006	Main Drive Longitudinal not at home position	Home the main drive longitudinal direction in the diagnostics screen and try again
005:076:007	Not all roller bed bogies are at bottom position	Conveyor movement is not possible when the roller bed bogies are not in their bottom position
005:076:008	Cutting Trolley Height not in Top	For safety reasons, the cutting trolley height must be in its top position to use the conveyors.
005:076:009	Outfeed Conveyor blocked	Check the outfeed conveyor for blockages.
005:076:010	Safety input triggered, automatic functions stopped and blocked	Reset light screen to resume automatic functions
005:076:011	Automatic functions can only be used when all axes have been homed	Home all axes on the material handling screen of the remote control and try again
005:076:012	Cutting Trolley Height not safe	Move the cutting trolley higher
005:076:013	Not all Diabolo Conveyors are connected consecutively	Not all the selected conveyors are in line. Check the selected conveyors
005:076:014	Lever of Diabolo Conveyor not at bottom position	Move the conveyor levers to their bottom position
005:076:015	Diabolo Conveyor negative end limit found	These are notification for the operator
005:076:016	Diabolo Conveyor positive end limit found	
005.076.017	Cannot move material to roller bed. Main drive is in the way.	Move the main drive to the safe position and the short infeed conveyor into position. Try again
005.076.018	Safety override not active. To continue press safety override	The safety is on, to proceed you must manually override the safety. Proceed with caution!
005.076.019	Diameter check during automatic infeed failed. Continue manually	The diameter check failed. The deviation from the entered diameter is too great to determine the speed. Check the entered diameter. Proceed manually with caution!
005.076.020	Not all bogies at end of roller bed are down	Lower the bogies at the end of the roller bed before using conveyor

Error number	Error text	Problem/Reference chapter
Diabolo Conveyor controller (RBPC machines)		
005:077:001	Not all Diabolo Conveyors are connected consecutively	Not all the selected conveyors are in line. Check the selected conveyors
005:077:002	Diabolo Conveyor not in top position	Conveyor movement is not possible when the conveyor diabolos are not in their top position
005:077:003	Lever of Diabolo Conveyor not at bottom position	Conveyor movement is not possible when the levers are not in their bottom position
005:077:004	Diabolo Conveyor negative end limit found	These are notification for the operator
005:077:005	Diabolo Conveyor positive end limit found	
Transversal Platform (SPC-RB machines)		
005:078:001	Timeout moving <named axis> to <named position>	The action has taken too long. Try again
005:078:002	Positive end limit found for <named axis?>	These are notifications for the operator
005:078:003	Negative end limit found for <named axis>	
Diabolo Conveyor Height hydraulics (RBPC machines)		
005:080:001	Diabolo Conveyor Height at top position	These are notification for the operator
005:080:002	Diabolo Conveyor Height at bottom position	
005:080:004	Timeout for moving Diabolo Conveyor Height to top position	It has taken too long for the diabolo conveyor to reach its top or bottom position. Check for blockages and try again.
005:080:005	Timeout for moving Diabolo Conveyor Height to bottom position	
005:080:006	Diabolo Conveyor hit Cutting Trolley	The cutting trolley is too close to the roller bed. Raise the cutting trolley before proceeding.
Settings		
009:001:001	Unable to open settings file: <named file>	Check the path and the file name.
009:001:002	File <named file> does not exist. Do you want to create this file?	File not found, check path. If it is a new setting, create the file.
009:001:003	Unable to create settings file: <named file>	There is a security block on some essential files, these files may not be changed.
009:001:004	Name change not allowed	The name of this setting may not be changed.
009:001:005	Unable to change name! Name already exists	The name of this setting already exists, choose a different name.
009:001:006	Removal not allowed	These are essential files, which may not be removed.
009:001:007	Duplication not allowed	This setting may not be duplicated.
009:001:008	Unable to duplicate! Name for duplicate already exists	Choose a different name for this setting.
009:001:009	Password incorrect. Defaulting to Operator user	Check your password and try again.

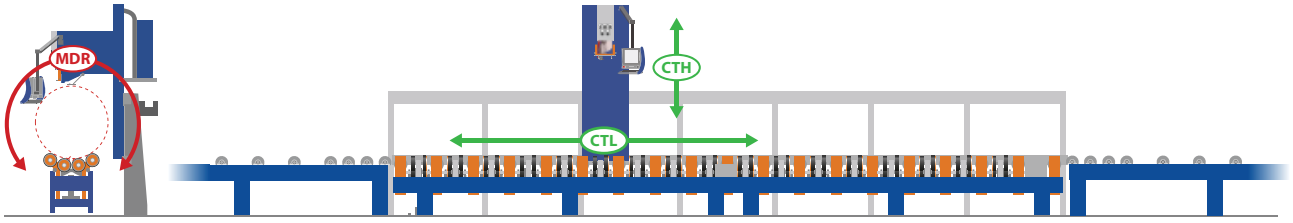
Axis definition

- CHT Cutting Head Tilt
- CHR Cutting Head Rotation
- CTL Cutting Trolley Longitudinal
- CTH Cutting Trolley Height
- MDR Main Drive Rotation
- MDL Main Drive Longitudinal
- MDH Main Drive Height
- MDT Main Drive Transversal

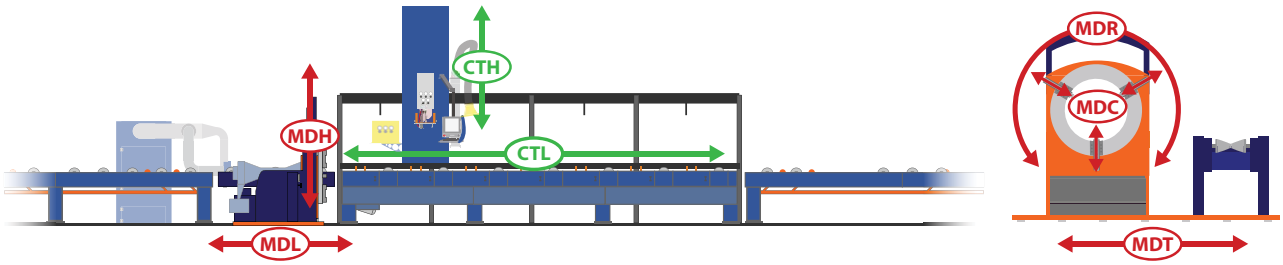
SPC 500 - 1200



RBPC



SPC 1200 RB



Chapter 1 - Amplifier errors

The amplifier type is M'Ax single axis servo amplifier. The amplifier is located in the control unit. These errors are usually caused by a missing or faulty signal.

Check the amplifier

- If the amplifier status is 'Drive healthy' you may assume the amplifier is okay.
- If the amplifier shows 'Drive healthy' status and the machine shows an amplifier error, an error has occurred for a short while and now the system is okay. This might happen if a motor is braking for a long time. It may happen, for example, when you are slowly rotating a pipe with a heavy eccentric weight. The pipe wants to rotate due to the eccentric weight and the motor has to slow down this rotation. In this case you need to balance the weight of the pipe better.

If the error is not caused by excessive braking:

- Check the resolver cable for an internal disconnection or short circuit to earth, especially at places where cables move, such as the cable chains. Keep in mind the disconnection or short circuit might not be present all the time.
- Replace the motor.

MDR, CTL, CTH and MDH motors

The M'Ax drives have the following four status LED's on the front side:

Red	IO Trip (control of motor lost)
Red	General trip (trip due to another cause, control lost)
Green	Drive healthy
Orange	Drive enabled

Open the top front cover to reveal the two line alphanumeric display used for reading the values of software parameters that are used to configure, control and monitor the drive. It also shows the operating status and fault and trip codes. There are three display modes:

Status mode Shows status of the drive
Parameter mode Selects parameter to edit
Edit mode Edits the selected parameter

Display	**Display mode**		
	Status	**Parameter**	**Edit**
Upper line	Value of a selected parameter (default parameter is 0.05 motor speed)	Value of a selected parameter (the value cannot be changed)	Value of a selected parameter (the value can be changed).
Lower line	Status of the drive: • Inhibit (Inh) • Ready (rdY) • Trip (trP)	Parameter number: a different parameter can be selected.	Parameter number: a different parameter cannot be selected.

Cutting Head Tilt (CHT) and Cutting Head Rotation (CHR) motors

The amplifier for both motors is a Maxon line driver. The motors are 24V DC with encoder feedback to the motion controller. The amplifier is used in current mode. The amplifiers are located at the back of the control unit.

- Check the main power of the amplifier: +24V and PGND.
- Only the green LED and no red LED's should be illuminated at the amplifier.
- If this is not the case the amplifier will have to be replaced.

Main Drive Clamping (MDC) motor (SPC 1500 - 2500)

The amplifier is a MaxiMaestro 4Q DC amplifier. The motor is a 180V DC with tag generator feedback to the amplifier, there is no feedback to the motion controller. The amplifier is operated in torque mode. The amplifier is located at the front of the control unit.

The MaxiMaestro amplifier has the following status LED's:

Green	Drive healthy

None of the LED's are turned on:

The amplifier probably has no main power

- Check the automatic fuse F6 below the amplifier.
- Check the main power to the amplifier, this should be 3 x 128V AC.
- Check the 380V/128V transformer.

The amplifier has main power

- Replace the amplifier.

The over-current LED is on

This only indicates a fault if the LED stays on for more than 5 seconds. It indicates that the motor has too much load mechanically or a short circuit in the motor or cables.

- Check the motor as described in chapter 0 'If the status still shows resolver break, replace the complete motor.'.
- Check the motor as described in chapter 1 ' overloaded'.

The DBR active LED is on

This indicates the internal electronic break system of the amplifier is activated. Normally this only happens on a strong deceleration of the motor, the LED should go out as soon as the motor has stopped.

- Is the main power to the amplifier okay, between L1-Z* and Z-2*? It should be 230V AC.
- Change the amplifier connection and see if the DBR active LED also comes on when connected at another location.

Chapter 2 - Following errors

Cutting trolley (CTL, CTH), cutting head (CHT, CHR) and main drive (MDR, MDC, MDH) motors

A following error means one of the CNC controlled motors did not reach the programmed position or could not keep up with the programmed speed or acceleration. If you only get the error message at a specific point of a special profile and not with an ordinary profile, the error might be caused by a software problem. In this case you should to contact your supplier.

The error is caused by one of the following parts:

- The encoder feedback.
- The amplifier.
- The motor.
- The cables.
- Too heavy a load on the motor.

To find out where the error lies:

1 Operate the motor with the remote control keys.
2 Check if the motor is moving.
3 Check if the motor position on the remote control changes.

The motor moves (a little) but the motor position on the remote control does not change

The encoder signal is incorrect, any motor movement will result in a change of position on the display.

- Check the encoder signals as described in chapter 8.

The motor does not move

The motor must be blocked mechanically or there is a defect in the motor or cables.

- Check the motor as described in chapter 10.
- Check to see if the motor is blocked as described in chapter 11.

The error occurs when the motor is running

The motor cannot keep up with the acceleration or maximum speed commanded by the motion controller.

- Check to see if the motor load is too high as described in chapter 11.

The error could not be located with the instructions above

- Check all parts of the motor axis that have not already been checked.
- Check the amplifier as described in chapter 1.
- Check the motor as described in chapter 10.
- Check if the motor is blocked as described in chapter 11.
- Check the encoder signals as described in chapter 8.

Height sensor

A ‘following’ error on the CTH motor or sensor may indicate a problem following the pipe’s surface.

This error may occur in the following situations:

- When the sensor pin drops off the pipe.
- When the sensor pin is moved too quickly, for example due to a large welding seam.
- When the sensor pin vibrates because the pipe surface is not very smooth.
- When the sensor pin vibrates due to melted particles on the pipe surface from a previous cut.

In the situations above the error is not caused by a machine error.

- Check the CTH motor in normal mode as described above.
- Check the encoder signal of the sensor as described in chapter 8.

Chapter 3 - End switch errors

An end switch error indicates that a motor has reached its positive or negative limit. The motor can only be moved away from the end switch. Usually an end switch error does not indicate a machine problem.

Software end switches

Software end switches are end positions (limits) set by the motion controller. If the end position is reached a normal end switch error is displayed. The software end switches are used for the cutting head rotation and tilt motors and they are set after initialization of the cutting head. The cutting head rotation motor has software and hardware end switches, both are active at the same time.

Cutting Head Tilt (CHT) motor end switches

The CHT motor has no physical end switches, only software end switches are used. As long as the cutting head is not initialized the software end switches are not set. The CHT motor will run to the mechanical limit and show a following error (chapter 2). A CHT motor end switch error during cutting indicates a software problem, contact HGG. You cannot have a false CHT end switch error.

Cutting Head Rotation (CHR) motor end switches

The CHR motor has a set of hardware and software end switches which are active at the same time. As long as the cutting head is not initialized the software end switches are not set. The CHT motor will run onto the hardware end switches. The hardware end switches are used to check the winding mechanism of the cable chain in the top part of the cutting head. Normally the end switches detect the positions 'cable chain fully wound' or 'cable chain fully unwound'. If the cable chain does not wind up properly you will get a CHR end switch error.

Cutting Trolley Longitudinal (CTL) motor end switches

The CTL axis has two normal end switches, left and right. The CTL axis also has an end switch to detect the main drive unit. The switch is triggered when there is a danger of the cutting head hitting the main drive unit. The cutting trolley may only pass the main drive unit when it is in the 'top' position. The limit switch has a double function, it is also used as home switch as described in chapter 4: CTL axis home error. The end switch is adjusted to allow enough space between the cutting head and main drive unit for deceleration, even when the cutting trolley approaches the main drive unit at maximal speed. If you want to cut really close to the chuck you need to disable the safety.

False end switch error messages

When an end switch error message is displayed, the end switch should actually be triggered. If the end switch has not been reached you have a false error message.

- Check if the end switch has actually been triggered.
- Check if the end switch physically functions, can you operate the switch manually.
- Check if the end switch is actually switching, this should be visible on the LED of the opto isolator at the back top section of the control unit. The LED is 'on' if the end switch is not pressed.
- Check if the end switch is adjusted properly.
- Check the end switch power supply P+24V PGND.
- Check the cabling of the end switches for disconnections.
- Check the connector to the control unit.
- Check the functioning of the end switch with a multimeter.

Missing end switch error messages

If a machine runs into a mechanical end stop without an end switch error message:

- Check if the end switch is adjusted properly.
- Check if the end switch physically functions, can you operate the switch manually.
- Check if the end switch is actually switching, this should be visible on the LED of the opto-isolator at the back top section of the control unit. The LED is 'on' if the end switch is not pressed.
- Check the end switch power supply P+24V PGND.
- Check the cabling of the end switches for short circuits.
- Check the functioning of the end switch with a multimeter.

Double end switch messages

If you get a positive and negative end switch error for one motor at the same time you have a false end switch error message. The error is most likely caused by a failure of the +24V power supply to the end switches, the problem might also be caused by the internal ±15V power supply in the control unit.

- Check for false error messages as described above.
- Check the 24V DC power supply to the end switches.
- Check the ±15V power supply inside the control unit.

Chapter 4 - Homing errors

Cutting Trolley Longitudinal (CTL) axis home error

The CTL axis has one home switch at the back of the cutting trolley, the home switch triggers a strip that indicates the position of the main drive unit. The switch is also used as a limit switch as described in chapter 3: CTL motor end switches. During the home search the switch point of the home switch is located and then the motor is moved to the actual zero position. The home switch should be triggered over the full length of the main drive unit, if the switch is not pressed, the cutting head may hit the main drive unit as it goes down.

- Check if the home switch is functioning as described in chapter 3.
- Check if the CHR limit end switches are functioning as described in chapter 3.

Cutting head home errors

If you get homing error messages together with other CHT motor or CHR motor related error messages first check out the other error messages. Cutting head homing is done for the CHT and CHR axes at the same time. If all other problems have been solved, home both axes and try again. In the diagnostics screen under the 'Cutting head' tab it is possible to move the axes individually, if the problem persists move the axis a small amount and try again.

Cutting Head Tilt axis home error

The CHT axis has one home switch at the back of the cutting head, rotate the cutting head to the 180º position for good access to the home switch. During the homing process, first the home switch is located and then the motor is moved to the actual zero position. The distance between the home switch and zero position is stored in the calibration settings of the machine. To eliminate any play during the initialisation procedure, the axis may reverse direction several times, depending on the start position.

- Check to see if the home switch is functioning as described in chapter 3.

Cutting Head Rotation axis home error

The CHR axis has one home switch on the bottom plate of the cutting head. During the initialisation process the cutting head is first moved to the negative end limit. From this point the switch point of the home switch is located and then the motor is moved to the actual zero position. The distance between the switching point and zero position is stored in the calibration settings of the machine.

- Check if the home switch is functioning as described in chapter 3.
- Check if the CHR limit end switches are functioning as described in chapter 3.

General home search errors:

If a 'Home timeout' error occurs together with other motor errors first check out the other errors.

The home switch could not be found.

- Check if the home switch is functioning as described in chapter 3.
- Check if the CHR limit end switches are functioning as described in chapter 3.

Chapter 5 - Sensor system errors

The sensor system is used to keep de distance between cutting head and pipe constant. A linear sensor detects the positions of the sensor frame. The position of this linear sensor can be displayed on the remote control. A spring is used to pull the system down, a pneumatic cylinder is used to bring the system to its top position. The cylinder is used to deactivate the sensor system (floating mode) and to test the function of the system at start up.

In 'pipe' mode the linear sensor is used as an active feedback to the cutting trolley height (CTH) motor. The motion controller tries to keep the sensor position constant.

- The sensor pin is pushed up by the pipe.
- The linear sensor value changes.
- The motion controller moves the CTH motor.
- The cutting arm and sensor system goes up.
- The linear sensor value changes back.

Because the sensor system and CTH motor work together, a height sensor error might also be caused by a failure of the CTH motor. The linear sensor has a home flag output that is used to initialize the sensor system, this is not an end switch but part of the encoder signal that comes from the linear sensor.

General sensor check

You can manually move the sensor system from top to bottom. The sensor position on the display should change from about 0 to 25. The home flag should change from top to bottom. The system must rotate absolutely freely, it may not come in contact with any parts of the cutting arm other than the sensor pin, spring and bearings.

If the sensor value does not change:

- Check if the sensor system actually drives the linear sensor pin.
- Check if you can manually push the linear sensor pin in.
- Check the linear sensor encoder signals as described in chapter 8.

Height sensor blocked

This means the sensor system does not come free.

- Check to see if the sensor is blocked mechanically.
- Check if the CTH motor is functioning, select the cutting trolley and jog up.
- Check the sensor encoder signals as described in chapter 8.

Floating mode and deviation errors

The floating mode is cancelled by the motion controller. When this error occurs during the 'pipe' function, as soon as the pipe is reached:

- Check the mechanical adjustment of the sensor system.
- Check the 'CTH sensor offset' in the configuration settings.

Deviation errors occur in sensor mode when the sensor system is out of its working area, either fully pressed or fully out. The CTH motor could not compensate the movement of the sensor system quickly enough. You will get this error message if the sensor system drops when it runs off the end of the pipe. The error can also be caused by oscillation of the sensor caused by pipe rotation or for example a heavy weld seam on the pipe surface.

- Check the mechanical adjustment of the sensor system.
- Make sure the pipe runs smoothly.
- Make sure the pipe surface is smooth.

Chapter 6 - Emergency stop

As soon as the emergency stop button is pressed power is removed from the following:

- AC motor amplifiers
- DC motor amplifiers
- Valves
- Remote control
- 24V DC power supply
- +15/-15V DC power supply.
- 5V DC power supply.
- 12V transformer.
- 110V transformer.

Only the computer stays on.

You can resume by resetting the emergency button and pressing the reset button on the main drive or the remote control. The machine will automatically be turned on again. If the emergency button was pressed during cutting you can resume cutting from the place it stopped.

There is however a risk that motors may have moved while the power was down. Since the power was down the motion controller has not seen this movement. If you wish continue, you should make sure that all motors are still at the correct location. If you are not sure it is better to restart from the beginning.

False 'emergency stop button pressed' message

The emergency system consists of an emergency relay that is activated by the computer and can be deactivated by one of the emergency buttons. All emergency buttons are placed in series. When the emergency relay is deactivated everything is switched off by hardware (not by software), including the 24V DC power supply. The computer checks the presence of the 24V-power supply, when this power fails the computer assumes the emergency stop button was pressed. This automatically indicates that a problem with this 24V DC power supply might cause a false error message.

Check for a false error message:

- Check to see if all emergency buttons are reset.
- Check that all cables are connected to the control unit.
- Check the impedance of the emergency buttons at the emergency relays, the impedance of all emergency buttons should be below 5W.
- Check the emergency cables for disconnections.
- Check to see if the 24V DC power comes on. You have a couple of seconds to turn on the machine after the computer starts. After the error message is displayed you cannot have 24V DC since the computer will have turned it off again.

Chapter 7 - Main drive unit errors

SPC 330 main drive unit

The SPC 330 has a CNC height adjustable main drive which is moved up and down using a servomotor and spindle. The CNC controller ensures that the chuck is moved to the correct height.

Clamping errors SPC 330

An independent CNC servomotor is used for clamping, this does not revolve with the chuck. A cylinder extrudes into a hole in the chuck plate preventing rotation during clamping. This cylinder triggers switches when it is completely extruded (out) or retracted (in). Clamping can only occur when the cylinder is fully extruded and rotation can only occur when it is fully retracted. If this is not the case, an error message will appear.

- Check that the air pressure on the chuck is high enough (7 Bar).
- Remove the pipe from the chuck.
- Check to see if the chuck operates normally without a pipe.
- Check that the cylinders can move in and out.
- Check if the end switches are adjusted correctly.
- Check if the chuck body comes into the correct switch position, see adjustment of the chuck in the maintenance manual.

Rotation of the chuck is also powered by a CNC servomotor.

SPC 500-1200 main drive unit

These machines use a hydraulic height adjustable main drive that can be controlled using the remote control or the buttons on the main drive unit. A separate hydro motor controls the clamping. It is important to ensure that the clamping direction is set correctly! Check the settings to see whether it is set to clamping on the inside or outside of the pipe (see below). The chuck is rotated using a CNC servomotor. Error messages may appear if the settings are incorrect or incomplete. Rotation is not allowed during profiling or when the machine is in automatic mode.

SPC 1500-2500 main drive unit

The SPC 1500 has a fixed height main drive unit. This can only be used in combination with height adjustable pipe trolleys. The rest of the larger machines (SPC 2000, 2500 and 3000) have a hydraulic height adjustable main drive which can be controlled using the remote control or the buttons on the main drive unit. All of these machines have a 3-jaw chuck, the clamping is powered by an electric motor mounted on and rotating with the chuck. Clamping can be controlled using the remote control or the buttons on the main drive unit. It is important to ensure that the clamping direction is set correctly! The chuck is rotated using a CNC servomotor. The same restrictions apply as on the SPC 500-1200 series above.

Pipe jammed in the chuck

If a pipe is clamped in the chuck and you get error messages during operation of the chuck you will not be able to remove the pipe from the chuck. This can be caused by a chuck problem but it can also be caused by one of the following external problems:

Clamping side setting

The chuck uses more force to release the pipe than to clamp the pipe, therefore you have to specify how a pipe is clamped. This can be set in the machine settings. Inside means clamped at the inside of the chuck (on the outside of the pipe), outside means clamped at the outside of the chuck (on the inside of the pipe). If the clamping side setting is wrong the chuck uses less power to release the pipe than it has used to clamp the pipe. The force might be insufficient to release the pipe. Make sure you make no mistakes in the procedure below, you might clamp the pipe further which will make it even harder to remove the pipe later.

- Set the clamping side correctly.
- Try to release the pipe using the remote control.

Jammed due to improper clamping or pipe/chuck height adjustment

If the pipe clamped in the chuck is forced up or down during rotation because it was not clamped properly or if the pipe trolley or chuck height was not set properly, the pipe might move in the jaws of the chuck, this may increase the clamping force on the pipe. If the force is too high the motor is not powerful enough to open the chuck and the pipe is blocked in the chuck.

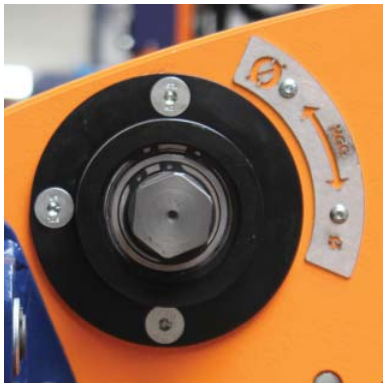
- Set the clamping side correctly.
- Try to release the pipe.

Gently try to push the pipe in line with the chuck with one of the pipe trolleys (do not leave one side of the pipe unsupported while the other side is clamped in the chuck), repeat the above procedure.

Manual removal of the pipe in the chuck

If the pipe cannot be removed with one of the procedures described above, the only option is to manually remove the pipe. Three methods are described below, each more extreme than the one before. Begin with the first, only if you are not successful should you move on to the next.

- At the back of the main drive, behind the chuck there is a large bolt to manually open and close the jaws of the chuck (see photo). The plate mounted beside the bolt shows which direction opens and which closes the jaws.
- Unscrew the three jaws from the chuck and force the pipe out.
- If all else fails, you will have to use a manual cutting torch and cut the pipe so that it can be removed.



Chapter 8 - Encoder signal check

The encoder signals are a position feedback of the motors to the PMAC motion controller. Any motor axis movement should be visible as a change in position on the remote control. Even when the motor only rotates a small amount and then stops you will see it on the remote control. Use the remote control to operate the motor. If the motor cannot be moved with the remote control, not even a view rotation, you will need to manually rotate the motor. This can be done as follows:

MDR, MDH CTH and CTL motors:

- Turn off the machine.
- Disconnect the main motor power connector.
- Remove the motor.
- Manually rotate the motor axis.

CHT and CHR motors:

- Remove the motor fuses.

Height sensor

The height sensor system drives the linear sensor that generates encoder pulses just as a motor does.

- Manually move the sensor system with the sensor pin. The sensor system should now drive the pin of the linear sensor.
- Check if the linear sensor pin actually moves in and out.
- Rotate the motor, the position should change.
- Move the motor back to the original location, the position should go back to the start position.

If the above is correct you may assume the encoder signal is correct.

Encoder failure

If the encoder signal does not change when the motor moves there must be an encoder failure. If you have problems with several motors, first check the following:

- Check the power supply of the encoder opto isolation board O+5V and OGND.
- Check the flat cable connections to the terminator board and PMAC.
- Exchange the two opto isolation boards (set the jumpers correctly).

MDR motor

This motor has a resolver feedback to the amplifier, the amplifier simulates an encoder.

- Check the resolver signal of the motor as described in chapter 9 'Resolver check'.

If the resolver signal is okay:

- Check the cabling from amplifier to opto isolation board.
- Check the encoder signal status as described in 'Encoder voltage and status' at the end of this chapter.
- Check the flat cables to the terminator board and PMAC.
- Exchange the two opto isolation boards (set the jumpers correctly).

If all connections are okay, the MDR amplifier must be defective.

CTH, CTL and MDH motors

These motors have a resolver feedback to the amplifier, the amplifier simulates an encoder.

- Check the resolver signal of the motor as described in chapter 9 'Resolver check'.

If the resolver signal is okay:

- Exchange amplifiers to see if the amplifier is defective.
- Place the encoder connector to another drive to see if encoder signals can come through.

- Check the cabling from amplifier to opto isolation board.
- Check the encoder signal status as described in 'Encoder voltage and status' below.
- Check the flat cables to the terminator board and PMAC.
- Exchange the two opto isolation boards (set the jumpers correctly).

CHT and CHR motors

These motors have an encoder that provides direct position feedback to the motion controller.

- Exchange the tilt and rotation connectors in the cutting head to see if the motor is defective.
- Check for a disconnection in the encoder cable.
- Check for a short circuit to another pin in the connector.
- Check for a short circuit to earth (disconnect the encoder cable from the control unit).
- Check the O+5V and OGND on the connector in the cutting head.
- Compare the voltage on the encoder lines in the control unit and the encoder box, are they the same?
- Check the encoder signal status as described below.
- Check the flat cables to the terminator board and PMAC.
- Exchange the two opto isolation boards (set the jumpers correctly).

Height sensor

The height sensor has an encoder that provides direct position feedback to the motion controller.

- Check for a disconnection in the encoder cable.
- Check for a short circuit to another encoder signal.
- Check for a short circuit to earth (disconnect the encoder cable from the control unit).
- Check the O+5V and OGND in the encoder box.
- Compare the voltage on the encoder lines in the control unit and the encoder box, are they the same?
- Check the encoder signal status as described below.
- Check the flat cables to the terminator board and PMAC.
- Exchange the two opto isolation boards (set the jumpers correctly).

Encoder voltage and status

The encoder signals are two block-shaped signals, channel A and channel B. For a complete check you need an oscilloscope but you will be able to carry out most of the checks with a multimeter. The status and voltage can be checked as follows:

MDR, MDH, CTH and CTL motors

These motors have normal and inverted encoder outputs.

- The voltage of the signals +CHA-<motor> – CHA-<motor>, +CHB-<motor> and –CHB-<motor> to OGND must be below 1V or above 4V when the motor is stationary.
- If the +CHA or +CHB is +0V, then –CHA or –CHB should be 5V and vice versa.
- When the motor is rotating the signals should switch from 0V to 5V, if the motor rotates very slowly you can see this on your multimeter, otherwise you will measure about 2.5V (the average).

CHT, CHR motors and height sensor

These motors have only normal encoder outputs (no inverted outputs are present).

- The voltage of the signals +CHA-<motor> and +CHB-<motor> to OGND must be below 1V or above 4V when the motor is stationary.
- The voltage of the signals -CHA-<motor> and -CHB-<motor> to OGND should be 0V.
- When the motor is rotating the signals should switch from 0V to 5V, if the motor rotates very slowly you can see this on your multimeter, otherwise you will measure about 2.5V (the average).

Chapter 9 - Resolver check

The resolver provides a position feedback of the rotating magnet on the motor axis to the amplifier. This signal is used to create a rotating field that makes the motor rotate. The resolver consists of 3 coils called sin, cos and ext. The signal is converted to an encoder signal for a position feedback to the motion controller. The amplifier checks the functioning of the resolver, if the amplifier does not show a resolver break signal you may assume the resolver is okay.

- Check the resolver on the disconnected resolver connector of the amplifier:
- Check to see if one of the resolver signals is earthed.
- Check to see if you can measure the three coils of the resolver, the impedance between +sin/-sin, +cos/-cos, +exe/-exe should be between 0 and 20W.
- Exchange the amplifier to see whether the amplifier or the resolver is the problem.

Too much axial pressure on the motor axis can cause a resolver break signal.

- Remove the motor and check the resolver status on the amplifier again.

If the status still shows resolver break, replace the complete motor.

Chapter 10 - Motor check

MDR, MDH, CTL and CTH motors

The motor type is AC brushless, the motor consists of 3 stationary coils and a rotating magnet. The coils are placed in a triangle.

- Check the motor signals on the disconnected motor connector of the amplifier:
- Check to see if one of the motor cables U, V or W is earthed.
- Check to see if you can measure the 3 motor coils, the impedance between U-V V-W and U-W should be close to 0W, all three should be just about the same.
- Check for a short circuit in the motor cable.

CHT and CHR motors

The motor type is 24V DC, the motor consist of a rotating coil and a fixed magnet.

- Check the motor signals on the disconnected motor connector of the DC line driver:
- Check to see if the motor fuses are okay.
- Check to see if one of the motor cables +AMPL<motor> and –AMPL<motor> is earthed.
- Check to see if you can measure the motor coil, the impedance between +AMPL<motor> and –AMPL<motor> should be close to 0W.
- Check for a short circuit in the motor cable.

MDC motor (SPC 1500 - 2500)

The motor type is 110V DC, the motor consist of a rotating coil and a fixed magnet.

- Check the motor signals on the disconnected motor connector of the amplifier:
- Check to see if one of the motor cables + and – is earthed.
- Check if you can measure the motor coil, the impedance between + and – should be close to 0W.
- Check for a short circuit in the motor cable.
- Check the slide contacts at the side of the chuck.

Chapter 11 - Motors overloaded

The general approach is to remove the motor and check if the motor is running okay with no load and then to check if you can manually move the system in order to find out where the system is blocked. If you find that the motor is running okay without any load and also the mechanical system is running okay, then the motor does not have enough power due to a motor failure, you will have to replace the motor.

MDR motor

The MDR motor might be overloaded due to a pipe clamped in the chuck, check the following:

- Is the weight of the pipe significantly out of balance?
- Is the pipe straight?
- Does the pipe have a large welding seam?
- Is the pipe levelled out properly?
- Does the chuck centre height match with the pipe centre height?
- Can the pipe rotate properly on the pipe trolleys or rollerball gutter?

To locate the block:

- Remove the pipe from the chuck.
- Check to see if the jaws have been obstructed or have collided with something.
- Remove the front cover and check for a block at the front side of the main drive unit.

The chuck does not rotate at all:

- Remove the MDR motor.
- Check to see if the motor rotates without the gearbox.
- Check to see if you can manually rotate the input shaft of the gearbox.
- Check the front of the main drive unit for failures while the chuck is rotating (at the slider contacts).
- Check the main bearing of the chuck.
- Check to see if the gearbox shaft and/or pinion are touching the back of the chuck during rotation.
- Unscrew the gearbox, make sure the pinion can rotate freely.
- Check to see if you can now manually move the input shaft of the gearbox.
- Check if the gearbox is running when the motor is mounted.
- Check to see if you can rotate the chuck manually.
- Remove the chuck and check the main bearing.

CTL motor

The most likely problems with the CTL motor are the sliders and the linear guiding rail.

- Remove and check the two cutting trolley sliders.
- Check the rail for rust.
- Check for particles that lie between the rail and the rack, also check between the two sliders under the cutting trolley.
- Check for particles in the teeth of the rack.
- Check to see if the two bottom wheels run smoothly.
- Unscrew the CTL gearbox and pull it out of the rack.
- Check to see if you can manually move the cutting trolley.
- If you manually move the cutting trolley (3 Km/H) it should not stop within 20 cm.
- Check that all rail are properly aligned.
- Check that all rack sections are properly aligned.
- Is the rear frame set up properly, is the upper beam horizontal?
- Check to see if the pinion is running now that it has been removed from the rack.
- Remove the motor and check to see if the motor is running.
- Check to see if you can manually rotate the input shaft of the gearbox.

CHT motor

The CHT motor has a low backlash gearbox, at low temperatures the grease may become too thick which causes the gearbox to run heavily. Try to operate the motor at a temperature of about 15ºC to see if this causes the problem.

Lower part

- Are both calibration pins removed?
- Check to see if the torch can rotate a little, there should be some stretch in the belt to allow a little movement.
- Remove the heat shield and check for dirt at the bottom.
- Check to see if the belt connection block is running onto the machined edges of the cutting head arm.

Upper part

- Check the mechanics visually for damage or loose particles.
- Remove the CHT motor.
- Check to see if the output shaft of the gearbox is running.
- Check to see if you can manually move the tilting system by pushing on the cutting head arm, since the CHT motor is removed the system can now be blocked by the loose belt.
- Check to see if the output shaft of the gearbox is running.
- Remove the gearbox from the motor.
- Check to see if the motor runs without the gearbox.
- Check to see if you can easily rotate the input shaft of the gearbox.

CHR motor

The CHR motor has a low backlash gearbox, at low temperatures the grease may become too thick which causes the gearbox to run heavy. Try to operate the motor at a temperature of about 15ºC to see if this causes the problem.

- Check to see if you can manually rotate the cutting head by pulling the top part.
- Remove the bottom plate of the cutting head.
- Check for loose particles in the tooth ring or CHR motor pinion.
- Check if the pinion was mounted too low. In this case it has touched the bottom plate.
- Check if the pinion was mounted too high, in this case it has touched the bottom of the cutting head.
- Check to see if the cable chain at the top of the cutting head can rotate properly.
- Check to see if the winding unit for the cable chain is functioning properly.
- Remove the CHR motor.
- Check to see if the input shaft of the gearbox is running.
- Check to see if you can manually rotate the cutting head.
- Check to see if the output shaft of the gearbox is running.
- Remove the gearbox from the motor.
- Check to see if the motor runs without the gearbox.
- Check if you can easily rotate the input shaft of the gearbox.

CTH motor

- Check the vertical guide rails for rust, wear or damage.
- Check the spindle for rust, wear or damage.
- Check the vertical sliders.
- **Hang the cutting arm in a crane.**
- Remove the CTH motor, the cutting arm may come down on its own weight.
- Check to see if the CTH motor runs without the spindle.
- Gently lower the crane in steps of 5 cm.
- If the cutting arm comes down on its own weight there is no mechanical problem.
- Check the rollerball bearing on the spindle at the back of the cutting arm.
- Check the top spindle bearing.
- Check the bottom spindle bearing.
- Remove the spindle and check if the spindle is straight.
- Replace the vertical sliders one by one.

WARNING!
The cutting trolley height motor also functions as the brake. If the motor is removed without supporting the cutting head with a crane, the cutting head will drop under its own weight. Contact HGG for instructions before carrying out repairs on the cutting trolley height system.

MDC motor (SPC 1500 - 2500)

- Make sure the force is set to maximum.
- Remove the 3 slider boxes with the jaws.
- Check the boxes and chuck for wear and damage.
- Make sure the boxes can slide properly in the chuck.
- Check to see if you can manually rotate the spindles.
- Check to see if the spindles rotate when the boxes are removed.
- Open the cover of the chuck in front of the clamping motor.
- Open the gearbox and check for wear and damage.
- Remove the MDC motor.
- Check to see if the motor is running without the gearbox.
- Check to see if you can manually rotate the input shaft of the gearbox.
- Replace the motor again.
- Remove the spindle gearboxes one by one and check to see if the MDC motor can rotate.
- Remove the chuck.
- Check the big bearing inside the chuck.

MDH motor

- Remove the MDH motor.
- Check to see to see whether the motor runs without the gearbox.
- Check to see if you can rotate the input shaft of the gearbox manually.
- Unscrew the bolts of the spindle nut at the bottom of the main drive unit.
- Lift the chuck with a crane, the spindle nut comes free.
- Check to see if you can rotate the spindle nut.
- Check to see if you can rotate the MDH motor.
- Remove the gearbox.
- Remove the spindle.
- Check to see if you can rotate the output shaft of the gearbox.
- Check the two bearings at the top of the spindle, below the gearbox.

Appendix D

Software Restore

Introduction

This manual describes how to restore the complete hard disk of the machine including all special HGG software. The USB stick is supplied to you by HGG during installation, it contains a disk image, the machine software and the ProCAM programming software.

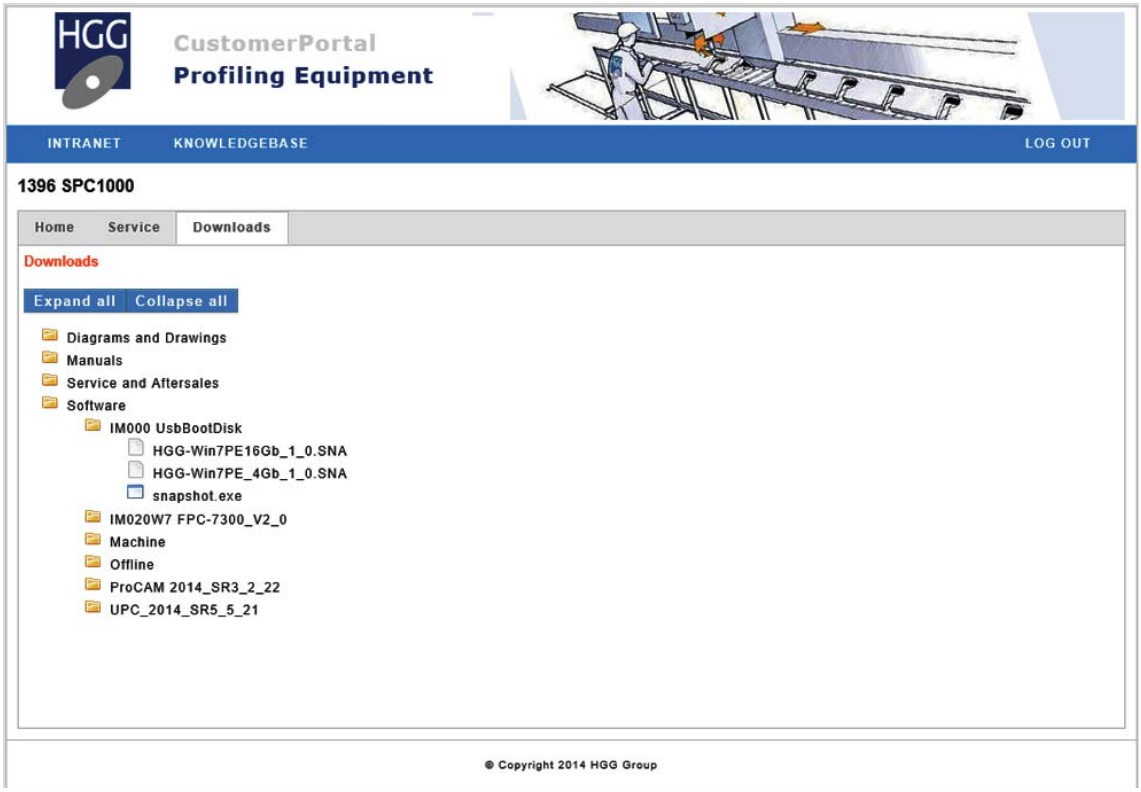
This procedure must only be carried out after having contacted the HGG service department to make sure that all efforts have been made to restore the system without using the USB stick.

WARNING!
Carrying out the restore will delete all existing settings and programs! If you wish to keep any of the data, you should make a copy before restoring the disk. If you are not sure, please contact the HGG service department.

Software locations

All the necessary software needed to configure your machine can be found in the 'Software' folder on the HGG Customer Portal. The following images show the locations of all the software. However, the ProCAD software for AutoCAD and Tekla only apply if you have these connections. You will need to download the necessary software before you begin.

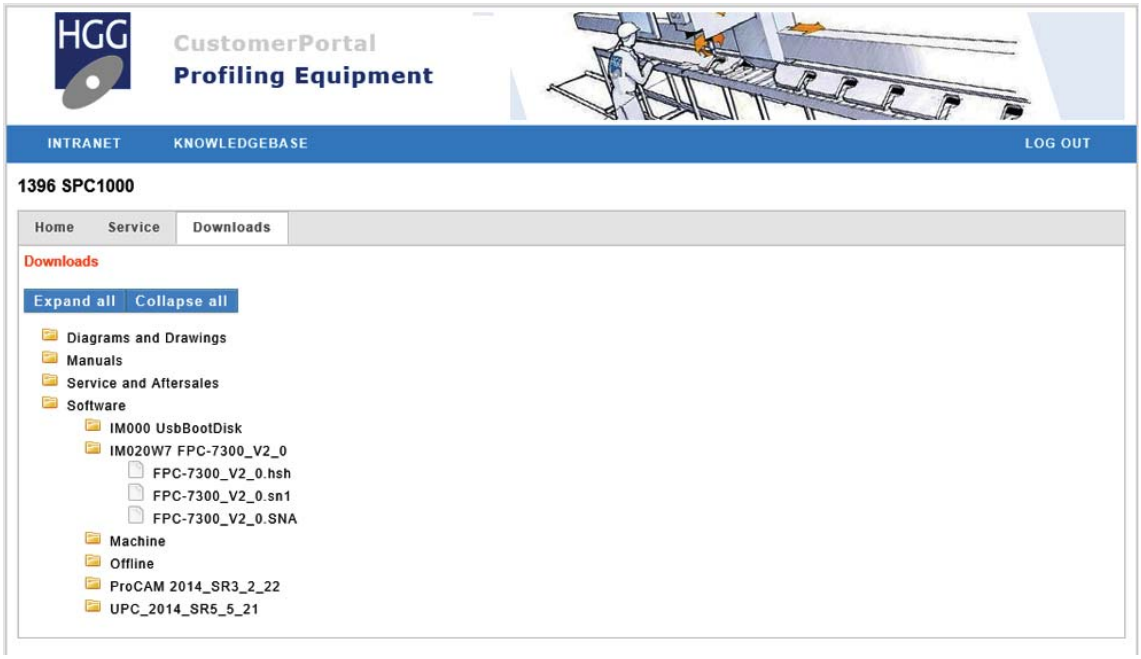
Bootable USB key



Folder: 'IM000 UsbBootDisk'

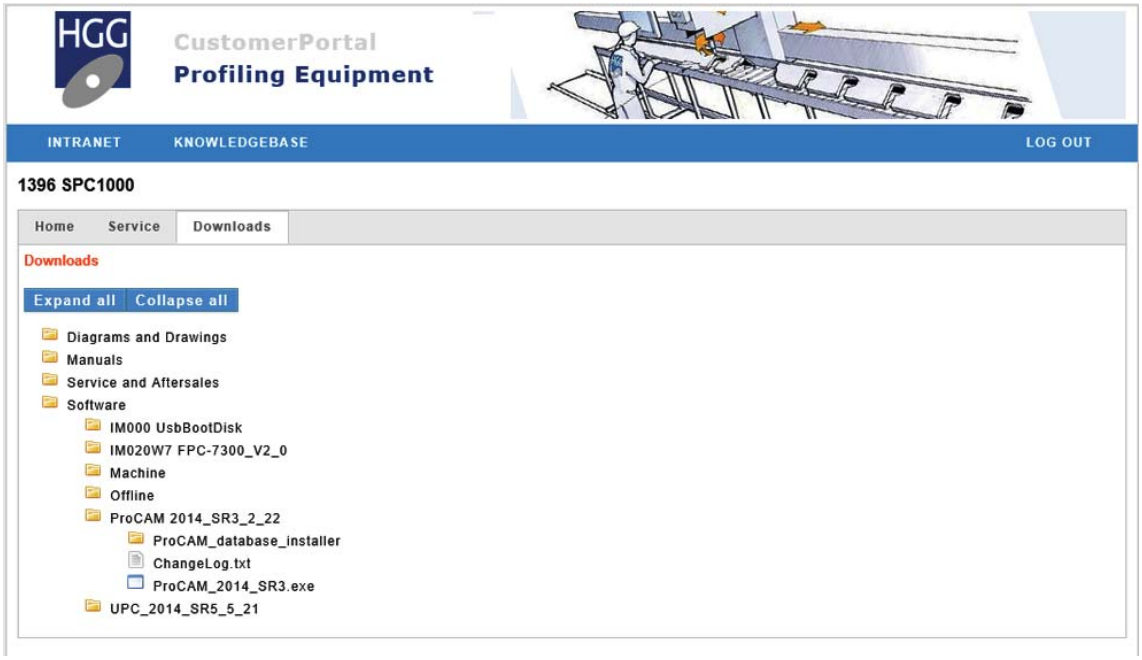
Here you will find the 'Snapshot' software and the image needed to create a bootable USB key. For the most recent computers (FPC-7700) you will need the 16Gb image. For the other versions either can be used depending on the capacity of your USB stick.

Machine image



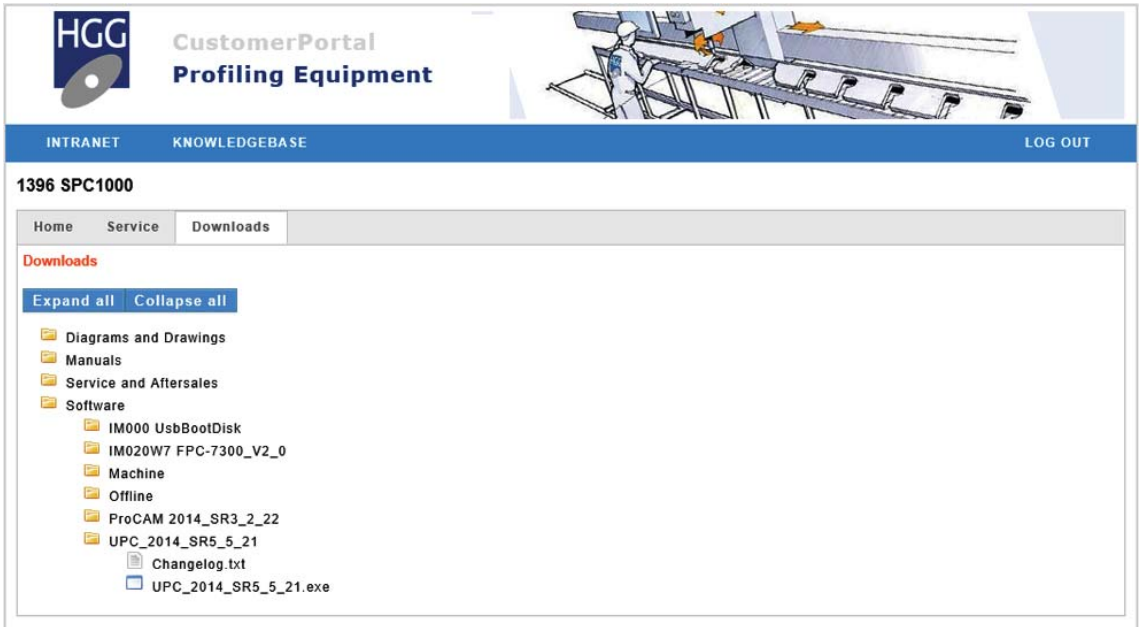
The latest machine image (FPC 7100/FPC 7300/FPC 7700) can be found in the folder:
'IM[nnn]W7 FPC-7300_ [version]'
(the folder will be named according to the computer on your machine FPC-7100, FPC-7300 or FPC-7700).

ProCAM software



The latest version of ProCAM can be found in the folder:
'ProCAM [version]'

UPC software



The latest version of the UPC (machine) software can be found in the folder:
'UPC_ [version]'

ProCAD software

If the ProCAD software for the ProCAM connections with AutoCAD and/or Tekla Structures is installed on your machine there will also be a folder present with the most recent version of this software. NOTE: upgrading to a more recent version of AutoCAD or Telka Structures will also require a license update!

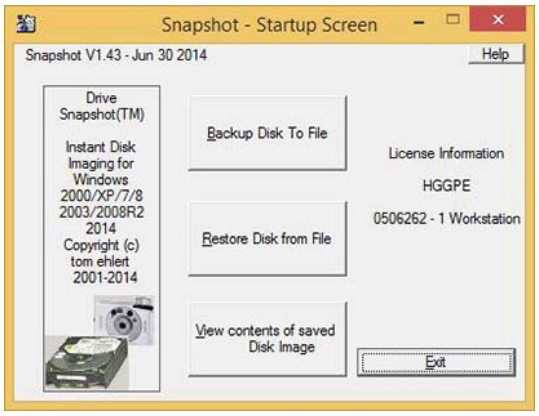
Creating a bootable USB key

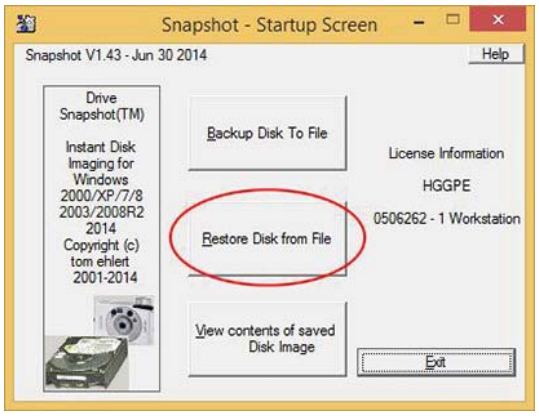
A USB data key is delivered with every machine, the keys are labelled 'Software' with the machine number (see photos below). Currently these are 16Gb keys which are needed for the larger image on the FPC-7700. For machines installed with the FPC-7100 and FPC-7300 computers a 4Gb USB key should suffice. This chapter assumes that a 16Gb key is being used, the process is the same for a 4Gb key.

Download the latest version of the necessary software (Snapshot and image) from the location described in the previous chapter. NOTE: the USB key will be formatted, all existing data will be erased!

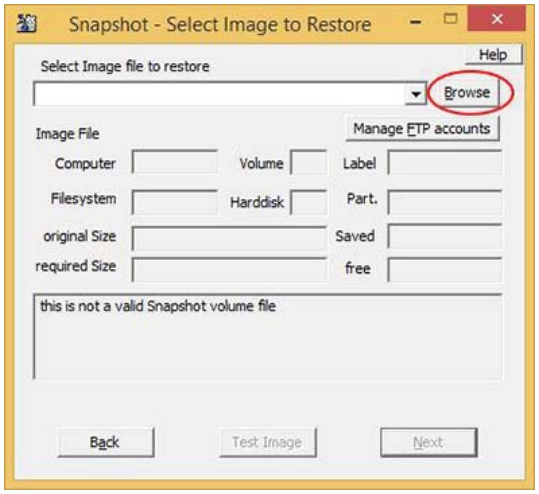
Prepare the USB key

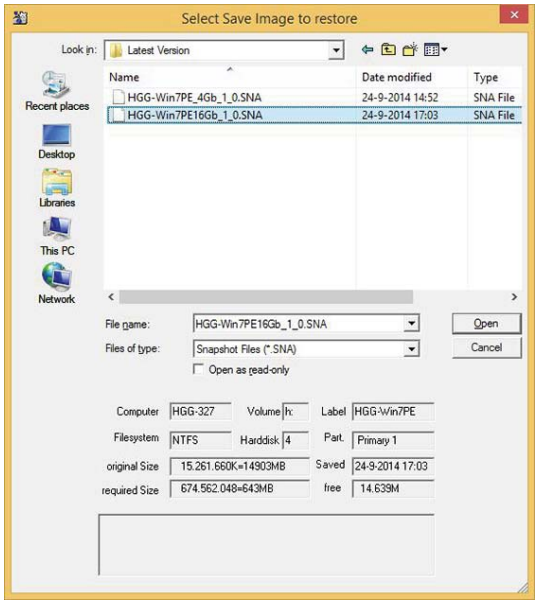
Start Snapshot and select 'Restore disk from file'.



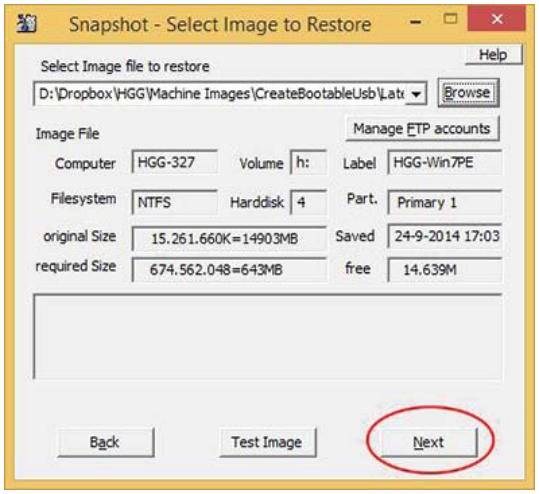


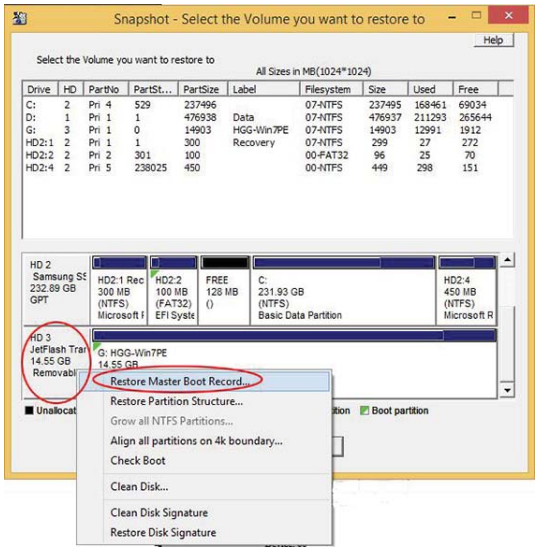
Browse to the location of the image, select the image and press 'Open'.





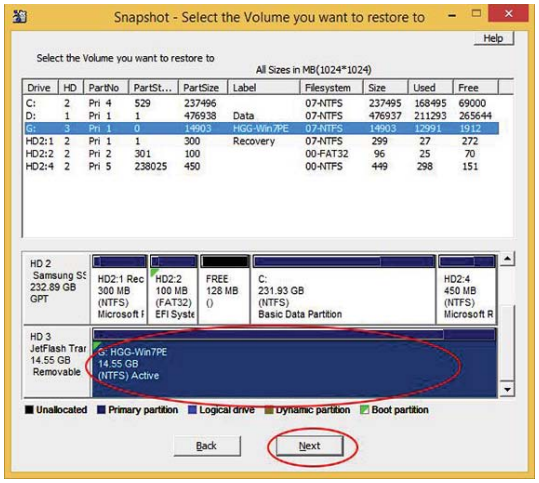
Press ‘Next’. Right click on the USB key and from the drop-down menu select ‘Restore Master Boot Record’.



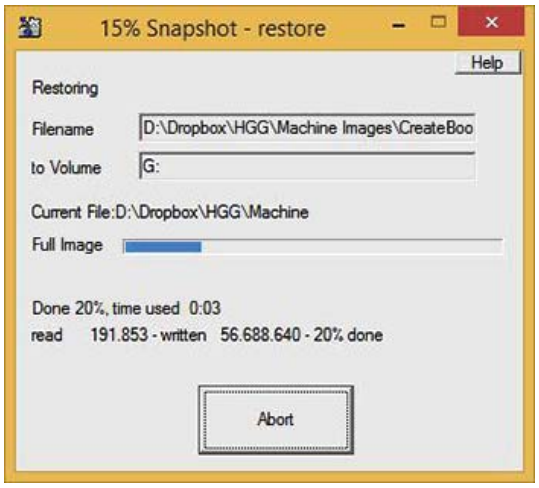


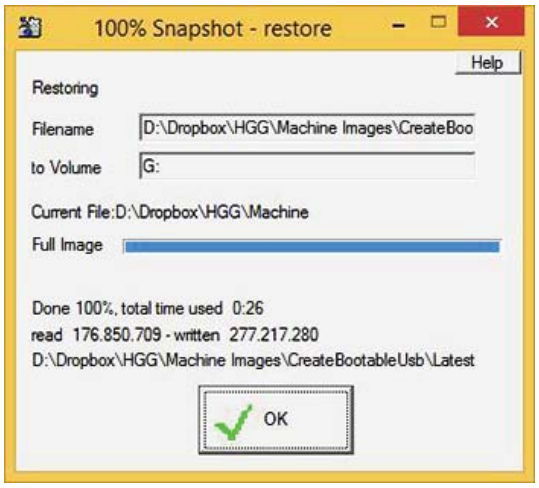
Confirm the deletion of data: ‘Yes’. Snapshot will confirm succesful restoration of the MBR, ‘OK’.

Select the USB key and press ‘Next’. Confirm the overwrite of the data: ‘Yes’.



Wait until the restoration is complete. When 100% complete press 'OK'.

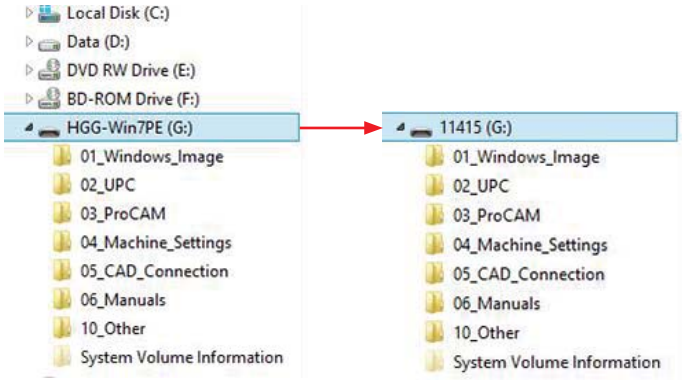




NOTE. You may see the following warning stating that the disk is not bootable. You can ignore this warning.

Rename the USB key

The USB key should now contain the data shown below. Firstly, rename the USB key with the serial number of the machine.

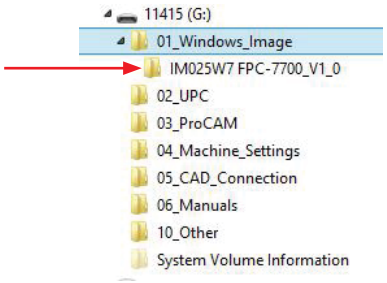


Copy the software to the USB key

The Windows images are maintained by HGG's UPC team. Each image is specific to the type of computer used on the machine: The SPC machine range uses the FPC7100, FPC7300, FPC7700 computers.

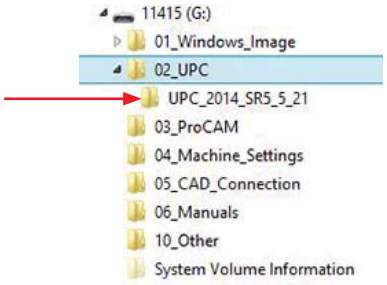
Windows restore image

Copy the image that you downloaded in chapter 1.1 to the '01_Windows_Image' folder on the USB drive.



UPC software

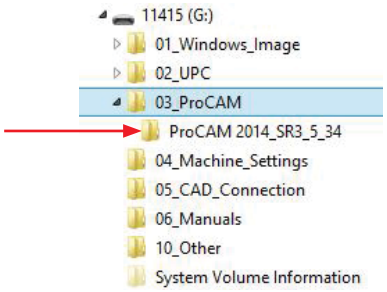
Copy the UPC version that you downloaded to the '02_UPC' folder on the USB drive.



A change log is included in the UPC folder, this contains information on the changes since the last version. The minimum version of the ProCAM software is alaso specified in the change log, this is the minimum version required for the correct operation of the UPC software. If the minimum required version is not installed the UPC software will show a warning during calculation.

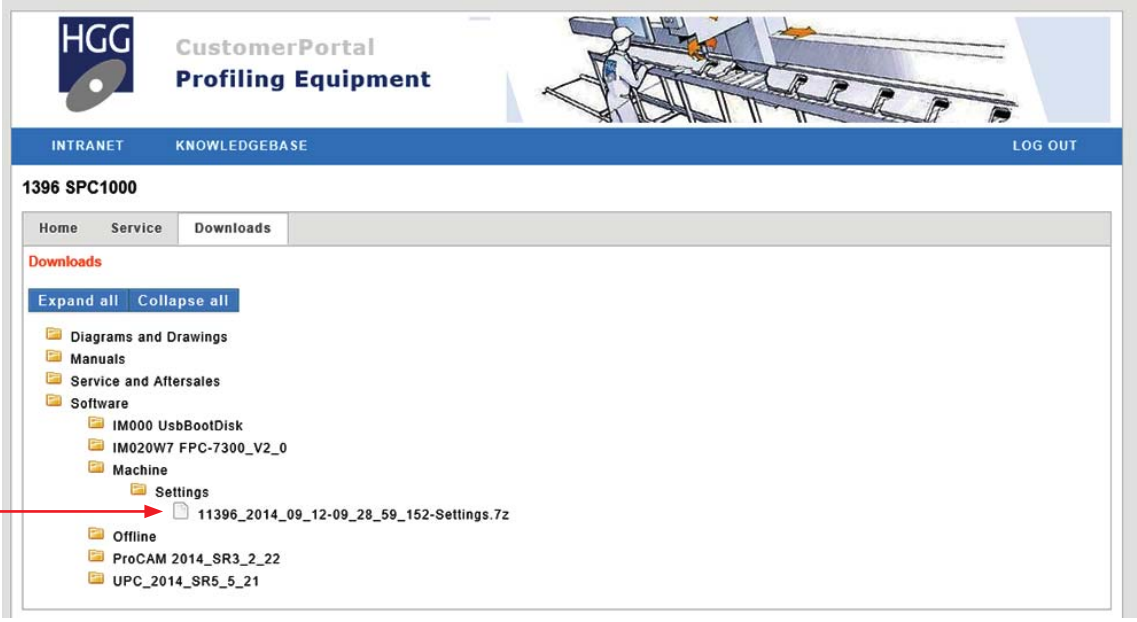
ProCAM software

Copy the ProCAM version that you downloaded to the '03_ProCAM' folder on the USB drive.



UPC Machine configuration

Copy the UPC machine backup file for the machine to the '04_Machine_Settings' folder.



ProCAD connection and manuals

If you have ProCAD connection software (for either AutoCAD or Tekla Structures), copy the installer to the the '05_CAD_Connection' folder on the USB drive. Finally, copy the desired manuals to the '06_Manuals' folder.

Restoring the hard disk

To restore the hard disk from the USB key it will be necessary to boot/reboot from the USB key. This means changing the order of the boot devices in the BIOS. The method is slightly different for the FPC7100, FPC7300 and FPC7700 used on the SPC machines.

If the computer itself is replaced, it will also be necessary to alter some BIOS settings before you begin. The procedure for changing the BIOS settings and the order of the boot devices is explained at the end of this chapter.

Installing the Windows image

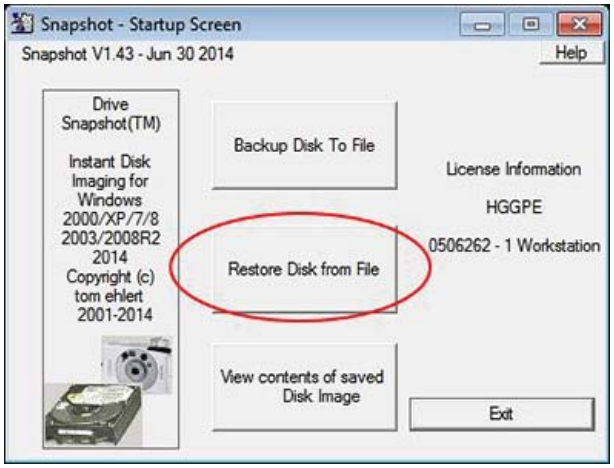
Insert the USB stick in the slot. Turn on the machine. Press the F11 (FN + F11) button during the start up.

A boot menu will appear. Choose the option USB:

Press 'Enter'.

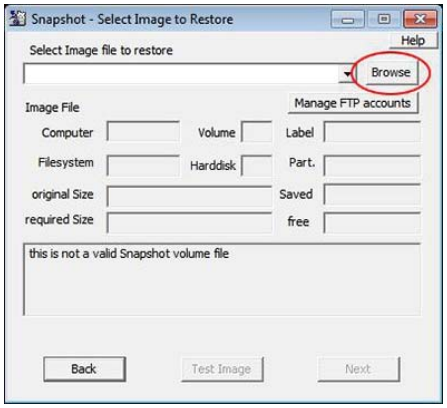
Win7PE will now be booted, wait until Windows has started up and you see this screen:

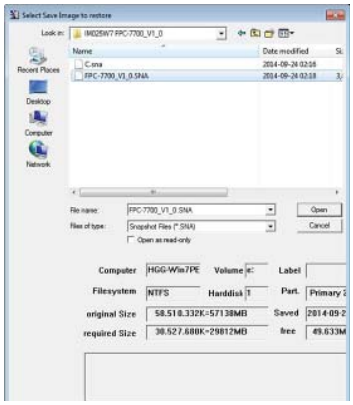
Double click on the 'Snapshot' icon to start Snapshot.

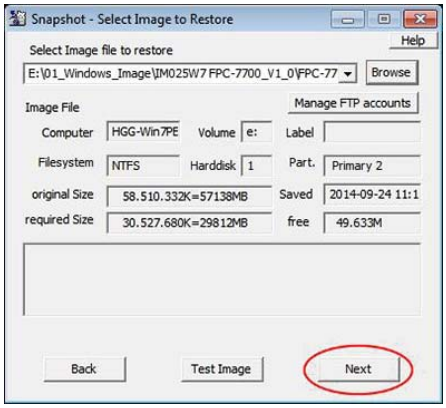


Press 'Restore Disk from File'

Press ‘Browse’ and locate the image you wish to restore
(in the example shown: E:\01_Windows_Image\IMO25W7 FPC-7700_V1_0\FPC-7700_V1_0.SNA).

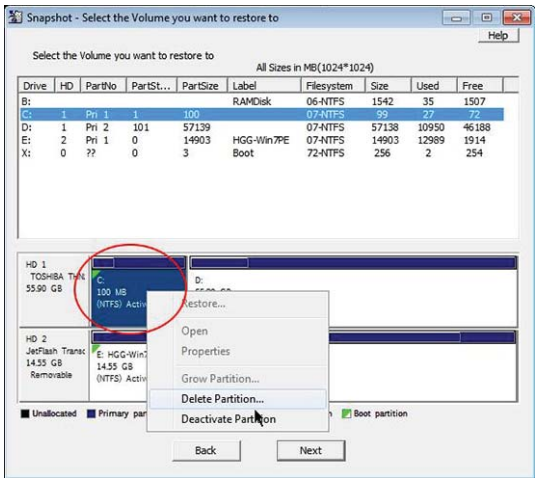


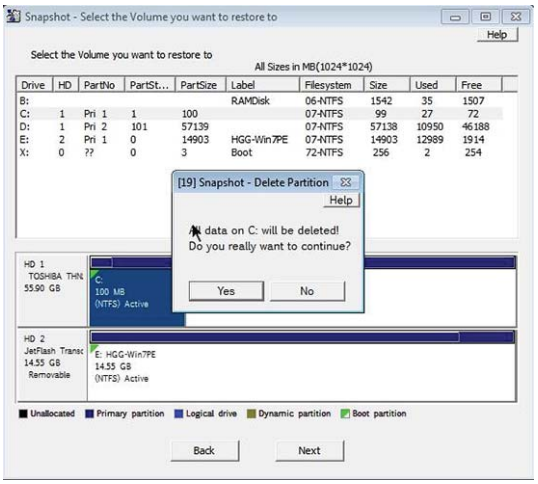




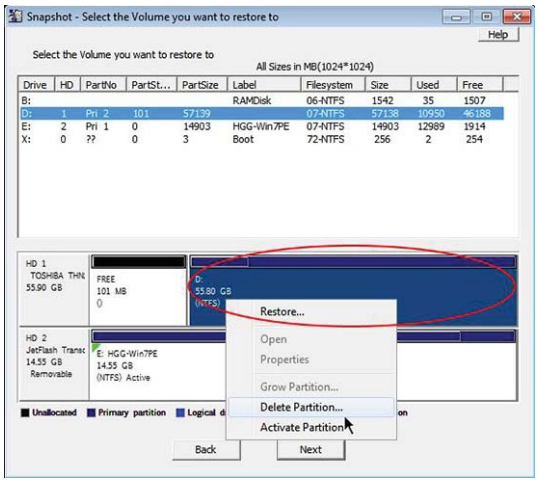
Press ‘Next’ to restore the image.

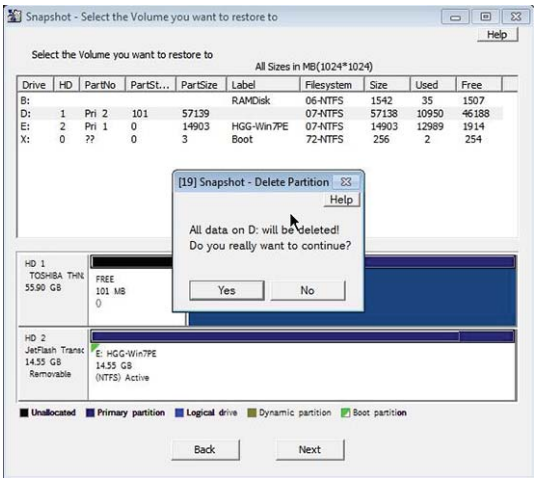
Any existing partitions on the disk to be restored need to be deleted before restoring the image.





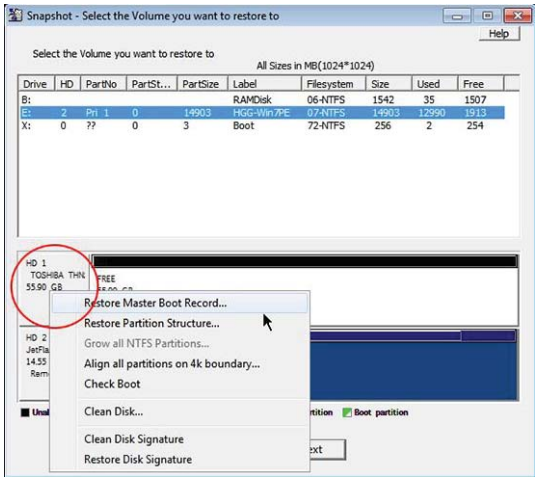
Right click on the partition and from the drop-down menu select ‘Delete Partition’. All data will be deleted, press ‘Yes’ to confirm.

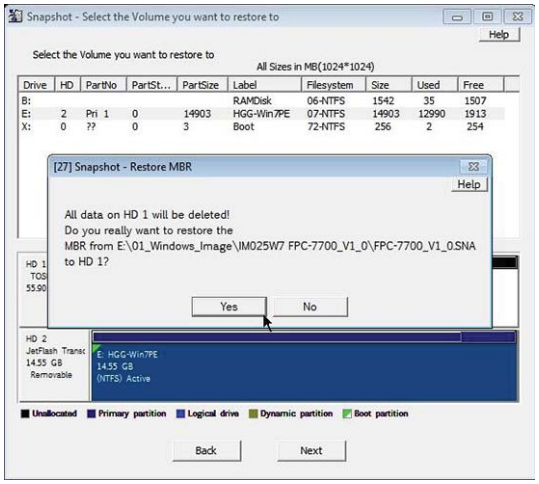




Repeat the process for ALL other partitions on the drive.

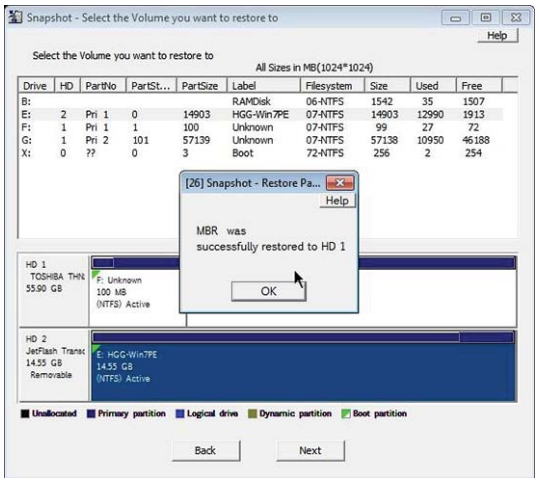
When all partitions have been deleted, right click on the disk to which the image is to be restored and press ‘Restore Master Boot Record’.

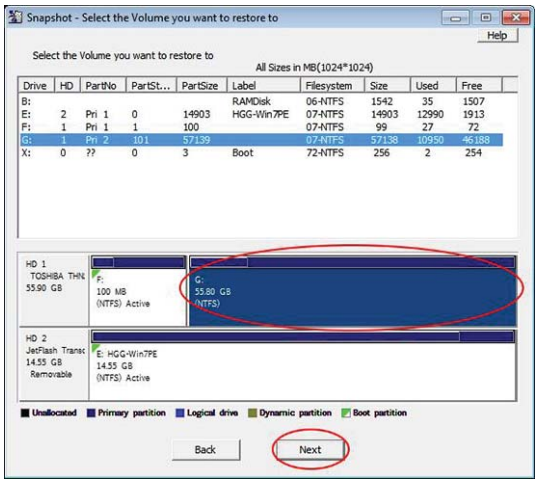




Confirm that you want restore the master boot record, press ‘Yes’.

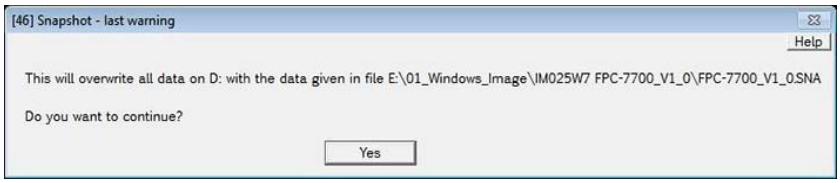
When successful you will see the confirmation window, press ‘OK’.



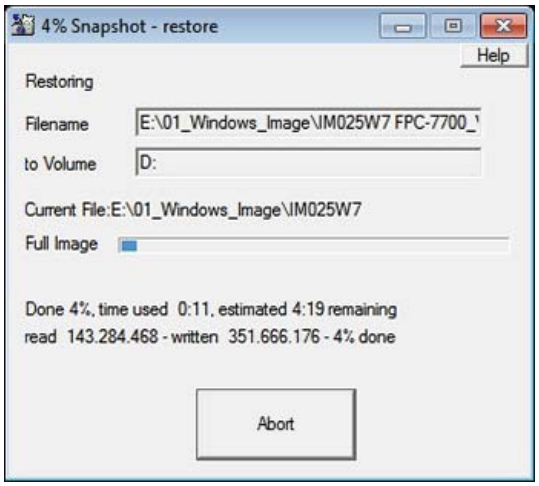


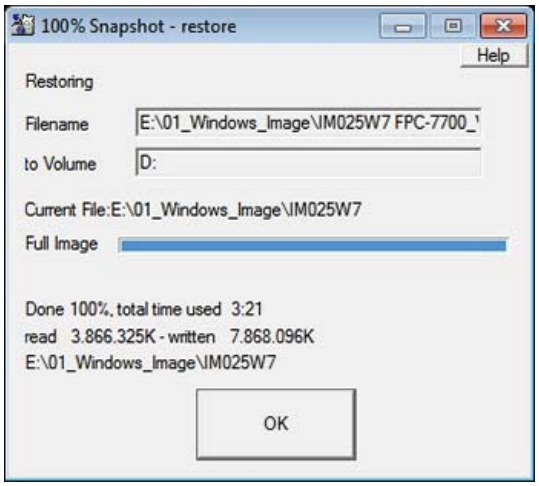
Now select the drive to which you wish to restore the image and press ‘Next’.

Confirm that you wish to overwrite the data on the drive, press ‘Yes’.



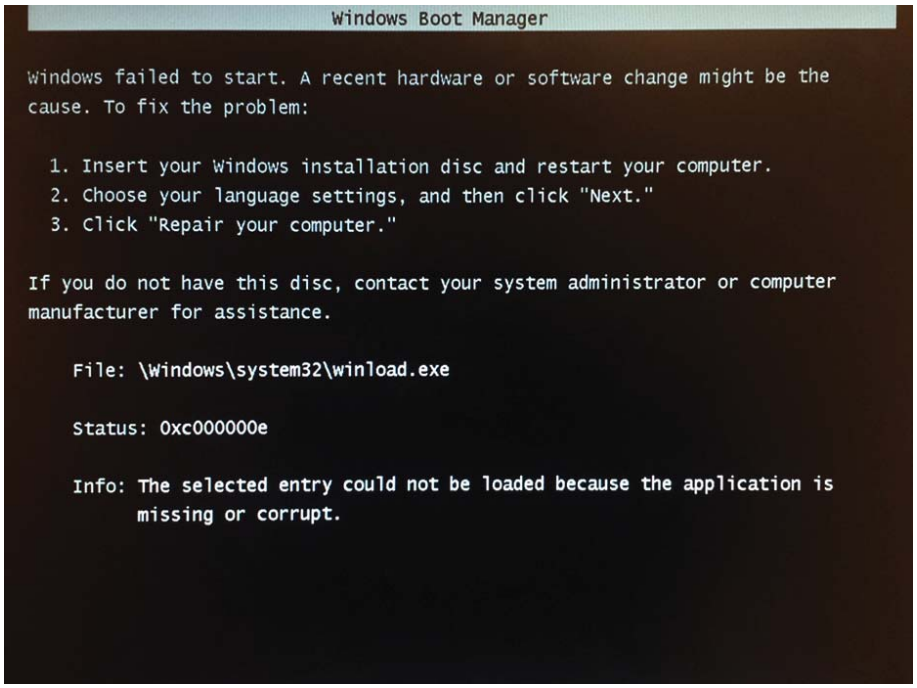
The image will now be restored.





Warning! Do not resize the partition

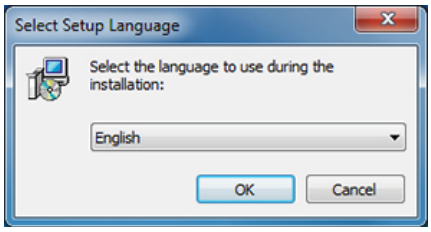
It is possible that Snapshot will ask if you want to resize the partition. This is due to the different sizes of the hard drives. If this happens, **NEVER RESIZE THE PARTITION!** This will cause problems when using Windows 7, it will fail to boot and display the following screen:



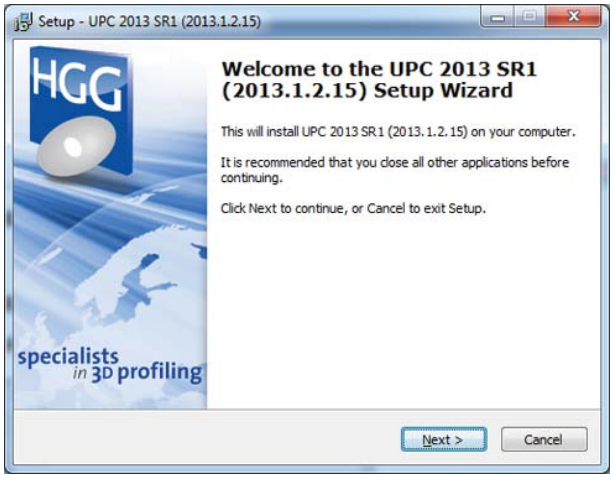
If this happens, follow the instructions to restore the image. Make sure that you delete all partitions and restore the master boot record before you restore the image.

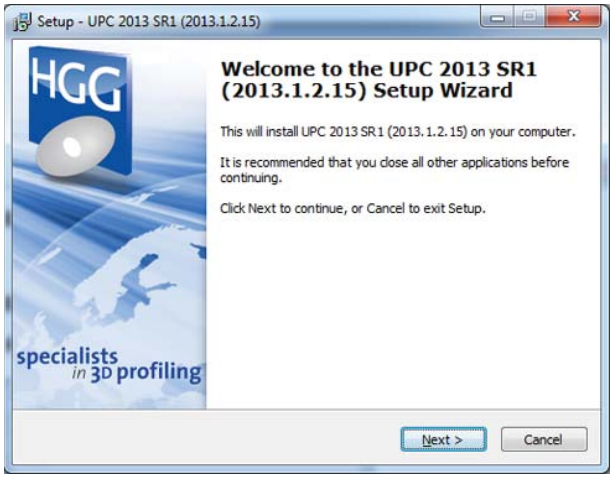
Restoring the UPC machine software

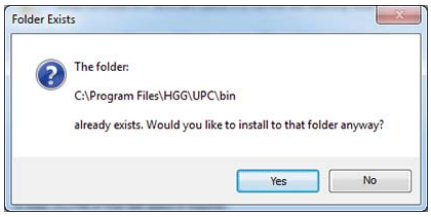
The following step is to install the UPC machine software. Start the UPC installer from the USB drive (in folder: '02_UPC'). Follow the instructions.



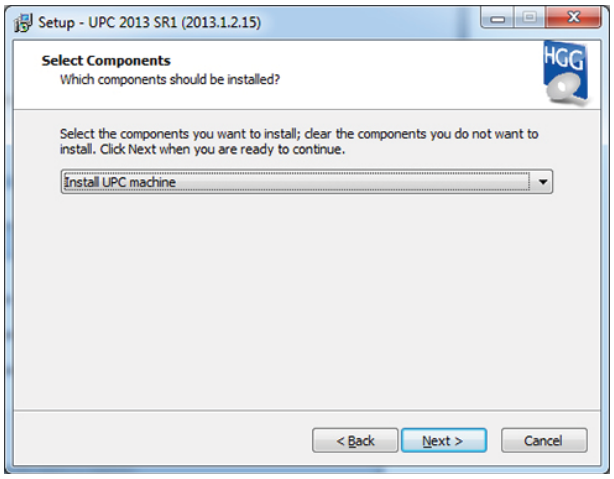
Choose a language for the installation wizard

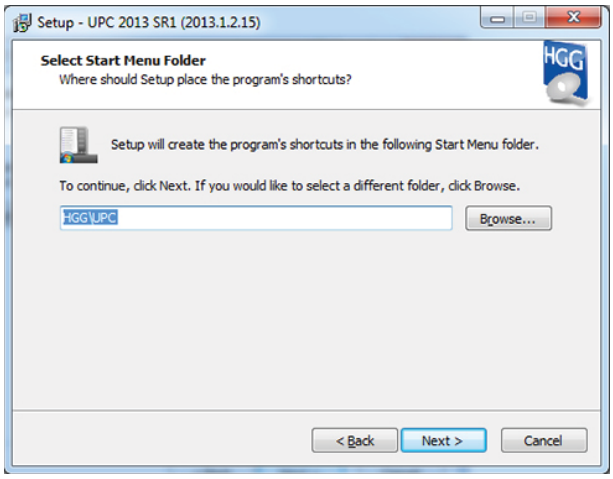


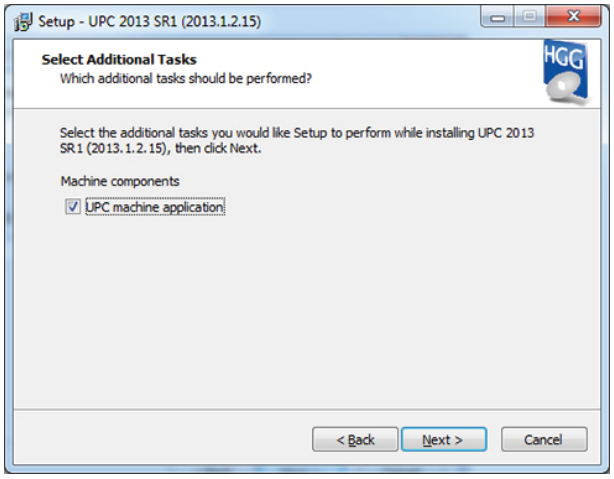


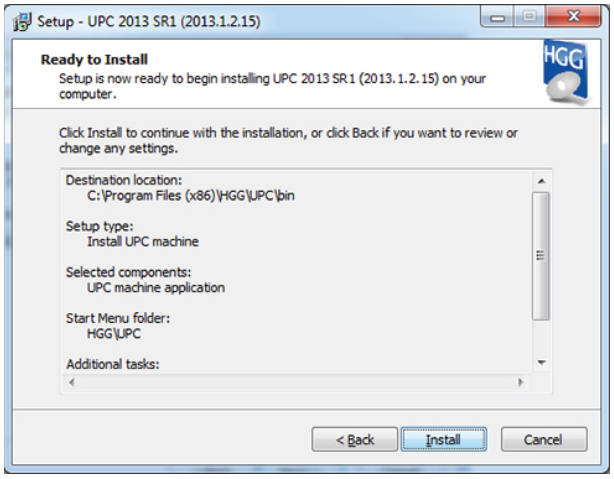


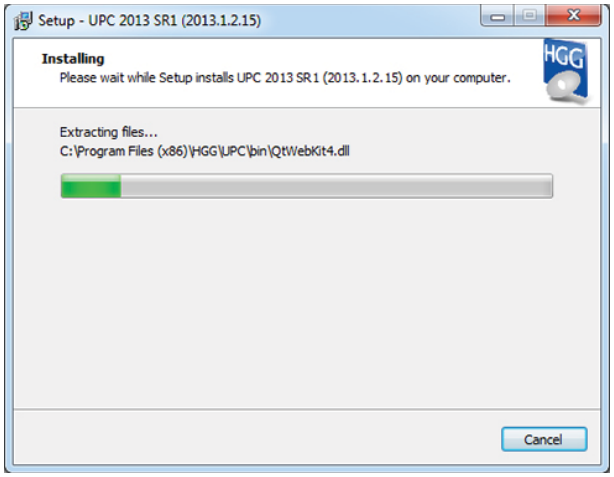
'Yes'

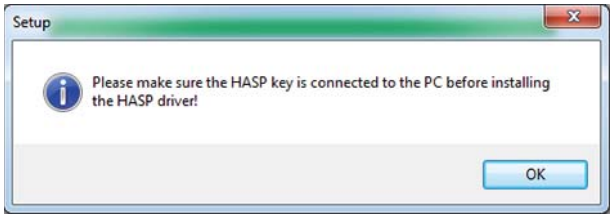


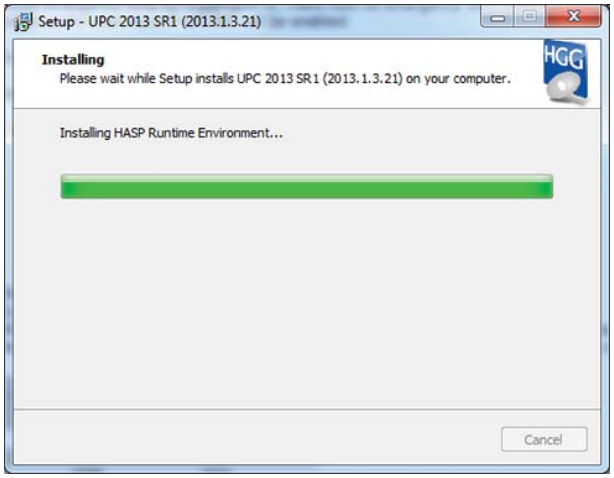


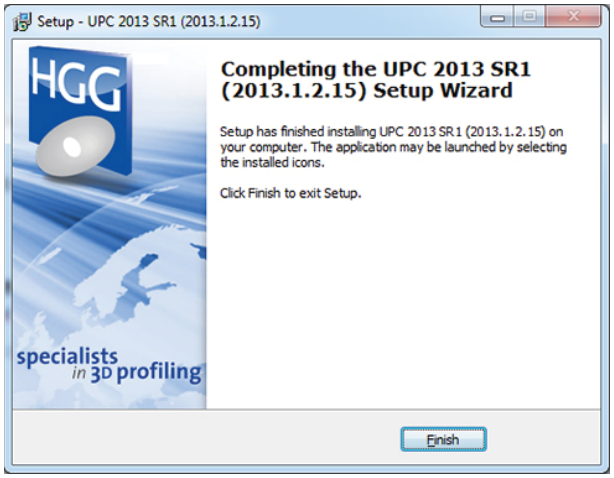

Setup - UPC 2013 SR1 (2013.1.2.15)
Select Additional Tasks
Which additional tasks should be performed?
Select the additional tasks you would like Setup to perform while installing UPC 2013 SR1 (2013.1.2.15), then click Next.
Machine components
UPC machine application
< Back
Next >
Cancel


Setup - UPC 2013 SR1 (2013.1.2.15)
Ready to Install
Setup is now ready to begin installing UPC 2013 SR1 (2013.1.2.15) on your computer.
Click Install to continue with the installation, or click Back if you want to review or change any settings.
Destination location:
C:\Program Files (x86)\HGG\UPC\bin
Setup type:
Install UPC machine
Selected components:
UPC machine application
Start Menu folder:
HGG\UPC
Additional tasks:
< Back
Install
Cancel


Setup - UPC 2013 SR1 (2013.1.2.15)
Installing
Please wait while Setup installs UPC 2013 SR1 (2013.1.2.15) on your computer.
Extracting files...
C:\Program Files (x86)\HGG\UPC\bin\QtWebKit4.dll
Cancel


Setup
Please make sure the HASP key is connected to the PC before installing the HASP driver!
OK

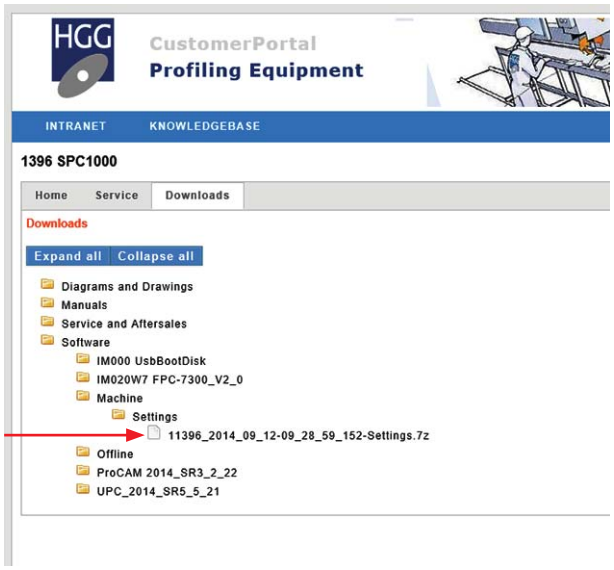

Setup - UPC 2013 SR1 (2013.1.3.21)
Installing
Please wait while Setup installs UPC 2013 SR1 (2013.1.3.21) on your computer.
Installing HASP Runtime Environment...
Cancel


Setup - UPC 2013 SR1 (2013.1.2.15)
Completing the UPC 2013 SR1 (2013.1.2.15) Setup Wizard
Setup has finished installing UPC 2013 SR1 (2013.1.2.15) on your computer. The application may be launched by selecting the installed icons.
Click Finish to exit Setup.
specialists in 3D profiling
Finish

Replacing the settings

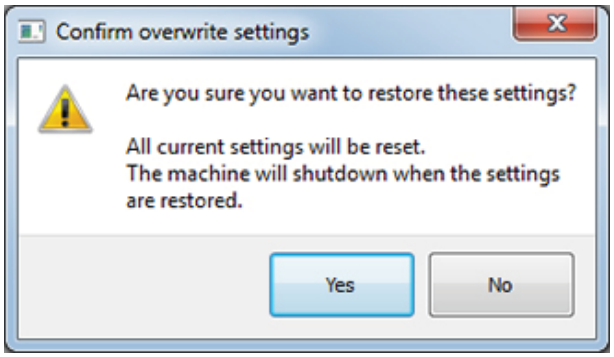
Once the installation is complete start the UPC software from the desktop. The machine will notify you that no settings have been found and ask if you want to import the settings.

Press 'Yes' and browse to your settings file. In the 'Software' folder on the customer portal, in the 'Machine' folder you will find a backup file of your settings (see 'Software locations' at the beginning of this appendix).



Alternatively, you may have already made your own backup file or files previously. Browse to the file location and select the backup file you wish to import.

Open the settings file.

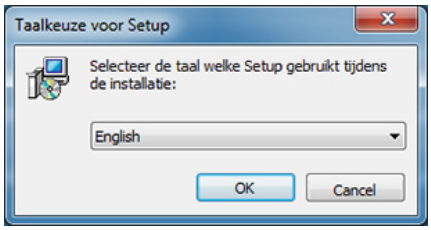


Confirm the overwrite of the settings, 'Yes'.

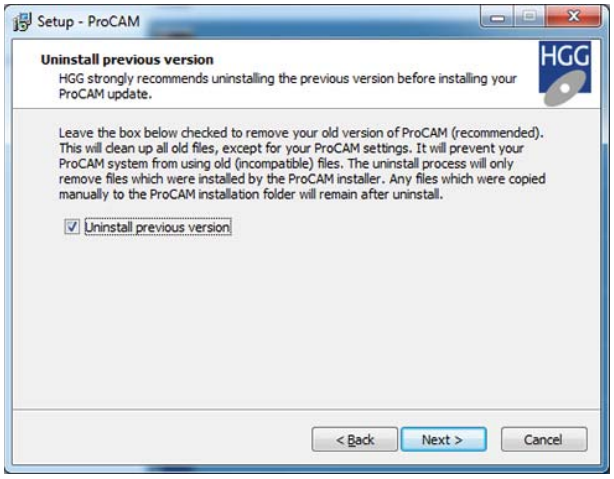
The software must be restarted after importing the settings. The UPC software will automatically shut down when the settings have been imported.

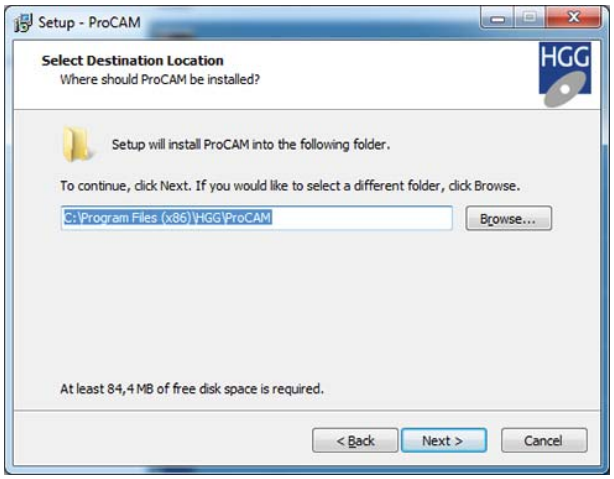
Restoring the ProCAM software

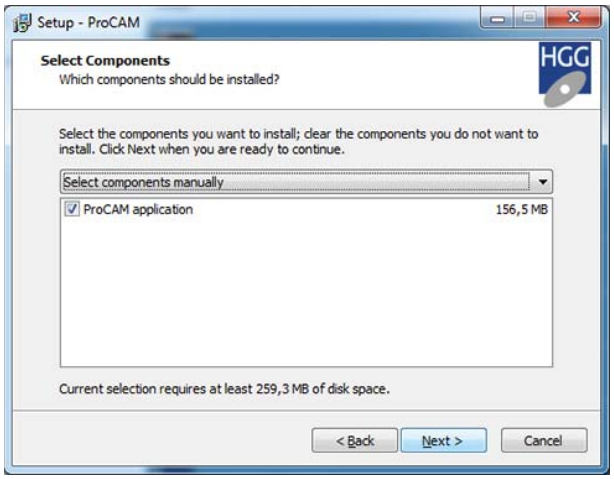
The final step is to install the ProCAM software. Start the ProCAM installer from the USB drive (in folder: '03_ProCAM'). Follow the instructions.

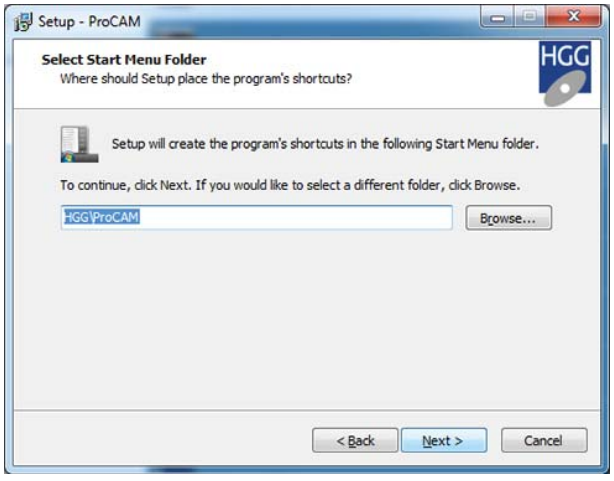


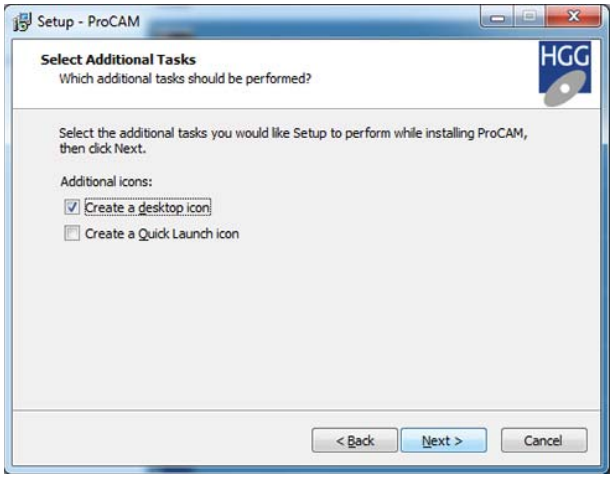
Choose a language for the installation wizard.

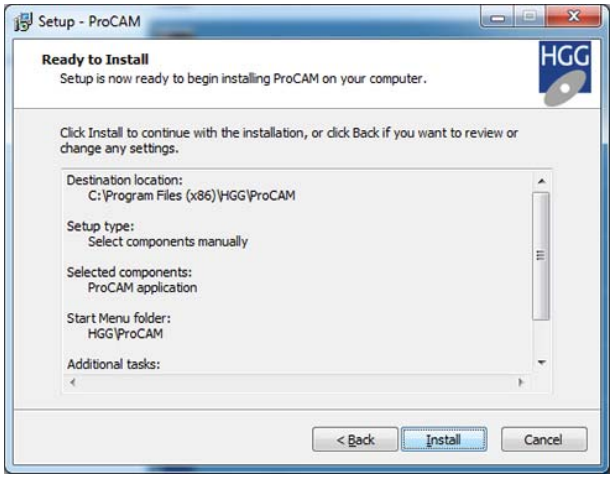


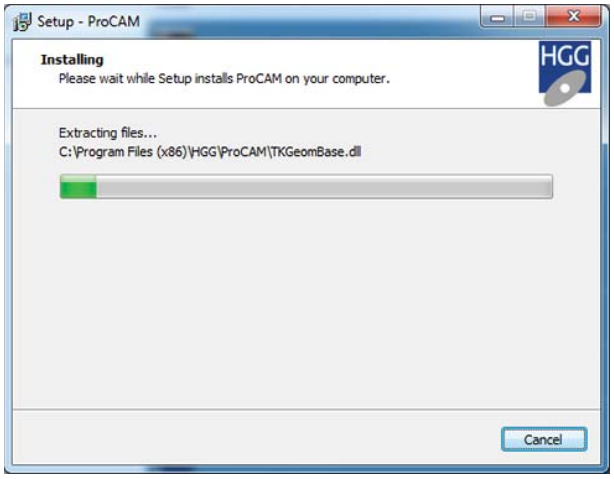












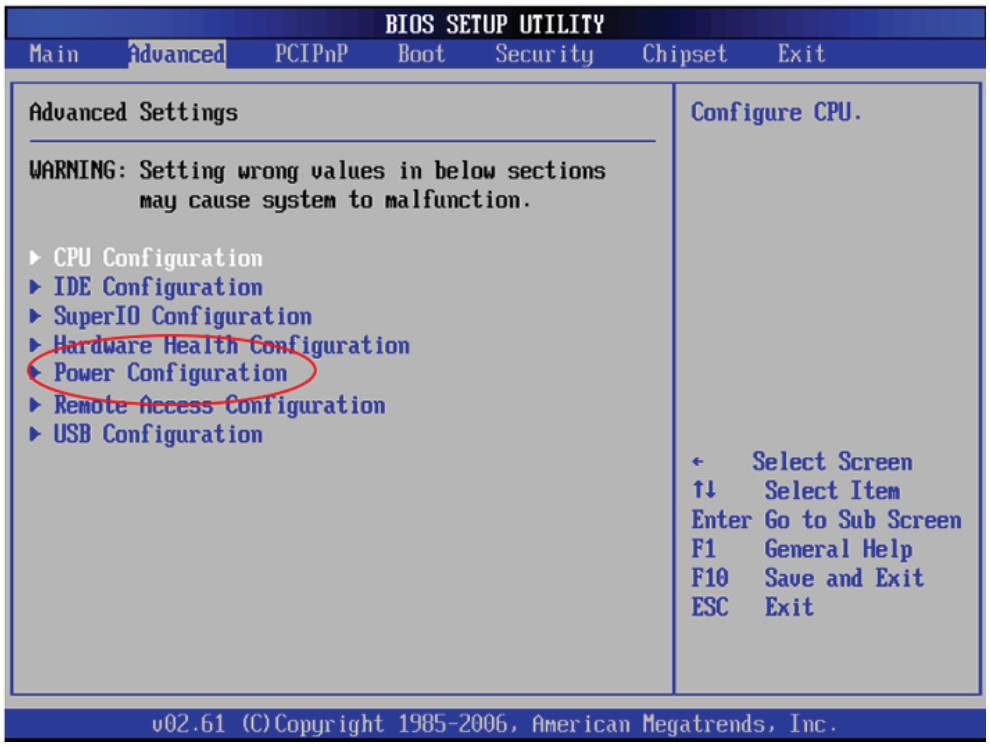
Now all the software has been re-installed and the machine is ready to use. If you experience any further problems please contact the HGG service department.

HGG opening hours:
Monday to Friday from 08:00-17:00 local time.
Phone: +31 227 50 40 30
Fax: +31 227 50 19 03
E-mail: service@hgg.nl

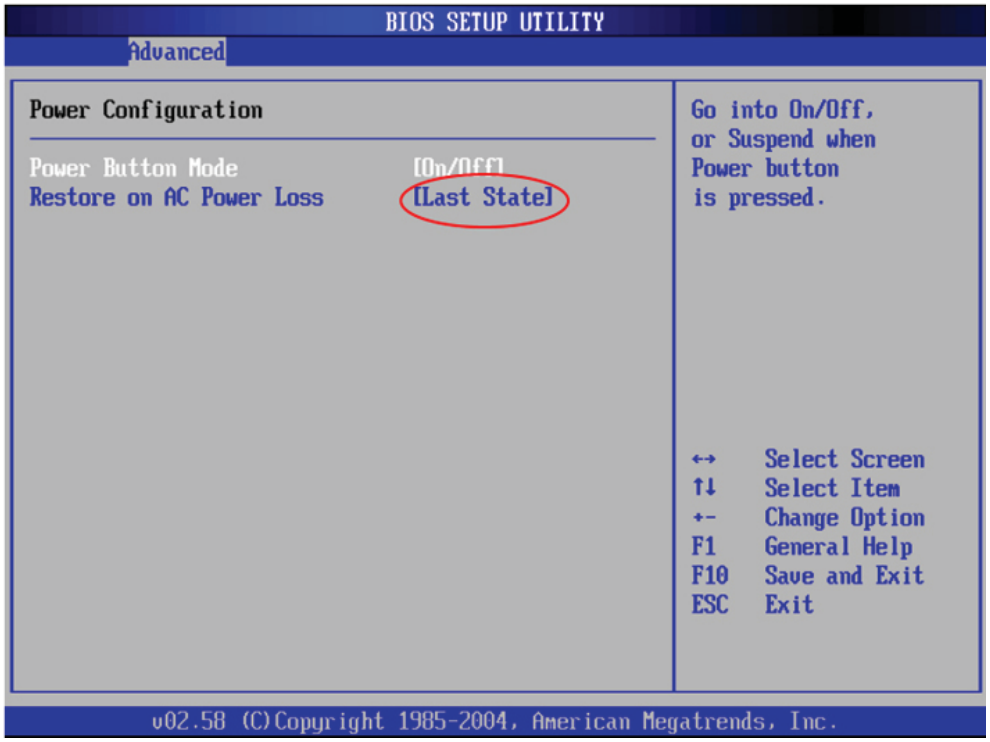
BIOS settings

FPC-7100

Go to the BIOS setup and select the 'Advanced' tab.

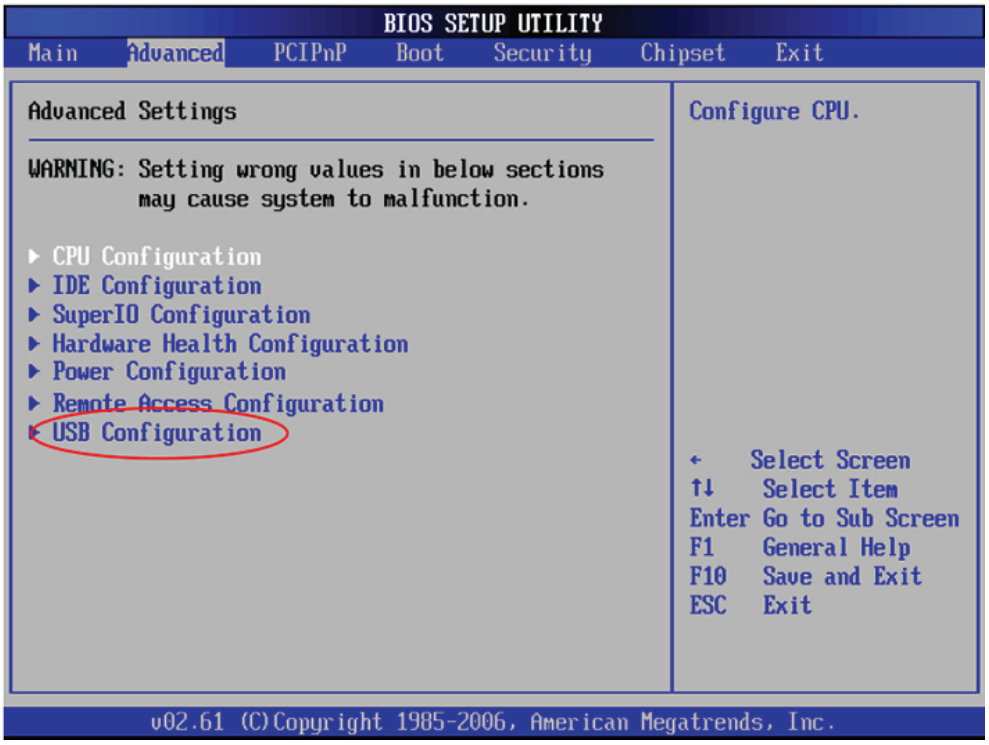


Select the 'Power Configuration' and press 'Enter'.

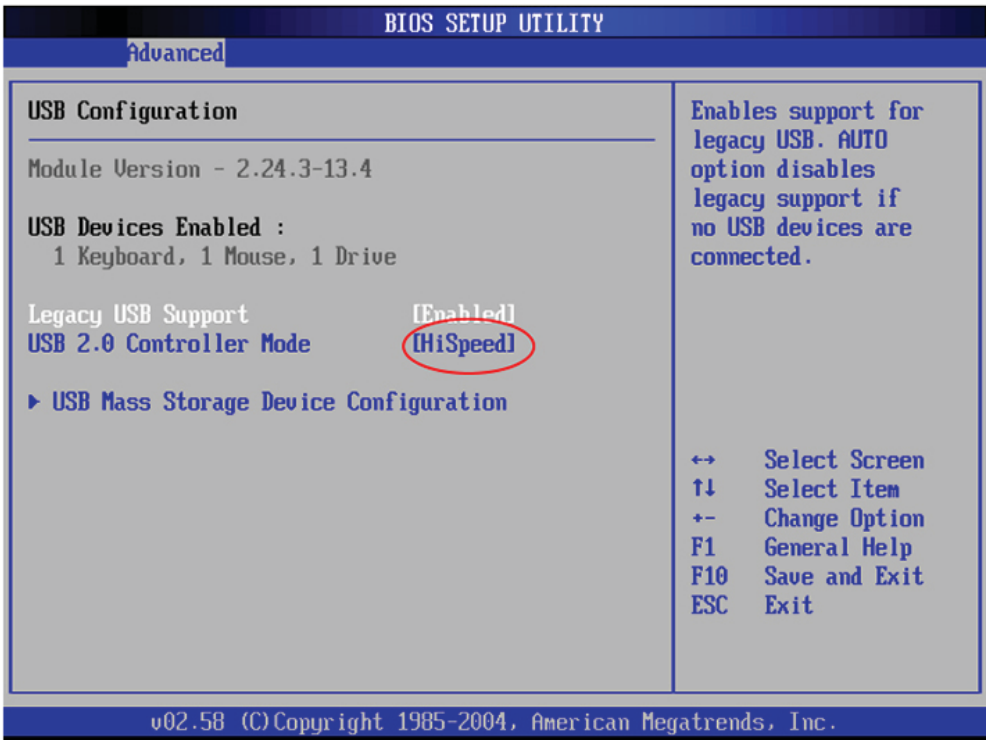


Change 'Restore on AC Power Loss' to 'Power ON'. Press 'F10', save and exit.

Now select the 'USB Configuration' and press 'Enter'.



Select the 'USB 2.0 Controller Mode'.

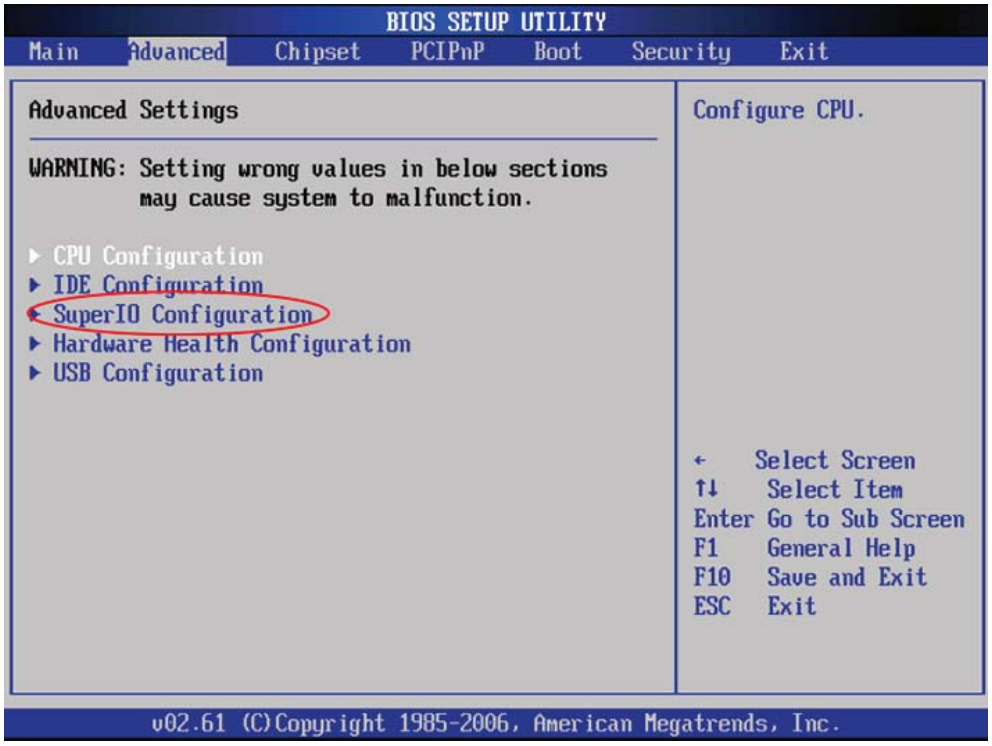


Set to 'HiSpeed' and press 'F10' save and exit.

You can now exit the BIOS Setup and procede to restore the hard disk as described earlier in this appendix.

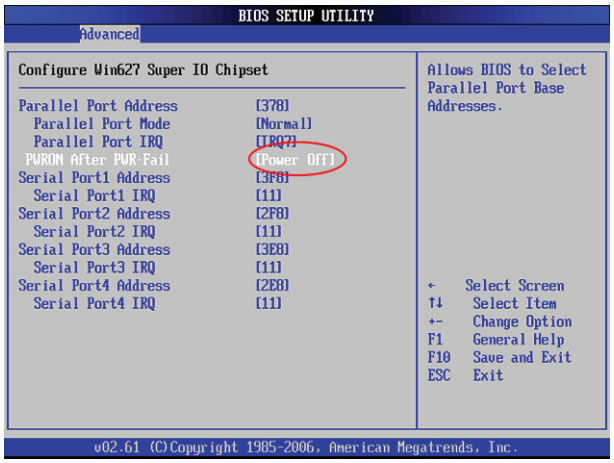
FPC-7300

Go to the BIOS setup and select the 'Advanced' tab.



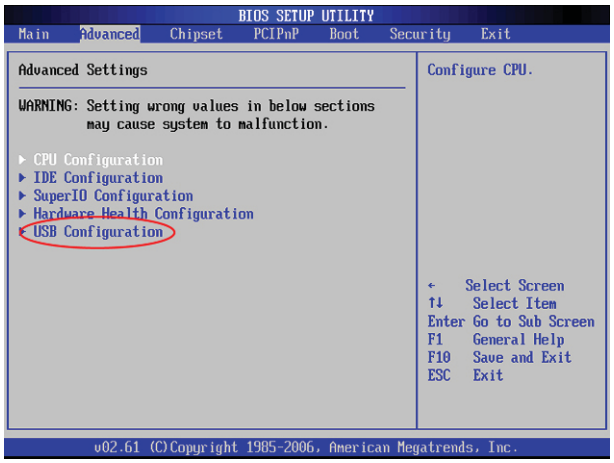
In the advanced settings changes must be made to the 'SuperIO Configuration' and the 'USB Configuration'. Navigate with the arrows and press 'Enter' to select a sub menu. When you have made the changes press 'F10' (save and exit).

SuperIO Configuration



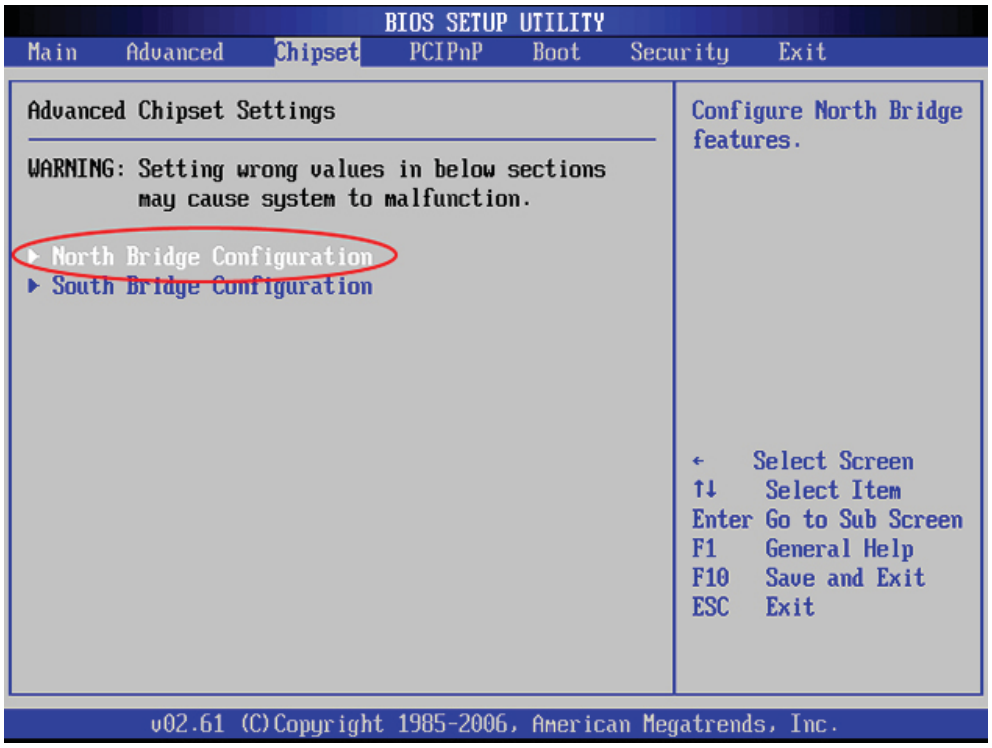
Set 'PWRON After PWR-Fail' to 'Power ON'.
This is to make sure the computer boots when the power is turned on.

USB Configuration



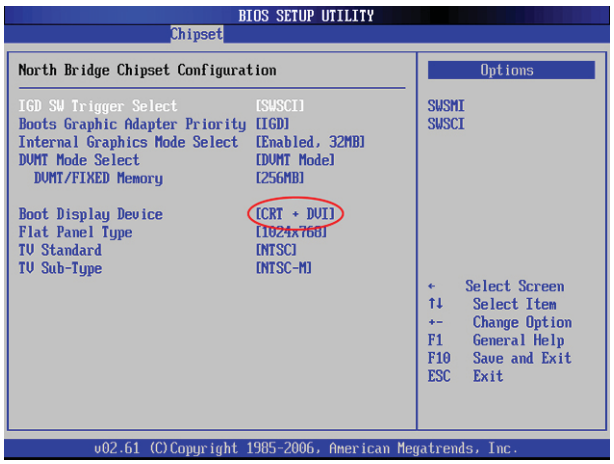
Set 'USB 2.0 Controller Mode' to 'HiSpeed'.
This will improve the speed when booting from USB and restoring images.

Next select the 'Chipset' tab



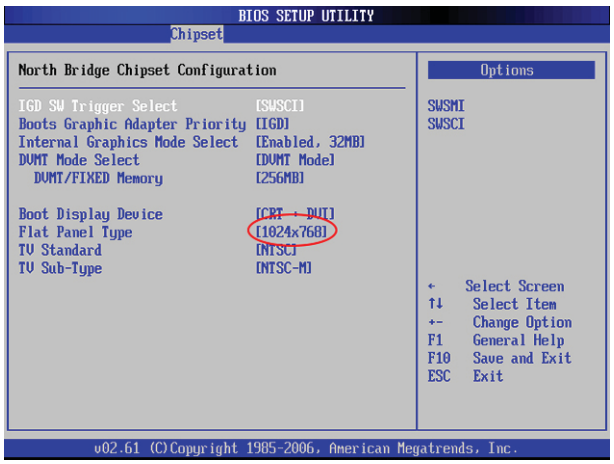
Two changes must be made to the 'North Bridge Configuration'.

SuperIO Configuration



Set 'Boot Display Device' to 'CRT + DVI'.
This will enable video output on the VGA and DVI ports.

USB Configuration

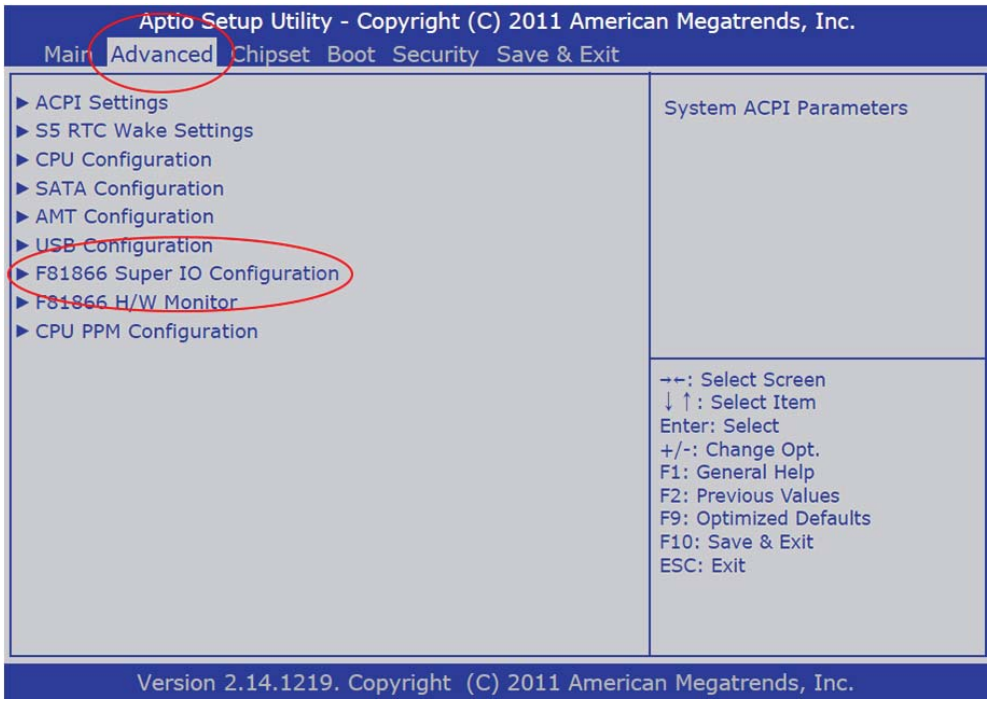


Set 'Flat Panel Type' to '1280x1024'.
This will give the optimal screen resolution in Windows.

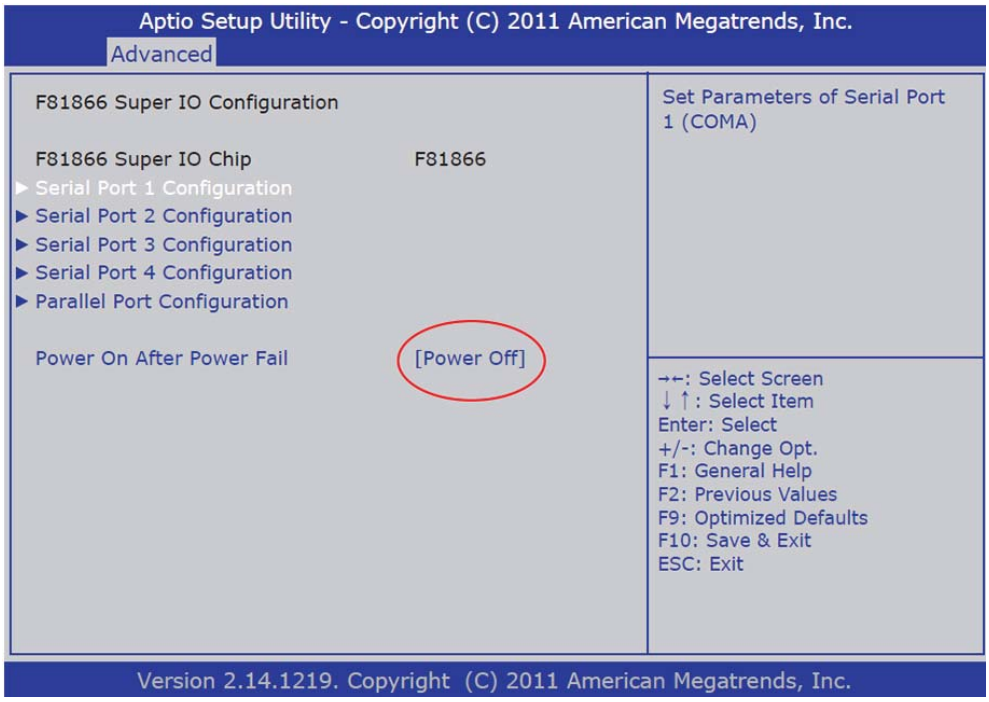
You can now exit the BIOS Setup and procede to restore the hard disk as described earlier in this appendix.

FPC-7700

Go to the BIOS setup and select the 'Advanced' tab.



Select the 'F81866 Super IO Configuration' and press 'Enter'.



Change the 'Power On After Power Fail' to 'Power On'.

You can now exit the BIOS Setup and procede to restore the hard disk as described earlier in this appendix.

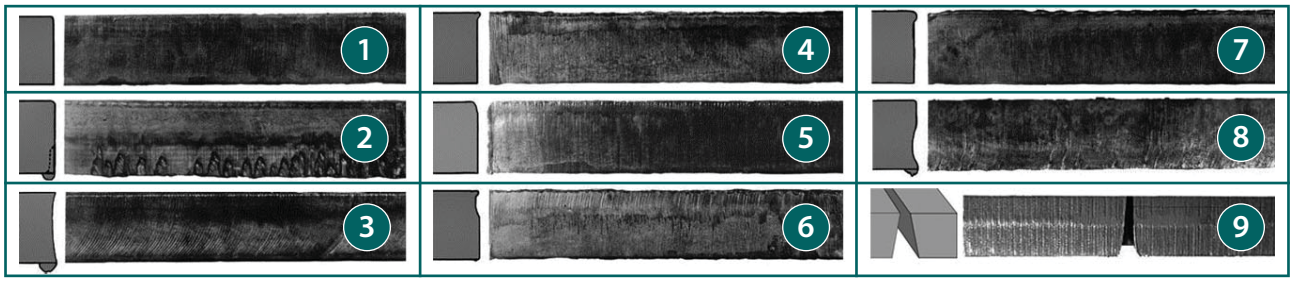
Appendix E

Cutting Quality

Cutting quality

Oxyfuel

The quality of the cut depends on several factors, the cutting speed, the distance from the nozzle to the surface and the quality of the preheat and cutting flames have the most influence. The table below shows examples to help the operator recognise common problems and correct them to obtain the highest quality cut. The correct nozzle should always be used!



1 Correct cutting technique
The cut surface is smooth and square and the kerf walls are parallel. The lag lines are almost vertical. There is little slag on the bottom edge. The top edge is slightly rounded when the preheat flame is properly adjusted. This surface is suited for many applications without further treatment.

2 Cutting speed too low
An abnormally low cutting speed results in heavy gouging of the cut surface and slag adhering in large globules to the bottom. Under these conditions oxygen and fuel gas are being wasted.

3 Cutting speed too high
An extremely high cutting speed results in heavy lag, as shown by the curved lag lines on the cut surface. The face is reasonably smooth but somewhat concave. Slag will adhere during cutting, but it can be removed with ease. Heavy lag cutting is only suitable for straight line cuts.

4 Nozzle too far from surface
When the nozzle is too high above the surface excessive rounding of the top edge occurs. Also, the cutting speed may have to be lowered. With the correct nozzle clearance, the preheat flames should not be more than 2½ centimeters (1 inch) above the top surface of the work.

5 Nozzle too near surface
When the nozzle is too low, part of the preheat flame's inner cone becomes buried in the cut kerf. This produces grooves in the cut face and excessive melting of the top edge. The flame also becomes subject to popping which may result in an incomplete cut.

6 Excess cutting oxygen
If the cutting oxygen pressure is too high or the nozzle size too large, a reduction in cut quality will result. Nozzles are made to operate within a limited range of torch pressures. Therefore, excessive oxygen pressure causes distortions in the oxygen stream once it leaves the nozzle.

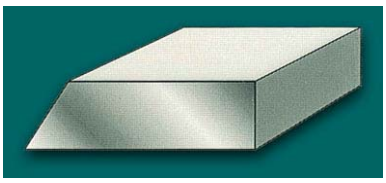
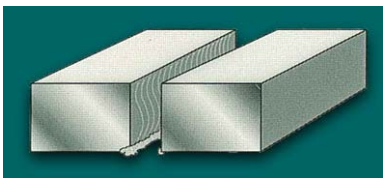
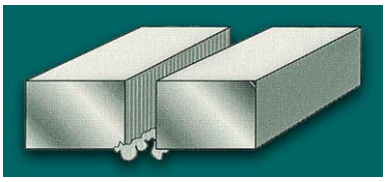
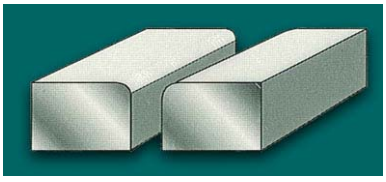
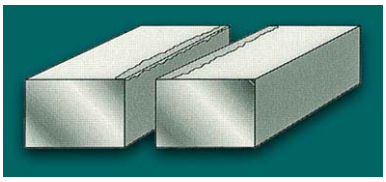
7 Excess preheat flame
Inexperienced operators often try to increase cutting speeds by using a heavy preheat flame. Excessive preheat causes melting of the top edge and may actually lower the speed of cutting. In addition, oxygen and fuel gas are wasted.

8 Dirty nozzle used
The nozzle has been fouled by some adhering scale causing the oxygen stream to lose its parallel form. The cut surface is no longer smooth and square and proof of pitting, under-cutting, heavy slag and scale is evident. The nozzle should be cleaned with care so as not to distort or bell-mouth the cutting oxygen bore.

9 Oversized nozzle
The use of oversized nozzles produces a cut that has a considerable cut face angle because the oversize oxygen stream expands as it passes through the plate. This results in the bottom of the cut being wider than the top.

Plasma

When cutting with plasma the main influences on the quality of the cut are the distance between the torch and material, the cutting speed and the current. These factors can all be adjusted to improve the quality. A damaged, worn or incorrect nozzle will have a major effect on the quality, always ensure that the correct nozzle is used, if you are not sure about the condition of the nozzle, replace it.

Problem	Possible causes	Solutions
 **Excess bevel angle** The angle of the cut edge is not perpendicular to the top and bottom.	• Torch not square • Torch too far from material • Current too low • Speed too fast • Wrong travel direction • Worn or damaged nozzle	• Square torch to material • Lower torch height • Increase current • Reduce cutting speed • Change cutting direction • Replace nozzle
 **High speed dross** Narrow kerf. Slanted or S-shaped lag lines. Small hard bead or roughness along bottom edge of cut (difficult to remove).	• Speed too fast • Current too low • Torch too far from material	• Reduce cutting speed • Increase current • Lower torch height
 **Low speed dross** Wide kerf. Vertical drag lines. Large bubbly accumulation along bottom edge of cut (easily removed).	• Speed too slow • Current too high • Torch too near to material	• Increase cutting speed • Decrease current • Raise torch height
 **Rounded top edge** Slight rounding of the top edge of the cut. The thinner the material, the worse the effect.	• Unsuitable secondary gas • Torch too far from material • Speed too fast	• Change secondary gas • Lower torch height • Reduce cutting speed
 **Top spatter** Light dross that accumulates along the top edge of the cut.	• Speed too slow • Torch too far from material • Worn or damaged nozzle	• Increase cutting speed • Lower torch height • Replace nozzle

Appendix F

Terminology

Terminology

Term	Description
Plasma cutting	Plasma cutting is a process that is used to cut metals and other materials using a plasma torch. In this process, an inert gas (in some units, compressed air) is blown at high speed from a nozzle, simultaneously an electric arc is formed through the gas from the nozzle to the surface being cut, turning some of that gas to plasma. The plasma is sufficiently hot to vaporise the metal being cut and moves at sufficient speed to blow vaporised metal away from the cut.
Lead in/Lead out	Before the machine starts to cut the programmed profile, the chemical process of cutting needs to be started. First the cutting flame needs to pierce the material, this results in a small crater and cutting slag. Since this crater can decrease the quality of the cut, it is better to pierce at a short distance from the cut. This distance is referred to as lead in. Similarly when the cut has been completed the torch shuts down, this can also affect the quality of the cut. The lead out is the distance the torch moves away from the cut before shutting down. The lead in and the lead out are always placed on the scrap side of the material.
Profiling	Profiling is the process of creating a part from raw material.
'Home' position	The 'Home' position is a reference point from which calculations can be made for the cutting process.
'Top' position	The cutting trolley and drill unit (optional) have 'Top' positions. This refers to the calibrated 'highest' point. In order to move the cutting trolley in the longitudinal direction (Y-axis, along the pipe) both the drill unit and the cutting trolley must be in the 'Top' position to prevent damage to the cutting head or collisions which could damage parts of the machine.
'Pipe' position	The 'Pipe' position is the position of the cutting trolley prior to cutting. The torch will be at the set burner height.
'Float' position	When in 'Pipe' position the sensor arms apply pressure on the pipe. The sensor arms follow the contours of the pipe ensuring the torch always remains the same distance from the pipe. In the 'Float' position the pressure is released so that the cutting trolley 'floats' above the pipe. Deviations in the pipe surface are not followed, the torch remains at the same height during profiling.
Pre-homing	Pre-homing precedes the homing process. The machine part will find a hardware switch as a reference point from which it can move to the 'Home' position (sometimes the machine part is already on a switch and must move away first to establish its position).
Ini point	This is the chosen initialisation point for a data file. Cutting will start from this point and all subsequent cutting uses this point as a reference.
Dry run	With the torch disabled the machine will follow the path of the cut. This can be used as a control measure to make sure the settings are correct before actually cutting.
Set	A set is a combination of profiling that is carried out in one action.
Macro	This is a programmable cutting shape.
TASK	This is the original acronym for the patented biaxial cutting head.
Stitch	A stitch is a portion of a macro that is left uncut to prevent parts from falling from or into the pipe.
Bridge	A bridge is the same as a stitch but is used with the Header Creation tool (optional).
Footprint	When marking is enabled the position of a profile will be marked on the fit pipe showing the position of the connection with the cut pipe. This feature can also be used to mark all profiles on a pipe before profiling begins as a control check.

Term	Description
Oxyfuel cutting	Thermal cutting process using a fuel gas and oxygen. The metal is heated to its kindling temperature with the flammable mixture then a jet of 'cutting' oxygen is fired at the metal causing rapid oxidation. The molten oxide is blown clear. This process only works on metals whose oxide has a lower melting point than the metal, such as mild steel (low carbon steel).
CHS	Circular Hollow Section, a hollow cylinder with a specified wall thickness, pipe, tube.
PPM	Pipe Profiling Machines, category to define HGG machines that cut tubes and pipes
Pipe	Hollow cylindrical metal profile, the pipe diameter is a nominal size referring to the inside diameter of the cylinder, not the actual diameter
Tube	Hollow cylindrical metal profile, the tube diameter refers to the actual, outside diameter of the cylinder.
Chuck	Mechanical rotating ring in the main drive that contains gripping jaws
Main drive	Houses and controls the rotational movement of the chuck and clamping movement of the jaws to grip tubes
Cutting trolley	The trolley that houses electronics, the control unit and the cutting head, can move sideways over the rear frame, the remote control is attached to the cutting trolley
Cutting head	The part of a cutting trolley that holds the torch. The cutting head can move up and down (and forward in some machines), and can simultaniously rotate and tilt the torch.
MDI	Manual Data Input, the manual input of data to form shapes, used in ProCAM
Remote control	The touch screen and keyboard from where the HGG machine is controlled
Spark arrestor	A passive fan that intercepts sparks from the air stream to prevent damage to the filtration unit

Operators Manual
Pipe Profiling Machines SPC 500-1200 PT

HGG Profiling Equipment
www.hgg-group.com