Preventive Maintenance Package

With our High Definition service packages we offer you individual maintenance services. The customized packages include all original components, which are recommended for the yearly maintenance corresponding with the operating year or operating hours, respectively. In the following you can see a list of all available maintenance packages with their respective article numbers as well as an overview of the included components.

Overview of the components change plan

Name	Component	Packages											
		01.01	01.02	01.03	01.04	01.05	01.06	01.07	01.08	01.09	01.10	01.11	01.12
Main contactor	Q1				1				1				1
Contactor nozzle-workpiece	Q4	1	1	1	1	1	1	1	1	1	1	1	1
Auxiliary contact	to Q4	1	1	1	1	1	1	1	1	1	1	1	1
Contactor HF- ignition unit	Q6	1	1	1	1	1	1	1	1	1	1	1	1
Filter mat		1	1	1	1	1	1	1	1	1	1	1	1
Main fan	M1					1					1		
Fan heat exchanger	M5					1					1		
Fan rectifier	M2, M3					2					2		
Coolant pump	M6						1						1
Kjellfrost		1	1	1	1	1	1	1	1	1	1	1	1
Relay	A1:K4-K6 A2:K0;K2;K5						6						6
Relay	A2:K1;K3;K4						3						3
External fan	M7					1					1		

On the table side our technition will replace bearings, realign the table and torch, update all software and perform an annual water change.

To sign up for the yearly service package please contact your sales representative at Boss Tables.

Advantages of the maintenance packages:

- Use of high-quality original spare parts
- Easy selection based on the operating year/ hours
- Always up to date according to the components change plan

If you operate a system with special voltages, we will check your requirements and prepare an individual offer.

Please always state the serial number of your plasma cutting system with your order.

Boss Tables Warranty Program

The Boss Tables Warranty Program provides customers with a 2-year "bumper to bumper" warranty that covers all components on the machine directly sold to the consumer from Boss Tables or an authorized reseller. This warranty includes computer and controller components, frame and structural problems attributed to "nominal use," Hypertherm plasma power supply units for 36 months, and electronics, accessory package electronic and mechanical components for 24 months. Routers are warranted by the manufacturer, and the warranties are only valid to the original purchaser.

The program does not cover damage to the machine or components from mishandling while in the customer's possession, including negligence such as dropping the machine upon arrival or during installation, improper installation of electrical components, loading excessive amounts of material, lightning and power issues related to the customer's location, fire and flood-related incidents, "kicking" of sheet clamps from material or dropping material onto the bed of the cutting machine, damage to the slats or sacrificial cutting surface, corrosion or galvanic or electrostatic corrosion due to untreated water, and more.

It is the customer's responsibility to treat the water to ensure no corrosion is taking place in the tank. Lifetime remote support is only valid to the original purchaser. By purchasing a Boss Tables CNC Table or other machine, customers agree to the warranty agreement and will have all the benefits of the warranty agreement. The warranty period starts when the machine leaves the possession of Boss Tables and expires after a period of 2 years or 24 months.

If a warranty replacement part is required, it must be cleared with a factory authorized representative. Once confirmed, a new part or service will be rendered to alleviate the issue. Upon speaking with a representative from the "factory" (resellers are not permitted), the part will be released as soon as possible and overnighted (if requested) at the expense of Boss Tables. The return shipping will be the responsibility of the customer, and damaged goods must be returned within 5 to 7 business days. Controllers must have a return tracking number sent to Boss Tables prior to receiving a replacement controller. We point out explicitly that only spare parts and consumables of Kjellberg original have to be used! Otherwise a warranty claim does not exist. Boss Tables and Kjellberg Finsterwalde as OEM, manufacturer of the equipment can not make any guarantees for the safety of the equipment according to the valid regulations.

Safety Users Read and understand this manual thoroughly before operating the machine.

WARNING

Warning of dangerous electric voltage
Electric shock can be deadly. Further personal and material damages can result from impact. Before opening (for example error search) or starting any maintenance and repair work principally the power supply source has to be switched off and visibly disconnected from the mains.
Opening the plasma unit may be carried out only under responsibility of a qualified electrician!

WARNING

Do not touch under electrical voltage related conductive parts!

The safety circuits may not be suspended!

The operator has to wear an adequate eye shield and insulating protective clothing!

Suitable ear protection measures have to be taken in every case (e.g. wearing of ear muffs or ear plugs)!

In any case the user of the unit installation has to carry out measurements of the concentration of toxic substances to proof the effectiveness of the exhaust equipment!

WARNING

Do not store flammable substances in the cutting area!

WARNING

Place the cylinders in an upright position and lock it against tilting over!
Don't use damaged cylinders, pressure reducers and armatures!

WARNING

All parts that come into contact with oxygen must be kept oil and grease free! When using oxygen, the explosion protection for oxygen must be connected to the pressure-reducer (protects against backfiring)!

WARNING

Use only „Kjellfrost" as coolant!

CAUTION

All details given on the label of the new anti-freezer have to be followed consequently!

- „Kjellfrost" is injurious to health
- Keep "Kjellfrost" in the original container, do not transfer!
- Don't drink Kjellfrost
- Keep it away from food, drinks and fodder
- Always clean your hands before a break and after end of work
- Avoid the contact with eyes and skin
- Safety goggles recommended during filling
- Wear protection suit
- Wear gloves from Nitril or Viton (see safety data sheet)
- Immediately taking off soiled, watered clothes
- Special danger of skidding by run out or spilled "Kjellfrost"
- Keep away from children

First aid

- after swallowing
  Don't bring up, clean the mouth, drink much water, open the window for fresh air and call the doctor , present packing or label.
- after eye contact
  Clean the eyes with much flowing water some minutes and call the doctor
- after skin contact
  Quickly clean it with much water and soap

WARNING

In order to change consumables, the plasma cutting system shall be switched OFF and secured against any accidental start. An unauthorised start-up is prevented by e.g. pulling out the key of the key-operated switch after switching off the plasma cutting system!

Under no circumstances pliers or other unsuitable tools have to be used for consumable change, they entail inevitably the damage of the consumables, for example burr formation and thereby malfunctions of the plasma torch.

You are only allowed to use ORIGINAL Kjellberg spare parts and consumables!
The use of other manufacturer consumables leads to the loss of the warranty claim.

WARNING

All components and parts coming in touch with oxygen have to be kept free of oil and grease!
This refers specially to the torch head and the consumables.

Use only exact the consumables which are destined for the technological operation!

After screwing off the protective cap to replace the swirl gas cap without any further replacement of consumables, the tightness of the nozzle cap must absolutely be checked and, if required, tightened again before mounting the protective cap!

apply to plasma torch:

PerCut 2000
PerCut 4000
PerCut 4000 XS

Make sure that all wearing parts are complete and correct installed!

Especially the cooling tube has to be inserted. Other wise the cooling is ineffective and the torch gets damaged.

No other parts as mentioned before have to be changed unauthorised on the plasma machine torch.

A further opening of the torch from the front side is not possible.

You have to mind on tightness of the plasma torch after consumable change, coolant does not leave!

The discharge chamber between cathode and nozzle has to be blown absolutely dry (press tumbler switch "gas test" approx. 20 seconds - see "operation sequences")

Warning label The warning label is visibly attached on the power source. The operator and the maintenance personnel must familiarize themselves with the meaning of the symbols before working at the unit.

1. The operator and the maintenance personnel must read and understand the instruction manual as well as learning the operation of the unit before work with it to avoid endangerments. The safety regulations of the respective company have to be taken into account.

2. Smoke, dust and gases developed during the cutting process are harmful for health and may not be breathed in. Principally a suitable fume extraction device has to be used.

3. Wearing of protective clothing (helmet, welder's overall, leather apron, gauntlets, safety shoes). The protective clothing has to be isolating, dry and heavily inflammable

4. Noise can damage the hearing! During the plasma cutting operation suitable ear protection has to be used. The radiation of the plasma arc can lead to eye injuries and skin burns. Eyes and skin have to be protected from the radiation of the plasma arc therefore. Protection devices are safety goggles and hand shields, which must have a sufficient lens shade.

5. Electric shock can kill! Live electrical parts may not be touched. Opening the plasma unit may be carried out only by an advised electrician. Before carrying out any maintenance or repair work the unit has to be disconnected visibly from the mains! Wearing of protective clothing (helmet, welder's overall, leather apron, gauntlets, safety shoes). The protective clothing has to be isolating, dry and heavily inflammable.

6. Working with plasma cutting systems possibly can lead to fire and explosions. Flammable and explosive materials must therefore be kept away from the cutting area. It has to be ensured that suitable and easily accessible extinguishing facilities are located nearby. The appropriate fire protection regulations have to be taken into account.

7. Appropriate warning labels may not be removed, painted over or covered.

Working in environments with increased electric endangerment

The plasma cutting system is built in compliance with valid standards EN 60974-1 and therefore applicable in environments with increased hazard of electric shock. The conditions for fulfilling these requirements are given by design measures in the plasma cutting system:

- The plasma power source and the plasma torch are forming a safety-proofed installation, which can be separated only by a tool (as far as a central connector with mechanical locking is present).

• The machine cannot be switched on as long no torch is attached or the attached torch isn't assembled completely.

• Opening the control circuit effects switching off the open circuit voltage, which drops down within the prescribed time below the limit Therefore the plasma cutting system is S-marked and applicable in environments with increased hazard to electric shock.

Endangerment by high voltage ignition

For igniting the pilot arc a high voltage igniter is installed in the power source. When pressing the ON-button the high voltage is applied to the cathode and nozzle. After initiating the pilot arc the HV-supply becomes switched off automatically. After the cutting process has started the pilot extinguishes.

⚠ WARNING

Electric shock through touching of the torch head, if the plasma unit is switched on.
Electric shock can be deadly. Further personal and material damages can result from impact.
Never touch the torch head, if the power source is switched on!

⚠ WARNING

Warning of electromagnetic interferences
Through the operation of the plasma cutting system in particular by the temporary high voltage ignition procedure results electromagnetic fields, which can lead to the influencing of an medical equipment (e.g. cardiac pacemakers, hearing aids, insulin pumps) and body implants.
Persons concerned must consult their specialist before beginning of work at plasma cutting system!

General The user is responsible for installing and using the installation according to the manufacturer's instruction. If electromagnetic disturbances are detected then the user is responsible to arrange the technical solution with the assistance of the manufacturer.

Endangerment by electromagnetic fields

The plasma cutting installation complies with the instructions of the EN 60974-10 (VDE 0544, part 10) "Arc Welding Equipment – part 10: requirements at the Electromagnetic Compatibility (EMC)". This standard is valid for Arc Welding Installations and related processes (e.g. plasma cutting).

WARNING

Warning of electromagnetic interferences
Through the operation of the plasma cutting system in particular by the temporary high voltage ignition procedure results electromagnetic fields, which can lead to the influencing of an medical equipment (e.g. cardiac pacemakers, hearing aids, insulin pumps) and body implants.
Persons concerned must consult their specialist before beginning of work at plasma cutting system!

WARNING

The plasma cutting system is an attachment of the class A according to EMC classification to CISPR11:
This class A cutting mechanism is not intended for the use in living quarters, in which the current supply is made by a public low-voltage utility system. It can be possibly difficult, both by line-bound and radiated disturbances, to ensure within these ranges electromagnetic compatibility.

Supervisors It is very important that a safe and appropriate working environment is provided for this Boss equipment and in compliance with applicable federal and local industry standards. It is imperative that programmers, machine operators and maintenance personnel be trained adequately in the use and care of the equipment. These employees should receive the proper instruction in order to have a complete understanding of the operation of this machine before beginning to program, operate or service it. Careful programming and debugging of new programs are essential for successful operation of this machine. Use program Stop Codes to stop machine motion for operator removal of parts or scrap. Never allow operators to place any part of their body into the machine while the machine is active. Ensure that all personnel understand the function and use of EMERGENCY STOP button. Maintenance Personnel Only qualified personnel should make repairs on this equipment. Use caution and follow Boss Tables procedures when working on the machine. Be sure to observe the following guidelines: 1. Before performing maintenance or repair, turn the power OFF and follow lock out/tag out (zero energy shutdown) procedures. Also, follow any lock out/tag out procedures applicable to your specific plant requirements. 2. Wear safety glasses and other personal protective equipment as required by applicable federal, local industry, and plant safety program standards. 3. Wear proper clothing. Do not wear watches, rings, jewelry, or loose-fitting clothes. 4. Read and review the manual carefully. 5. Be familiar with the operation of the machine. 6. Practice preventative maintenance. Inspect the equipment regularly and repair or replace worn components and tooling. 7. Always replace safety guards and other safety devices removed for service and make sure that they are fully functional before operating the equipment. 8. Never remove, jumper out or bypass a safety device to permit machine production. 9. Never place yourself in a hazardous situation to observe a problem and ask someone else to operate the machine. This could be a very dangerous and life-threatening situation.

Operator This equipment has been designed with operator safety in mind (when used under normal operating conditions). The user must always be alert to the possibility of dangerous situations. Always exercise care and caution. Report any minor problems immediately, so that they can be corrected before becoming major difficulties. Only qualified personnel should make repairs on the machine. 1. Be familiar with the machine. 2. Be alert to the significance of the various warning indicators and be conscious of the functions of pushbuttons and other controls. Use the controls properly. Review and understand the operation of the EMERGENCY STOP function and the CYCLE STOP function. 3. Never operate the equipment unless it is in good working order. 4. Wear safety glasses and other personal protective equipment as required by applicable federal, local industry and plant safety program standards. 5. Wear proper clothing. Do not wear watches, rings, jewelry or loose-fitting clothes. 6. Avoid all moving parts of the machine or workpiece when setting up or operating the equipment. Never reach into the machine while it is active. Use the EMERGENCY STOP or CYCLE STOP function to stop machine motion. 7. Recognize and avoid unsafe operating conditions. 8. Maintain a clean work area. Avoid accidents by keeping work areas clean and neat. 9. Never leave the machine in an unsafe condition. 10.Never leave a machine running unattended. 11.Never remove or bypass safety devices. 12.Report any unsafe conditions, personal injury or machine problems immediately to your appropriate supervisor(s) and safety manager(s). 13.Never operate the machine with someone within a hazardous area.

- Follow all established lock out/tag out (zero energy shutdown) procedures when performing maintenance or repairs on the equipment.
- Do not operate the machine if you are fatigued, impaired or under the influence of drugs or alcohol.
- Do not modify or alter the machine in any way without prior approval from your supervisor and the manufacturer.
- Only use approved tooling and accessories when operating the machine.
- Never attempt to override or bypass machine alarms or warning indicators.
- Follow all applicable federal and local industry safety standards and regulations.
- Attend all required training sessions and refresher courses on the operation and maintenance of the machine.

Endangerment by oxyhydrogen

Oxyhydrogen is an hydrogen-air mixture, that explosively reacts in a hydrogen proportion between 4 and 76 Vol.-%

WARNING

Danger of formation of highly explosive oxyhydrogen

- at hollow spaces,
- at the displacing chamber of the water cutting table and
- below the sheet panel lying on the cutting table.

There is danger of injury by exploding oxyhydrogen and flying parts.

The following information has to be observed to avoid the danger!

Plasma cutting of aluminium

Never cut aluminum in contact with water - neither under water nor on the water or on a water cutting table!

The molten aluminium which is blown out of the cutting kerf forms in water an aluminium granule which is oxidizing in water very fast because of its large surface. Hydrogen is generated due to the bond of oxygen of the water. This reductive process can last for days in the slag of the water cutting table. There may lead to formation of highly explosive oxyhydrogen.

Plasma cutting in connection with water

If you use process gases, which contains hydrogen,for plasma cutting in connection with water, there may lead to formation of highly explosive oxyhydrogen. For water tables with level control it has to be ensured, that:

• nitrogen is used instead of compressed air for regulating the level. For water tables without level control it has to be ensured, that:

• hydrogen can escape freely everywhere and is burnt out

• the guiding machine has to be positioned after the cutting outside the water table to avoid, that hydrogen or oxyhydrogen (hydrogen-air mixture) can gather in hollow spaces (like switch boxes) • that no hydrogen can gather below the plate which is placed on the table grating

It is not allowed to store the plates on the cutting grating for a longer time!

Water table use Keep the operator's body and clothing dry. Do not stand, sit, or lie in/on any wet surfaces when using this equipment. Never work in a damp or wet area without proper insulation against electric shock. Disconnect main power before servicing the torch, power supply or service connections to the plasma arc system, or any part of the machine bed. Wear adequate personal equipment (overalls, gloves, safety boots etc.) when operating the machine. Remove or secure articles of clothing, such as ties and loose sleeves, which may catch or be drawn into moving machinery.

Eye Protection LENS SHADE: • Arc Current AWS (USA) ISO 4850 • Up to 100A No. 8 No. 11 • 100 – 200A No. 10 No. 11 – 12 Safety • 200 – 400A No. 12 No. 13 • Above 400A No. 14 No. 14 Medical treatment facilities and a qualified first aid person should be available for immediate treatment of flash burns to the eyes and skin. It is recommended that the cutting area be prepared in such a way as to minimize the reflection and transmission of ultraviolet radiation. Walls and other surface areas should be painted in dark colors to reduce reflection. Protective screens or curtains may be installed to avoid unnecessary ultraviolet transmission. Warning The plasma arc cutting process produces rays that can burn eyes and skin. Always wear eye protection with appropriate lens shades.

Noise The noise levels generated during plasma arc cutting may be as high as 105 decibels. This depends on the distance from the machine, arc, plasma torch nozzle design, gas velocity, material type, and plate thickness. Boss Tables recommends that each user check the sound levels in his own shop under normal operating conditions. Based on those findings, provide adequate ear protection to all personnel who must work near the machine, in accordance with applicable local, state, and federal industry standards. Noise levels that can cause discomfort or damage to hearing will vary greatly from one individual to another. We recommend that ear protection be furnished to any worker who requests it, regardless of applicable industrial standards or tested noise levels. Exposure to noise from the cutting process can damage hearing. Wear appropriate ear protection when operating the machine or when working in the proximity of the machine.

Safety Devices Plasma arc units are provided with certain safety interlocks designed to prevent equipment damage and/or personal injury. Never short out or in any way attempt to defeat the safety interlock devices. All exposed electrical connections must be covered with the proper insulation material. Safety devices must be regularly checked for proper operation and replaced immediately if found to be inoperative. ***Warning Never attempt to operate the plasma unit with any of the power supply covers not in place***. This is extremely hazardous to the operator and any other person in the area. It also prevents the equipment from properly cooling critical components and could result in equipment damage.

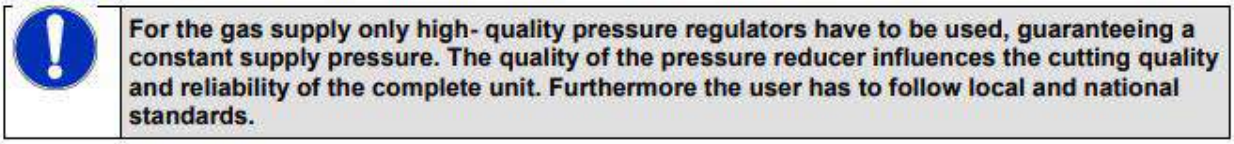
Safety Risk of Electric Shock Plasma cutting equipment uses high open circuit voltages to initiate the plasma arc. Normal load voltages are higher than experienced with other types of welding equipment. Extreme CAUTION must be exercised when operating or servicing this equipment.

Input Connections A wall mounted line isolating switch, fused as required by local electrical codes, must be fitted as close as possible to the plasma arc power supply. ***Danger*** Always verify that ALL electrical supplies are isolated before undertaking any service or maintenance work. The machine may have more

than one electrical supply. ***Warning Plasma arc can cause injury and burns.*** Verify that no person is in the proximity of the plasma torch at any time and that the plasma system is switched on. Serious burns

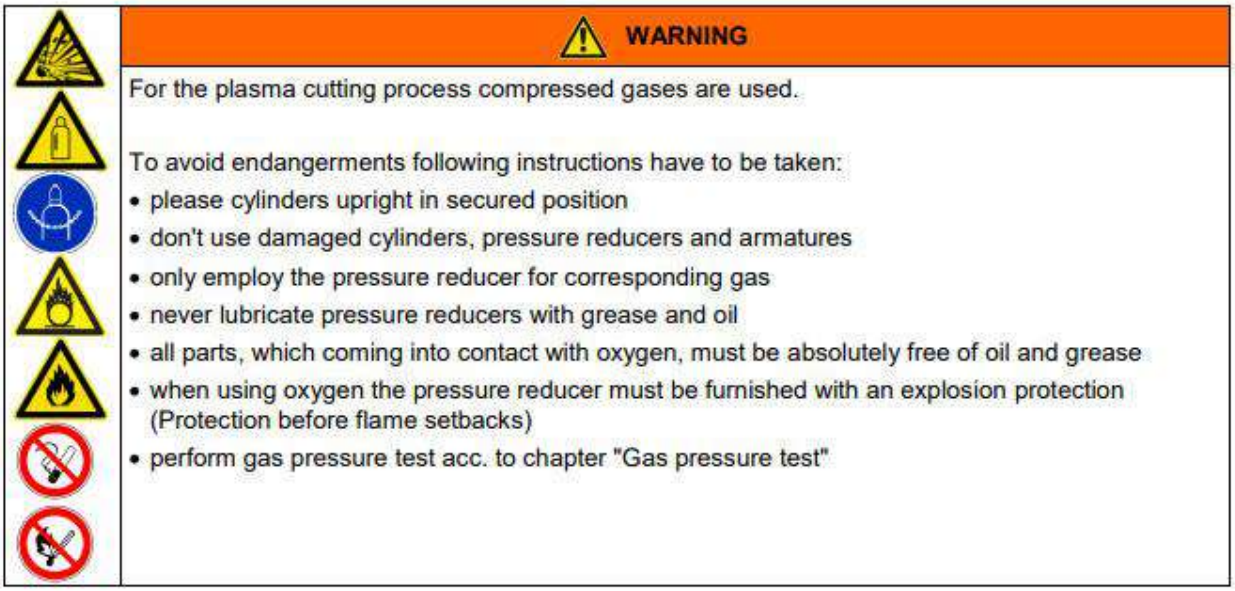
and or electrical shock hazards exist, even when the plasma cutting system is not active. ***Warning Frequently inspect the cable for damage or cracking of the cover or sleeve.*** Bare wiring can kill! Replace damaged cable immediately. Grounding Be sure all ground lugs are of adequate size to carry the rated current load. Make all connections tight to avoid resistance heating. Connect the material grid of the worktable to a good earth ground. Boss CNC Pro Plasma Tables require a dedicated earth ground that is isolated from all other electrical systems.

Handling of pressure reducer



For the gas supply only high- quality pressure regulators have to be used, guaranteeing a constant supply pressure. The quality of the pressure reducer influences the cutting quality and reliability of the complete unit. Furthermore the user has to follow local and national standards.

The operator has to follow national and local regulations! (for example in germany Employer's Liability Insurance Association and in canada CAN/CSA-W117.2)



WARNING

For the plasma cutting process compressed gases are used.

To avoid endangerments following instructions have to be taken:

- please cylinders upright in secured position
- don't use damaged cylinders, pressure reducers and armatures
- only employ the pressure reducer for corresponding gas
- never lubricate pressure reducers with grease and oil
- all parts, which coming into contact with oxygen, must be absolutely free of oil and grease
- when using oxygen the pressure reducer must be furnished with an explosion protection (Protection before flame setbacks)
- perform gas pressure test acc. to chapter "Gas pressure test"

Handling of the coolant "Kjellfrost"

(only valid for units with liquid cooled torches)

For all liquid- cooled plasma torches Kjellberg Finsterwalde is using the coolant „Kjellfrost", suitable as anti-freezer as well. „Kjellfrost" contains anti- corrosive inhibitors. Thereby all the components of the cooling device are protected effective against corrosion. Please notice following items particularly:

• „Kjellfrost“ is classified as a hazardous substance in sense of the standard for hazardous substances, but not in the sense of the standard for the transportation of hazardous substances.

• Danger dominant ingredient: Ethylenglykol (Ethandiol)

• Never add water to the „Kjellfrost“ (for dilution or filling up). Only pure „Kjellfrost“ has to be used for filling up!

• The safety data sheet can be requested when required: (Tel. 5633801535).

⚠ CAUTION

All details given on the label of the new anti-freezer have to be followed consequently!

- „Kjellfrost“ is injurious to health
- Keep "Kjellfrost" in the original container, do not transfer!
- Don't drink Kjellfrost
- Keep it away from food, drinks and fodder
- Always clean your hands before a break and after end of work
- Avoid the contact with eyes and skin
- Safety goggles recommended during filling
- Wear protection suit
- Wear gloves from Nitril or Viton (see safety data sheet)
- Immediately taking off soiled, watered clothes
- Special danger of skidding by run out or spilled "Kjellfrost"
- Keep away from children

First aid

- after swallowing
  Don't bring up, clean the mouth, drink much water, open the window for fresh air and call the doctor , present packing or label.
- after eye contact
  Clean the eyes with much flowing water some minutes and call the doctor
- after skin contact
  Quickly clean it with much water and soap

WARNING

Leaked or slopped coolant "Kjellfrost" and evaporation of water portions can cause an increasing concentration of the component ethanediol.

If there is a sufficient energy-rich ignition source, it can cause an inflammation and combustion of the ethanediol-debris.

Absorb leaked or slopped coolant "Kjellfrost" with liquid-binding material (sand, diatomite, oil binder, acid binder, universal binder) immediately.
Dispose the absorbed material according to official regulations.

WARNING

Leaking coolant "Kjellfrost" additional with influence of extreme heat causes a very fast vaporation of water portions and an increasing concentration of the component ethanediol.

This can take place, for instance, if leaking coolant impacts the glowing dross at the cutting table as a result of a damaged plasma torch by collision or above the wear limits driven cathode.

This can cause an inflammation and combustion of the ethanediol-debris.

Absorb leaked or slopped coolant "Kjellfrost" with liquid-binding material (sand, diatomite, oil binder, acid binder, universal binder) immediately.
Dispose the absorbed material according to official regulations.

Fire-fighting measures against ethanediol-fires

Suitable extinguishing agents:

- water spray
- alcohol resistant foam
- carbon dioxide (CO_2)
- extinguishing powder
  Fight larger fires with water spray or alcohol resistant foam.

Special hazards caused by the substance, its products of combustion or resulting gases:

- carbon monoxide (CO)
- oxides of carbon, nitrogen (NO_x), sulphur
- as well as not identified organic and inorganic compounds.

Special protective measures:

Do not inhale explosion gases or combustion gases.

Additional information:

Dispose of fire debris and contaminated fire fighting water in accordance with official regulations.

General Maintenance

WARNING

Warning of dangerous electric voltage
Electric shock can be deadly. Further personal and material damages can result from impact.
Before opening (for example error search) or starting any maintenance and repair work principally the power supply source has to be switched off and visibly disconnected from the mains.
Opening the plasma unit may be carried out only under responsibility of a qualified electrician!

Intervals of maintenance

Following measures have to be taken in regular intervals:

Maintenance rate	Maintenance work	Target group	
		Operator	authorized electrical personal
weekly	• visual inspection of the condition of the plasma power source, all system components and the plasma torches • control of the filling level of the coolant (fill up on demand) • inspection of the service units or fine filter for the gas supply on cleanliness (discharge resulted condensation)	x	
monthly	• by application of Hydrogen or Oxygen: inspection of the gas supply (see chapter gas pressure test)	x	
all 4 to 6 month	• Cleaning the power source and all components (control of the filter pads)		x
	• Cleaning small filters inside the gas connectors of the plasma gas control units	x	
all 6 month	• electrical revision		x
yearly	• for liquid cooled units: complete change of coolant „Kjellfrost"	x	

Cleaning

Cleaning of the power source

From the power source all dust and dirt which has collected inside by the fan have to be removed in intervals of 4 to 6 months. Blowing out should be done carefully with dry compressed air, more effective is to use a vacuum cleaner.

When working in shifts or under unfavourable conditions the regular cleaning should take place in shorter intervalls.

For ensuring an effective cooling filter mattes, if existing, should be cleaned in water (approx. 40°C) by using standard detergents. Manual cleaning is useful as well (beating; exhausting; with compressed air, e.g.) In the same way all components of the system have to be cleaned.

Filter regulators and micro filters have to be cleaned weekly. Resulted condensation has to be drained; filter inserts have to be replaced in time. The small filter screws inside the gas connectors of the plasma gas control units have to be inspected every 4 to 6 months, and cleaned if necessary. For that reason the pressure reducers of the gas cylinders have to be closed and the respective gas hose removed from the control unit. The filter screws only can be taken out by a small screw driver.

Plasma torch

The plasma torches have to be handled with care. Powerful treatment and stress load have to be avoided. All consumables have to be in clean condition and carefully changed in time (see instruction manual of the Plasma Machine Torch).

Damages of parts inside the torch, like nozzle holder and cathode tube have to be avoided.

Besides the change of consumables by using the special torch tools no other action to the torch head is allowed! Plasma torches must be transported and stored at protected places with full inserted parts on the torch head only!

Hose parcels have to be protected against damages, like sharp bending, twisting, over rolling, and thermal damages as well. The cleanness of the small filters in the gas connections has to be checked regularly at the plasma machine torch. The small filter is to be screwed in with the thread forward into the connection of the respective gas hose.

⚠ CAUTION

Coolant does not resign from the operational plasma torches at any time!
See chapter handling of the coolant "Kjellfrost".

Defective plasma torches will be repaired exclusively by the service department or authorised repair shops of the company Kjellberg Finsterwalde!

⚠ WARNING

All components and parts coming in touch with oxygen have to be kept free of oil and grease!
This refers specially to the torch head and the consumables.

You are only allowed to use ORIGINAL Kjellberg spare parts and consumables!
The use of other manufacturer consumables leads to the loss of the warranty claim.

Gas pressure test

When using oxygen, hydrogen or inflammable gas mixtures the check of the gas supply system is particularly important. An unnoticed gas leakage can have serious consequences. The following gas pressure test has to be carried out separately for hydrogen, oxygen and every other inflammable gas mixture monthly:

1. Selection of the corresponding gas at the switch of the gas console (PGE) or through the data record (PGC).

2. Start the plasma unit and switch up the tumbler switch “Gas pressure test“ for filling the gas hoses.

3. Close inlet valves at the pressure reducers (Tumbler switch “Gas pressure test” has to be remain switched on!).

4. Check the initial pressures of the attached gases at the respective pressure reducers. The adjusted initial pressures have to be kept constant for at least 3 min on the adjusted value

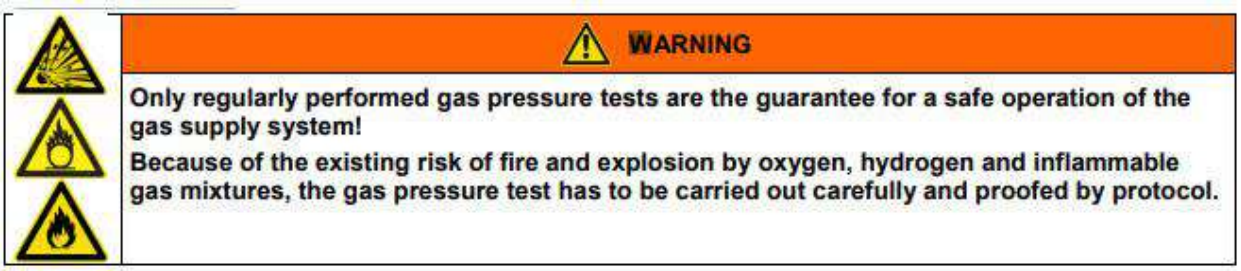
If a pressure drop appears, the reason has to be investigated and removed immediately. After that the pressure test has to be repeated.

After a successful completion of the gas pressure test the following actions have to be carried out

1. Turn off the tumbler switch “Gas pressure test“.

2. Switch off the plasma unit.

3. Open the outlet valves at the pressure reducer.



Coolant

For first filling of the cooling circuit please see item „Filling in the coolant“ Changing the coolant Regardless of the service life of the plasma system, the coolant has to be changed completely at least every 12 months.

For this purpose, please provide an appropriate collection tank and consider the volume of the coolant tank and the amount of coolant in the hose package.

- Unscrew the hoses of the coolant supply (M18x1.5) and the coolant return (G1/2“) at the rear panel of the power source.

- Empty the coolant hoses and the plasma torch carefully with compressed air.
- Remove the left side panel of the power source.
- Unscrew the cover of the coolant tank with filler hose.
- Unscrew the upper hose connection for the coolant return at the tank (G3/8“).
- Remove the connection cable of the floating switch from the terminal block.
- Untie the strap at the tank and remove the tank from the power source.
- Remove the lower hose connections for the filling level indicator (quick coupling) and the coolant supply (G1/2“) via a collection tank.
- Empty and clean the coolant tank.
- Inserting the coolant tank is carried out in reversed order.
- In order to clean the pump sieve, unscrew the cap (SW 24) at the pump head. Remove and clean the sieve and re-insert it.
- Screw the left side panel back onto the power source.
- Screw the hoses for the coolant supply (M18x1.5) and the coolant return (G1/2“) back onto the rear panel of the power source.
- Fill in new "Kjellfrost" according to item „Filling in the coolant“.
- Check the screw connections for tightness.
- Dispose of the coolant according to local / regional / national / international regulations.

Table Maintenance

Care should be taken to extend the life and use of your Boss CNC Plasma Table. Periodic lubrication and cleaning is required.

Remove debris and clean gantry gear and track, spray with “Moly” Dry Film Spray Lubricant. This is located on the under sides of the machine along the rails as well as along the X axis.

Rails should be clean and free of debris at all times. Grease Y Axis bearing zerts with white lithium grease. Linear rails must remain free of rust. Polish the rails with a scotch brite and lubricant to remove deposits.

Track tray should be free of debris and track should be blown off with compressed air.

Periodic greasing of the gantry is required. Grease zerks are located next to the gantry sides and x/z axis. ***Warning do not over grease!*** Boss Table reccomends Premium Grade white lithium. ¼ pump per zerk followed by movement. Repeat the process until a film is visible on the rail.

Internet Connection & Teamviewer

To connect to wireless internet on a Windows computer:

1. Click on the Wi-Fi icon in the bottom right corner of the taskbar.
2. Select the Wi-Fi network you want to connect to and click Connect.
3. Enter the network password if prompted and click Connect.

To connect to wired internet on a Windows computer:

1. Connect an Ethernet cable to your computer and to the router or modem.
2. Click on the Start menu and go to Settings > Network & Internet.
3. Click on Ethernet in the left pane.
4. Make sure Ethernet is turned on, and your computer should automatically detect and connect to the network.

Note: If you're having trouble connecting to the internet, you may need to troubleshoot your network settings or contact your internet service provider for assistance.

To connect to TeamViewer on a Windows computer, follow these steps: Teamviewer is preinstalled and located on your computers desktop.

1. Launch the TeamViewer application on your computer.
2. Provide your partner with your unique TeamViewer ID and password. Your partner will need to enter this information to connect to your computer.
3. Once your partner has entered your ID and password, you will receive a notification asking if you want to allow the connection. Click "Allow" to proceed.
4. Your partner will now be able to remotely control your computer.

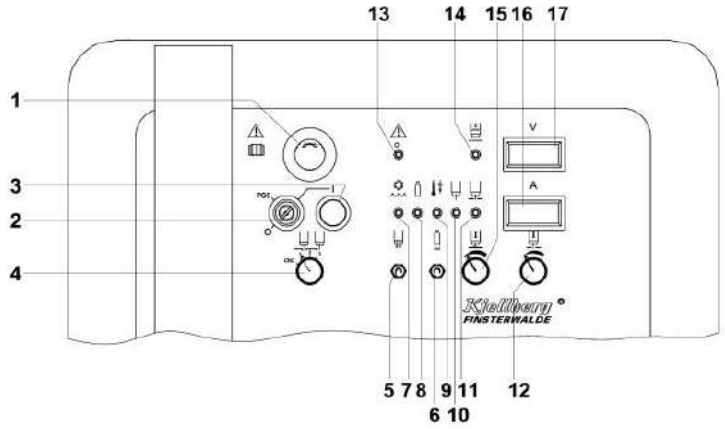
Note: Ensure that you only share your TeamViewer ID and password with someone you trust. Also, be careful when allowing a remote connection to your computer as this can potentially compromise your data and security.

Powering up

Your table's controller is located on the end of the table (home side). The main power toggle switch is located on the side of the controller box, the controllers power switch is the toggle switch next to the main power switch as shown above.

Power on the power strip in the cabinet and computer located on the cabinets left side.

Powering up the Kjellberg



Control and display elements

1. Red emergency stop device S3 "Emergency stop", (reset button)
   - activated: Plasma cutting unit OFF
   - unlocked: Plasma cutting unit can be switched ON
2. Key switch S1 "Mains ON"
   - Position 0: Voltage for control transformer and fan of controling is OFF
   - Position PGC: Voltage for control transformer, fan of controling and PGC is ON
   - Position I: Voltage for control transformer, fan of controling and PGC is ON, unit can be switched ON by S2
3. Green illuminated button S2 "PA ON"
   - Activation: power ON for main transformer, cooling unit, fan and control system
   - signal lamp H1 ON: power source ON
4. Selector switch S7 "Technology" Adjustment : see cutting charts
   - Position CNC: - CNC- controller (all areas)
   - Position 1: - range 1 • Position 2: - range 2 (starting gas)
   - Position 3: - range 3 (starting gas and flying cutting of steel)
5. Tumbler switch "Gas test" upper position: gas test ON
   - for adjusting the gas pressure
   - for blowing out of the remaining drops of coolant after change of consumables
   - LED signal lamp yellow H31 "cumulative error" (13) ON
   - plasma cutting system not ready for operation cutting

6. Tumbler switch “Gas pressure test" Upper switch position: Gas pressure test ON

- LED signal lamp yellow “cumulative error” (13) and “Process error” (14) are ON
- solenoid valves are closed
- plasma cutting machine is not ready for cutting Carry out the gas pressure test corresponding to the chapter “Maintenance special“.

6. LED-signal lamp green H29 “Coolant OK"

- LED ON: cooling circuit operates (flow rateis o. k.)

7. LED-signal lamp green H28 “Gas OK"

- LED ON: pressure of plasma and swirl gases and also for control gas, seecorresponding instruction manual of the gas console

8. LED-signal lamp green H28 “Gas OK"

- LED ON: pressure of plasma and swirl gases and also for control gas, seecorresponding instruction manual of the gas console

9. LED-signal lamp green H30 „Temperature OK"

- LED ON: - Rectifier within the permissible thermal area - main fan ON

10. LED signal lamp white H11 “Pilot arc"

- LED ON: pilot arc is ON

11. LED signal lamp white H10 “Main arc”

- LED ON: main arc is ON 12. potentiometer "cutting current " adjustment of the cutting current (35 - 300 A) 5 A-steps

13. LED signal lamp yellow H31 "cumulative error gas, coolant, temperature"

- LED ON: - plasma cutting system not ready for operation - indicates error through error codes at the current display (16)

14. LED signal lamp yellow H32 "process error"

- LED ON: - plasma cutting system not ready for operation cutting - indicates error through error codes at the current display (16)

15. potentiometer “marking current“ adjustment of marking current (10 - 50 A)

16. current display

- indicates cutting current (actual value)

- indicates cutting current (nominal value)
- indicates “error codes”,see error chart / error codes

17. voltage display

- indicates the cutting voltage
- indicates "gas test"(6A5)

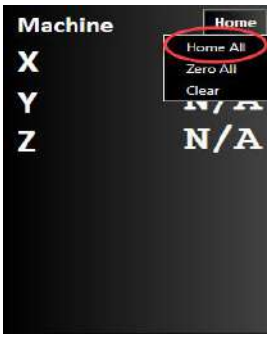
To power on the unit, first ensure that the emergency stop button is disengaged. Turn the key switch to **S1 ON.** Press the green button which will illuminate when engaged. The unit will perform it’s initial startup diagnostics after which will be cleared to operate.

To operate your machine open Flashcut on the desktop.

Your machine will open in CAD. To jog your machine and home it, left click on CNC at the top of the screen.

You can now jog your table around. **HOLDING Ctrl** using the **arrow** keys for left, right, up, and down. Use the **PgUp** and **PgDn** located above the arrow keys to travel the Z axis up and down. You can also use the jog function on the lower right in Flashcut CNC.

Begin by homing the machine. To home the machine, jog the table to the lower left side of the table. Do not ram the gantry into the stops. Stop 4 inches before the X and Y limit switch, select Home All and it will do both at the same time.
Note: Always home the machine after opening a new process of Flashcut.



Do not leave the gantry against the stop switches while parked. With the machine homed it is now able to run code and know its parameters.

Evaluation Mode

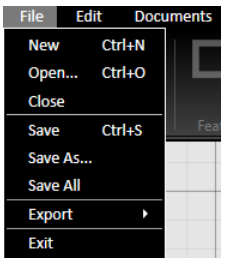
FlashCut CNC will run in evaluation mode until you click the ***Connect*** icon  in CNC or activate a license in a second copy. In evaluation mode, you can try out many features of the program. Some features will be disabled, while others will be limited. For example, you cannot communicate with the CNC controller, you will not be able to save files, and only 25 lines of G-Code will be generated when you send a CAM toolpath to the CNC workspace.

Activating a Second License

To enable the full functionality of the program, you must activate a PC license. Select the License button  in any workspace. Click on the ***Activate PC License*** icon and add the user key found on your controller. Click the ***License Software*** button to complete the registration.

Getting Familiar with CAD Menu & Ribbon

File Menu



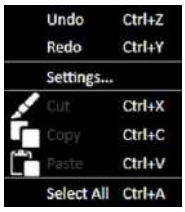
- New (Ctrl+N) Creates a new CAD/CAM drawing in a new FlashCut CAD window. When selected from the menu or entered from the keyboard, the New file command displays a dialog window that requires the user to select the type of file: 2D Part, 3D Part, or Pipe Part. The command does not close the current drawing. Note that you can view any open drawing by selecting it from the Documents menu.
- Open (Ctrl+O) Opens an existing CAD/CAM file for editing in a new FlashCut CAD window. It does not close the current drawing.
- Close Closes the current CAD/CAM drawing from the CAD editor. If the drawing is unsaved, the software prompts you to save the file before closing.
- Save (Ctrl+S) Saves the current CAD/CAM drawing using the existing file name and location. It will not save any other CAD/CAM drawing that is open. FlashCut will prompt you to create a file name and destination. FlashCut saves drawings to the CAD/CAM (file extension .cadcam) format. The Save command is unavailable when no recent changes have been made.

- Save As Saves the current drawing to a new file name or destination. It will not save any other CAD/CAM drawing that is open. FlashCut prompts you to create a file name and destination. Saved files use the extension .cadcam.
- Save All Saves all open drawings, including those in other windows. This command is unavailable when no recent changes have been made.
- Export Exports the file as a DXF/DWG file. There are two alternatives: Export DXF with Options or Export DXF. FlashCut CAD/CAM and CNC Control Software Page 27 Both commands bring up a Windows dialog box that allows you to select the location, filename, and specific file format.
- Export DXF Brings up the Windows save dialog. No parameters can be altered. The available file formats are DXF 2000 or DXF R12.
- Export DXF with Options Brings up the Windows dialog box, and provides a configuration panel in the Parameters area. After setting the parameters for the file, you may either Accept or Cancel the changes.
-

- Export Curves as Polylines When selected, curves will be saved as polylines in the DXF file. When not selected, arcs and circles will be maintained, but ellipses and splines will be saved as polylines. Polylines are drawing objects composed of multiple separate line segments.
- Export Text as Polylines When selected, text shapes will be saved as polylines in the DXF file. Polylines are drawing objects composed of multiple separate line segments. When not selected, text will be saved as a font.
- Export Units Choose from either inches or millimeters.
- Exit Closes the entire FlashCut application. If any drawings are unsaved, FlashCut prompts you to save these files or discard changes before closing.

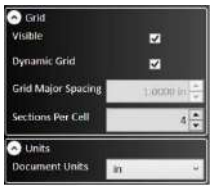
Edit Menu

The Edit menu has the following commands: •Undo (Ctrl+Z) • Redo (Ctrl+Y) • Settings… • Cut (Ctrl+X) • Copy (Ctrl+C) • Paste (Ctrl+V) • Select All (Ctrl+A)



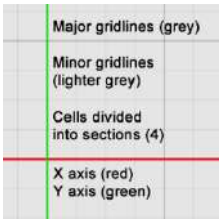
Undo (Ctrl+Z) Reverses the previous drawing action. Up to 20 actions can be reversed.
Redo (Ctrl+Y) Repeats the previous drawing action, or reverses the Undo stack.
Settings Displays controls for setting the Grid and Units for the drawing window. After changes are complete, you may either Accept or Cancel the changes.

-Grid



Visible This option will hide/display the gridlines in the workspace.
Dynamic Grid Toggles dynamic gridlines within the drawing window. When checked, these gridlines remain the same size on the screen despite zooming and panning motions. When unchecked, the dimension that these gridlines represent remain the same while zooming and panning.

Grid Major Spacing Changes the size of the major gridlines when Dynamic Grid is not enabled. These lines will change with zooming and panning. The number specified determines the numerical spacing between gridlines.
Sections Per Cell Determines the number of minor horizontal and vertical gridlines in between major gridlines. Range: 1-100.



-Units

Document Units Select the dimensional units of the CAD drawing. You may choose the following units: mm – millimeters, in – inches. FlashCut gives you the option to convert any existing parts (drawing objects) in the workspace. Selecting Yes rescales the existing values into new units (i.e., a 1 inch circle is a 25.4mm circle). Selecting No reinterprets the values into new units (i.e., a 1 inch circle becomes a 1mm circle). *Note that changing the units for a drawing will clear all CAM data.*

Cut (Ctrl+X) Removes selected features and places them on the clipboard to be pasted. Note that objects are selected by clicking on them with the selection arrow (which becomes available by pressing the Esc key). To select all segments of a feature (chain select), hold down the Alt key. You can include other objects by holding down the Ctrl key while you select the objects that you want. You may also select multiple objects by creating a selection box with the selection arrow. Creating a selection box that goes from left

to right will select all objects that it touches and a selection box that goes from right to left will select all objects that it completely envelopes.

Copy (Ctrl+C) Copies the selected features and places them on the clipboard to be pasted.

Paste (Ctrl+V) Pastes copied or cut features from the clipboard. The features will be centered at the cursor point and you will be able to maneuver them to a desired location. Clicking the mouse will paste the features permanently into the drawing.

Select All (Ctrl+A) Use the Select All command to select all geometry in the workspace.

Documents Menu

The Documents menu allows you to toggle between all open drawings in both FlashCut CAD and FlashCut CAM. The checked document is visible and available for editing. Note You may copy features from one drawing and paste them into another drawing.

CAD Ribbon

The ribbon features an assortment of command icons to create, modify, and transform elements such as points, curves and shapes in the drawing window. To use a tool, select it with the cursor. Pressing the Esc key enables you to exit out of any particular tool.

New (Ctrl+N)

Creates a new editable document in CAD.

Open (Ctrl+O)

Opens an existing CAD/CAM drawing for editing in a new FlashCut CAD window. It does not close the current drawing.

Save (Ctrl+S)

Saves the current CAD/CAM drawing using the existing file name and location. It will not save any other CAD/CAM drawing that is open. FlashCut will prompt you to create a file name and destination. FlashCut saves drawings to the CAD/CAM (*.cadcam) format. These files represent CAD drawings readable by FlashCut CAD version 6 or later. This command is unavailable when no recent changes have been made.

Import silhouette, centerline, or color image

Selecting the **Import Tools** icon from the ribbon brings up a menu with three different options: **Import silhouette image**, **Import centerline image**, and **Import color image**.

Import silhouette image – creates an outline of the silhouette of an image.

- **Use Arc Fitting**

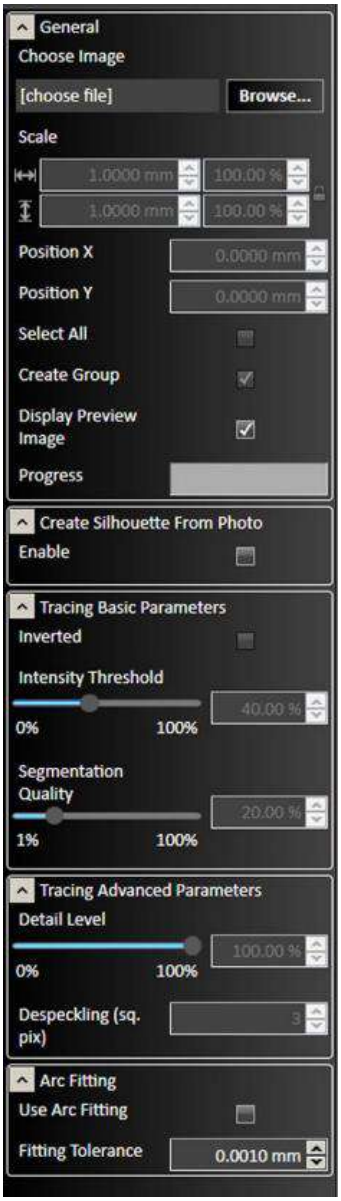
When selected, **Arc Fitting Tool** will be applied to the imported image.

- **Fitting Tolerance**

The **Tolerance** can be set in drawing units. A lower number will increase accuracy.

Import centerline image – creates an outline of the centerline of features in an image.

Import color image – creates an outline based on the colored areas of an image.

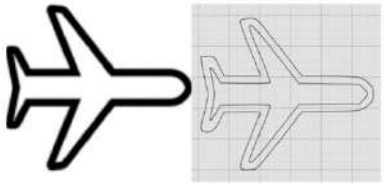


Understanding silhouette and centerline images

Below are three images: the original line drawing (left), the drawing imported as a silhouette (center), and the same drawing imported as a centerline image (right). When creating a silhouette, FlashCut attempts to identify the drawing by its contrast against the background. Note how both sides of the plane's outline have been reproduced. In the centerline image, FlashCut has translated the shape into a single line.

Import silhouette image

This tool takes an imported image and renders it as a series of closed line segments, forming a silhouette. Higher resolution images generally produce a silhouette with more precise edges and corners.



After changes are complete, you may either Accept or Cancel the changes.

Choose image Click **Browse**… to select an image file from the computer. Select **Open** to call up the desired image.

Scale Select how large or small the image will appear in the drawing relative to its original size. Scaling can be done as an absolute dimension or as a percentage of the original image size.

Position X Enter the value for the X coordinate of the lower left corner of the imported image.

Position Y Enter the value for the Y coordinate of the lower left corner of the imported image.

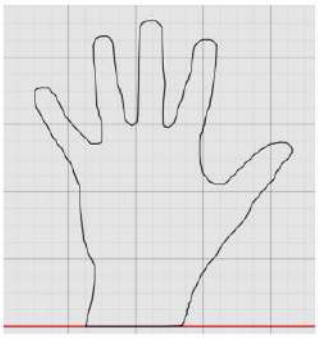
Select All When checked, the entire silhouette is selected for movement or reshaping after parameters are confirmed. When not checked, nothing will be selected.

Create Group The Create Group checkbox allows the user to import the image as a Group instead of importing the image as individual elements.

Display Preview Image Superimposes a translucent preview of the imported image while the new drawing is being generated.

Progress Indicates the rendering progress after changes are made to the drawing. Making edits during rendering consumes more system resources. It is advised to wait for rendering to finish between edits.

Create Silhouette from Photo Finds the boundary between the background color of the image and any other color. This is beneficial for importing the profile of a part/item, when the part/item is taken in front of a solid color backdrop.



When you enable Create Silhouette from Photo, FlashCut presents these options:

- **Background color** –Select which corner of the image that is to be used to sample the background color. The color sampled from the specified corner will be set as the background color. When importing a photo, the edges of the object are determined by the color contrast between an object and the selected background color. The Color Tolerance setting is used to adjust the level of contrast.
- **Pick small details** – Increase the value if the algorithm missed some small details. Import performance may be lowered if this value is increased. 10% is a good default value.
- **Color Tolerance** – This tolerance is used to determine the contrast between the background and the silhouette. Pixels within this range will be considered part of the background. Range: 0- 100.

Tracing Basic Parameters

- **Inverted**, when checked, this option reverses the shapes enclosed by the curves of the silhouette.
- **Intensity threshold** Select how much detail FlashCut CAD transfers from the image to the final drawing. When increased, the program increases the number of features. Range: 0-100.
- **Segmentation quality** Select how finely the program will divide curves. FlashCut CAD automatically breaks curves into separate line segments. When segmentation quality is increased, the program divides curves into smaller segments, preserving more detail. This also increases the size of the drawing file, and the program's memory usage. Range: 1-100.

Tracing Advanced Parameters

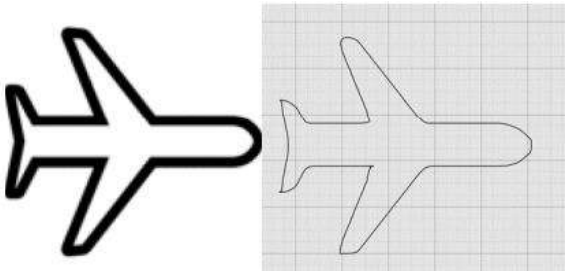
- **Detail level** Select the degree of accuracy of the lines in the silhouette to the original image. A smaller detail level allows for more variation from the original drawing, while a larger level replicates the image more closely. Range: 0-100.
- **Despeckling** Reduces the number of small dots that appear in the image. It also can reduce the overall detail of the image being imported. The larger the number, the lower the dot tolerance, causing fewer dots to appear in the imported silhouette. Range: 0-100.

Arc Fitting

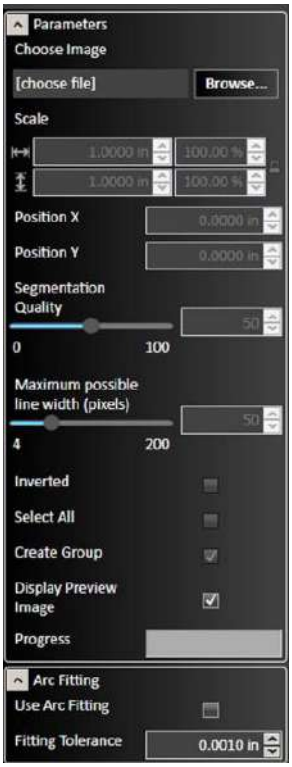
- **Use Arc Fitting** When selected, Arc Fitting Tool will be applied to the imported image.
- **Fitting Tolerance** The Tolerance can be set in drawing units. A lower number will increase accuracy.

Import centerline image

This tool imports a bitmap image and renders each feature as a single toolpath line down the center of the feature. Images with defined lines generally result in a cleaner drawing that requires fewer revisions.



After changes are complete, you may either Accept or Cancel the changes. 



Choose image Click Browse… to select an image file from the computer. Click Open to call up the desired image.

Scale Select how large or small the image appears in the drawing relative to its original size.

Position X Enter the value for the X coordinate of the lower left corner of the imported image.

Position Y Enter the value for the Y coordinate of the lower left corner of the imported image.

Segmentation quality Select how finely the program will divide curves. FlashCut CAD automatically breaks curves into separate line segments. When segmentation quality is increased, the program divides curves into smaller segments, preserving more detail. This also increases the size of the drawing file, and the program's memory usage. Range: 1-100.

Inverted When checked, this option reverses the shapes enclosed by the curves of the image. The relationship is the same as that between a part and a cutout: if inverted, the object created from the imported image will behave like a cutout (below, right).

Select all When checked, the entire image is selected for movement or reshaping after parameters are confirmed. When not checked, nothing will be selected.

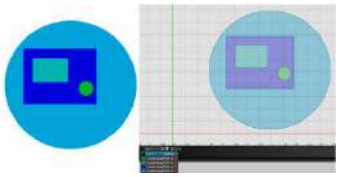
Create Group When checked, the imported drawing objects will be grouped together. Display Preview Image Superimposes a translucent preview of the imported image while the new drawing is being generated.

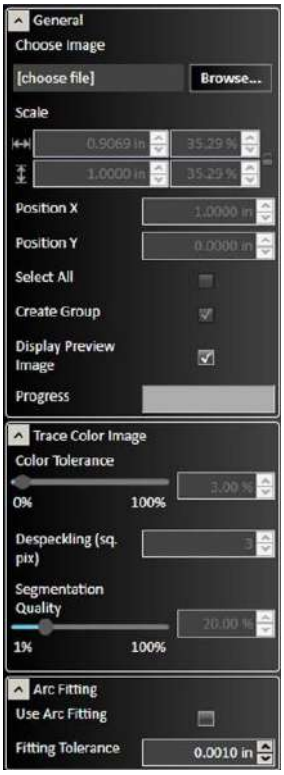
Progress Indicates the rendering progress after changes are made to the drawing. Making edits during rendering consumes more system resources. It is advised to wait for rendering to finish between edits.

Arc Fitting When Use Arc Fitting is selected, Arc Fitting Tool will be applied to the imported image. The Fitting Tolerance can be set in drawing units. A lower number will increase accuracy.

Import color image

This tool creates shapes from the source drawing based on color. Boundaries between different colors define where the lines are drawn. Each new shape is placed on a unique layer, which is color coded. In the example below, the original bitmap image (left) is translated into four shapes (right), each occupying its own color-coded layer. See Layers for more information about displaying and manipulating drawing objects using layers. After changes are complete, you may either Accept or Cancel the changes.





Choose image Click Browse… to select an image file from the computer. Click Open to call up the desired image.

Scale Select how large or small the image appears in the drawing relative to its original size.

Position X Enter the value for the X coordinate of the lower left corner of the imported image.

Position Y Enter the value for the Y coordinate of the lower left corner of the imported image.

Select all When checked, the entire image is selected for movement or reshaping after parameters are confirmed. When not checked, nothing will be selected.

Create Group When checked, the imported drawing objects will be grouped together.

Display Preview Image Superimposes a translucent preview of the imported image while the new drawing is being generated.

Progress Indicates the rendering progress after changes are made to the drawing. Making edits during rendering consumes more system resources. It is advised to wait for rendering to finish between edits.

Color Tolerance Defines color tolerance for grouping silhouettes by color. Range: 0-100.

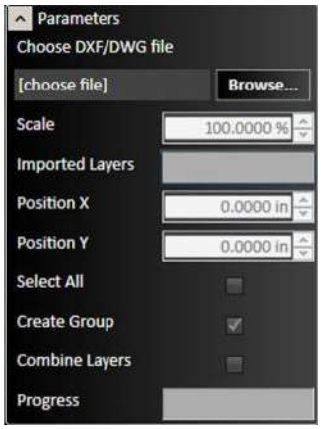
Despeckling Reduces the number of small dots that appear in the image. It also can reduce the overall detail of the image being imported. The larger the number, the lower the dot tolerance, causing fewer dots to appear in the imported image. Range: 0-100.

Segmentation quality Select how finely the program will divide curves. FlashCut CAD automatically breaks curves into separate line segments. When segmentation quality is increased, the program divides curves into smaller segments, preserving more detail. This also increases the size of the drawing. Range 1-100.

Arc Fitting When Use Arc Fitting is selected, Arc Fitting Tool will be applied to the imported image. The Fitting Tolerance can be set in drawing units. A lower number will increase accuracy.

Import DXF/DWG image

This tool imports a two-dimensional DXF or DWG file into the drawing. After changes are complete, you may either Accept or Cancel the changes.



To choose an image Click **Browse**… to select a DXF file from the computer. Click **Open** to call up the desired image.

Scale Select how large or small the image will appear in the drawing relative to its original size. X and Y values will be scaled equally. **Imported layers** Select which layers from the DXF file you want to appear in the drawing.

Position X Enter the X value of the program zero position here. FlashCut sets program zero based on the specified point on the imaginary rectangle that contains all DXF file entities.

Position Y Enter the Y value of the program zero position here. FlashCut sets program zero based on the specified point on the imaginary rectangle that contains all DXF file entities.

Select All When checked, the entire image is selected for movement or reshaping after parameters are confirmed.

Create Group When checked, the imported elements are grouped together as a single object.

Combine Layers When checked, combines multiple layers in target drawing into one.

Progress Shows progress of file import.

Create Tools

These tools add new elements to the drawing. After selecting a tool, move the cursor into the drawing window in order to begin constructing the element. You may use the mouse to place and size each element or you can edit parameters for the element, such as dimensions and location, in the parameter window after creating the element. Click the shape or features and then edit the desired parameters. After changes are complete, you may either Accept or Cancel the changes.

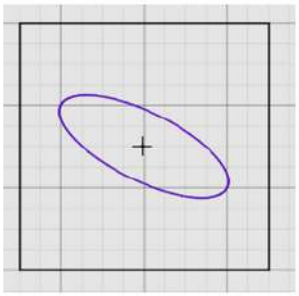
Each tool (with the exception of **Point**) lets you define the Treatment parameter to determine whether the element is cut or only marked.

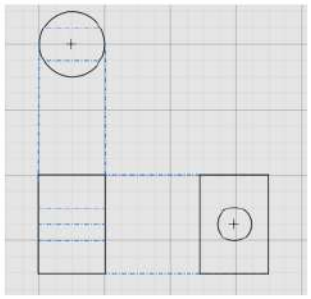
Select **Cut Element** to use the plasma cutter. This is the pre-selected option. These elements appear in the CAD window as solid black lines.

Select **Mark Element** to use the scribe. Marked elements appear in the CAD window as purple solid lines. If the drawing contains a marked element that is not contained within a part, FlashCut will notify you when you send the drawing to CAM.

In addition, you may select the ***For Construction*** option to indicate that the feature is a construction line and should not be cut or marked. Construction lines appear in the CAD window as blue dashed lines and are not used by FlashCut CAM and CNC.

The drawings below contain a marked ellipse inside a cut rectangle (left), and an orthographic projection using construction lines (right) to indicate the relationships between the three views.





Note that the behavior of all of the Create tools is influenced by the active Snap tools.

Line Lines may be created either as **Continuous Lines** by adding segments and vertices with each mouse click, or as a simple **Two Point Line**. When creating a Two Point Line, the properties may be adjusted manually in the parameters window. Any single line segment (e.g., any segment that is part of a polygon or a multi-segment line) may be selected and its properties displayed. Continuous lines are used for reference lines in the construction selection.

Rectangle FlashCut CNC offers several different options for constructing rectangles, including selecting **two corner points**; selecting a center and corner points; selecting **three corner points**; selecting a center and two outer points; and selecting **three points** to generate a parallelogram. Select which method will be used, and then click the rectangle points in the drawing window. You can manually enter point coordinates as well.

Arc FlashCut CNC offers several different options for constructing arcs. The **Centerpoint Arc** prompts you to select a center point, a point on the arc, and the start and end angles of the arc. The **Tangent Arc** allows you to select an endpoint of a line or curve and then select a second point on the outer radius of the arc. This creates an arc tangent to the line or curve at this point. The **3 Point Arc** enables you to select two points on the curve, followed by a third point that determines the degree of curvature in between these points.

Circle FlashCut CNC offers two different options for constructing circles. The **Center Circle** enables you to select a center point, followed by a point on the circumference of the circle. The **Perimeter Circle** prompts you to select three points on the circumference, through which the circle will be drawn.

Text FlashCut CNC enables you to enter text into drawings. All TrueType fonts installed on the system are available. Text objects are scalable, and can be styled, aligned, etc. In the drawing field, click the desired point for the text. This point varies with the alignment setting of the text. Once the text is correctly configured choose the **green check mark** or press ↵**Enter** to Accept the changes. Note If you have the advanced text feature, there is no need to explode the text to create a toolpath, unless you are changing the text with tabs or welding.

Point Click on the drawing to create a new point at that location.

Elliptic Arc Creates an arc that is a section of an ellipse.

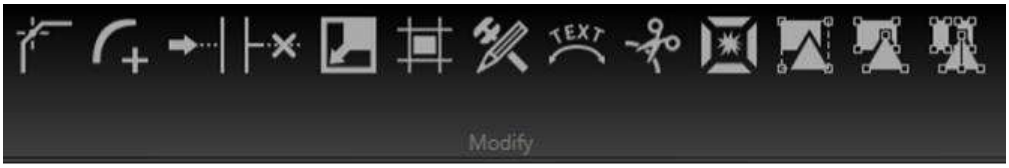
Ellipse Creates an ellipse.

Spline Creates a complex curve in multiple segments. When complete, each point can be manipulated by using the blue control line, or by editing the parameters.

Shape Tool FlashCut CNC offers a library of shapes for both simple and complex parts. Select the shape tool from the ribbon to load the library in the parameters area. To choose a specific shape, select it from the list. Shapes can be edited for size and characteristics.

Modify tools

The Modify tools on the ribbon affect a shape that is already in the drawing. First, select the features to be modified, and then click the tool to modify the feature. You may edit parameters for the modification in the parameter window.



Apply Chamfer Select two intersecting lines or their intersection point, and then click **Apply Chamfer** to add a sloped chamfer to this edge. You can scale the size of the chamfer by dragging the mouse towards or away from the chamfer, or in the parameter window, type the distances from the intersection in both directions and the slope angle. Choosing the **Lock Angle** option causes both distances to change when one of them is edited, holding the angle measurement constant. Once the chamfer is correctly configured choose the green check mark or press **↵Enter.**

Apply Fillet Select two intersecting lines or their intersection point, and then click **Apply Fillet** to add a rounded fillet to this edge. You can scale the size of the fillet by dragging the mouse towards or away from the fillet, or in the parameter window, type in the radius of the fillet. Once the fillet is correctly configured choose the green check mark or press **↵Enter**.

Extend Tool Click the **Extend Tool**, and then hover the selection cursor over the endpoint of the line or curve to be extended. A preview of the extension should appear, in blue, to show where the line or curve will intersect with another object in the drawing. Click the mouse to finalize the extension.

Trim Tool Click the **Trim Tool**, and then hover the selection cursor over the line or curve to be trimmed. A preview of the cut should appear (in red, below) where the line or curve will be removed. Click the mouse to finalize the trim.

Scale Entities Select a feature or group of features to be scaled and click **Scale Entities**. FlashCut CNC offers you two options for scaling. The **3 Points** scale prompts you to select a center point and a point close to the feature. Drag the mouse to increase or decrease the size of the features about the center point and click to apply the modification. The **Point and Factor** scale enables you to select a center point and type in a factor by which the features will be scaled.

Apply Offset Select that feature and then click **Apply Offset**. You may then select parameters for the offset in the parameter window. The offset tool duplicates selected features and positions them at the specified distance away from the original feature. **Reversed** changes the direction of the offset distance. **Bidirectional** creates a second copy, opposite the first. When the Bidirectional option is chosen, the Close Opened Wires option appears.

Close Opened Wires option closes the gaps created by the offset ends when chosen. **Use Arc Connectors** rounds out the corners of the offset by transforming them into arcs.

Fix Drawing  The **Fix Drawing** tool is used to correct mistakes in the drawing that could prevent accurate toolpaths from being created, such as line segments that do not touch. To identify issues and fix the drawing, select the icon, and choose a **Join Tolerance** or **Overlap Tolerance** larger than any of the errors in the drawing. Use the **Search Issues** button to identify issues with the drawing that could lead to mistakes in fabrication. Issues noted with a green circle can be fixed automatically by selecting **Fix All**. Issues noted with a red circle must be addressed manually.

Curve Text 

The **Curve Text** tool modifies an existing text object to follow a curved shape. Start by creating both the text object and the curved shape you want to use. Select both the text object and the curve object in the viewport, then click **Curve Text**. The text will be automatically aligned with the curve. If the text object and curve object are not already selected. The tool will provide instructions for how to select the text object and curve object. The position of the text can be adjusted with the cursor and modified by changing the alignment parameter.

Cut Tool  Use the **Cut Tool** to divide an entity such as an arc or a line segment into multiple sections. Select the **Cut Tool** and click the mouse at the position on the entity where you want the cut to be made. You can verify the cut by hovering the cursor over the feature. Only a part of it will highlight if the cut worked properly.
Explode Entities Transforms a feature that is solid and not composed of lines (such as a text object) into individual line segments. This is necessary for toolpath generation of any feature that is solid.

Explode  Transforms a feature that is solid and not composed of lines (such as a text object) into individual line segments. This is necessary for toolpath generation of any feature that is solid. Select a solid feature, and then click **Explode**. Exploding is necessary to **Bridge** fonts.

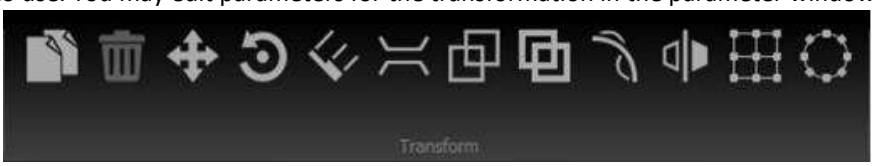
Group  The **Group** command combines selected objects so that they can be modified or transformed as a single unit. If you choose this command with no objects selected, you will be prompted to select the objects to be grouped, and to confirm the action by right-clicking.

Ungroup  The **Ungroup** command separates the selected grouped objects. If you choose this command without a group selected, you will be prompted to select the objects to be grouped, and to confirm the action by right-clicking.

Ungroup All  The **Ungroup All** command can separate multiple sets of grouped objects in one operation. If you choose this command without a group selected, you will be prompted to select the objects to be grouped, and to confirm the action by right-clicking.

Transform Tools

These tools do not change the physical properties of the drawing features. Instead, they modify the size, scale, and number of features in the drawing. Select the features to be modified and select the specific transform tool to use. You may edit parameters for the transformation in the parameter window.



Copy Entities Select the features to be copied in the drawing window, choose the Copy Entities button and then click a reference point about which the new features will be copied. Position the cursor at the paste location and click to paste the copied features. You may paste multiple features until you exit from the tool.

Delete Selected Objects Select the features to be deleted, and then click the Delete Selected Objects tool. The features will be removed.

Move Entities Select the features to be moved, and then click the Move Entities tool. Click the mouse to set a reference point, and then move the cursor to move the feature(s) in relation to that point. Click the mouse again to select the new location for the features.

Rotate Entities FlashCut CNC offers two modes for rotating features in relation to a set point. The 3 Points rotation prompts you to select a center point, a point near the feature, and a final point to which the feature will rotate. The Point and Angle rotation requires you to select a central rotation point, and then enter a rotation amount in degrees. After changes are complete, click the green check mark or press ↵Enter to Accept changes or the red X mark to Cancel changes.

Measure Entities with Ruler You can measure entities in one of three modes: as a ruler between points or between entities, or as a protractor between points on an arc. The tool allows for measurement between any two points, and displays offset in X and in Y directions.

Bridge Entities Connects two or more objects with a bridge that spans the gap between them. Can also be used to divide a single object into separate objects. The width of each bridge can be set individually. To create a bridge, select Bridge Entities. Use the cursor to draw a line. This line will become the bridge. You can modify the width of the bridge if desired. Select the green checkmark to Accept the change.

Perform Boolean Operation on Entities Perform Boolean Operation can be used to modify one shape by adding or subtracting another shape to it. The three available operations are Weld (combine) solid areas, Weld Cutouts, or Subtract. Select Perform Boolean Operation, select the specific operation in the parameters window, then select the objects one at a time, right clicking to confirm each selection. The first object selected will be modified by the second. The example below shows the results of all three operations on the initial set of shapes.

Weld Selected Entities To quickly combine multiple shapes into a single shape, first create the desired overlapping objects. Select the Weld Selected Entities tool, select the objects, and right-click to confirm the operation.

Arc Fitting Tool Create arc and line segments for objects that are not already drawing objects, such as imported images. The Tolerance can be set in drawing units. A lower number will increase accuracy. Progress during recalculation is shown in the bar. When Show Graphics is selected, an outline lines and arcs will be displayed in the drawing window. This feature is also available when using the Import tools.

Mirror Entities Select the features to be mirrored, select the Mirror Entities tool followed by a point through which the features will be mirrored. Clicking the mouse will move the features to a new position. When the Copy Object box is chosen, the features will be duplicated to the new position rather than only moved.

Linear Pattern Tool The linear pattern tool duplicates selected features in a grid fashion. Select the feature to be duplicated, select the Linear pattern tool then specify parameters. Alternately, click and drag the blue points on the drawing screen to select the parameter for Total Distance. After changes are complete, click the green check mark or press ↵Enter to accept changes or the red X mark to cancel changes.

Circular Pattern Tool The circular pattern tool duplicates selected features in a circle around a specified point. Select the feature to be duplicated, select the Circular Pattern tool, and then specify the parameters.

Pan and zoom tools The pan and zoom tools are located at the top left of the workspace and are used for moving and magnifying the drawing in the drawing workspace. Click on a specific tool to change the cursor's function. Pan Click and drag anywhere in the drawing window to move the drawing around. Right clicking and dragging in the window allows you to pan without selecting the pan tool first. Zoom Extent Click and drag a box in which to zoom in. This tool allows to user to focus in on a specific section of the diagram. Zoom Click and drag anywhere to zoom in and out on the drawing. You can also use the scroll wheel to zoom; scroll up to zoom in and scroll down to move out. Zoom to Fit Click this button to adjust zoom automatically to best fit the drawing.

Snap tools The snap tools affect how drawing tools interact with the background grid or with features already created. Clicking a snap tool toggles it on or off. Snap tools cause a feature or segment to lock on to the closest active snap location when the cursor is dragged nearby. Note that more than one type of snap can be active at one time. Note that the snap tools can also be reviewed and selected by right clicking in the drawing window. This brings up a contextual menu, including a sub-menu to control snaps.

Free form stretching and manipulation tools Any objects or set of objects in FlashCut CAD can be stretched, positioned, or rotated by manipulating a set of control points with the cursor, or by entering values using the toolbar. Note that different types of objects respond differently to scaling. For example, circles will expand, and straight-line segments will be extended, but ellipses and arcs will be divided into multiple line segments.

Layers Drawings can have multiple layers. Each layer can have no objects, one object, or many objects. Layers can be used to selectively display objects or modify how they will be treated in Flash cut CAM.

FlashCut CAM

FlashCut CAM (Computer-Aided Manufacturing) generates an accurate toolpath from a CAD drawing. This toolpath is used to create the G-Code that will be used in FlashCut CNC. The FlashCut CAM main screen is shown here. An explanation of each area of the screen follows.

An explanation of each area of the screen is provided in these topics:

1. Tabs
2. Menu bar
3. Configuration, License, and Help buttons
4. Ribbon
5. Pan and zoom tools
6. Display options tools, Part shading and Grid tools
7. Drawing workspace
8. Parameters area
9. Status bar
10. Accept / Cancel

Getting Familiar with CAM Menu & Ribbon

File tools There are two file tools on the ribbon: • Open (Ctrl+O) • Save (Ctrl+S)

Make Top Level Feature a Cut Out If this option is selected, the outermost level of the drawing will be understood as a cut out. For example, a simple shape (circle, rectangle, etc.) will be cut so as to make a precisely defined aperture in the workpiece. The lead in will begin inside the boundary defined by the outermost line, and the kerf will be placed inside the line. Note When this option is selected, you will not be able to use either grid nesting or true shape nesting. These options will be greyed out in the ribbon.

Make Top Level Feature a Part If this option is selected, the outermost level of the drawing will be understood as a part. For example, a simple shape (circle, rectangle, etc.) will be cut so as to preserve the material inside the line defining the boundary of the shape. The lead in will begin outside the boundary defined by the outermost line, and the kerf will be placed outside the line. Note This option is selected by default.

Selection When you click the **Selection** icon, FlashCut pops up the following choices for selection options: This tool allows you to select various objects in the drawing by type. Note Breaks are the points on the toolpath where any lead in and lead outs will be placed and is represented by a red diamond on the toolpath. For a discussion of breaks, see **Lead in/out settings.**

- All Breaks Selects all available breaks in the document, including perimeter breaks and cutout breaks.
- Perimeter Breaks Select this option to select all breaks that are on the outside of the part. When the toolpath is offset to the outside of the part the break on this toolpath is defined as a perimeter break.
- Cutout Breaks Select this option to select all breaks that are on the inside of a cutout. When the toolpath is offset to the inside of a feature or a cutout, the break is called a cutout break.
- All Parts Choose this option to select all of the parts in the viewport. This allows the user to drag and drop all parts to another position on the workpiece.
- All Operations Choose this option to select all of the operations used to fabricate the part.

When either All Parts or All Operations is selected, the following parameters can be set.

Tool

- Fabrication Head Change fabrication head, if desired.

General

- Override Kerf Width When selected, permits changing the default kerf width. See Kerf Width.

Custom Kerf Width

- Only displayed when the Override Kerf Width option is checked.

Feedrate factor

- Default is 100%.

Tabs

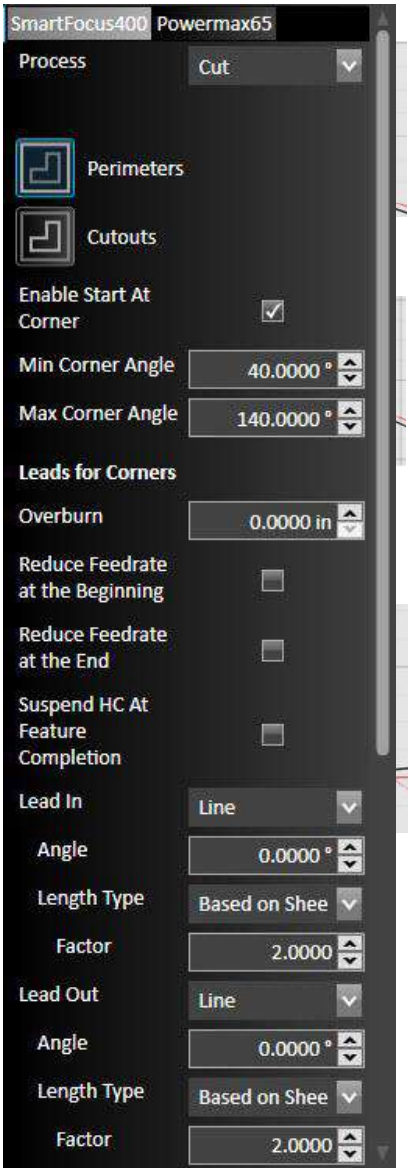
- Override Tabs When selected, permits changing the parameters used for any tabs included in the toolpath.
- Use Tabs When selected, tabs will be added to the toolpath.
- Tabs Width Specify the width of each tab, in document units.
- Tabs Placing Method Alternatives are Specify Spacing and Specify Number.
- Spacing Specify spacing between tabs, in document units.
- Minimal Tabs Count Specify value between 1 and 1000.
- Outside Corner Specify the behavior of tab placement at the outside corner. Alternatives include Avoid, Consider, or Prefer.
- Inside Corner Specify the behavior of tab placement at the outside corner. Alternatives include Avoid, Consider, or Prefer.

Lead in/out settings

Lead in and **lead out** lines are used to provide a way for the torch to ease into a shape. Usually, they are oriented in the same direction as the toolpath in order to ensure a clean cut of the final piece. The lengths of these lines are initially calculated from the thickness of the workpiece. The initial locations of these lines are automatically generated by an internal algorithm using basic rules. FlashCut CAM enables you to override these initial settings for each individual feature.

Editing settings To adjust the lead in and lead out settings, select the red diamond icon on the desired feature. This brings up the parameters window. If you want to change the location of the lead in and lead out, then you can simply drag the red diamond along the toolpath to the desired location. In the examples to the right, the top drawing shows a closed break with an overburn. The cut begins with an arc shaped lead in, and finishes with an arc-shaped lead out. The parameters for this break are shown below. The bottom drawing shows a tab break, no lead in or lead out.

Manual editing FlashCut CAM now permits manual adjustment of individual lead ins and lead outs in the toolpath. Click on the red diamond to make the line segment active. A blue dot appears at the end of the line. Hover over the blue dot until it turns green. This dot can now be used to drag the end of the lead in or lead out to the desired position. The example at right shows a single lead in with its end point selected (cursor not shown for clarity).



Break Type

- Closed When selected, the lead point and the end of the cut will overlap, closing the break between the beginning and end of the cut.
- Overburn To ensure a clean cut, you may set the torch to continue through a cut along the same toolpath. This feature allows you to determine how far this overburn will go. Lead out lines appear after the overburn.
- Tab When selected, there will be a gap between the lead point and end of the cut, creating a tab break between the beginning and end of the cut.
- Width The distance of the tab can be set here.

LeadIn/LeadOut Type Select the type of leading line to be used for the lead in and lead out lines.

- No Lead removes the respective line.
- Line results in a straight line. If you choose Line, the Line Length and Line Angle options below are displayed.

- Arc creates an arc tangent to the feature. If you choose Arc, the Arc Radius and Arc Angle options are displayed.
- Line Length Select the length of the leading line.
- Line Angle Select the angle that the leading line makes with the toolpath. The angle is measured clockwise.
- Arc Radius Select the radius of the circular arc.
- Arc Angle Select the angle that the arc travels through, measured from the edge of the toolpath.

CAM Actions

The CAM actions bar enables you to replicate and nest various features in the CAM drawing, as well as select various settings for lead in and lead out lines and the plasma torch. Clicking each option brings up numerous settings in the parameter window.

Project Settings Configures options applied to the current CAM project. Click the Project Settings icon to bring up the following options in the Parameters window.

General

- Default Cutting Fabhead Select the default cutting fabhead. Multiple fabheads can be defined in the Configuration interface.
- Default Marking Fabhead Select the default marking fabhead.

Material Settings

Workpiece

- Width Specify the width of the sheet being cut. Changes to this value will change the size of the material in the drawing window as well as any nesting settings.
- Height Specify the height of the sheet being cut. Changes to this value will change the size of the material in the drawing window as well as any nesting settings.

- Recent Sheet Sizes Select the sheet size from a list of recently selected material types.

Material

- Material Type Specify the material type. The parameters will automatically adjust to match your selection.

- Thickness Specify the thickness of your material. The parameters will automatically adjust to match your selection.
- Recent Materials Select from a drop-down list containing recently selected materials.

Material thickness and type MUST match what is being cut!!!!

Change Project Tab Settings  When selected, tabs will be included in the toolpath for the drawing. This is very important for cut quality and operating your plasma.

- Cutting at a lower amperage will yield the best results. Test cuts should be made to identify best quality setups.

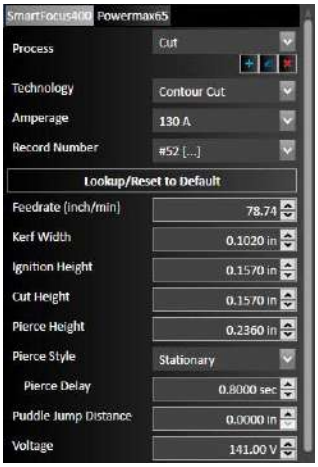
Plasma Settings  plasma fab head settings can be adjusted here. Click the icon to bring up options in the parameters window. You can override any of the recommended settings by simply typing in the respective field. After specifications are complete, you may either Accept or Cancel the changes. The values in the parameters are derived from Kjellberg's factory settings and are close with only minor tweaks necessary. Changes made here will apply to the specific drawing, but will not change the values set in the configuration window. The configured values for the fab head are in turn populated from the cut charts.

Amperages and settings set in Flashcut MUST match consumables and power unit settings!!! Failure to do so will end in incomplete and/or erratic cuts as well as torch damage!

Nozzle Select your plasma torch nozzle. The parameters will automatically adjust to match your selection. Note that each of the following parameters will be automatically adjusted when the nozzle is specified. However, they can also be input manually

Quality Level Toggle whether the toolpath will be optimized for best quality or fastest cutting.

Feedrate Specify the default feedrate at which the machine will move while cutting.



Kerf Width Input the width of the kerf of the plasma torch. This will determine the thickness of the cut, and the toolpath will change to reflect the new size. The toolpath is automatically offset outside by ½ the kerf width for parts, and automatically offset inside by ½ the kerf width for cutouts.

Pierce Height Specify the height at which the torch will initially pierce before cutting along the toolpath. If your machine is set to do a touch off at the beginning of each cut, then the pierce height is relative to the last touch off location.

Cut Height Specify the height at which the torch will cut the part along its toolpath. If your machine is set to do a touch off at the beginning of each cut, then the pierce height is relative to the last touch off location.

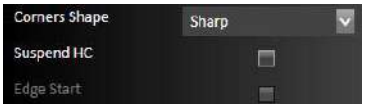
Pierce Delay Specify the time between the command for the torch to fire and the motion of the machine. The delay allows the torch time to pierce completely through the material prior to any other machine motion.

Voltage This is the target voltage for the THC system in order to maintain a specified cut height. The set point value is determined by the cut chart for each plasma torch, and can also be found in the operator's manual of the plasma torch. It and is dependent on the material type, thickness, torch settings, and other parameters. When **sampling** is enabled, the system will automatically detect this voltage and track it throughout the cut. The higher the voltage the higher the torch will cut, lower the set point to bring the torch closer to the material during cut moves.

Amperage Specifies the operating amperage of the torch.

Pressure Specifies the air pressure of the torch in psi.

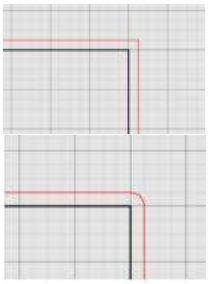
Note-consult your troubleshooting manual for adjustments to tweak cuts. Adjust minimal rates.



Corners Toggle whether the corners on the toolpath will be sharp or rounded. Different types of corners will result in more precise cuts depending on the qualities of the fab head and the material. Changes to the corner settings may take a short time to render the toolpath.

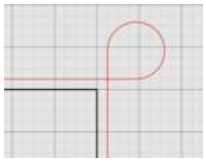
Edge Start When checked, indicates that the cut will start at the edge of the workpiece. The torch should sit as close to the material as possible without piercing.

- **Sharp corners** The toolpath follows the same angle as the part, maintaining a consistent distance from the edge.

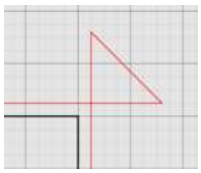


- **Rounded corners** The toolpath describes an arc at the corner of the part, maintaining a consistent distance from the edge.

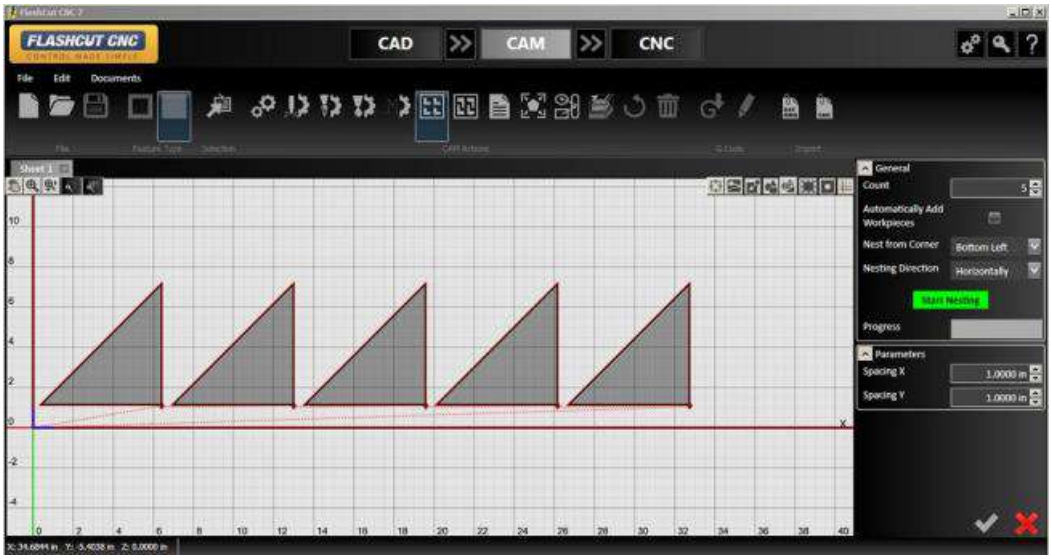
- **Rounded loops** The toolpath proceeds past the corner and describes a loop to reorient the fab head in the desired direction to cut the next section of the part. May result in a more precise cut at the corner.



- **Triangular loops** The toolpath proceeds past the corner and describes a triangle to reorient the fab head in the desired direction to cut the next section of the part. May result in a more precise cut at the corner.

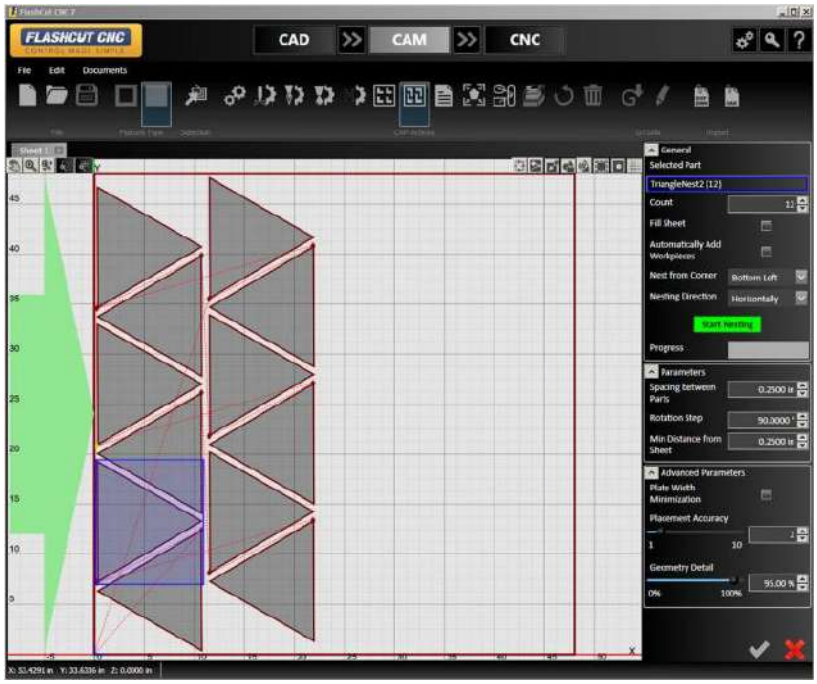


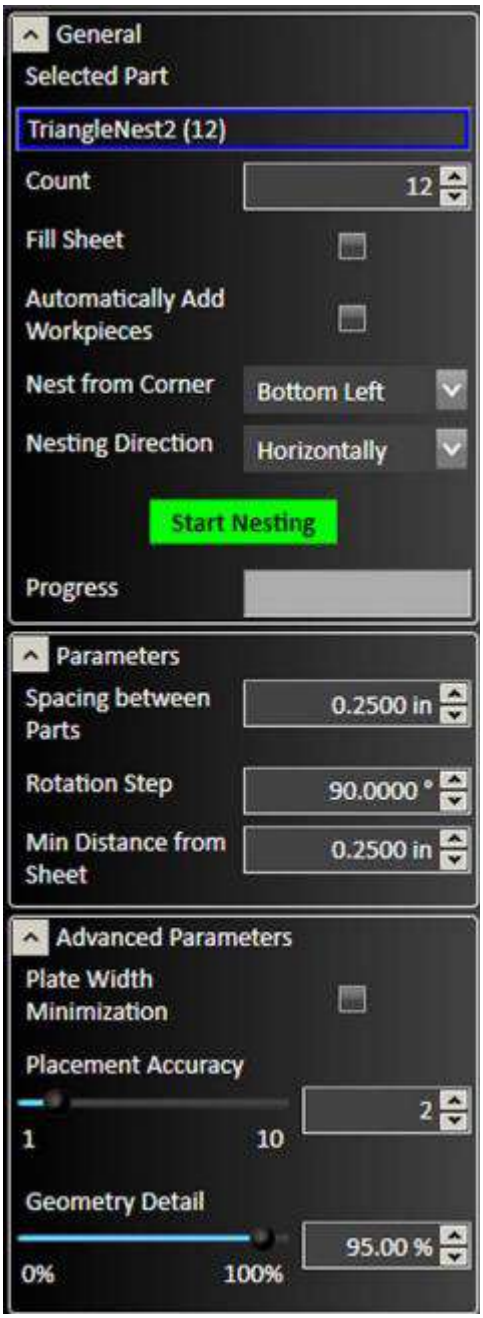
Grid Nesting The grid nesting function duplicates a part in a grid pattern. In the parameter window, type in the count of parts that you want to cut along with the X and Y spacing of parts in the grid. The number of rows and columns is determined by the sheet size. Copies fill rows left to right, and when the edge of the material is reached, they will advance up a row. Grid nesting does not change the orientation of any of the parts being nested as illustrated in the screen below where 5 triangles are grid nested. The parameters for grid nesting are described below.



- Count Determines the total number of parts that will be nested, inclusive of the original.
- Automatically add workpieces Adds a new sheet to the drawing containing a new workpiece if the number of shapes to be cut exceeds the capacity of the current workpiece.
- Nest from corner Selects the starting point of the nesting operation.
- Nesting direction Selects the direction from the starting point in which new nested parts will be added.
- Start Nesting Starts the nesting operation
- Progress Shows the progress of the nesting operation. Complex nesting operations can take significantly longer.
- Spacing X Sets the horizontal spacing between parts.
- Spacing Y Sets the vertical spacing between parts.

TrueShape Nesting The TrueShape nesting function will duplicate, rotate, and translate each part to create a nest that minimizes the amount of material used in a sheet. Twelve triangles are nested below using TrueShape Nesting. Notice the material usage is much lower for TrueShape nesting as it is for the same number of triangles using Grid nesting. The parameters for TrueShape Nesting are described below.





Selected Part If more than one part is in the CAD drawing, this option enables you to determine the count of each part that you need in the nest. A solid blue box will appear around the shape that is currently being replicated.

Count Determines the total number of parts that will be nested, inclusive of the original.

Fill Sheet When selected, parts will be added to fill the size of the current workpiece. Accepting the operation will change the count.

Automatically add workpieces Adds a new sheet to the drawing containing a new workpiece if the number of shapes to be cut exceeds the capacity of the current workpiece.

Nest from corner Selects the starting point of the nesting operation.

Nesting direction Selects the direction from the starting point in which new nested parts will be added.

Start Nesting Starts the nesting operation

Progress Shows the progress of the nesting operation. Complex nesting operations can take significantly longer. **Spacing between Parts** Determines the minimum distance between parts. Takes compensated toolpath, lead ins and lead outs into account. Minimum: 0.0001

Rotation Step Specify how many part rotations will be tried by the algorithm. For example, if the value is set to 90 degrees, the system will try angles 0, 90, 180 and 270. A smaller step may produce a tighter nest, but it will also increase computation time. Setting the value to 360 means no rotation will be applied to parts. Range: 0-360 degrees.

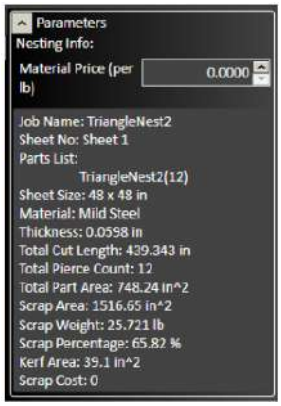
Min Distance from Sheet Determines the minimum distance from the edge of the sheet to any feature on any part including kerf compensation, lead ins and lead outs. A value of zero corresponds to the edge of the material.

Plate Width Minimization Toggle in order to minimize the horizontal space taken by the nesting shapes. Vertical arrangements will take priority. Enabling this option can produce better nests at the cost of a slight increase in area.

Placement Accuracy Specify how accurately the algorithm will try to nest parts. Smaller values may lead to parts spacing larger than specified. Higher values will increase placement accuracy, but will also increase computing time. Range: 1-10.

Geometry Detail Specifies how much parts are simplified for nesting calculations. Decreasing this value may lead to faster nesting with a decrease in accuracy. Range: 0-100%.

Nesting Information Generates a report from the nested parts, estimating material use, waste, and cost. A sample generated from the nested triangle example (above) appears here (right). Note that material price can be input directly into the field. All other information is generated automatically from the drawing



Fit workpiece to the parts Shrinks the workpiece to fit the area defined by the parts.

Sequence tool When selected, the sequence tool will display the order in which parts will be cut or operations executed. The example below shows a trio of parts being cut from left to right. To change the order, click the edge of a feature and drag the arrow to the next feature you want to execute. When finished, select the green check mark to finalize changes.

Simulation Tool Allows visualization and analysis of the material removal process. An example of a completed simulation appears below. The normal CAM toolpath window appears on the left. On the right, an isometric view of the cutter and the material is displayed. The controls (right) can be used to start, stop, pause, advance, or rewind the simulation. The slider with the arrows controls the speed at which the simulation plays

CAM Reset Resets CAM page and clears all drawings as well as clearing the tool path.

Delete Deletes the selected toolpath.

G-Code The G-Code tools on the ribbon allow you to create or edit a G-Code program for the CAM process for the current workpiece.

Create G-Code file Click the Create G-Code file icon to create a G-Code program for the CAM process for the current workpiece.

Open editor Click the Open editor icon to open the FlashCut CAM G-Code editor with the G-Code program for the CAM process for the current workpiece.

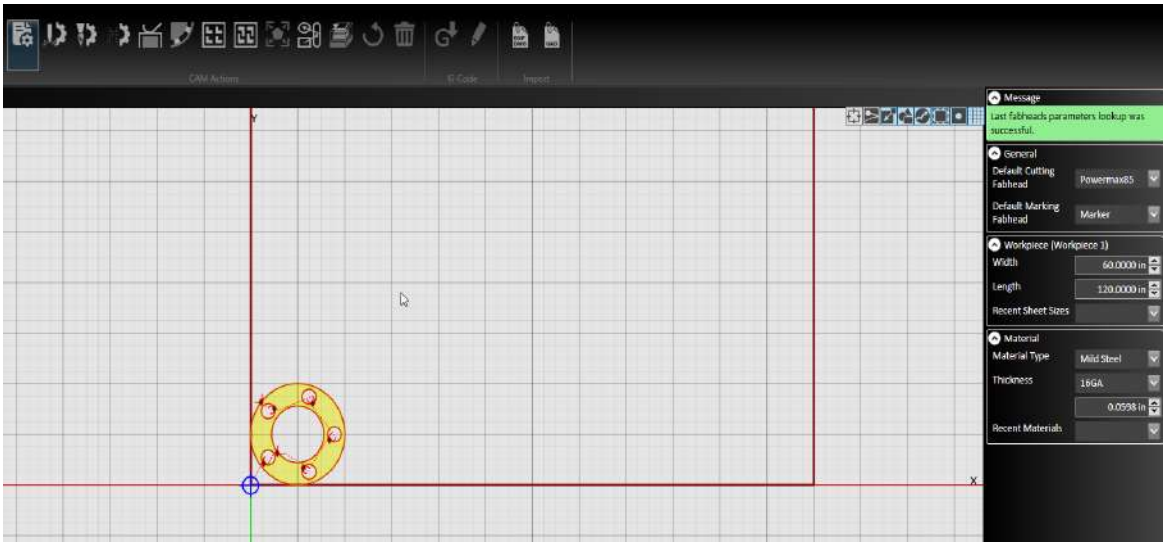
Import Files can be imported into the CAM drawing workspace. If other objects are added, new toolpaths will be generated. Note Objects imported as files will not appear in the CAD drawing space.

DXF/DWG Imports DXF/DWG file to the CAM drawing workspace. The file selection dialog, and other options are shown in the Parameters window.

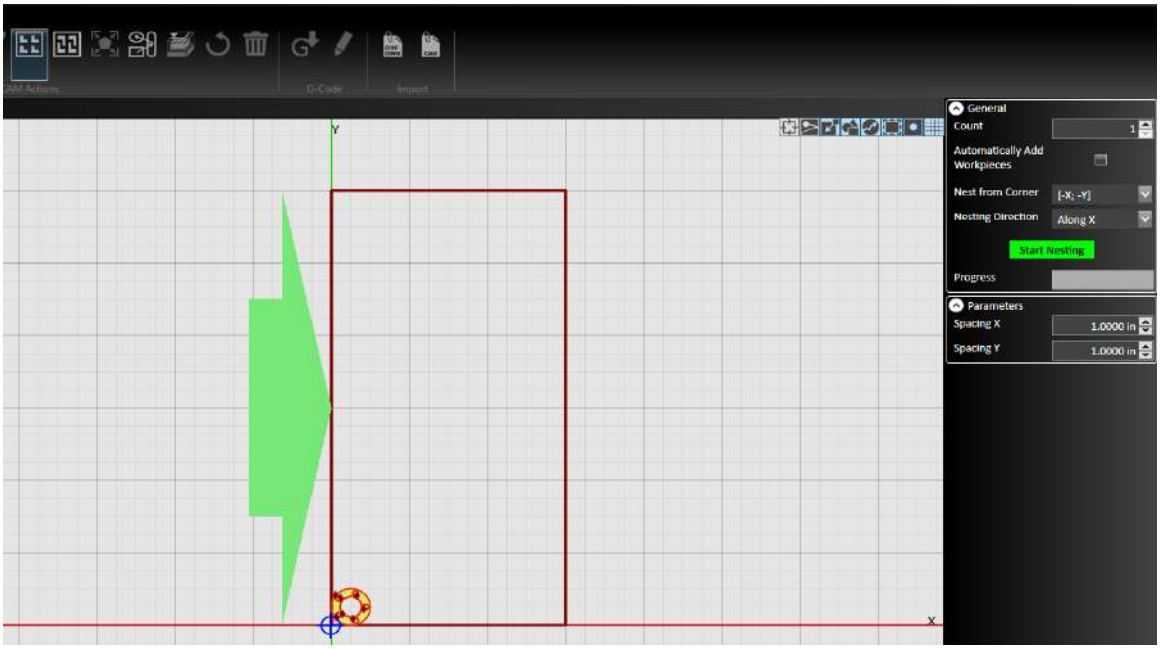
CADCAM Imports a CADCAM file to the CAM workspace. The file selection dialog and a progress bar are shown in the Parameters window.

Nesting

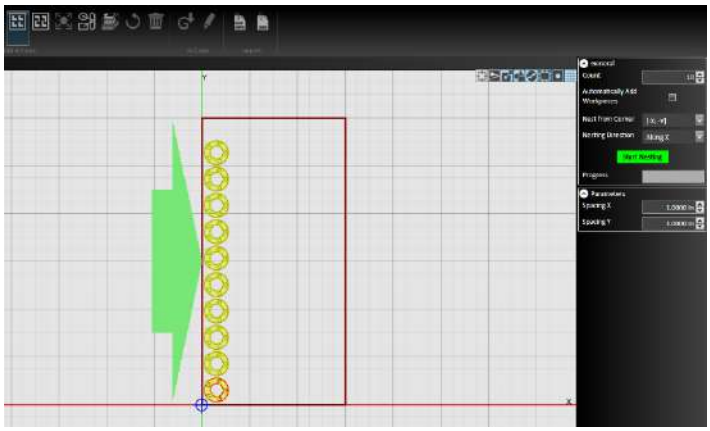
Before preparing to nest it is important to enter the sheet size into Flashcut. This will ensure proper nesting amounts and accuracy.



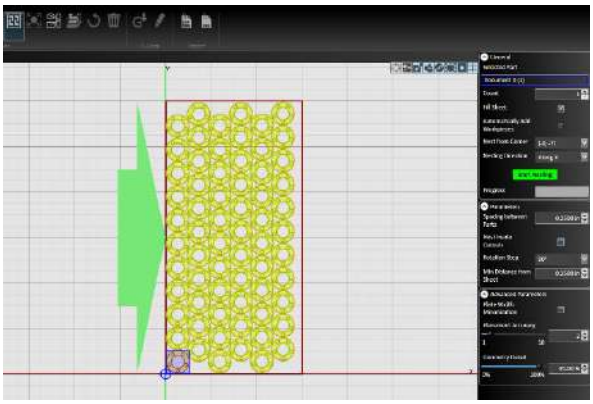
Grid Nesting allows you to quickly but simply nest out an item.

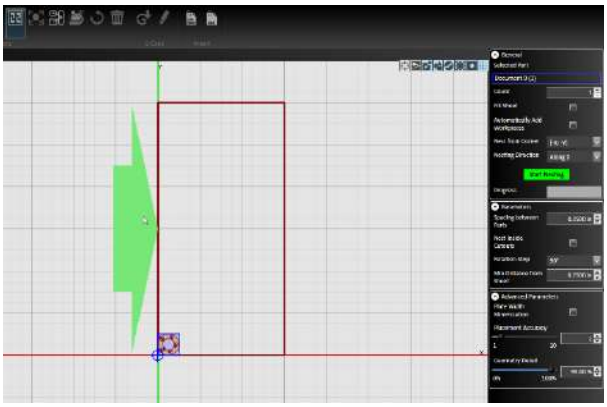


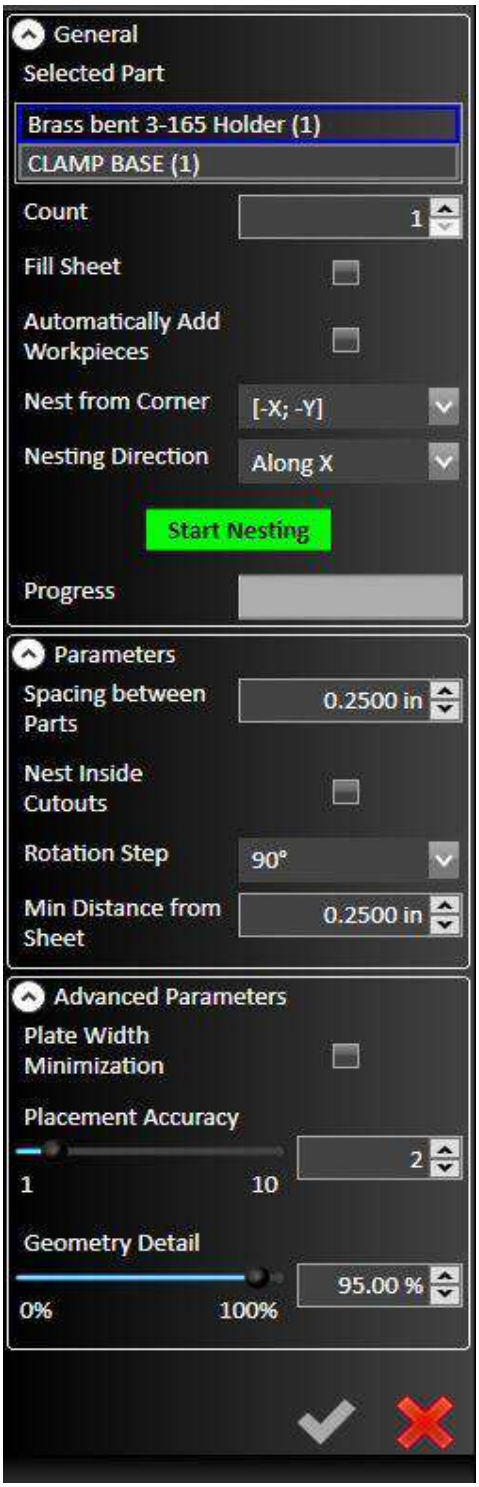
Select the number of parts to be nested and determine what orientation to nest them, the arrow next to the material box will guide you. Spacing can be entered as well. After or during nesting these can be changed. To nest click the Start Nesting button. If desired nesting is complete click the green accept check mark.



Trueshape Nesting works like grid nesting with the addition of more options. Trueshape Nesting allows you to nest multiple different parts in different rotations as well as simply filling a sheet.







The parts are listed in the top area. In the (#) is the total number of parts desired.

The number of parts needed are entered in the count. Highlighted part count are adjust in the count box and will change the total in the (#)

Fill sheet will automatically add parts

Automatically add work pieces will add more sheets as needed for great quantities of parts.

Nesting Corner will group parts in the specified corner

Direction will choose the side to hug parts to.

Part spacing will adjust the gap between parts AND THE LEAD IN. MOVE IF NEEDED TO NEST TIGHTER

Rotation step will cange how many times it will rotate the parts at the determined angle. Smaller the step the more complicated parts will be nested but it will add time to the nesting process.

Distance from sheet will keep parts from the edge.

Placement accuracy 10 is the highest and will produce bester nest but add time to process.

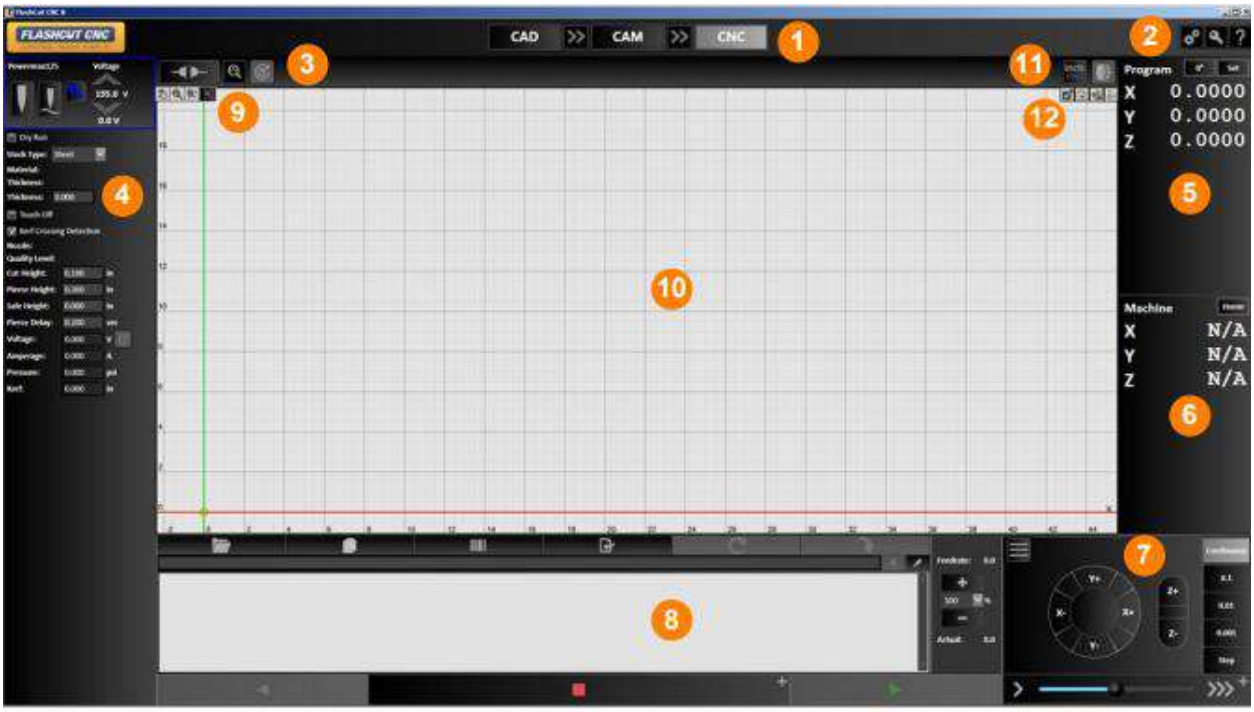
Geometry detail if raised to 100 will give more concise part definition

When finished hit start nesting and review nest.

Hit Check Mark to Save

FlashCut CNC

FlashCut CNC (Computer Numerical Control) control is the final step in the cutting process and may be accessed at any point from the other two steps, or independently if you already have a file to import. The panel is used to program and control each axis on your machine via the FlashCut CNC Controller. For comprehensive information on programming and G-Code, see the Programming Reference. The main screen is shown below. An explanation of each area of the screen follows.



An explanation of each area of the screen is provided in these topics:

1. Tabs
2. Configuration, License, and Help buttons
3. System Status, Connect, and Reset Motor Drivers
4. Fab head settings
5. Program coordinates panel
6. Machine Coordinates Panel
7. Jog and point control panel
8. G-Code window
9. Pan and zoom tools
10. Drawing workspace
11. Toggle Display Units
    Toggle manual control
12. Material
    Machine Envelope
    Part Numbers
    Show/Hide Grid

System Status, Connect, and Reset Motor Drivers

System Status Click the magnifying glass icon to view the live status of the input and output lines. Input Lines If a normally closed (NC) input line is normal, it will be in the closed state and the blue LED will not be illuminated. If the machine is connected, these icons are live when a switch changes its state. If an NC switch is tripped then it will be in the open state and the blue LED will be illuminated. Normally, only input lines that have been defined are displayed. However, if the show all checkbox is selected, the status of all input lines will be displayed.

Output Lines The output line status icons are either white for off, or blue for on. You can also control the state of these switches by clicking on them here.

Controller The serial number and USB speed of the controller are also shown.

Connect Clicking this icon connects or disconnects the signal generator. When connected, the icon is illuminated and the two halves are in contact. Ensure that the signal generator (CNC controller) is securely connected via USB cable to your PC, and that the USB driver is installed. Click the Connect icon. FlashCut begins communication with the signal generator. If there is a problem with the connection, a dialog box appears. FlashCut CAD/CAM and CNC Control Software Page 116 When properly connected, the Connect icons will join and turn blue. Press Disconnect prior to unplugging the signal generator. When the signal generator is connected, all moves are performed by the machine tool. Before the unit connects, a safety reminder screen appears. It is imperative that you and anyone else near the machine understand, agree with and adhere to all of the safety guidelines. If the safety guidelines are not accepted, the software will not connect.

Note, please refer to your Troubleshooting Manual for System Status Alert codes.

Reset Motor Drivers  Toggles the enable line to reset all motor drivers controlled by the system.

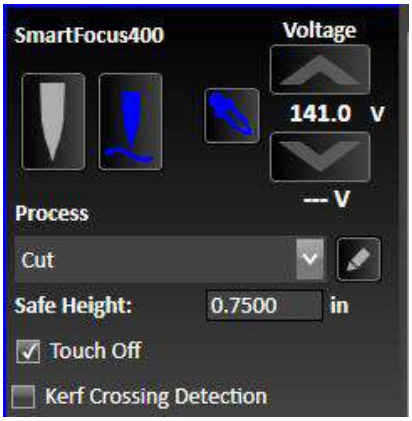
Fab head settings Each fab head that has been configured and saved will be displayed here. See Configuring FlashCut for more information. If multiple fab heads are configured, the parameters for a specific fab head can be viewed and edited by selecting the appropriate tab.

Laser pointer control If a laser pointer is configured, it can be turned on and off by clicking the icon. The pointer can also be locked in the on position.

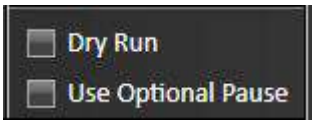
Marker control (Scribe) If a marker is configured, it can be turned on and off by clicking the icon.

Plasma torch settings

Parameters are populated from Settings set in the CAM window. If an editable parameter is changed here, the settings in CAM will not be affected. Some controls will not be displayed unless they are enabled in the fabrication head configuration panel. See Plasma in Configuring FlashCut.



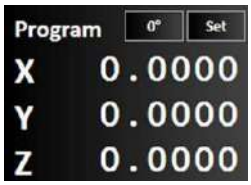
- **Torch On/Off** – Click to turn the torch on or off. Before turning on the torch, FlashCut CNC will display a warning dialog asking if it is safe to proceed.
- **Torch Height Control** – Click to turn THC on or off.
- **Use Sampling** – Click to turn sampling on or off.
- **Voltage** – Click up or down arrows to raise or lower the voltage.
- **Dry Run** – When selected, the machine will execute the operations, but the torch will not be lit, and cuts will not be made.
- **Material and Thickness** – These properties are visible here but are configured in the **CAM** window under **Project Settings**.
- **Touch Off** – The torch will touch the material in order to establish a zero point on the machine coordinates. Toggling Touch Off will make the torch touch down to reestablish the zero point between rapid and feedrate moves.



- **Kerf Crossing Detection** – When selected, helps prevent the torch from diving into the material where one cut crosses another.

Program coordinates panel

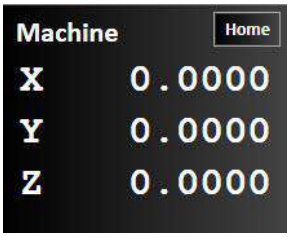
The program coordinates refer to the exact position of the tool with respect to Program Zero. The program coordinate system is referenced by the G-Code file as the set of absolute coordinates. Axes in the workspace represent the program coordinates. The **Set** dropdown menu sets program zero points along each axis, as selected from the dropdown menu.



- Zero X will zero the X axis.
- Zero Y will zero the Y axis
- Zero X and Y will zero both X and Y axes.
- Zero Z will zero the Z axis.
- Zero All will zero each program axis.
- New sets the position of the tool relative to program zero.
- Shift sets the position of the tool relative to the last feed hold position
- Sense Powermax Zero will home and zero the torch head.

Program zero (X & Y) are set at reference 0,0 in cad unless otherwise edited. All drawings should be zeroed from the lower left corner of the material.

Machine Coordinates Panel



The machine coordinates refer to the exact position of the tool with respect to the machine home. The coordinates will read N/A until the tool is able to locate its home position. After connecting the signal generator to FlashCut, it is necessary to seek out and set the home point, or Machine Zero, of the tool. It is recommended that each axis is jogged first near the home switch before homing. Once machine zero is set, the machine tool envelope is redefined in the workspace.
The Home dropdown menu provides the following commands:

- **Home All** will reset all three axes to the home point.
- **Zero All** will set the current point as the origin of the machine coordinates.
- **Clear** will close the machine coordinate system. N/A will display on each axis. You will need to reestablish a machine zero point.

Your machine will need to be homed after first opening Flashcut

Jog and point control panel

Jog The jog control panel provides these controls for manually positioning all axes.
Axis jog buttons Pressing and holding an axis jog button (+X, +Y, +Z, -X, -Y, -Z) moves the machine tool exclusively on the selected axis. Ramping is used in cases where the jog rate is faster than the stop/start feedrate.
Diagonal jog buttons Pressing and holding a diagonal jog button (unlabeled) moves the machine tool evenly along two axes. Ramping is used in cases where the jog rate is faster than the stop/start feedrate.
If you want the move to be made at the maximum allowable speed, toggle the Plus icon and check the Rapid Move box.
Jog mode Determines the function of the jog buttons. Continuous jogging moves the tool at the assigned jog rate buttons are held down. Discreet distances move the tool incrementally the specified distance. Step jogging advances the motor exactly one motor step.
Jog rate Adjust the slider to change the speed at which continuous jogging will occur. Sliding to the left decreases the speed, while sliding to the right increases the speed. FlashCut CAD/CAM and CNC Control Software

Move to point allows you to move (jog) your tool to a specified exact point. You may specify the feed rate to be used for these moves by editing the value in the Feedrate field.

- Click the Program Zero button to move the tool to the program zero point shown on the Program coordinates panel.
- Click the Machine Zero button to move the tool to the machine zero point shown on the Machine Coordinates Panel.

If you want the move to be made at the maximum allowable speed, toggle the Plus icon and check the Rapid Move box

Note, machine can be moved by holding Ctrl and using the arrow keys to move the X and Y. PgUp and PgDn will raise and lower the Z axis.

Rip Cut is used to execute simple cuts without making a drawing or writing a G - Code program. Select the axes (X and/or Y) of the cut, the distance in each direction, and the federate. Press the green arrow to make the cut.

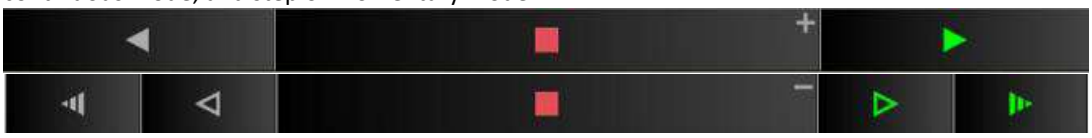
G-Code window

1. Open G-Code file
   File name
2. Load all G-Code files in a folder
3. Barcode
4. Run CAD Import Wizard
5. Reset G-Code
6. Jump to Line
7. Close G-Code file
   Edit G-Code
8. G-Code workspace
9. Feedrate override controls
10. Run G-Code in reverse
11. Feed hold
12. Toggle G-Code run mode
13. Run G-Code

1. **Open G-Code file** When a CAD or CAM design is sent to be manufactured in FlashCut CNC, it appears in the G-Code workspace. However, to open an existing program manually, click the Open G-Code file button to browse to a G-Code file and open it in the G-Code workspace. A visual preview of the code will appear in the workspace. The name of the G-Code file is displayed in the G-Code workspace. This workspace displays the currently loaded G-Code file. While the program is running the current line of code is highlighted in real time, this way the user can track their progress throughout the operation.
   File name FlashCut CNC displays the file name of the currently displayed G-Code file here.
2. **Load all G-Code files in a folder** Prompts the user to select a folder. All G-Code files in the folder will be loaded into FlashCut CNC.
3. **Barcode** Allows the user to input a barcode representing a list of files to be cut.
4. **Run CAD Import Wizard** Allows the user to open DXF files directly into FlashCut CNC. Imported files will not be visible in the CAD and CAM windows.

5. **Reset G-Code** Click the Reset G-Code file button to reload the current G-Code file. This will not change the position of the tool. Jump to Line This button allows the user to jump or skip ahead to a specific line in the program.

6. **Close G-Code** file Click the Close G-Code file button to close the current G-Code file. You may replace it by loading a G-Code file, creating a part with FlashCut CAD or FlashCut CAM, or by writing a new G-Code manually with the G-Code editor.
7. **Edit G-Code** Click the Edit G-Code button to edit the currently displayed G-Code file with the G-Code editor.
8. **G-Code workspace** This workspace displays the currently loaded G-Code file. While the program is running the current line of code is highlighted in real time, this way the user can track their progress throughout the operation. Note Double-clicking in the G-Code workspace now brings up the G-Code editor.
9. **Feedrate override controls** Increases or decreases the defined feed rate by the given percent in the box. A setting of 100% override corresponds to zero change in feed rate. This function does not affect rapid move speeds, where feed rate is undefined.
10. **Run G-Code in reverse** This is useful when troubleshooting a program in simulation mode or dry run mode. Not typically used while cutting. Some commands are not possible to reverse through; For example, M106(fabhead change) and G611(advanced pierce options).
11. **Feed hold** Click the Feed hold button to pause execution of the G-Code file. The machine tool stops, ramping down if necessary. The slower the ramping rate, the longer it takes from the time the Feed hold button is clicked to the time the tool comes to a complete stop. This button pauses any motion including automatic tool changing, tool length sensing and so on.
12. **Toggle G-Code run mode** Click the Plus/Minus sign on the Feed hold button to toggle between continuous mode, and step or momentary mode.

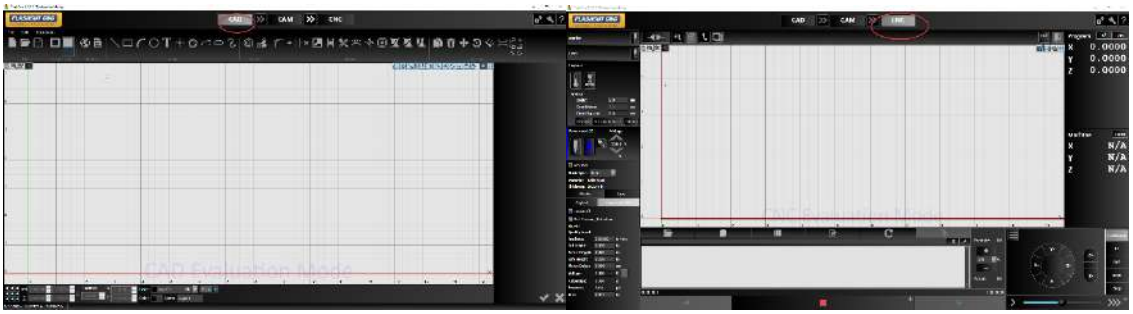


    - Run G-Code – solid arrowhead. G-Code will run to completion, unless Feed hold is pressed.
    - Run Step G-Code – striped arrowhead. One line of G-Code will be executed.
    - Run Momentary G-Code – outlined arrowhead. G-Code will run as long as button is depressed.
13. **Run G-Code** Click the Run G-Code button to begin execution of the current line of the G-Code file. When in step mode, execution stops automatically at the end of the current line, or when the Feed Hold button is clicked. When in continuous mode, execution continues until the end of the program, or until you click the Feed hold button. If the program has been stopped in the middle of a G-Code line, clicking the Run G-Code button begins execution exactly where the program stopped.

Progress meter When the Calculate Run Time for Progress Meter is selected, the G-code window will display a progress bar showing the total estimated time to complete the operation, and a countdown of the elapsed time. See G-Code.

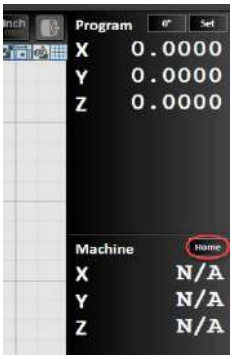
To Operate your Boss Table, begin by opening FlashcutCNC on your desktop.

Flashcut will initially open CAD. Homing of the machine is required at this time. Select CNC to to jog the machine.

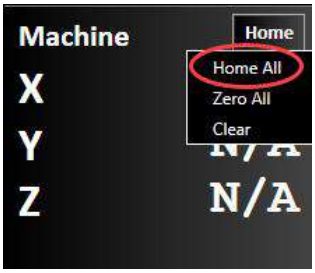


Note, Check the area of the table for obstacles and item on the rails. Remove items

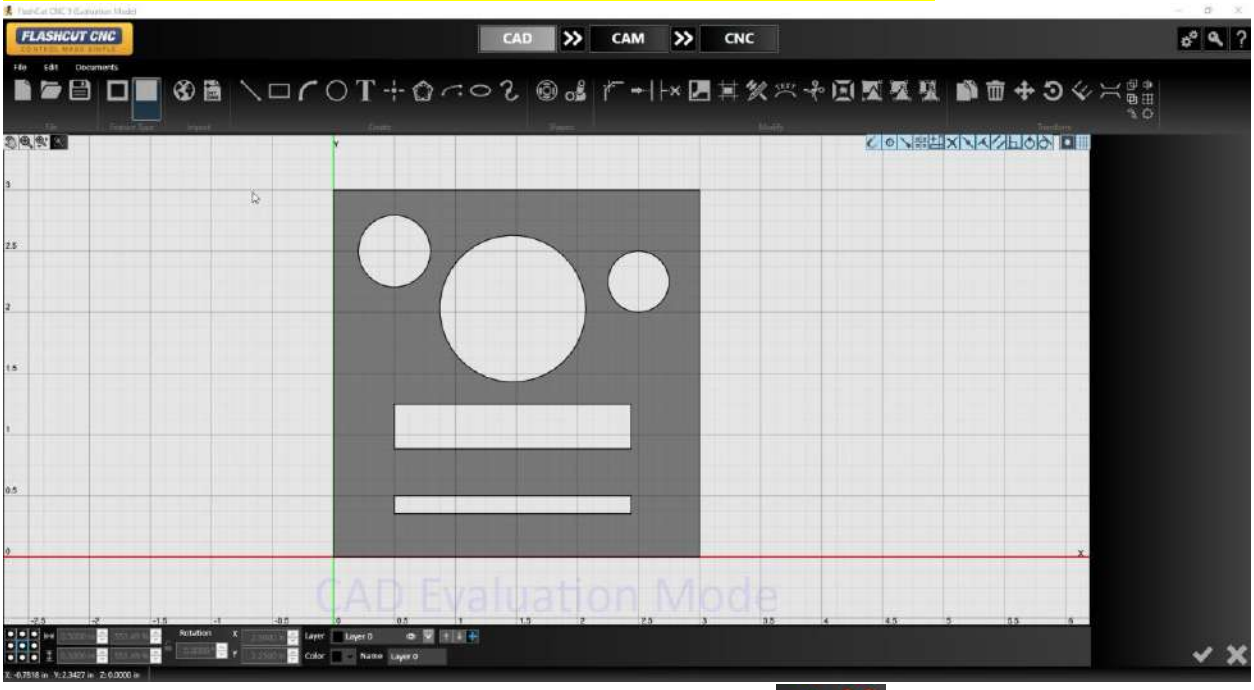
Holding **Ctrl** and using the **Arrow** keys drive the machine to the lower left corner close to 4”-6” from the stop switches.



the stop switches and set the parameters for the table. ***Your Boss Table requires homing after initially loading Flashcut after closing.***

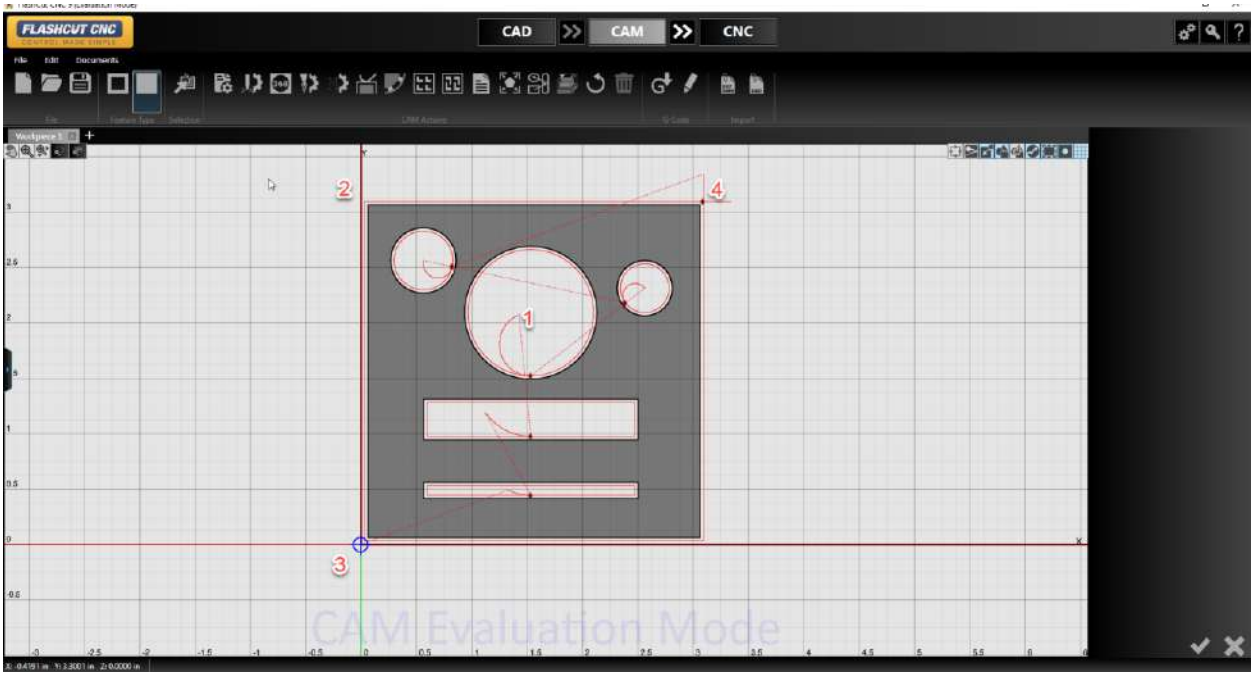


Return to CAD and begin designing a drawing. To import a .DXF file into CAD select Import DXF/DWG File. Otherwise you can freely draw a design, open a previous cad/cam file or use one of the preloaded parts in flashcut. For this instance, we will use a 3”x3” square for our test cut. It is recommended to save your design before switching between CAD>CAM>CNC.



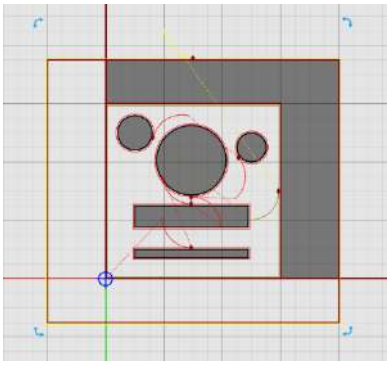
After completing and action select accept or cancel to continue.  Pressing **ESC** will remove the selected tool being used and revert to the previously used tool if not cleared. Once the design is finished, import it into CAM to setup tools and toolpaths. To do this click on the arrows between CAD and CAM.

Your design will be transferred to CAM. Toolpaths and Rapids will be automatically written but can be edited in the Change Project Breaks Settings  or by clicking on the toolpath.

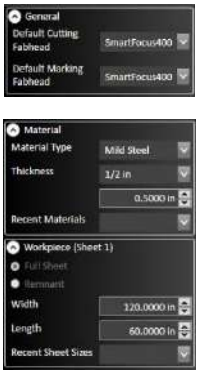


1- Shows an inside cut toolpath with an arched lead in. Lead in can be moved or sized by clicking the diamond associated with the lead in.
2- Cutting paths has clearance along the material edge. To move the design, highlight the whole drawing and move with the Arrow keys. Zooming in and out will affect the size of the movement steps.
3- This is the programs zero for the X and Y axis. All rapids after zeroing the machine will start from here.
4- Outside offset cut with a corner lead in. Lead ins can be moved by selecting the diamond associated with the lead in and dragging it along its path.

To flip lead ins from outside to inside simply draw a box around the design in CAD and import it into CAM. Select the boxes toolpath and press the **Delete** key. You will notice Flashcut has flipped lead ins to inside cuts.



After editing the toolpaths, open the **Project Settings** to edit the power source/fabhead. Open **Material settings** to alter the material to be cut. ***It is extremely important that the material and thickness selected matches what is being cut!!!*** In this case we have selected a Smart Focus 400, material size is 60”x120”, mild steel is the type at 1/2” or .5” thickness. Finish by accepting or canceling .*Note, any issues in the project settings will prompt a message to appear in the upper project settings window.*

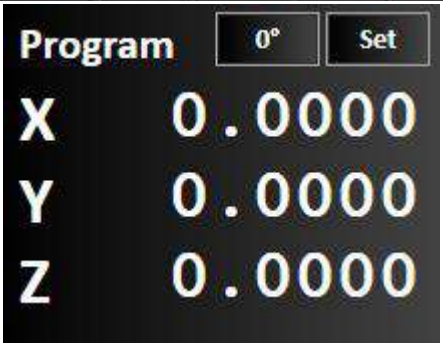


Next move to the Plasma Settings , this will be where the editing is done for the consumables and cut settings. Important, ***The selected nozzle type must match what is loaded into the torch head!!! Example, 130 amp is selected and 130 amp consumables are loaded into the torch. NO EXCEPTIONS!!*** In this case we will be using a 130 amp consumables. The recommended torch settings will automatically load. These numbers can be tweaked to achieve a superior cut. Please refer to the Troubleshooting Manual for instructions. By enabling Contour Cut / Smart Hole Detection the torch will throttle down when cutting holes. In this instance the torch will throttle back to 40% when making a 3” or smaller cut with Torch Height Control (THC) turned off for holes. Finish by selecting accept or cancel.

Once completed in CAM click the arrows between CAM and CNC to open CNC.

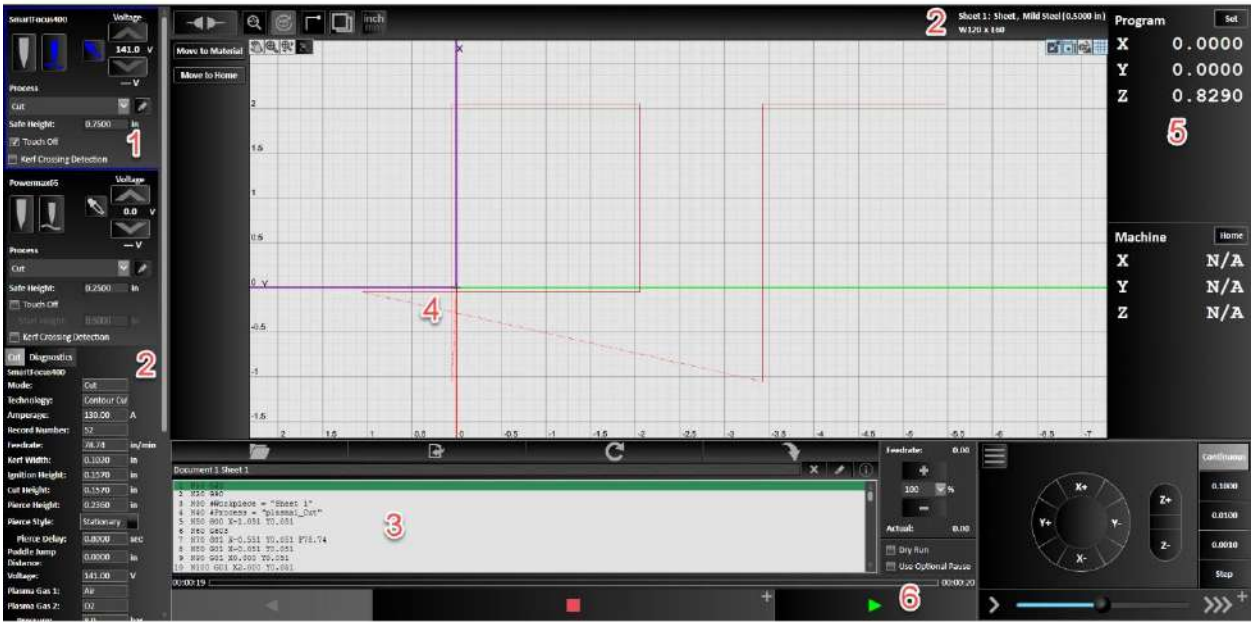
In CNC you will notice the toolpaths and rapid lines. The torch location will be represented by a crosshair +. You will need to set the parts position on the sheet. To do that a Program Zero needs to take place. As in CAD and CAM the center of the grid map is 0,0 and the drawing is in the upper right-hand corner from 0,0 as shown below. This is true on the tables bed as well.

Using the Jog menu in the lower right of Flashcut or by pressing **Ctrl** and the **Arrow** keys travel your torch to the lower left of the steel to be cut and click on the **Set** icon in the **Program menu**. Click **SensePowermaxXXZero**. Your torch will lower down and touch the material as well a zero the Z axis. Click the **Set** icon again and select **Zero X and Y**. The part will be located off of the torch tip and your machine parameters will look like the image. If you nested your part 4 inches away from the lower left corner your part will be offset 4 inches from the tip. With the exception of the laser all components will zero from the torch location.



Prechecks before running a cut

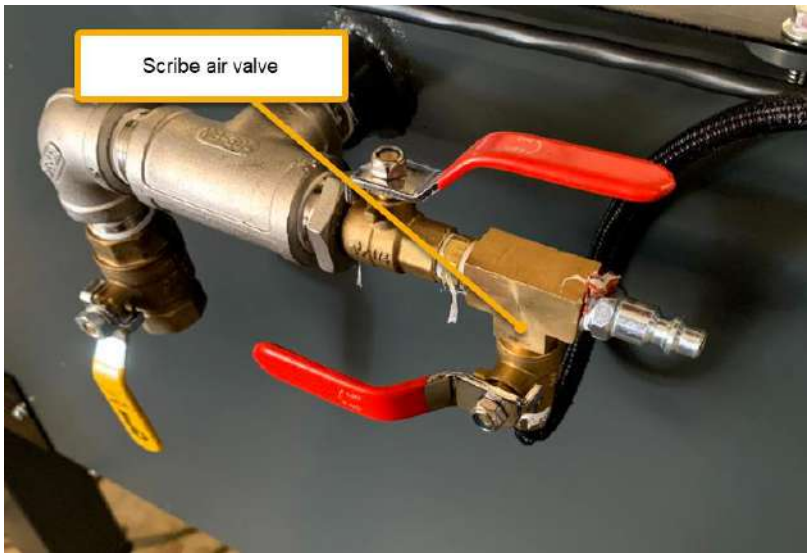
It is good practice to do a quick precheck before running the machine. A few things to look for are proper amperage set and no errors on the Kjellberg power unit. The table is free of obstructions and all axis' are clear. Lastly a quick check in Flashcut as shown below.



1- Voltage set to correct number as well as torch height control selected if desired.
2- Dry Run is unchecked and selected nozzle and amperage match Flashcut, machine and Hypertherm.
3- G-Code is at line #1.
4- Drawing is correct and true to the placement on the material sheet or plate.
5- Machine is zeroed
6- If all items look good hit Run G-Code!

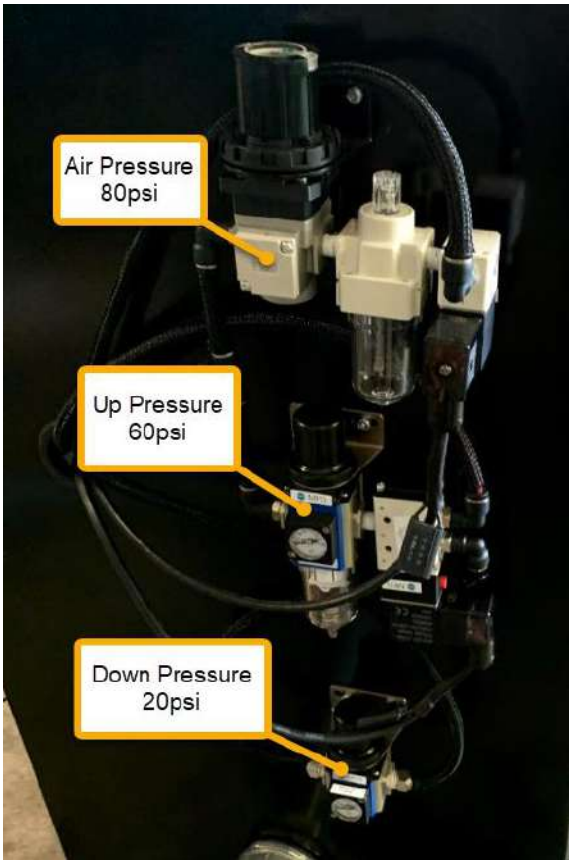
Air Connection and Initial Setup

Your Boss HD Plasma Table will always require an air hookup of a minimum 90 psi when paired with a scribe. Boss Tables use a pneumatic scribe and are configured from the factory, so no adjustment is needed.



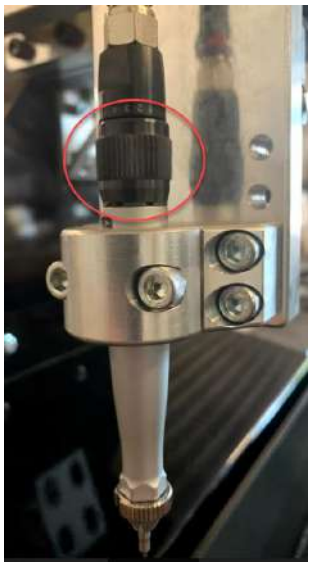
The air inlet valve is where the scribe gets it's air. A minimum of 90 psi is needed.

On the back of the control cabinet are the pressure valves for the air scribe. The correct PSI is already set from the factory so there is no need to adjust the valves. Maintain a level of air tool oil in the top valve as shown below.



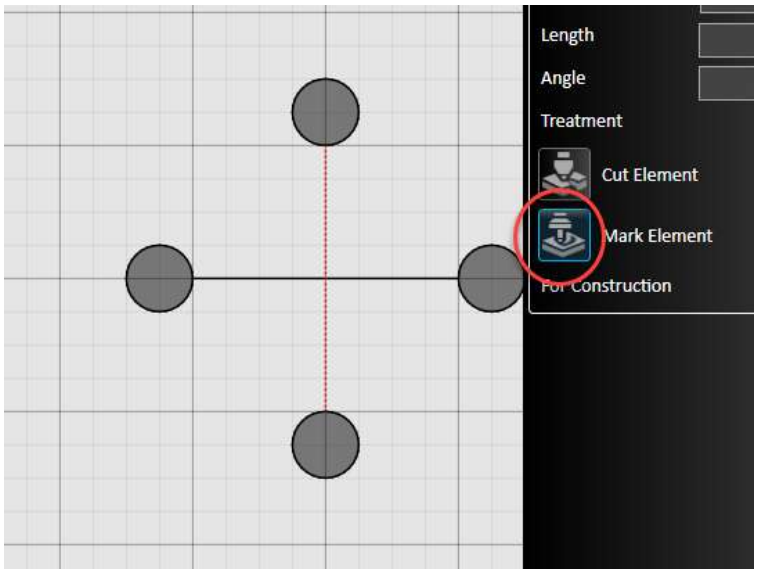
Above are the air scribe valves located on the back of the Boss Tables control cabinet. The top valve with the glass cup receives the air tool oil.

Your air scribe is adjustable by turning the black band dial. This will increase or decrease the air pressure at the scribe head.



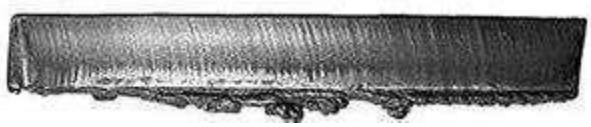
Scribe Use

The scribe operation is set in the cad section of Flashcut. Simply select the object you want to scribe and select the Mark Element icon in the parameters to the right. The object will change from solid to dotted.



Setup from here will be the same as other cutting operations. Use the torch to zero like any other cut. The machine will compensate for the scribe offset automatically.

Troubleshooting cut quality problems – parts have too much dross (slag)



Low speed dross

- Increase the cut speed in 5 ipm increments
- Increase the standoff in 1/16 increments or 5 volt increments
- Decrease the amperage in 10 amp increments
- If none of these measures improve the cut, consider a smaller nozzle size

High speed dross

- Check the nozzle first for signs of wear (gouging, oversize or elliptical orifice)
- Decrease the cutting speed in 5 ipm increments

- Decrease the standoff in 1/16 increments or 5 volts increments
- Increase the amperage (but do not exceed 95% of the nozzle orifice rating)

Top spatter dross

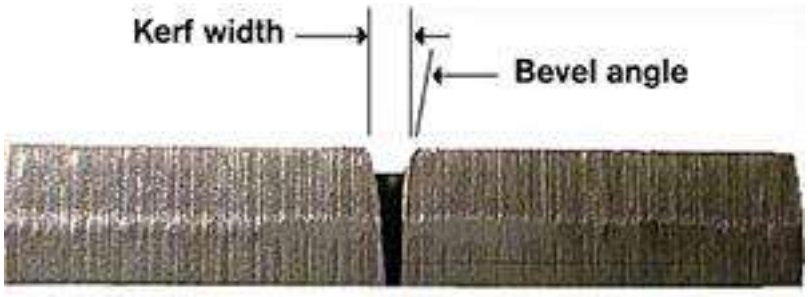
- Check the nozzle for signs of wear
- Decrease the cutting speed in 5 ipm increments
- Decrease the standoff in 1/16 increments or 5 volt increments

To judge the optimum cutting speed:

- Method 1: make a series of test cuts at various cutting speeds and choose the speed that produces the cleanest cut. Lag lines (small ridges in the surface of the cut) are a good indication of cutting speed. Slow cutting speeds produce vertical lag lines that are perpendicular to the plane of the plate. Fast cutting speeds make slanted s-shaped lag lines that run parallel to the plate along the bottom edge. By examining the lag lines the operator can determine whether an increase or decrease in speed is needed to find the dross free window. Many operators have the tendency to slow the machine down at the first appearance of dross, but often an increase in speed is necessary.

- Method 2: watch the arc (through the appropriate welding lens) during the cut and dynamically change the speed to produce the optimum arc characteristics. To do this, observe the angle of the arc as it exits the bottom of the work-piece. If you're cutting with air plasma gas, the arc should be vertical as it exits the bottom side of the cut. With nitrogen or argon/hydrogen, a slight trailing arc is best, and with oxygen plasma gas, the best cut speed is one that gives you a slight leading arc.

Troubleshooting cut quality problems – cut angularity



Kerf too wide (part too small)

This problem can be caused by a worn nozzle, high torch standoff (arc voltage), excessive amperage, inadequate gas flow, or low speed. Each of these variables will cause the arc column to grow, widening the kerf. An incorrect (small) kerf compensation value will also cause an undersized part. Kerf too narrow (part too big). This problem can be caused by low torch standoff (arc voltage), inadequate amperage, excessive gas flow, or high speed. These variables cause the arc column to shrink, narrowing the kerf. An incorrect (large) kerf compensation value will also cause an oversized part.

Bevel angle is the angle of the cut edge

A cut with 0° bevel is a straight cut, perpendicular to the plane of the material. Most plasma torches use a clockwise swirling flow of plasma gas, which produces a straighter cut on the right hand side of the kerf with respect to forward torch motion. Typical bevel angles for conventional plasma torches range from 1-3 degrees on the "good" side of the cut and 3-8 degrees on the "bad" side of the cut. High tolerance plasma cutting systems can achieve even lower bevel angles. Although some bevel is inherent in the plasma process due to the shape of the gas jet as it exits the torch nozzle, it is possible to minimize it. Bevel angle greater than 5 degrees may indicate a problem with PAC machine parameters.

(Excessive) Positive bevel

Positive bevel - top of part smaller than bottom

This problem may be caused by a worn nozzle, high torch standoff (arc voltage), inadequate amperage, or excessive speed. All of these variables cause the arc to lag which causes more energy to contact the top of the kerf than the bottom. As a result, the kerf is wide at the top and narrow at the bottom. Improper cut direction around the part may also cause excessive positive bevel angle. A part with excessive positive bevel all around it may also have a hard bead of high-speed dross at its bottom edge.

Negative bevel

Negative bevel - bottom of part smaller than top, undercutting

This problem can be caused by low torch standoff (arc voltage), excessive amperage, or low speed. These parameters cause the arc to remove more material at the bottom of the plate. Usually, a consistent negative bevel around the part is accompanied by low speed dross.

Irregular bevel

Positive cut surface - positive and negative bevel on the same piece

This problem usually indicates that the nozzle has failed, the torch is out of square or the electrode and nozzle are misaligned. These variables cause the arc to deviate from a straight path through the material. Often one side of a square part will have a positive bevel and the opposing side a negative. The cross section of the part looks like a parallelogram rather than a rectangle. Sometimes the cut surface may not be flat, but rather concave on one side and convex on the other. These are all signs of severely worn or misaligned parts.

Incomplete cuts (not cutting through the material)

Common causes may include:

1. Worn out/damaged consumables
2. Cutting too fast
3. Incorrect torch height
4. Amperage is too low for the material thickness
5. Incorrect gas/airflow settings

Troubleshooting cut quality problems – hole quality

Bolt holes should be cylindrical

Hole diameter at the top and bottom should be nearly equal – in order to ensure a good fit with the bolt. One critical parameter that affects cylindricity of the hole is cutting speed. Programmers enter cutting speed as a lineal rate in inches per minute (in/min) or millimeters per minute (mm/min), but when cutting a circle, the torch must slow down to compensate for the natural lag of the plasma arc as it cuts. Most CNC controls automatically compensate for this phenomenon with an algorithm that factors down the velocity for hole cutting. Called centripetal limiting, this calculation accounts for the length of the radius, torch acceleration, and minimum corner speed to adjust the actual cutting speed around a circle. The programmer or operator may be able to adjust the lineal speed up or down to optimize actual circular-cutting speed for improved cylindricity. This would mean programming different, lower speeds for bolt holes than for straight cuts on the same part.

Cut height, or voltage setting

Cut height, or voltage setting, is another parameter that affects cut quality on bolt holes. For small holes, cut height should remain constant throughout the cut. With voltage regulated torch height control (THC), cut height is determined by an arc voltage setting of typically 100–180 V. Depending on the responsiveness of the system, using THC for small holes may worsen rather than improve cut quality. It may be necessary to lockout the THC during cutting of small parts to prevent the torch from cutting too high or low and to prevent the torch from diving at the end of the cut. The THC can be locked out by switching into manual mode after the pierce is complete or reprogramming the part to specify corner-slow-down – no THC – during hole cuts. Newer more responsive torch-height controls may help with defects caused by improper cut height.

Programming lead-ins and lead-outs

The type and size of lead-in and lead-out can significantly affect cut quality, particularly with bolt holes and slots. Two common defects are divots and bumps. A divot occurs when the arc removes too much material at the end of the cut. As the plasma arc crosses the lead-in kerf – the removed material from the beginning of the cut – it transfers to the saved part, causing a small indentation or, sometimes, a larger scooped-out region. This makes the hole out-of-round.

A bump occurs if the lead-in and lead-out do not adequately overlap. Some of the material in the hole is not completely removed, leaving a bump of uncut metal that prevents the hole from accepting a bolt.

Finding the appropriate lead-in and lead-out to minimize divots and bumps at start and end points can be challenging. Operators can use a trial-and-error process to find the appropriate combination. Generally, a radiused lead-in with a very small or negative lead-out (negative overburn) to the saved part will produce the best hole. Sometimes a short, straight lead-in works better with a small leadout (positive overburn). The outward-spiral lead-in is a special design that can be very effective for hole cutting. *(Note: This differs from the traditional locking lead-in used in oxyfuel cutting, typically not used for plasma cutting.)* The outward-spiral lead-in allows the machine to reach full speed and the arc to stabilize before cutting the hole perimeter, providing the smoothest machine motion throughout the cut.

Nozzle size and amperage

In general, a small nozzle with lower amperage and slower speed will produce a smaller kerf and a finer cut.

For example, with a 200-A plasma system, the highest power – 200 A, 2 mm (0.086") orifice, 3 mm (0.130") kerf) may not be suitable for cutting small bolt holes and intricate details.

Let us say you want to cut a precise 12 mm (1/2") hole in 12 mm (1/2") mild steel. A 100-A nozzle with a smaller orifice, 1-1/2 mm (0.059"), and kerf width, 2 mm (0.089"), cutting at a slower speed will produce a much finer cut.

To get the best cut from a given nozzle, always set amperage at 95 to 100% of the nozzle's rating. The downside: reduced consumable life and slower cutting speeds. The upside: a nearly finished part with minimal rework.

When to use high-tolerance plasma

High-tolerance plasma uses a small nozzle orifice and intense gas swirl to constrict the arc. The result is an energy-dense arc with a very narrow kerf that can cut intricate details and very small holes. Conventional plasma systems can cut within 0.76 mm (.030") accuracy and produce cuts with 3–5° of bevel, sometimes as little as 1°. High tolerance systems can cut with 0.25 mm (0.010") accuracy and 0–3° of bevel. They can accurately cut holes as small as 4.76 mm (3/16").

Six rules for cutting bolt holes

1. Use the smallest nozzle size rated to pierce and cut the material
2. Make sure the pierce-delay allows full arc penetration before machine motion starts
3. Lock out voltage-regulated THC
4. Use a radiused or spiraled lead-in
5. Program a slower cutting speed
6. Use a short or negative leadout to the saved part

Air Issues

Air Pressure Is Too High

If the pressure is too high this will dissolve the arc column and weaken the power of the plasma arc.

Things to check:

- Air compressor pressure
- The pressure between the Air filter and air compressor
- If the air filter relief valve is faulty or set too high

Air Pressure Is Too Low

If this occurs, then an optimal plasma arc cannot be formed. This will result in a poor-quality cut and built-up slag.

Things to check:

- Is the compressor providing enough air?
- Are the air channels blocked?
- Is the air filter relief valve set correctly?

If you have a 4x8 or larger table, you need to be at a minimum 5HP 80 gallon tank or larger. Ideally your compressor should be able to output 1.5 to 2 times the CFM needs of your plasma cutter.

Refrigerated compressed air dryer

REFRIGERATED COMPRESSED AIR DRYERS

Refrigerated Compressed Air Dryers use Freon to lower the temperature of the compressed air. This temperature reduction condenses the water vapor within the compressed air into droplets, allowing it to be eliminated through an onboard condensate drain.

Regenerative Desiccant Air Dryers

Minimum Pressure: 100 psi **Maximum Pressure: 175 psi**
Water, oil, and particulates must be removed prior to dryer in order to maximize dryer effectiveness and life of desiccant.

THIS SIDE UP

Stronger Construction

Aluminum billet and hard coat anodizing provides superior strength and corrosion resistance; eliminating casting porosity.

115v Control Time

Timer cycles the towers into regeneration mode every 2 minutes.

Customizable Performance

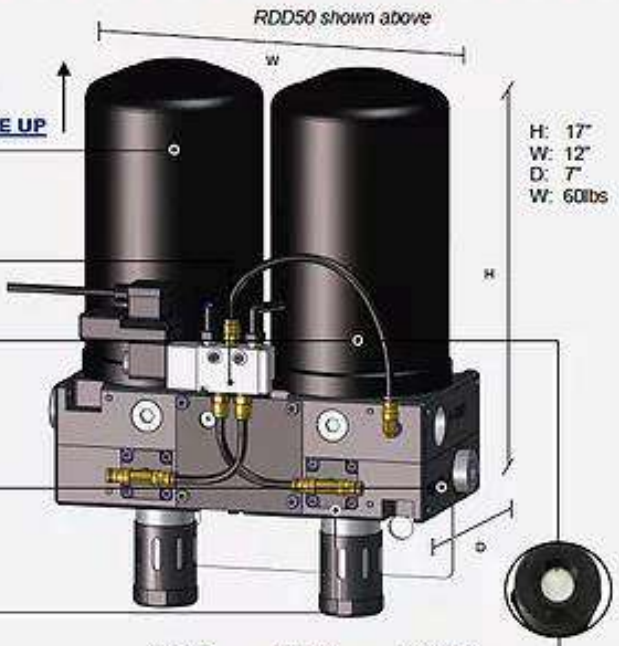
Cartridge style regeneration orifices provide the ability to control the amount of air used to dry the towers. Reducing air volume and increasing orifice size can provide dew points down to –40°F. Flow rates up to 100 CFM @ 175 psi. See orifice chart below.

Dual 1" Inlet / Outlet Ports

Dual inlet ports and outlet ports provide easier installation and allow air to come in and out of same side or in one side and out the other. This unique design allows for greater mounting flexibility.

Less Parts, More Reliable

Single piston spool per tower reduces the number of moving components; allowing for easier serviceability.



RDD50 CFM Capacity	Part # Orifice Size	RDD100 CFM Capacity
0 - 10	RD .015	NA
11 - 25	RD .030	NA
26 - 40	RD .045	51 - 80
41 - 50	RD .060	81 - 100

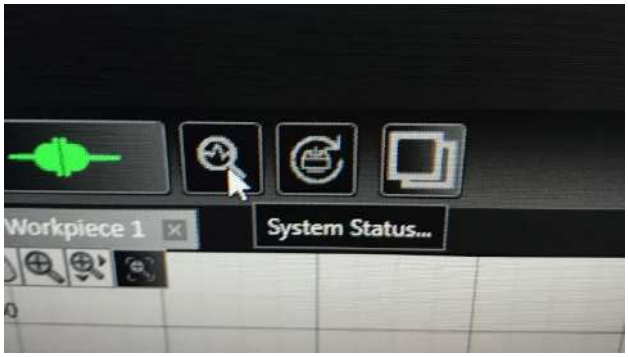
Regenerative Desiccant Air Dryers

Part # RDD50 2 Tower Dryer 0-50 CFM
Part # RDD100 4 Tower Dryer 51-100 CFM

Optional: 3/4" Dryer Mounting w/ 3-way Ball Valve
Part # DM75RD

Flashcut Diagnostics

Flashcuts diagnostics (System Status) can be accessed by clicking the magnifying glass in the Flashcut program. From there you can view and address and active alerts on your system. Alerts will be have a lit up circle next to them.



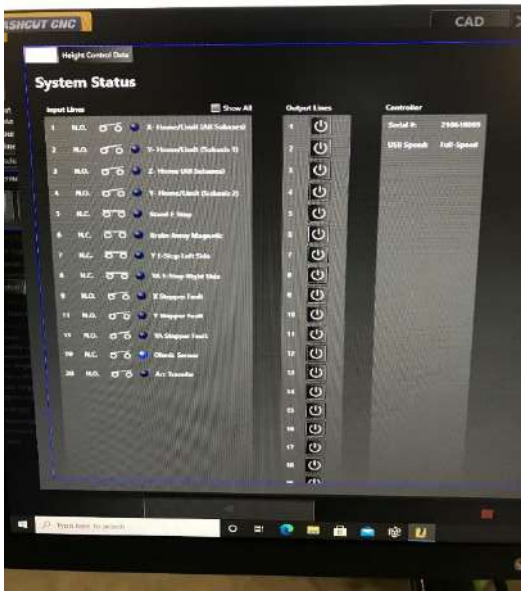
Common alert codes and fixes

Input 7 alert…….E-Stop button tripped on controller cabinet

Input 10 alert…….E-Stop button tripped on Y Axis

Input 11 alert…….E-Stop button tripped on Y Axis closest to wire tray

Input 12 alert…….Check magnetic torch breakaway



Flashcuts diagnostic screen shows the alerts and alert description. The diagnostics is showing a Ohmic Sensor alert in this case.

Water Table Issues

Your Boss CNC Plasma Table is equipped with a water reservoir. Should your table bubble while filling simply add more water to the reservoir. Never fill the reservoir and bed to full compacity as air in the tank is needed to fill. An air connection is required to fill your table, as the air is inserted into the tank it pushes water up and out to the cutting bed. Closing the valves will stop the bed from filling and close off the tank. At this point the air line can be removed until further filling is required.

Notes/ Changes Made