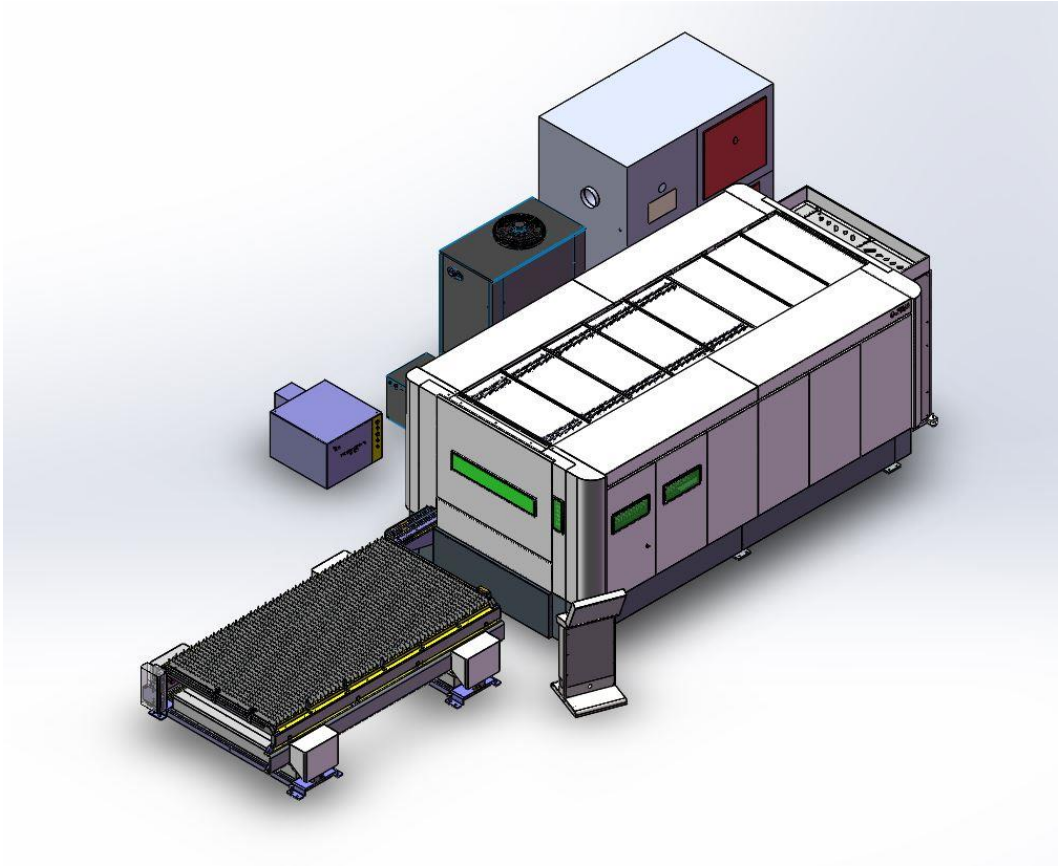
2D-High Speed
Laser Cutting Machines

,, DURMA ’’
HD-F III Series



MACHINE TYPE: HD-F 3015 III

SERIAL NUMBER: 822015399

DATE: 30.10.2015

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ABOUT DURMAZLAR MACHINE

Durmazlar Machine is the leading machine producer in Turkey and the leader of the world market on metal working machines with its annual production capacity.

Durmazlar Machine, which improves its services and production as a tradition inherited from its founder, is one of the leading industrial institutions of Turkey. Today, more than half century after its foundation, Durmazlar Machine is exporting to 82 countries in the world with its total 150 thousand square meters of closed production area and 1000 employees and is working constantly to acheive better.

Durmazlar Machine has adopted the principle to produce world standard products by marketing the latest technologies in most competetive prices.

Durmazlar Machine, the producer of the first metal working machines of Turkey, is today producing CNC hydraulic press brakes, full automatic presses, CNC hydraulic shears, punch presses, Laser cutting and Plasma Cutting machines. These machines find a wide application area in automotive, construction, textile, electronics, air transportation sectors, shipyards, industry of defense and industry of heating-cooling.

Production process is performed by highly precise working machines to provide the same high performance after many years of use with the application of powder and robotic welding technology and stress-releiving treatments.

In Durmazlar factories, which have the technology of processing one-part body up to 20 meters in its high sensitive CNC centers, investments are made to produce long-term machines. Both standard and customer based patterns are toughened by laser technologies.

In order to secure Durma quality in each machine, the controls are carried out by using high technologies in every stage of production in Durmazlar Machine.

Our presence has a meaning with our customers reliance and our aim is to develop consistently by acknowledgment that our largest capital is our employees.

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Introduction

This instruction has been made for professional use. The instruction has to be stored the whole lifetime of the machine. If the machine is moved to another place or sold, the person in charge of the handover must arrange for the instruction to follow the machine.

This instruction contains the following sections:

- Introduction
- Safety
- Technical data
- Main structure of the machine and operating description
- Operating instruction
- Maintenance instructions

Also the following documents are delivered together with the machine:

- Drawings
- Spare part book
- Other certificates and documents required by the delivery

These instructions of the machine are the original ones,draw up in Turkish. Other language versions are translations of the original instructions.

Safety instructions

The term **DANGER** indicates a hazardous situation which, if not avoided, will result in death or serious injury.
The term **WARNING** indicates a hazardous situation which, if not avoided, could result in death or serious injury.
The term **NOTICE** indicates a hazard with a risk which, if not avoided, could result in property damage.

Description and intended use of the machine

The machine to which this manual refers has been designed for laser cutting and welding of metal and other components.

NOTICE : The machine must not be used to cut plastic metarials which, due to the heat used, produce fumes and dust hazardous to human health (foe example, PVC).

The machine may not be used for processes other than those for which it has been designed.

WHAT IS LASER?

LASER is the abbreviation of the "**L**ight **A**mplification by the **S**timulated **E**mission of **R**adiation". In basic words laser is a beam of light with the distinctive properties:

-Monochromatic: Means that all the photons in the beam have the same wavelength.
-Same Direction: All the photons are almost parallel in the same direction.
-Same Vibration: All the photons vibrate in the same direction.

Laser spectrum lies between the ultraviolet and infrered wavelengths. Most of the laser light is invisible. Most powerful laser available in the market is the CO2 laser known also as the nitrogen laser. This laser type uses some properties of CO2 and Nitrogen molecules to form the laser light. CO2 plays role in the formation of the laser and Nitrogen makes it possible to collect the beam. Up to 20 Kw stable power levels can be obtained with this type of laser.

The biggest threat of this laser is that it is invisible. It is called heat light because the light spectrum is in the infrared area of the electromagnetic spectrum.

Laser light becomes more and more applicable in industrial processes together with the ease to form it. It is used in the area of welding, cutting, marking, drilling in engineering applications. Production with laser provides automation quality and speed and reduces the errors. A variety of machines use laser as processing tool and it is possible to work 24 hours. The costs are also reduced with serial production. Especially in cutting applications big savings can be obtained by eliminating the use of different dies and consumable tools.

Steel, nikel alloys, titanium, chrome, sainless steel, aluminum and alloys etc. can be cut with laser. Laser cutting has many advantages over other methods. No need for dies and aparats, very good cutting surface, up to 50 mm thickness to be cut, lower operating costs are few of the advantages.

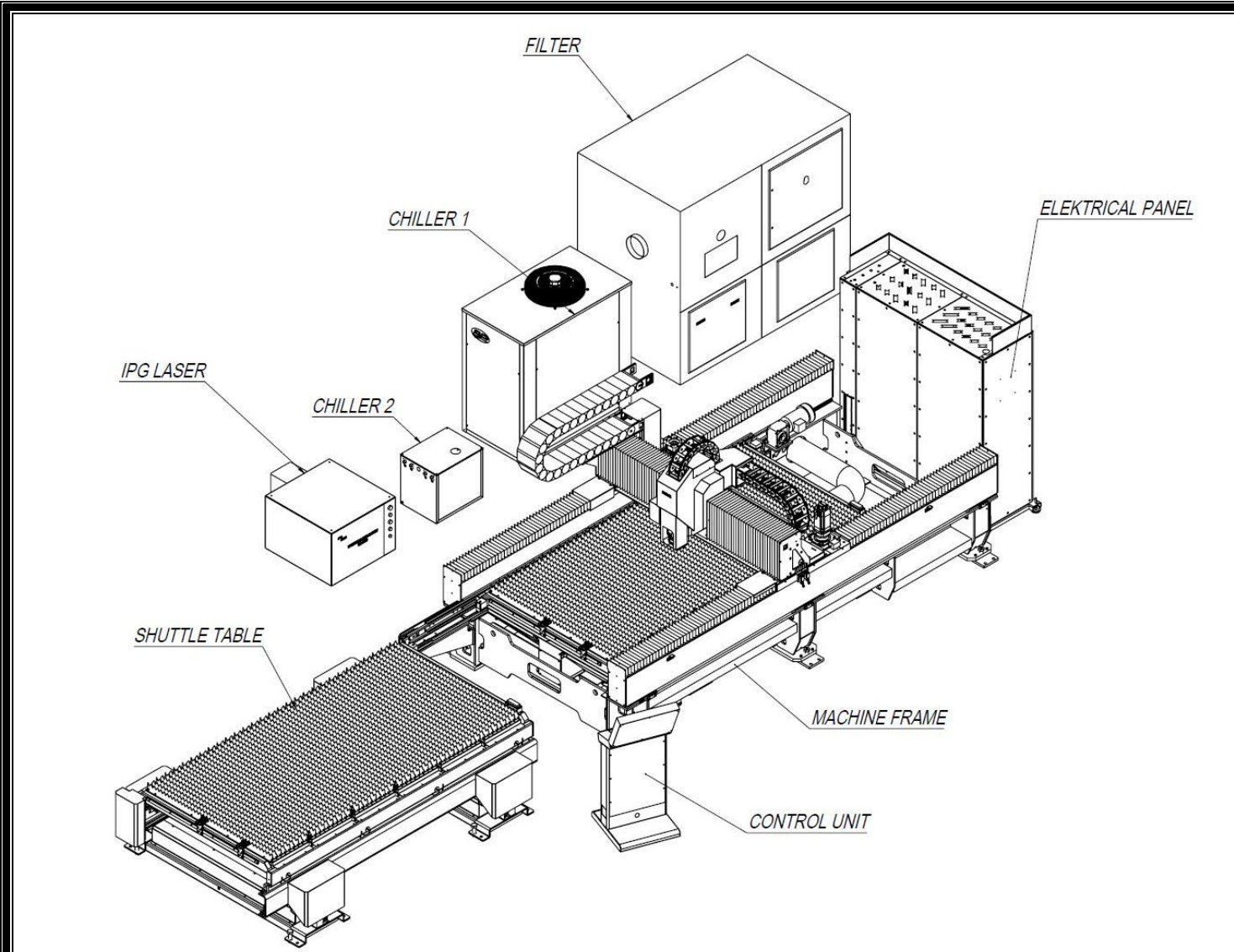
Using different types of 3D Cad programs the production gains speed and variety of different shapes with same thickness can be cut simultaneously.

LASER FORMATION AND BEAM DELIVERY IN THE SYSTEM

Fiber laser machine is a combination of diode-pumped solid-state laser machine and fiber optic cable. The gain medium forms the core of the fiber, which is surrounded by two layers of cladding. The lasing mode propagates in the core, while a multimode pump beam propagates in the inner cladding layer. The outer cladding keeps this pump light confined. Fiber laser has no gas consumption and laser beam is brought to laser head by a fiber optic cable. Fiber cable works on the princible of full reflection of light. The beam goes on by reflecting in the inner wall of the fiber cable. Power loss is not occurred in fiber optic cable, so the need for additional cooling system is eliminated. Standard wavelenght of fiber laser is ten times lower than CO2 laser. Also energy efficiency of fiber laser is very high compared to other laser types.

CHAPTER 1 - MACHINE PROPERTIES

DURMA LASER HD-F / HD-FL



1.1 – BASIC MACHINE

The HD DURMA machine is a high speed 2-D laser cutting system for machining flat sheet plates up to a maximum size of 3000x1500/4000x2000/6000x2000 mm. It works on the principle of ‘’Flying optics’’. This means that the raw sheet rests on the cutting table and the laser head moves in X and Y directions. This construction type allows extremely high acceleration values and, in conjunction with a direct encoder measuring system, maximum precision of the component geometry. Moving axes are driven by dynamic low moment of inertia and high performance AC Servo motors that don’t need maintenance. There are not any intermediate load transmitting elements between the motor and the pinion which otherwise could cause precision losses. High precison two-way, hardened helical racks with low clearance make it possible to acheive very high acceleration (10m/s^2) and speed (100m/s) values. With linear motors which are used as an option, the values of 30 m/s^2 and 200 m/min can be reached. Machine and the bridge are welded construction. After the welding, machine body and the axes are subject to stress releiving treatment. This process eliminates the deviations in machine geometry and stresses that may result during welding. Dust and suspended particles are vacuumed via a sectioned chamber system during laser cutting. A conveyor system have been integrated to the machine in order to carry the scrap particles to the scrap bin during cutting. The shuttle table is designed to increase the productivity and minimize the material preparation time. The table allows loading of raw metal sheets or unloading of finished parts onto one table while the other table is on duty.

1.2 – LASER SOURCE

The dynamic operating range of IPG’s low-order-mode kilowatt class fiber lasers is available from 10% to full power with no change in beam divergence or beam profile throughout the entire range. This allows a single laser to be utilized for both high and low-power applications**.**

IPG lasers’ divergence specifications are far superior than other lasers and allow the use of long focal lenght processing lenses for vastly improved depth of field, less damage to optical components.

The units can be supplied with fiber lenghts to 100 meters, different fiber diameters. Fiber lasers have a monolithic, entirely solid state, fiber-to-fiber design that does not require mirrors or optics to align or adjust and are typically smaller and lighter in weight than traditional lasers, saving valuable flor space.

- Excellent beam parameter product (BPP)
- Constant BBP over entire power range
- Small focus over large working distance
- Maintenance free operation
- Modular ‘Plug & Play’ design
- Compact, Rugged & Easy to install
- Estimated diode lifetime up to 100,000 hours

1.3 – CONTROLLER UNIT

The Sinumerik 840D CNC controller is an efficient 32-bit microprocessor system with an integrated PC. The controller has a Durma operator interface and a complete cutting database for all standard cutting applications. The database includes the cutting parameters for standard materials (steel, stainless steel, aluminum) for common thickness ranges. Based on these reference values the operator can easily improve the cutting quality for different types of materials.

- The laser power is controlled as a function of the path, velocity, time and travel.
- Closed-loop clearance control can be universally adapted
- Optional functions
- 6 MB expanded user memory and USB external memory option.

1.4 - (CAD/CAM) SOFTWARE (METALIX / LANTEK)

- Fully automatic cutting.
- Advanced optimisation: tools optimisation
- Fast tool way collision protection. Toolway optimisation to prevent damage from possible deformed material.
- Automatic entry point.
- Cutting direction, clockwise or opposite is supported.
- Advanced corner applications provides perfect corners and soft cutting. Fillets, cooling, slowing down, circulation.
- Real type writing styles: Writings supported by your operating system can be applied directly on the material to be cut
- Z-axis control.
- Shared Cuttings: This property is especially useful for thick plates and reduces the need for making holes during cutting.

1.5 – LASER CUTTING HEAD

The cutting head is equipped with a capacitive sensor that keeps the distance to the material being machined constant and thus guarantees a consistent focusing position. The capacitive sensor system regulates continuously the distance between the nozzle and the workpiece by fast controlling of the z-axis. Laser cutting head includes a cartridge system which allows different focal lengths to be adopted for ideal cutting quality. The laser head and the lenses it contains are suitable for high pressure
(25 Bar) cutting. In order to prevent the laser head from heating it is selected with water cooling property.

Cartridge replacement system allows to change focal length in a short period. The standard cutting lenses are integrated in interchengeable casettes that ensures quick changing without requiring readjustment.

1.6 - FILTER

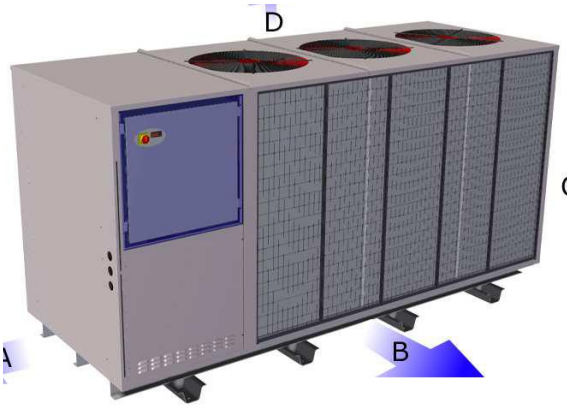
PL-4000 Plasma Laser Filter Unit

PL-12000 Plasma Laser Filter Unit

Used to eliminate dust, particles and harmful fumes generated during cutting. It is fully automatic dust collecting shake filter. The filter is equipped with carbon steel plate body construction, dust bunker, transport foots, 55 lt scrap box, four fire resistant cartridges, integrated spark trap ability to protect filter components, compressed air units for filter cleaning and manifolds, pneumatic and solenoid valves, VCM451S(3kW) fan set, fan starter, manual adjustment damper mounted on fan exit.

To protect the laser machine and suction filter cartdiges unit , please use *ASF-15 ANTI SPATTER FLUID on* the surface of the cutting sheet.

1.7 - CHILLER



1- Deionised water of the chiller unit must be replaced every 6 months.
2- The chiller unit pump motor must NOT be kept OFF position more then 2 days . (This makes bacteria in the chiller tank) .
3- If you keep the pump motor of the chiller unit more then 2 days at OFF position , you must NOT run the laser machine before you will replace the deionised water of the chiller unit.

Used to cool IPG resenator , cutting head and linear motors.

1.8 - SAFETY

The laser cutting system, machine and CNC controller are fitted with safety devices. These swiches and sensors, on one hand, protect the operator from hazards and, on the other hand, counteract damage to the system, e.g. as a result of incorrect path measurement programming or collision between the workpiece and the machine. A diagnosis system keeps the operator informed about the current status of the system and allows him to intervene in the dialogue to make corrections for remedy and faults. The steps that should be carried out for this purpose appear as plain text on the controller screen.

1.9 – PROTECTIVE MEASURES

The working area of the machine is screened off with sliding doors. These can be opened to gain free access, e.g. to insert a new steel sheet billet, lens and head replacement, general maintenance and for other purposes. During a laser cutting operation the safety devices are electromagnetically locked in order to prevent an accidental triggering of the machine's EMERGENCY STOP function. The machine's safety equipment corresponds to the CE guidelines currently in force. The machine is windowed by makrolon coated material (allowing to see inside) and enclosed by a cabin.

1.10 – TECHNICAL DATA

Cutting Performance

Cutting Axes		
X Axis	3060	mm
Y Axis	1530	mm
Z Axis	160	mm
Max. Sheet Size	3048 x1524	mm
Max. Sheet Weight	200	kg/m^2
Dynamics		
Max. speed X-Axis	120	m/min.
Max. speed Y-Axis	100	m/min.
Max. speed Synchronous	156	m/min.
Max. acceleration X-Axis	12	m/s^2
Max. Acceleration Y-Axis	10	m/s^2
Max. acceleration Synchronous	15	m/s^2
Positional Accuracy	± 0,05	mm
Repeatability	± 0,05	mm
Control Unit		
CNC	SINUMERIK; 840D SL; NCU 730.3PN	
PC	PCU 50.5-C 1.86 GHz / 1024 MB XP / SSD	
Port	2x Ethernet;4xUSB; 1x Profibus	
Expansion Slots	2xPCI ; 1xCF Card	
Screen	TP 015A , 15" Touch panel	
Laser Cutting Head	Precitec Procutter	
Focus Length	150 mm	
Focus	Automatic	
Filter	VANTERM	
Capacity	2500	m^3/h
Power	4	kw
Chiller	OMI	
Chiller for 2 kw	CHWT 162+ CHA 4	
Chiller for 3 kw	CHWT 242+ CHA 4	
Chiller for 4 kw	CHWT 242+ CHA 4	
Chiller for 6 kw	CHWT 292+ CHA 4	

Maximum Cutting Thickness

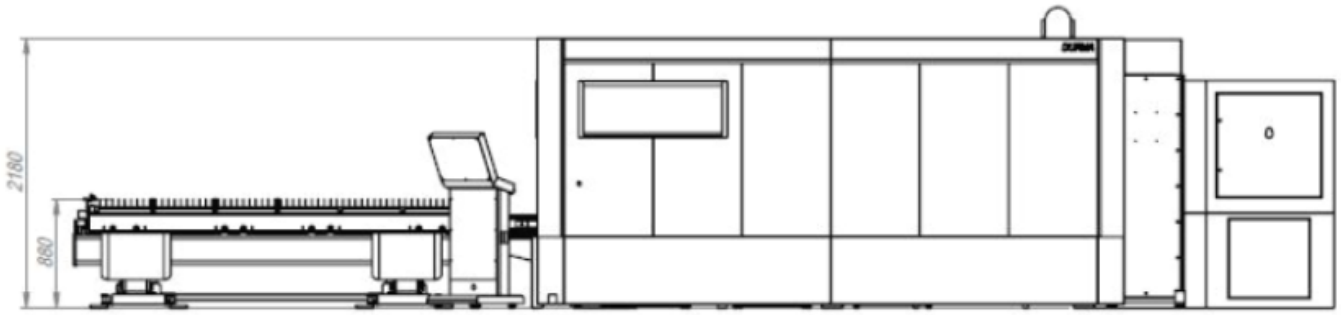
	Max. Cutting Thickness depending on Laser Power				
Material	**YLS 1000 (1 kW)**	**YLS 2000 (2 kW)**	**YLS 3000 (3 kW)**	**YLS 4000 (4 kW)**	**YLS 6000 (6 kW)**
Mild Steel	8	12	16	20	25
Stainless Steel	4	6	8	10	12
Aluminum (AlMg3)	4	6	8	12	15
Copper	2	3	5	6	6
Brass	2	3	8	10	10

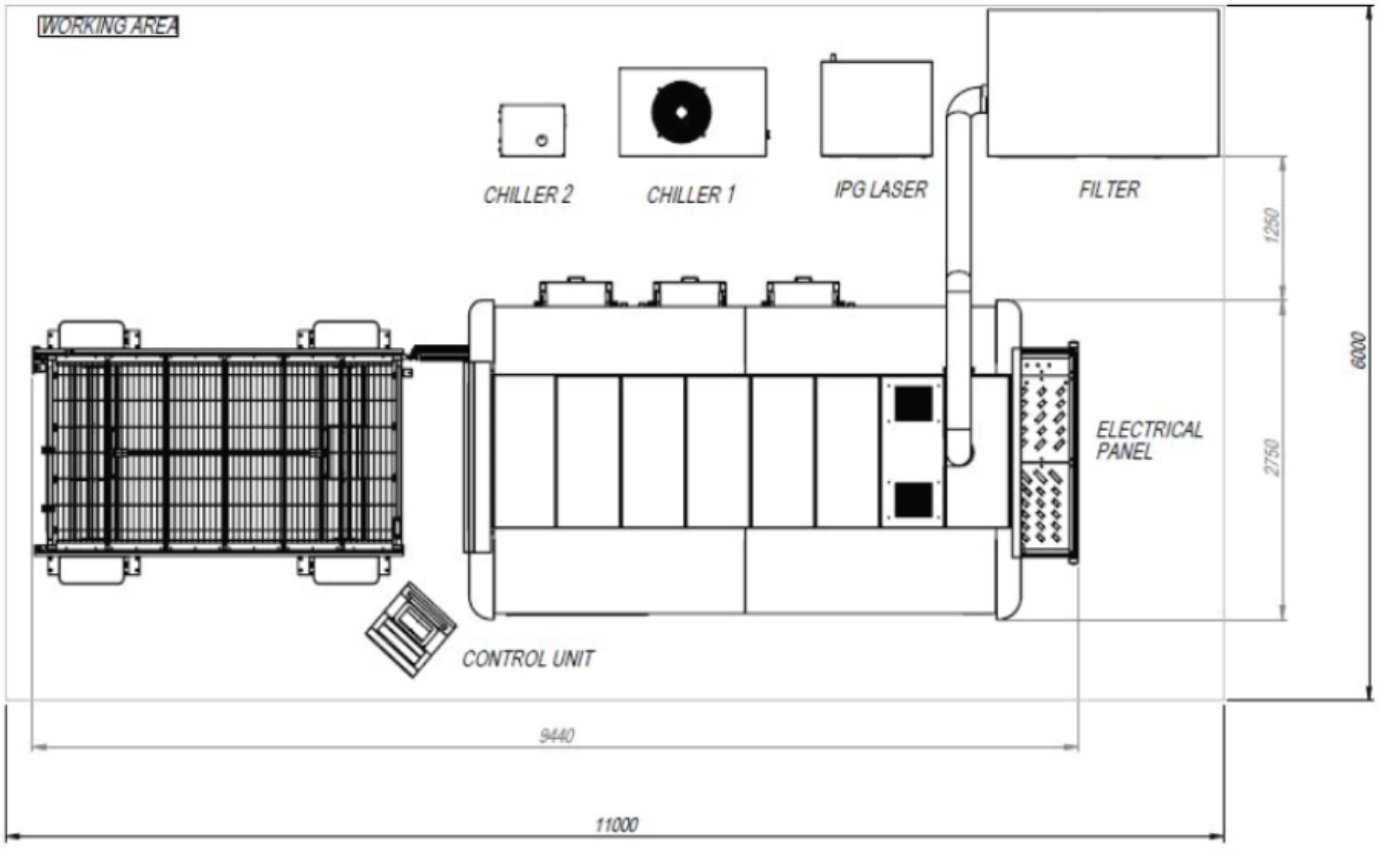
Resonator				
Product Designation	YLS-2000	YLS-3000	YLS-4000	YLS-6000
Description	Kw-Class Yiterbium Fiber Laser System			
Available operating modes	CW,QCW,SM			
Polarization	Random			
Available output power	200-2000 W	300-3000 W	400-4000 W	500-6000 W
Emission wavelength	1070 - 1080 nm			
Feed fiber diameter	Available in single mode, 50,100,200,300 µm			
Output Termination Options	QBH-Type (HLC-8). LCA, QD compatible			
Ancillary Options	Options Available: Internal coupler, Internal 1x2 beam switch, Internal 50:50 beam splitter, External 1x4 or 1x6 beam switch.			
Interface	Standard: LaserNet, Digital I/O, Analog Control Additional Options: DeviceNet or Profibus			
Cabinet Style/ Dimensions	25U Standalone NEMA 12 Enclosure (HxWxD, mm) 1106x856x806			

Machine Electrical Consumptions

ELECTRICAL CONSUMPTIONS				
		POWER	FUSE	CABLE
IPG	2 KW	7 KW	16 A	4x4 mm2
	3 KW	10 KW	25 A	4x6 mm2
	4 KW	14 KW	32 A	4x6 mm2
	6 KW	28 kW	63 A	4x16 mm2
CHILLER 1	2 KW	10 KW	16A	4x4 mm2
	3-4 KW	14 KW	25 A	4x6 mm2
	6 KW	19 KW	32 A	4x6 mm2
CHILLER 2		1 KW	10 A	3x1,5 mm2
FILTER		4 KW	16 A	4x4 mm2
ELECTRICAL PANEL		22 KW	100 A	4x25 mm2
TOTAL POWER	2 KW	44 KW		
	3 KW	51 KW		
	4 KW	55 KW		
	6 KW	74 KW		

1.11 – MACHINE DIMENSIONS





Machine Weight:10000kg.

CHAPTER 2 – MACHINE AND SAFETY

2.1 - HAND AND BODY PROTECTION

During cutting no one should stand over the cutting table. Great care should be taken to avoid damages during loading or unloading material. For safety hard tip working shoes should be used for danger of dropping material. Either magnetic lifting system shall be used to unload material or otherwise teperature resistant gloves must be used since the material gets hot during cutting. Protective glasses suitable for the laser type used (see laser properties) should always be used during cutting process.

2.2 - SAFETY PROCEDURE

- When supplying the machine, read all electrical description on the machine and apply to the given value.
- Never bring any part of your body next to the working point.
- Never work and service the machine, maintenance or change any parts without reading the instruction manual and consult the manager when you have any doubts.
- Specialized person should give service and maintenance to the machine.
- Don't go over the given maximum pressure which is mentioned on the machines and pressure description labels.
- For the safety of the machine, emergency stop buttons are placed on control panel and mobile control unit.
- Don't cut the sheets one on the top of the other.
- There is a electrical current warning label on the command panel, electrical panel and connection of motor.
- Keep away unauthorised persons from the machine.
- The machine is not convenient for the explosive and combustible environments.
- Our company is not responsible for any damages, are caused by unobeyed directions mentioned in Usage and Care Catalogs.
- Never operate the machine while the cabin is open.
- Class 4 laser is used. Always use protective glasses where necessary.
- Heavy metal particles and fumes may harm your health. Stay away from the cutting zone. If necessary use suitable filter masks.
- If necessary enough lighting should be provided.
-Electrical panel is IP54 protected. In any case don't touch panel and other electrical parts . Always check the grounding connections for safety.
-The cable channels between electric pannel and the machine shall be rigidly supported and clear of all moving or contaminating portions of the machine. Covers shall be shaped to overlap the sides; gasket shall be permitted. Covers shall be attached to cable trunking systems by hinges or chain and held closed by means of captive screws or other suitable fasteners. Cable trunking systems shall not have opened but unused knockouts. On horizontal cable trunking systems, the cover shall not be on the bottom.
- Only Trained Personnel Can Use !
- In the case of high sound, always wear protective must be used.
- Not to cause any accident according to laser operator safety , only one operator must run the laser machine.

2.2.1 - THE IMPORTANT POINTS ABOUT CUTTING ALUMINIUM AT LASER MACHINE

At the cutting aluminium by laser, there are two important points about filter unit. These are ;

1 - While steel powder and aluminium powder contact with each other in the filter, there is a chemical reaction starts and this reaction is exothermic , so generates heat. By this heat there is a fire happens in the filter. For this reason before cutting aluminium while the laser machine does not work, automatic cleaning (jet-pulse) is actuated manually, about 30-45 minutes, the steel powder which is on the cartridge, should be poured to the dust bin and the filter unit should be stopped, the dust bin should be taken out and emptied and the bin should be cleaned and put back and finally started cutting aluminium.As soon as cutting aluminium finishes as before filter should be cleaned, the bin should be taken and cleaned, followed by should be started to cut normal steel.

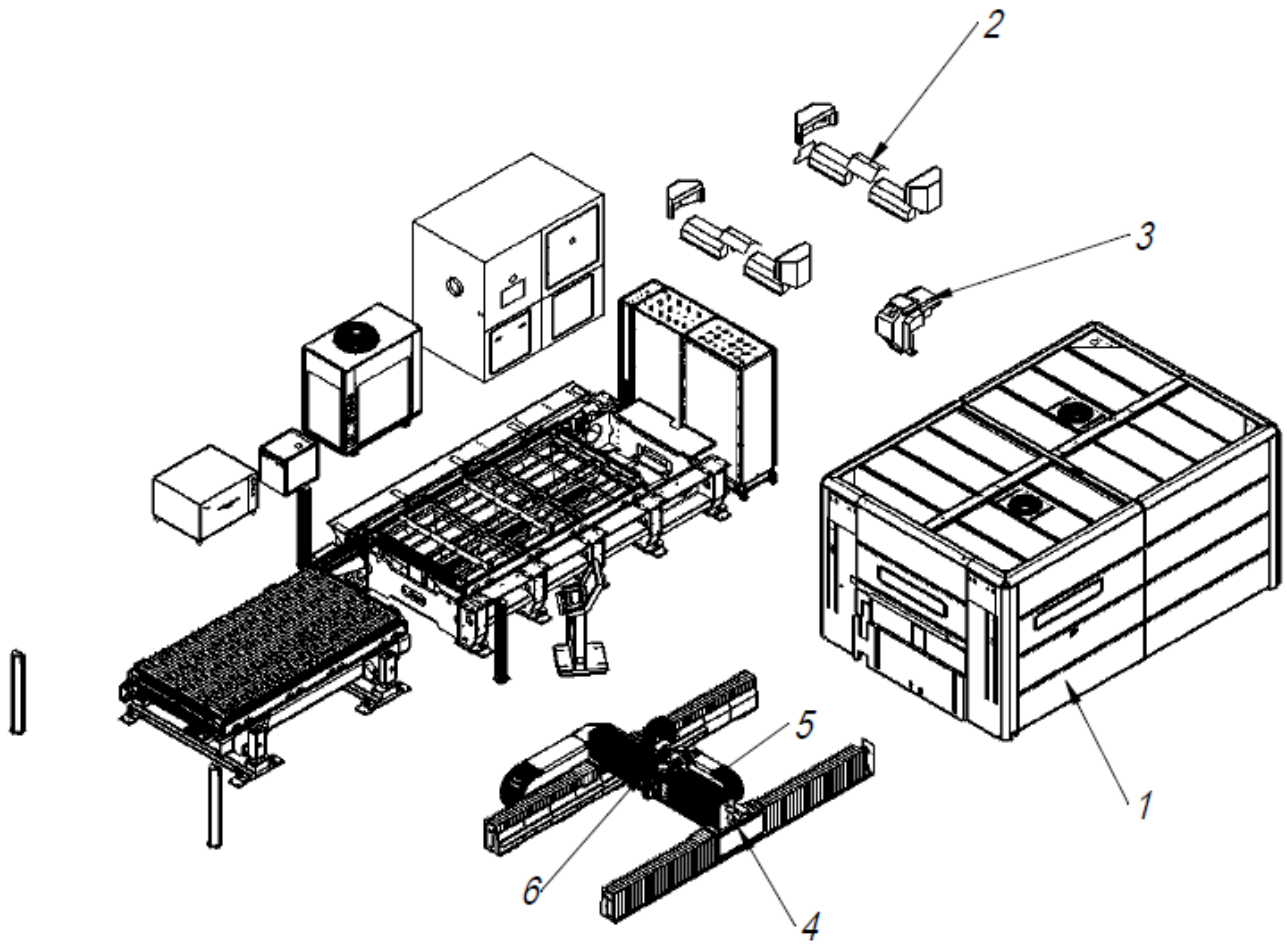
2 - In some situations which is wanted intermittently cutting aluminium (for example it is evening and in the morning of following day or there is a weekend holiday, on Monday cutting aluminium will continue) the other important danger is the danger of explosion. Especially in winters, waiting in long term, it can be condensation at cooling surfaces and water particles can occur in the filter. Hydrogen gas (H2) is as known an explosive gas and be formed in the reaction which consist of the contact of water with aluminium powder. Before holiday if aluminium had been cut and after holiday if wanted to cut aluminium.

a - Before holiday, cartridge filters and dust bin should be cleaned as described at the first article. The dust bin should not be put into the filter after cleaning and should not be waited outside.

b - During the holiday all the covers of filter unit (including service cover and electrical panel cover too) should be kept open, even if Hydrogen (H2) gas be formed it can spread out to the environment easily and should be prevented not to collect in the filter with naturel ventilation.

- If conveyor system does not exsist, cutting aluminium sheet can be dangerous. Not recommended.
- When cutting aluminium, scrap boxes must be cleaned in every one hour. For busy jobs, it is recommended to clean more often.
- During cutting aluminium, conveyors should run continiously.
- Dailiy cleaning should be made for conveyors. Slag and dust of aluminium should be removed.
- Air of the workplace where the cutting operations occur must be cleaned and refreshed if a long break was given after the aluminum part cutting operation.

2.3 - SAFETY COVERS AND SWICHES



1. LASER MACHINE CABIN: When for any reason the cabin is opened the system closes for safety by the swiches on the cabin door. The glasses used on the cabin prevent the laser beam from escaping outside.

2. SHUTTLE TABLE PROTECTION COVERS: Used to protect the hydraulic equipment and the swiches on the table.

3. Z AXIS PROTECTION COVER: This cover is used to protect the solenoid valves, mirrors and other components on the Z axis. All mirrors on the machine contain proximity safety swiches that close the system in case the mirrors are opened.

4. X AXIS MIN / MAX LIMIT SWICHES: The axis movement is limited at minimum and maximum points by limit swiches.

5. Y AXIS MIN / MAX LIMIT SWICHES: The Z axis movement on the bridge is limited at minimum and maximum points by limit swiches.

6. Z AXIS MIN / MAX LIMIT SWICHES: The laser cutting head motion is limited at minimum and maximum points by limit swiches.

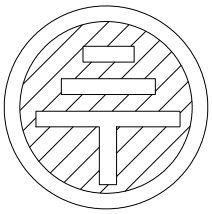
2.4 - INTRODUCTION AND SAFETY LABELS ON THE MACHINE

TYPE			
ÜRETİM YILI BAUJAHR ANNO DI COSTRUZIONE ROK VYROBY ROK PRODUKCJI TILLVERKNINGSÅR	- MANUFACTURING YEAR - AÑO DE FABRICACIÓN - ANNEE FABRICATION - VALMISTUSVUOSI - BYGGEÅR - BOUWJAAR		
SERİ NO MASCH-NR MATRICOLA VYRONBÍ ČÍSLO NUMER MASZYNY SERIENUMMER	- MACHINE NO - N°DE SERIE - N'DE SERIE - VALMISTUSNUMERO - MASKINNR. - SERIE-NUMMER		
KAPASİTE KAPAZITÄT CAPACITA' KAPACITA NACISK KAPACITET	- CAPACITY - CAPACIDAD - CAPACITE - TEHO - KAPASITET - CAPACITEIT		
STROK HUB CORSA ZDVIH SKOK SKOK	- STROKE - CARRERA - COURSE - ISKUNPITUUS - SLAG - SLAG		mm
VURUŞ SAYISI HUBZAHL PRO MIN. COLPI AL MINUTO POČET ZDVIHU ZA MIN. CYKLE NA MINUTE SLAG/MINUT	- STROKE IN A MINUTE - GOLPES POR MINUTO - COUPS PAR MINUTE - ISKULUKU - SLAGANTALL PR. MIN. - AANTAL SLAGEN/MIN		1/min
YAĞ KAPASİTESİ ÖLTANK KAPAZITÄT CAPACITA' SERBATOIO OLEJAVÁ NÁPLŇ POJEMNOŚĆ ZBIORNIKA OLJETANKENS RYMD	- LUBRICANT CAPACITY - CAPACIDAD DEL LUBRICANTE - CAPACITE RESERVOIR - ÖLJYMÄÄRÄ - KAPACITET OLJETANK - TANK INHOUD		lt
ÜST KALIP AĞIRLIĞI GEWICHT OBERWERKZEUG PESO UTENSILE SUPERIORE HMOTNOST H.NÁSTROJE CIĘŻAR NARZ. GÓRNEGO ÖVERVERKTYGETS VIKT	- TOP TOOL WEIGHT - PESO DEL PUNZÓN - POIDS DU POINSON - YLÄTYÖKALUN PAINO - VEKT OVERVERKTOEY - GEWICHT BOVENSTEMPEL		Kg
ALT KALIP AĞIRLIĞI GEWICHT UNTERWERKZEUG PESO UTENSILE INFERIORE HMOTNOST S.NÁSTROJE CIĘŻAR NARZ. DOINEGO UNDERVERKTYGETS VIKT	- BOTTOM TOOL WEIGHT - PESO DE LA MATRIZ - POIDS DELA MATRICE - ALATYÖKALUN PAINO - VEKT UNDERVERKTOEY - GEWICHT MATRIJS		Kg
EN BREITE LARGHEZZA ŠÍŘKA SZEROKOŚĆ DJUP	- WIDTH - ANCHO - LARGEUR - LEVEYS - BREDDE - BREEDTE		mm
BOY LÄNGE LUNGHEZZA DÉLKA DLUGOŚĆ LÄNGD	- LENGTH - LARGO - LONGUEUR - PITUUS - LENGDE - LENGTE		mm
YÜKSEKLİK HÖHE ALTEZZA VÝŠKA WYSOKOŚĆ HÖJD	- HEIGHT - ALTO - HAUTEUR - KORKEUS - HOEYDE - HOOGTE		mm
AĞIRLIK GEWICHT PESO HMOTNOST CIĘŻAR MASKINVIKT	- WEIGHT - PESO - POIDS - PAINO - VEKT - GEWICHT		Kg
DURMAZLAR MAKİNA SANAYİİ ve TİCARET A.Ş. Organize Sanayi Bölgesi 75. Yıl Bulvarı BURSA / TÜRKİYE Tel : +90 224 219 18 00 pbx. Fax : +90 224 242 75 80 MADE IN TURKEY			

ETIKET-1

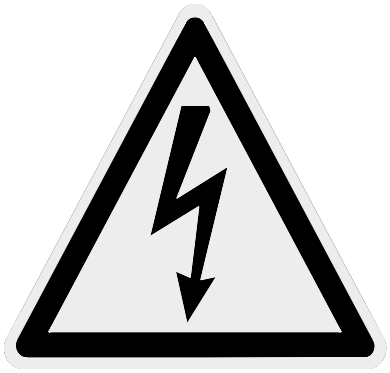
Motor Motorleistung Potenza Motore Motor Silnik Motoreffekt	- Motor - Potencia del motor - Moteur - Moottori - Motorkapasitet - Motorvermogen		KW
Faz Stromart Fasi Fáze Ilość faz Antal faser	- Phase - Fase - Phase - Vaihe - Fase - Phase		~
Frekans Frequenz Frequenza Frekvence Częstotliwość Frekvens	- Frequency - Frecuencia - Frequence - Taajuus - Frekvenz - Frequentie		Hz
Çalışma gerilimi Betriebsspannung Voltaggio Pracovní napětí Napięcie zasilania Driftspänning	- Working voltage - Voltaje de trabajo - Tension d'alimentation - Jännite - Driftsspenning - Bedrijfsspanning		V
Kumanda gerilimi Steuerspannung Tensione comandi Řídící napětí Napięcie sterowania Manöverspänning	- Command voltage - Voltaje de dominio - Tension de commande - Ohjausjännite - Styrespenning - Stuurspanning		V
Akım Nennstrom Assorbimento Proud Prąd Driftströmstyrka	- Current - Intensidad - Intensité - Virta - Nettstroem - Netspanning		A
Ara sigorta akımı Nennstrom der Hauptsicherung Fusibile intermediario Střední proud Zabezpieczenie prądowe Huvudsäkring	- Intermediate fuse current - Corte de corriente - Puissance totale - Nimellisvirta - Total hovedsikring - Hoofdzekering		A
Elektrik devre no E, schaltplan Schema elettrico n° El. schèma Nr maszyny Elschemats nr.	- E. circuit scheme no - Circuito E, esquema n° - Circuit E, Schéma n° - Kytkentäkaava - E.skjaltplan nr. - Schema no		
DURMAZLAR MAKİNA SANAYİİ ve TİCARET A.Ş. Organize Sanayi Bölgesi 75.Yıl Bulvarı BURSA / TÜRKİYE Tel : +90 224 219 18 00 pbx. Fax : +90 224 242 75 80			

ETIKET-2



ETIKET-3

Label - 1: Machine introduction label
Label - 2: Electrical introduction label of the machine.
Label - 3: Grounding warning label



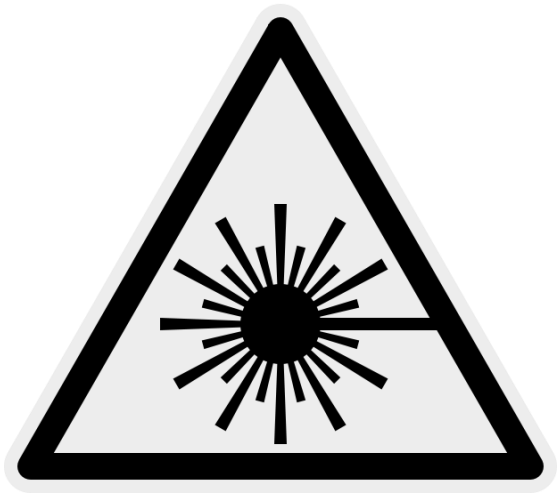
Label-4

Label-5

Label - 4: The label for electrical warning.
Label - 5: General laser warning label

Label – 6

Label - 6: General warning label, designates the rules for the operator of this machine.



Label – 7

Label – 7: The label for laser radiation warning.

Label – 8

Label – 8: The label for beam pipe.

Label – 9

Label – 9: The label for the chain of movable table.

Label – 10

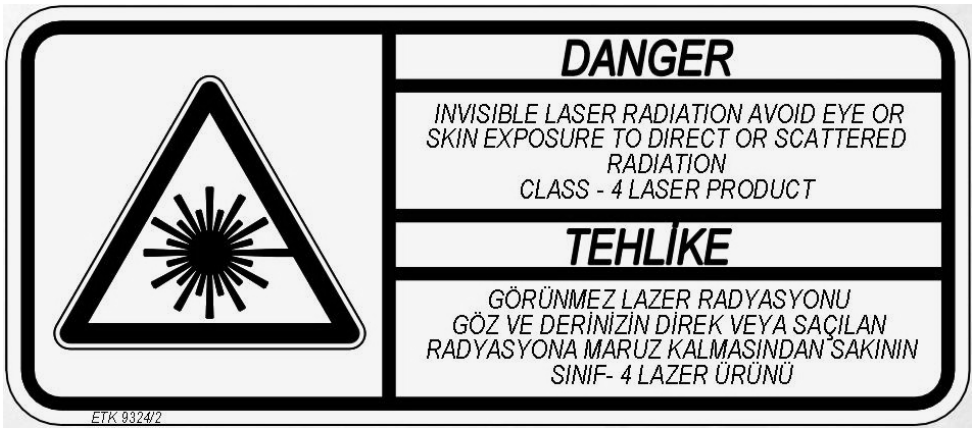
Label – 10 (On cover sheet of shuttle table)

Label – 11

Label – 11 (On doors of cabin in operator area)

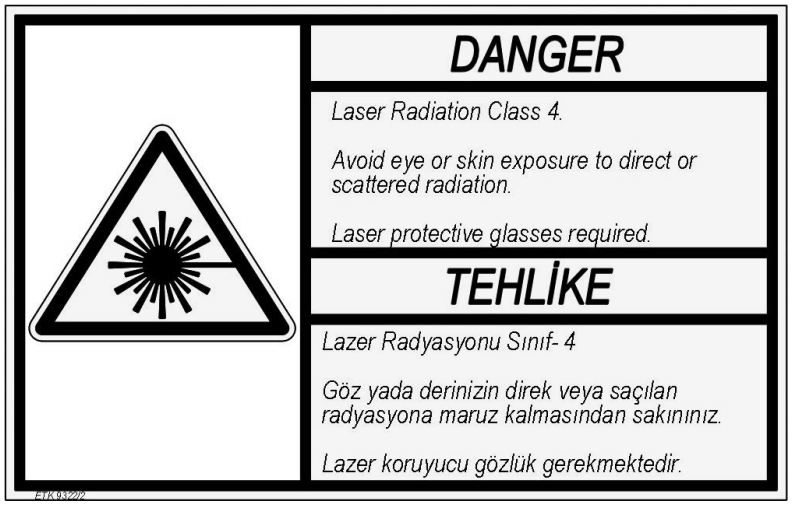
Label – 12

Label – 12 (On doors of cabin in operator area)



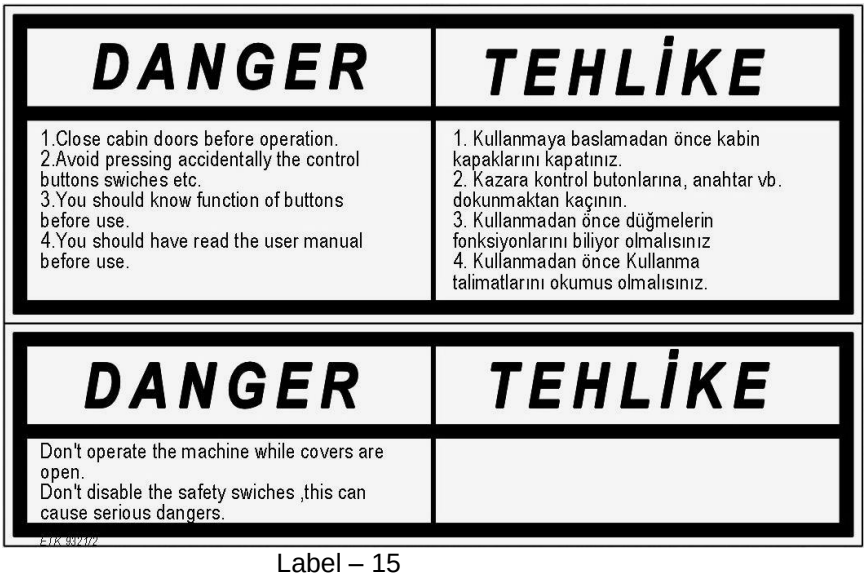
Label – 13

Label – 13 (Spare label)



Label – 14

Label – 14 (On resonator)



Label – 15

Label – 15 (On doors of cabin in operator area)

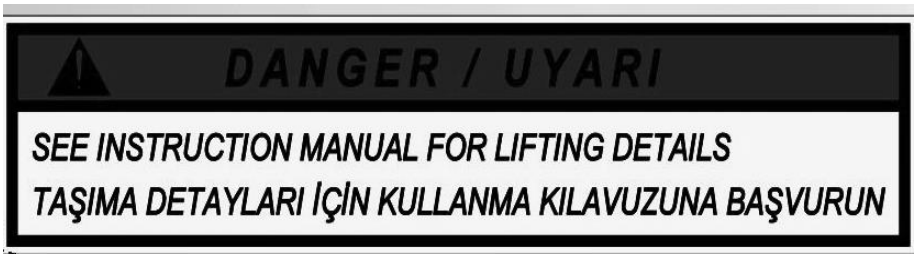
SAFETY INSTRUCTIONS	GÜVENLİK TALİMATLARI
1. Read carefully and undersatand the Operator's Manual and all warnings on the machine before operation.	1. Makineyi kullanmadan önce Kullanma kılavuzunu ve makine üzerindeki uyarıları dikkatle okuyun.
2. NEVER place any part of your body near moving parts of the machine.	2. ASLA vücudunuzu makine üzerindeki hareketli parçalara yaklaştırmayın.
3. Be sure that the power is off or machine is not in automatic operation mode before placing any part of your body near the machine.	3. Makineye yaklaşmadan önce güç bağlantısının kesilmiş olduğundan ve makinanın otomatik modda olamdığından emin olun.
4. Do not operate the machine if any safety device (guards, interlocks, swiches etc.) does not function properly.	4. Herhangi bir emniyet aleti (kilit, okuyucu vs.) düzgün çalışmıyorsa makinayı çalıştırmayın.
5. Unload the wotkpieces after it cools.	5. Kesilen malzemeleri boşaltmadan önce soğumalarını bekleyin.
6. Always wear safety shoes and glasses while operating the machine.	6. Makinayı kullanırken her zaman emniyet ayakkabısı ve gözlüğü kullanın.
7. Refer to the Operator's manual for installation or repair. Turn off the power before starting maintenance.	7. Kurulum veya bakım için Kullanma Kılavuzuna başvurun. Bakıma başlamadan önce ana şalteri kapatın.
8. Some materials emit harmful gases during cutting. Proper filtering system must be used. Inform yourself before laser processing of unknown materials.	8. Bazı malzemeler kesim esnasında zararlı gazlar yaymaktadır. Uygun filtreleme kullanılmalıdır. Kesilen malzemeler hakkında bilgi edinilmelidir.
9. The laser beam is invisible! Never stare head-on into the path of a laser beam.	9. Lazer ışını görünmezdir. Hiçbir zaman doğrudan lazer ışın yoluna bakmayın.
10. Avoid all unnecessary exposure to direct or secondary laser radiation (reflections).	10. Doğrudan ya da ikincil (yansıyan) lazer ışınına maruz kalmaktan sakının.
11. Do not keep paper, oily rags, or other combustible materials anywhere near an open laser beam.	11. Açık lazer ışınına yakın yerlerde kağıt, yağlı kumaş, ya da diğer yanıcı maddeler bulundurmayın.
12. Never operate the machine while the cabin is open.	12. Kabin açık durumdayken asla makinayı kullanmayın.

Label – 16

Label – 16 (On top right area of front door)

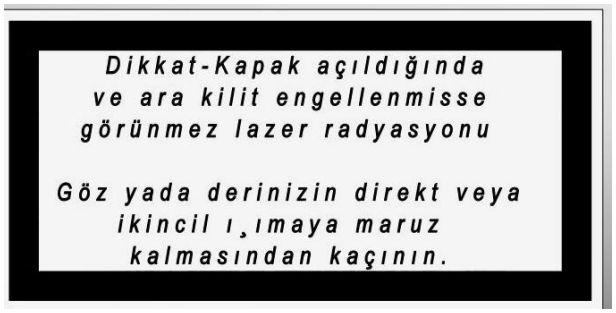
Label – 17

Label – 17 (On doors of electric panel)



Label – 18

Label – 18 (On lifting point of electric cabin)



Label – 19

Label – 19 (On shutter of resonator)

Label – 20

Label – 20 (On exhaust shutters)

Label – 21

Label – 21: The label for top outlet of filter.

Label – 22

Label – 22 (Beside of table rail)

CHAPTER 3 – NOTES FOR MACHINE INSTALLATION

3.1 - INTRODUCTION

As the main priciple of the company, satisfaction of the customers is the crucial factor. By considering the manufacturing costs, endurance and high quality are provided.

These guidance notes are provided to help ensure that the loading, unloading and handling of your machine is carried out safety and efficiently.Please note that the Manufacturer cannot be held responsible for damage due to improper machine handling, disregard of the instructions or disregard of Health and Safety Regulations.

Your machine should be operated by experts or licensed persons and it should Setup by qualified person. When necessary, contact to Durmazlar A.Ş or distrubutor that you bought the machine from, to setup the machine.

3.2 - MACHINE RECEPTION

On receipt of the machine please ensure to the best of your ability that there is:
a – No damage has happened during transport.
b – No parts are missing.
c – Neither the machine nor the parts are deficient in any way.

3.3 - MACHINE TRANSPORTATION

- Our machines are covered by nylon sheet to avoid them from damages and environment conditions while transportation and storage.
-When the machine will arrive to the working area, where it will be runned and stored, crane, lifter and etc. devices should be ready. Selection of the zone that the machine will be settled down should be completed and the enviroment conditions should be convenient. Do not apply lifting operation by forklift.
- Check the zone that the machine will be settled down, it should be smooth and without any cracks. The recommendation is, at the time of loading, the machine should be over a soft and parallel ground.
- Before adjusting the machine to its last position, check the fixing bolts to be sure that they are in the convenient position. Balancing bolts should be oiled and set to the ground as full length.
- HD-F 3015 and HD-FL 3015 have four lifting points to be used inside the machine.
- The electrical panel has lifting points on top. It should be tied by either lifting rope or chain and hook and lifted carefully.

Points to remember, and recommendations:
a – Always the lifting equipments should be adequite according to the loading capacities.
b – The correct lifting method should be used while lifting the machine. The chains and hawser should be selected according to this method.
c – When lifting the machine from its transport to its point of use, it is strongly recommended that a lifting beam of the appropriate lifting capacity is used.
d – If an appropriate lifting beam is not available, chains and shackles of the appropriate lifting capacity must be used.

3.4 - PRE-START UP DETAILS

Working parts and some considerable surfaces are covered by special protective material against rusting. The protective metarial can be easily cleaned by using suitable cleaning supplies.

The machine should be supported to the ground or airbags by metal parts. The sizes of the metal parts vary according to the requests. The machine should be fixed directly to the ground or over the airbags by fixing screws. Before the fixing operation, the appropriateness of the concrete ground to the machine should be prepared. Also, the quality and the sizes of the screws should be considered for this operation.

The machine should be checked using a precision levelling instrument. The machine level is adjusted using the jacking screws in each foot. **THE FRAME MUST NOT BE TWISTED.** The frame should not be twisted to achieve exact parallelism.

3.5 - DURMA LASER PRE-INSTALLATION CHECK-LIST

İntroduction

This document contains points which need to be taken into account by the customer before installing a Durma laser cutting machine. The customer should formally agree that he accepts and understands the pre-installation requirements as part of the delivery.

Operating conditions

The Durma laser cutting machine should be installed in a dry and dust-free environment with stable temperature. There should not be any equipment or machinery nearby that generates vibrations.
The ambient conditions should fulfill the following requirements:

Ambient temperature	10°C...35°C
Ambient relative humidity	20%...75%

Recommended foundation

Durma recommends a floor foundation for the fixation area of the machine according:

Concrete strength class	C30/37
Concrete slab thickness	500mm
Floor flatness in the machine area	<10mm

Electrical connection

The connection of the machine to the power supply of the factory is customer’s responsability. The requirements for the electrical power supply are:

Supply voltage	3 x 400V and PE
Frequency	50Hz
Max. voltage fluctuation	+/- 7%
Trip characteristics of the fuse	slow
Max. grounding resistance	4Ω

Compressed air connection

The connection of the machine to the compressed air supply is customer's responsability. The requirements of the compressed air supply are:

Compressed air supply pressure	6bar...8bar
Max. size of solid particles	5µm
Max. concentration of dust particles	5mg/m^3
Max. dew point temperature	+3°C
Max. oil content	1mg/m^3

Note that the air-intake of the compressor should be from outside and not in the vicinity of any source of solvents or any other air pollution.

Compressed air as assist gas

İn case compressed air is used as assist gas for the laser cutting process, the air quality requirements are:

Compressed air supply pressure	6bar...12bar
Max. size of solid particles	0.1µm
Max. concentration of dust particles	0.1mg/m^3
Max. dew point temperature	-40°C
Max. oil content	0.01mg/m^3

Note that the cutting results with air as assist gas will depend a lot on the air qualiıty, on the maximum air pressure and on the air flow rate that can be maintained through the delivery system!

Assist gas connection

The connection of the machine to the assist gas supply is customer's responsability. The requirements for the assist gas supply are:

Min. purity of O_2	99.95%
İnlet pressure of O_2	6bar...8bar
Max. flow rate of O_2	500Nl/min
Min. purity of N_2	99.95%
İnlet pressure of N_2	28bar...30bar
Max. flow rate of N_2	1500Nl/min

Note that the gas delivery system (regulators and gas tubing) should be dimensioned according the given inlet pressures and required flow rates! The longer the gas lines to the machine, the bigger the tubing diameters should be. Durma recommends the use of stainless steel gas lines with compression ring fittings.

Cooling water

The demineralized water for the chiller delivered with the machine must fulfill the following requirements:

pH-factor	6.5...7.5
Max. conductivity	10µS/cm

Dust collector

The filtered air from the exhaust of the dust collector delivered with the laser cutting machine should not be blown back into the factory hall. Durma recommends to use a Ø250mm steel tube to connect the clean air exhaust of the dust collector to the outside of the factory. The exhaust duct-work should be as short and straight as possible and is customer's responsability.

3.6 - MOTOR CURRENT INFORMATION

kW / HP	220-240 V (50Hz/60Hz)			380-400 V (50Hz/60Hz)			415 V (50Hz/60Hz)			440 V (50Hz/60Hz)			575 V (50Hz/60Hz)		
	A	A	q mm²	A	A	q mm²	A	A	q mm²	A	A	q mm²	A	A	q mm²
3 / 4	16	11.5	1.5	10	7	1.5	10	6.5	1.5	10	6	1.5	6	3.5	1.5
4 / 5.5	25	14.5	1.5	16	8.5	1.5	16	8	1.5	16	8	1.5	10	5	1.5
5.5 / 7.5	25	20	2.5	16	11.5	1.5	16	11	1.5	16	10	1.5	16	8	1.5
7.5 / 10	32	27	6	25	15.5	2.5	25	14	2.5	20	14	2.5	16	10	1.5
11 / 15	50	39	10	32	22	4	32	21	4	32	20	4	25	16.5	2.5
15 / 20	63	52	16	40	30	6	40	28	6	32	26.5	6	24	20.5	4
18.5 / 25	80	64	16	50	37	10	50	35	10	40	33	6	40	21	4
22 / 30	80	75	25	63	44	10	50	40	10	50	39	10	40	26	6
30 / 40	125	103	35	80	60	16	63	55	16	63	51.5	16	50	32	10
37 / 50	150	126	50	100	72	25	80	66	25	80	64	25	63	50	16
55 / 75	200	182	95	125	105	35	125	100	35	100	90	35	80	70	25

3.7 - STORING CONDITIONS

Transport the machine by taking all the necessary precautions not to have any damage on the machine. If machine is to be stored more then a period of 1 month, the clauses indicated below must be met carefully.

1 – The position and the shape of the machine should be kept while transportation.

2 – If the machine is to be stored in a damp enviroment, damp removing materials ought to be placed on the electric panel and hydraulic block, by means electrical parts shall be protected from moisture.

3 – Protective oil must be used where necessary to prevent rusting.

4 – Machine must be protected carefully against sunlight.

5 – Storage must never be carried out in open air (wet enviroment). Defect may occure in the valve sockets or electrical parts.

6 – Storage and using conditions for hydraulic and elektronik equipment.

Storage temprature..... ……. -10°C - 50°C
Using temprature. ……... + 5°C - 40°C
Oil temprature……... + 5°C - 70°C
Humidity condition……..... % 75

If the temprature is less then 5°C, the machine must be worked until it comes to normal temprature.

3.8 - FIRE DATA

Flash point (°C) and method: 193 closed cup.
Auto ignition temperature (°C) > 200
Flammability limits: 1.5 – 6
Products of combustion: Mainly oxides of carbon, water vapour with unidentified organic compounds.

Special fire / explosion hazards: Large surface areas exposed to air / oxygen (e.g., oil-soaked rags, paper or absorbed soillages) may be easily ignited and these should be cleared up at once.

Special fire-fighting procedures: Firefighters should enter area wearing self-contained breathing apparatus. Do not spray water directly into stroge containers due to boil over danger.Extinguishers: Foam, dry chemical powder, carben dioxide, halon.

3.9 - RECOMMENDED FIRST AID

For oil and other chemicals:
Eye contact: Flush with plenty of water for at least 15 minutes. If irritation persists, obtain medical attention.
Skin contact: Wash with soap, or approved skin cleaner, and water. Remove heavily contaminated clothing. Where skin rashes or other abnormalities occur as a result of excessive contact, medical advice should be obtained.
Inhalation: In the event of discomforting effects produced by overexposure, remove to fresh air. If effects persist, obtain medical attention.
Ingestion: Milk or water to drink may be beneficial. DO NOT INDUCE VOMITING. Main hazard is aspiration into the lungs during of following ingestion, childen being more susceptible than adults. If this occurs (e.g., during vomiting), send to hospital immediately.

3.10 - GENERAL MAINTENANCE

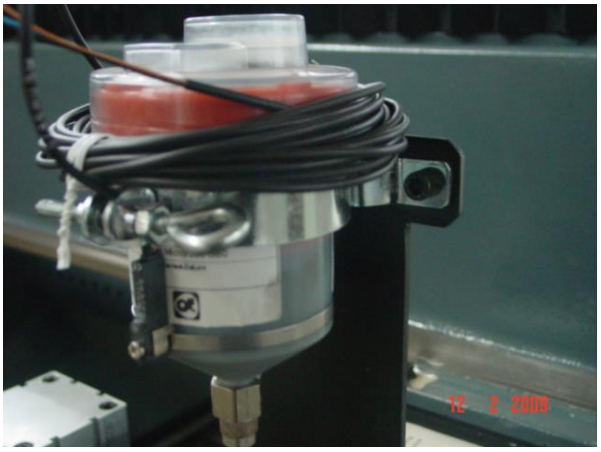
The person should have enough experience and knowledge about the machine. For the safe clean and maintenance, obey the following rules.

- While the cleaning and the maintenance of the machine, the main power switch should be turned off and it should not be allowed to turn the power on by anyone.
- While the units on the machine is cleaning by pressured air, the electrical supply of the panel should be off and some time should be passed to enable the devices get cool.
- Wearing gloves is necessary for safety while checking the gears bearings and other mechanical components.
- Do not step on the machine table and the other parts on the adjustment body.
- Do not clean the electrical and electronical devices with the solvent, combustion liquid or water.
- Keep away the flammable materials on the machine like oil, rubber, plastic from the fire.
- Do not change the hydraulic equipments, electrical devices, gears, safety instruments and cables without consulting the manufacturer of these products.
- Close and tighten the lids and the covers which are opened for maintenance operation.

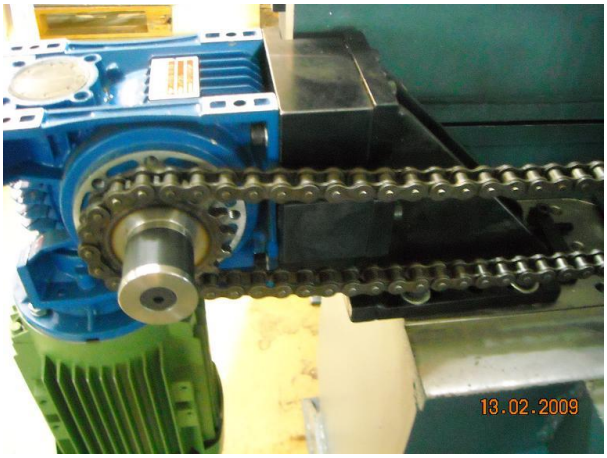
3.11 - CENTRAL LUBRICATION SYSTEM

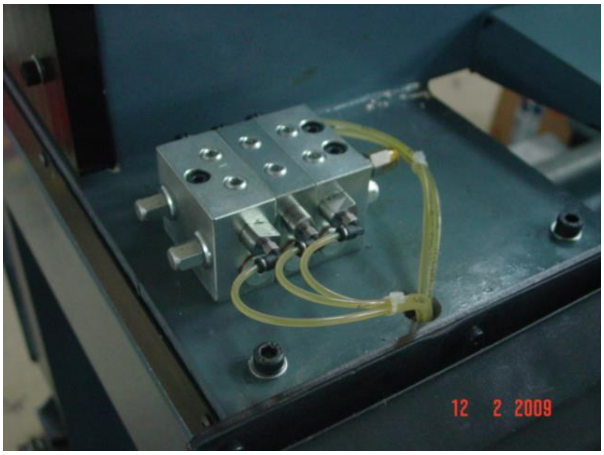
Central lubrication system is used on the machine. This reduces the maintenance reguirements by making it possible to easily lubricate unreachable lubrication points. The automatic lubrication system uses the principle of increasing the pressure by pneumatic pump and reductor and distributing the oil via progressive distribution blocks.

Central lubrication system is used for linear guides and guide blocks. X axis/Y axis/ Z axis and shuttle table guides are lubricated this way. For the rack and pinion PLC connected separate automatic lubrication system is used as recommended by their manufacturer. Lubrication oil type is Mobil EP004.



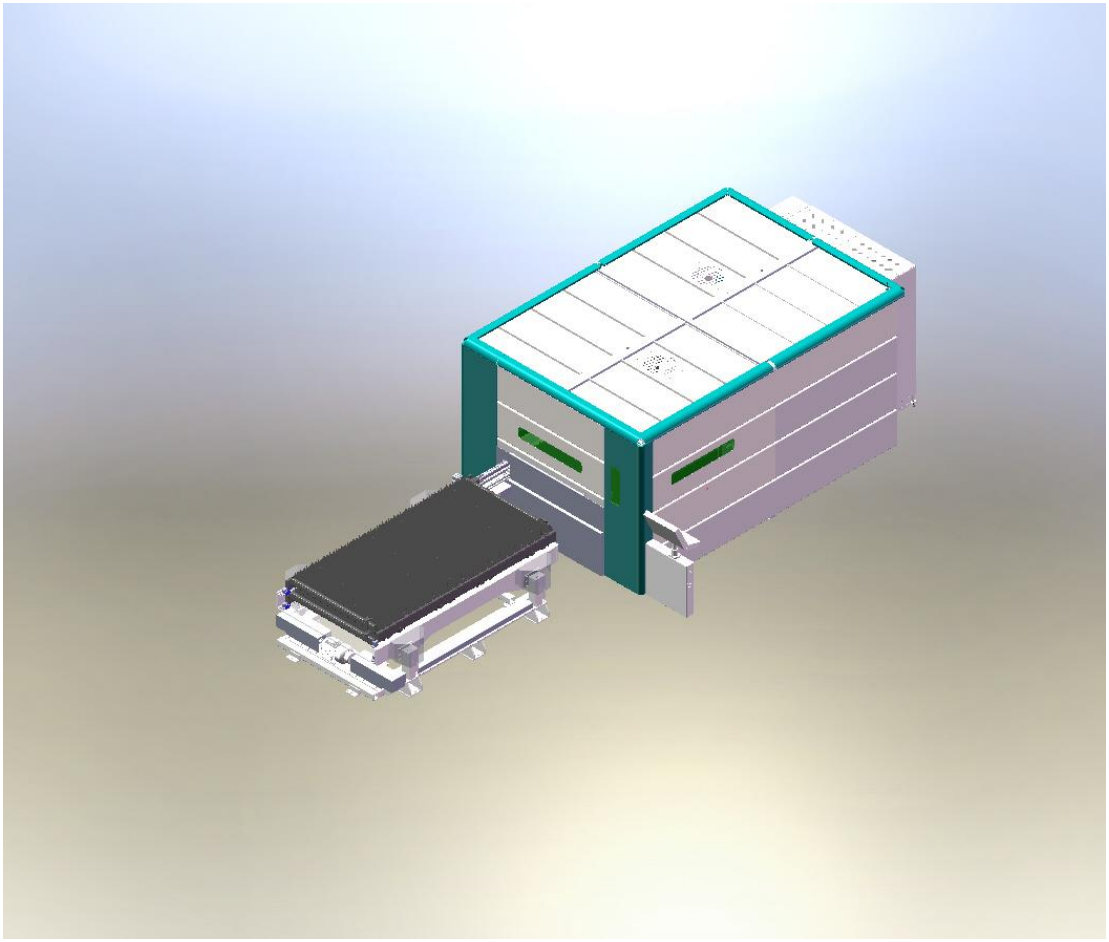
Recommended Maintenance:
a) Air pressure check should be made daily (Min. 5,5 bars)
b) Automatic lubrication oil level should be checked weekly (For guides).
c) Automatic lubrication oil level should be checked weekly (For Rack/Pinion)
d) Laser cutting head ballscrew nut and bearing lubrication should be checked.
e) Table pulling chain should be lubricated with grease when necessary.
f) All the gears should be visually inspected and cleaned from dust and particles.





3.12 – CABINET

The machine is equipped with a safety cabinet designed to protect the operator, and any personnel located in the area around the machine, from laser radiation (direct or diffused) and from moving mechanical parts.



3.13 - LASER SOURCE

Refer to the related publication.

3.14 - HEAD

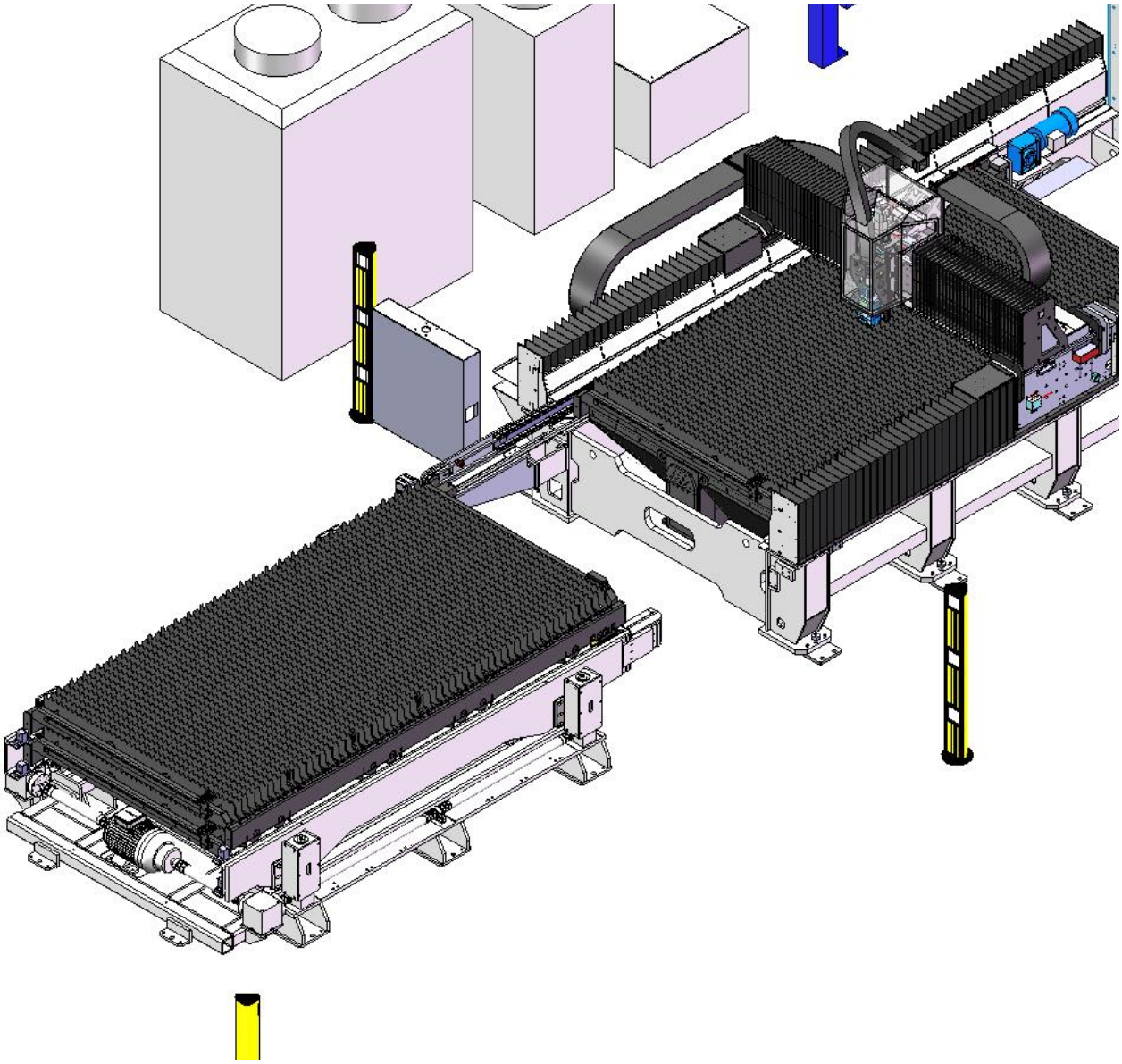
The head includes the head body and the sensor support.

3.15 - PNEUMATIC SYSTEM

The pneumatic system consists of:

- air treatment unit
- pressure regulator unit and distribution lines.

3.16 - SHUTTLE TABLE



3.17 - CLOTHING

The operator must wear safety shoes with a non-skid sole.

The clothes worn must be suited to the work to be performed: coveralls or aprons must be made of natural, low-flammable fiber (such as cotton).

When working in heat-emitting areas use special fire-proof safety gloves. During maintenance operations, the operator and/or maintenance technician must also wear earmuffs or earplugs at all times.

When working on the machine, do not wear accessories and garments that may dangle, interfere with movements of or snag the Operator.

3.18 - ACCESSING THE WORK AREA

- During operation, the operator is normally stationed at the control panel / control desk.
- The machine's working area is surrounded by a safety zone.
- The safety zone is marked out by fixed structures, safety fences, and safety devices.
- The machine may be left running in automatic mode.
- During machine operation, no-one, including the operator, is allowed within the safety zone.

WARNING:

- **Do not store products or other items in the safety zone.**
- **Crushing hazard: the working movements of the machine and the machined part present a serious risk of accident.**
- **When starting the machine, always ensure that neither people nor foreign objects are within the safety zone.**

The machine delivery includes the following safety devices and functions that trigger alarms and stop the machine when necessary:

NOTICE 1 : **The safety devices must always be kept in perfect working order and periodically inspected.**

NOTICE 2 : **Safety devices must not be removed or disabled for any reason**

3.19 - LASER SAFETY

The Durma Laser is classified according the laser safety standard EN 60825-1:2009

Class 1: Lasers that are not dangerous under reasonable conditions of use, even for optical instruments for the direct vision of the beam.

Class 2: Lasers which emit visible radiation at a wavelength between 400 and 700 nm, in which eye protection is normally ensured through a persons own natural aversion response, including blinking.

Class 4: Lasers which produce hazardous diffuse reflections and cause injury to the skin. The radiation represents a fire hazard. Extreme care should be used when using this class of laser.

The high powered laser used in the Durma Laser system is a Class 4 laser, and the positioning laser (red diode) is a Class 2 laser based on the classifications reported above.

Under normal operating conditions (with the cabin closed and safety devices on) the Durma Laser cutting machine is a class 1 laser system.

3.20 - SAFETY DEVICES

To ensure reliable and safe operation of the machine, periodic inspection of the machine's safety devices must be performed. Carry out the inspections according to the following instructions.

WARNING	
	• Bypassing a safety device is strictly forbidden. • Immediately rectify any faults or defects detected during inspection, or contact Durma Laser Service. • The machine must not be used until all faults detected have been eliminated.

The following push-buttons are installed in various parts of the machine to immediately stop its operation :

Operator interface control panel emergency push-button;

Auxiliary emergency push-button .

Each of these is made up of a red, mushroom-head and self-retaining safety push-button, which acts as an emergency stop (pressing the push-button stops all machine operation immediately).

The consequences of pressing an emergency stop push-button are as follows:

Immediate stopping of the electric motors.

Interruption of the motors and laser generator power supply circuit.

Interruption of the auxiliary power supply circuit.

No operations may be carried out for as long as the emergency push-button remains pressed; to restore normal operating conditions, you must release the push-button by turning it in the direction indicated by the arrow engraved on it.

The emergency stop push-button must be used only in case of dangerous conditions for the operator or the machine. Using this device for normal stopping is against safety rules and may damage the machine.

3.20.1 – MAIN KNIFE SWITCH WITH DOOR LOCK

The switch is located inside the electrical panel and may be adjusted from outside by means of a knob located on the panel door.

The switch has two positions, "0" (open) and "I" (closed); the panel may be opened only with the switch set to "0", thus with the electrical power supply cut off.

3.20.2 – KEY SELECTOR SWITCHES

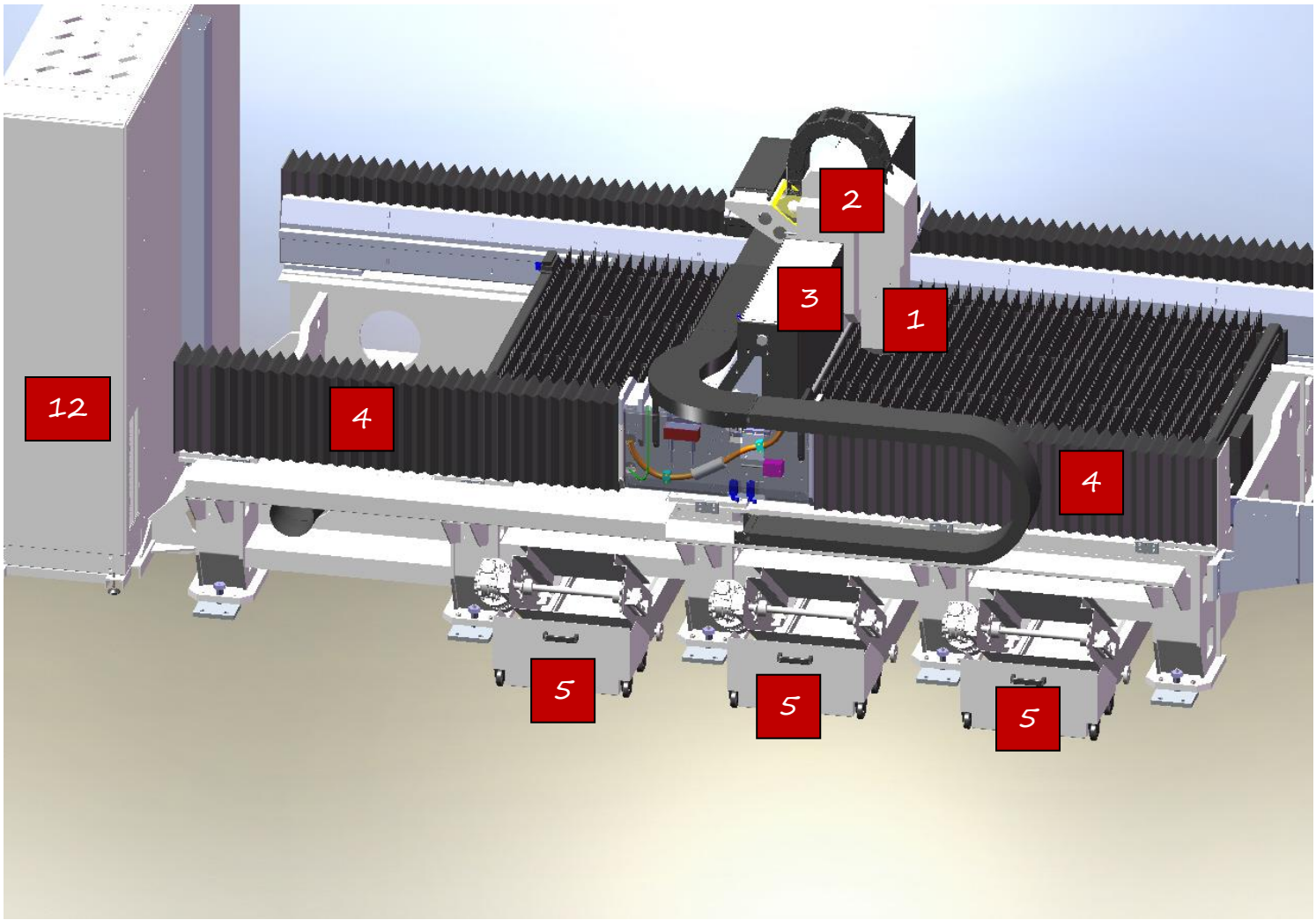
Some control selector switches, which for example enable the machine status in manual mode or deactivate the cabin door safety devices, etc., may be activated only by means of a special key.

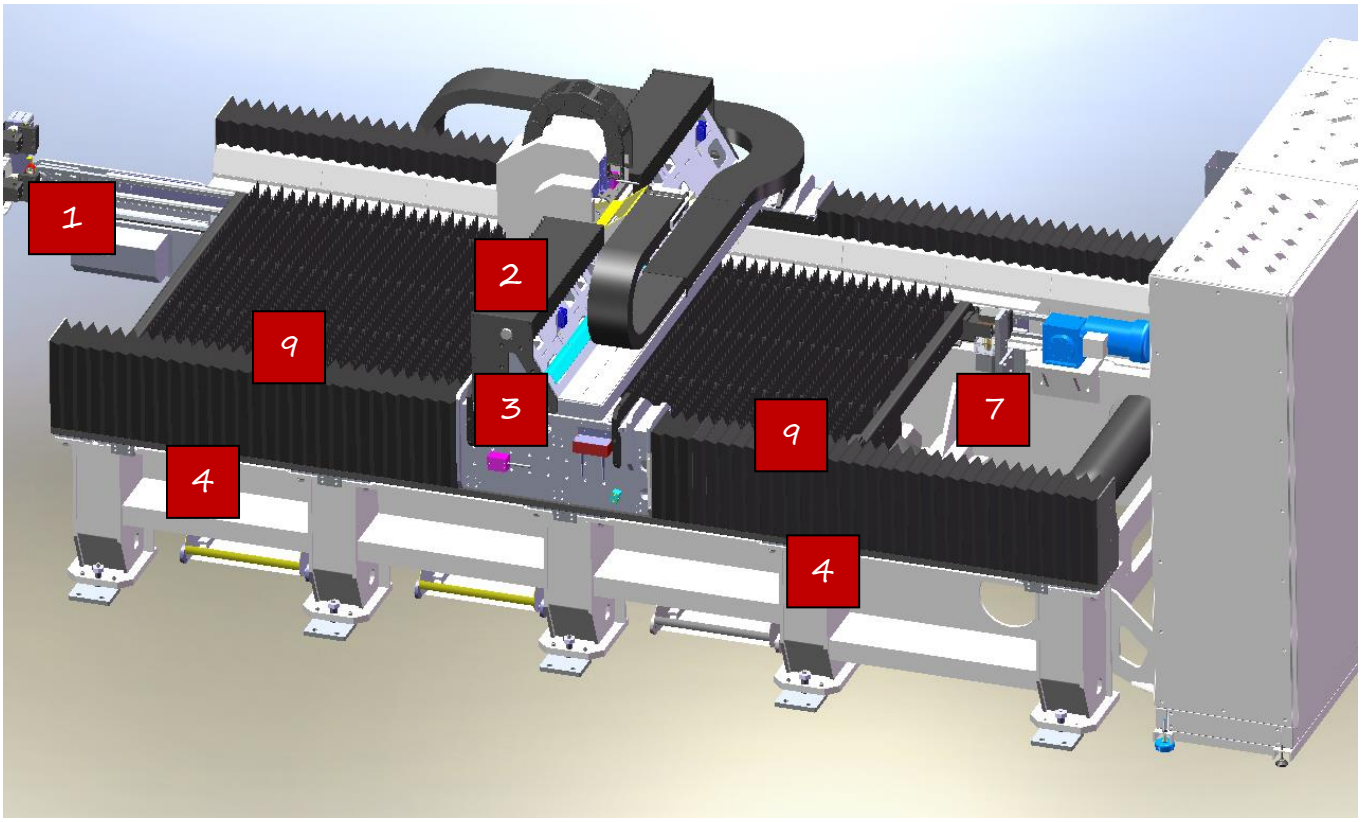
3.21 - MAINTENANCE

Maintenance point	Action	İnterval	HDFX	HDF	HDFL
10,11	Check the functioning of the safety devices of the machine (emergency stop buttons, signal lamps, door limit switches, etc.)	Weekly	x	x	x
D	Check the air pressure setting at the dust collector, 4.5 bar.	Weekly	x	x	x
D	Clean the spark separator in the dust collector.	Weekly	x	x	x
C	Check the temperature of cooling water.	Weekly	x	x	x
C	Check the air filters of the cooler. Clean or replace if necessary.	Weekly	x	x	x
C	Check the water filter of the cooler. Clean or replace if necessary.	Weekly	x	x	x
12	Check the filters for compressed air.	Weekly	x	x	x
12	Check the cutting gas inlet pressure (02=9 bar +/-0.5 bar and N2=28 bar…30 bar). Pressure regulators are in the customer gas installation.	Weekly	x	x	x
12	Check the compressed air pressure of central lubrication system. (Min. 5.5 bar)	Weekly	x	x	x
12	Check the grease level of the central lubrication system.	Weekly	x	x	x
1	İnspect the protection window. Replace if needed.	Weekly.	x	x	x
2,3,4	Clean the linear guides of X-, Y- and Z-axis.	Monthly	x	x	x
2,10,12	Check the condition of the pneumatic hoses and connectors. Repair leaks or replace when necessary.	Monthly	x	x	x
7,8	Check fastening of the limit switches for all movements. Tighten and clean if necessary.	Monthly	x	x	x
1	Check tightness and condition of the O-ring on the ceramic component of the cutting head.	Monthly		x	x
1	Check the condition of the cutting head: cooling and gas pipes. Clean the cutting head and it's surroundings.	Monthly	x	x	x
C	Check the amount of water in the cooler. Add when necessary.	Monthly	x	x	x
9	Check the condition of the suction unit. Clean if necessary.	Monthly	x	x	x
5	Clean the conveyors and the surrounding area.	Monthly		x	x
6	Lubricate the screwjacks of the shuttle table.	Monthly		x	x
1	Clean the ball screw of cutting head.	2000h	x	x	x
C	Change the air filters of the cooler.	2000h	x	x	x
C	Change the cooling water and add inhibitor.	2000h	x	x	x

C	Change the cooler filter cartridges.	2000h	x	x	x
5	Take out the scrap conveyors. Clean and check their functionality.	2000h		x	x

D: See the operation manual of the dust collector for details
C: See the operation manual of the cooler for details

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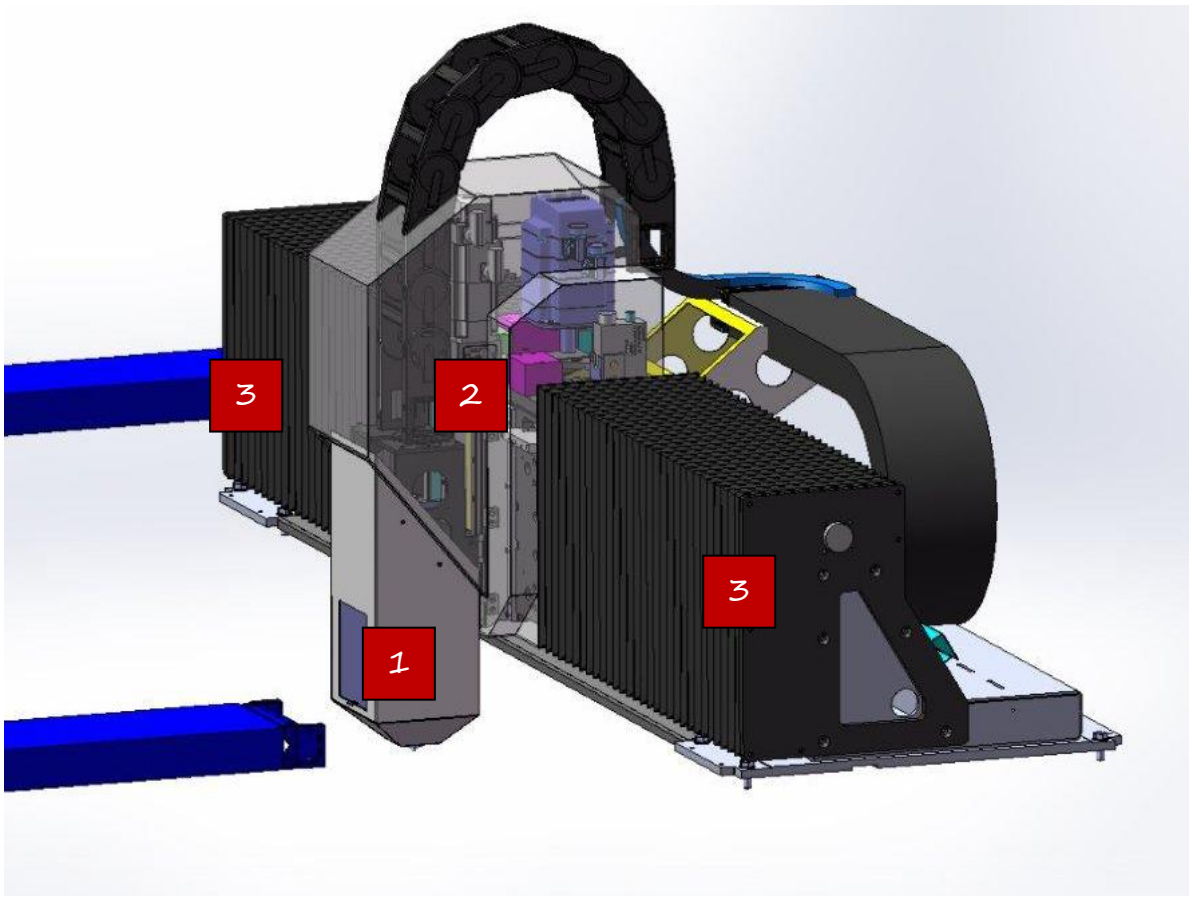
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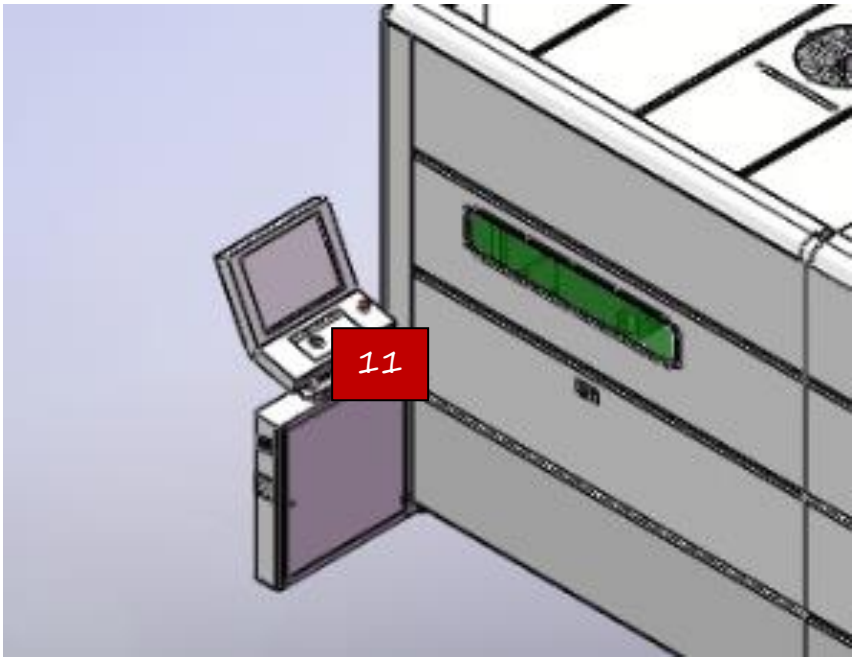
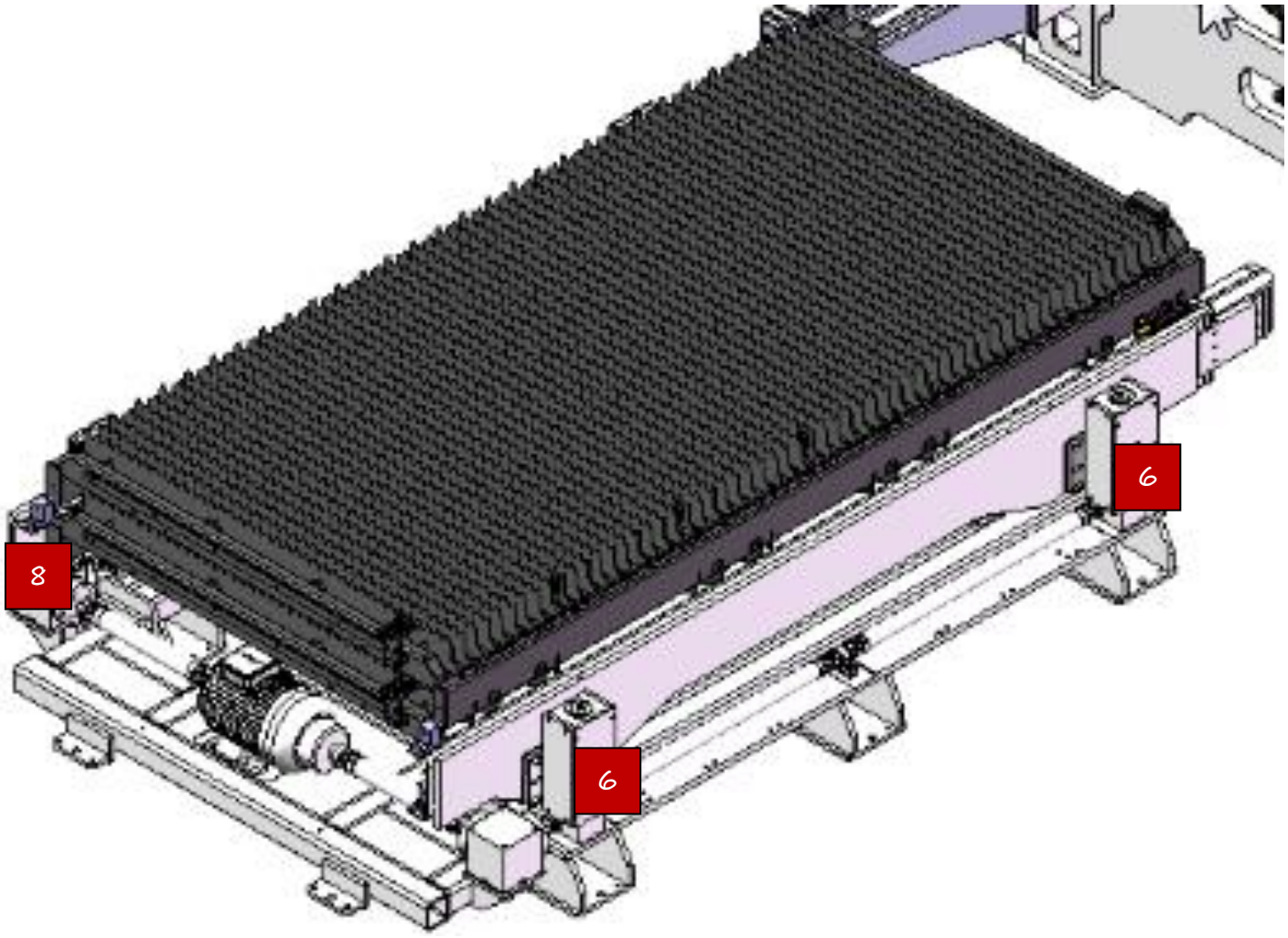

11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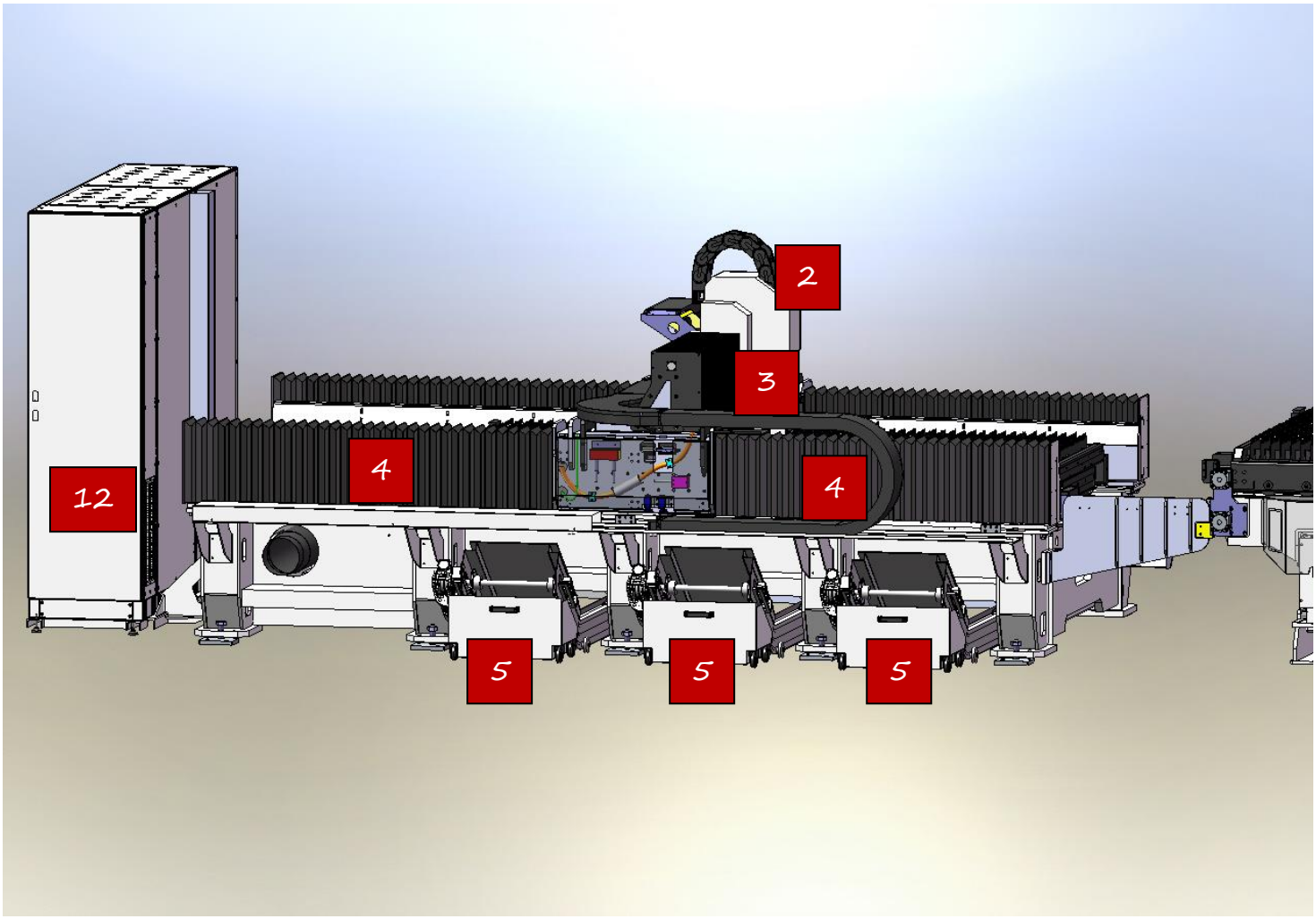


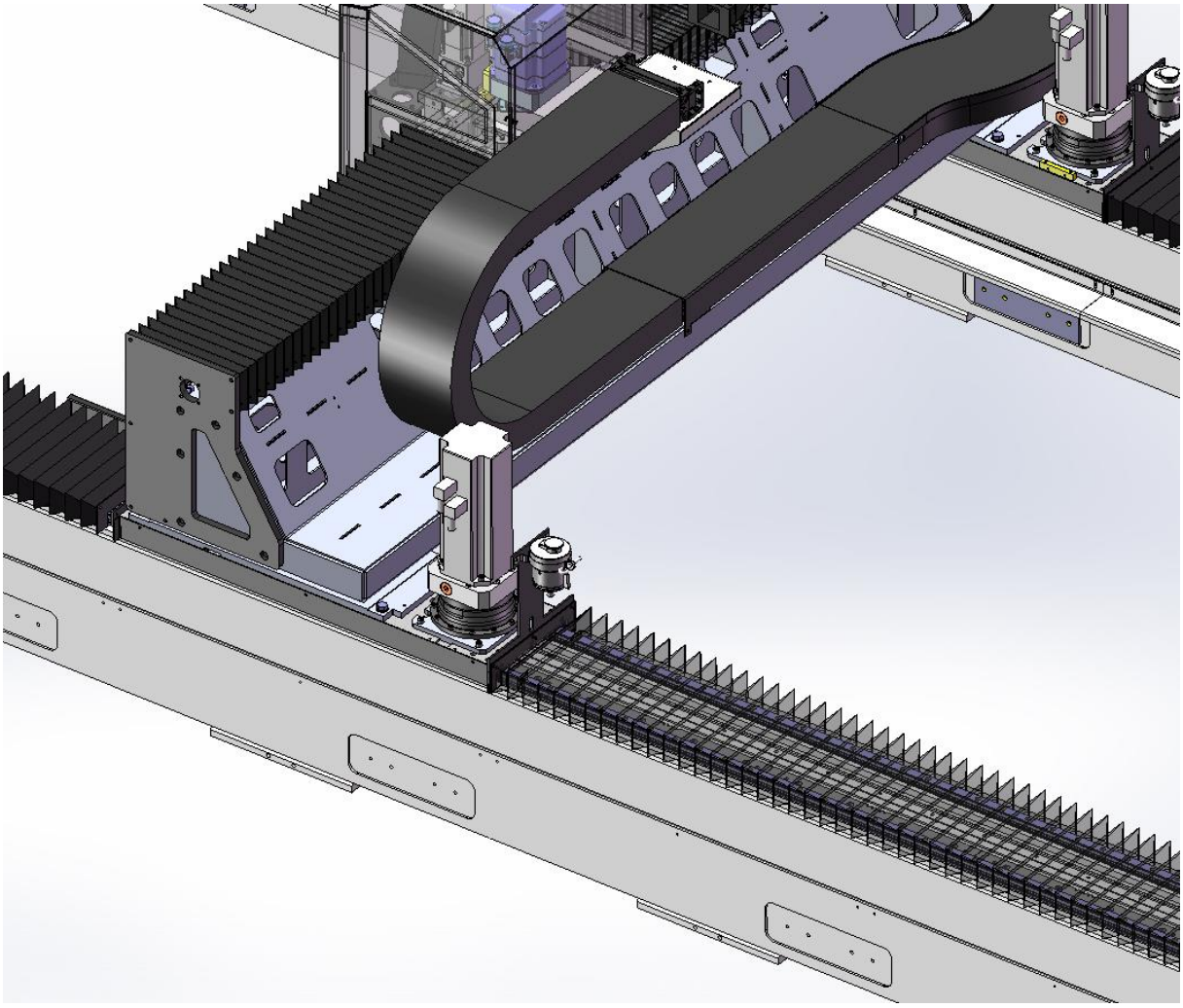
Also ;

1. Conveyors and the environment of conveyor must be weekly cleaned .
2. Plastic derivative materials must not be placed on conveyor pans .
3. Cutting aluminum, copper, brass and similar alloy materials, pan of the chips and conveyors must be daily cleaned .
4. Cutting aluminum, copper, brass and similar alloy materials, the filter element must be cleaned .
5. Fire extinguishers must be placed on the sides of machine .

3.22 - RACK and PINION MOTORS

A rack and pinion is a type of linear actuator that comprises a pair of gears which convert rotational motion into linear motion. A circular gear called "the pinion" engages teeth on a linear "gear" bar called "the rack"; rotational motion applied to the pinion and it moves on the rack.

Max Speed : 90 000 mm/min
Acceleration : 1G



3.23 - LUBRICATION SYSTEM

Central lubrication system is used on the machine. This reduces the maintenance requirements by making it possible to easily lubricate unreachable lubrication points. The automatic lubrication system uses the principle of increasing the pressure by pneumatic pump and reductor and distributing the oil via progressive distribution blocks.

CHAPTER 4 – HMI DOCUMENTATION

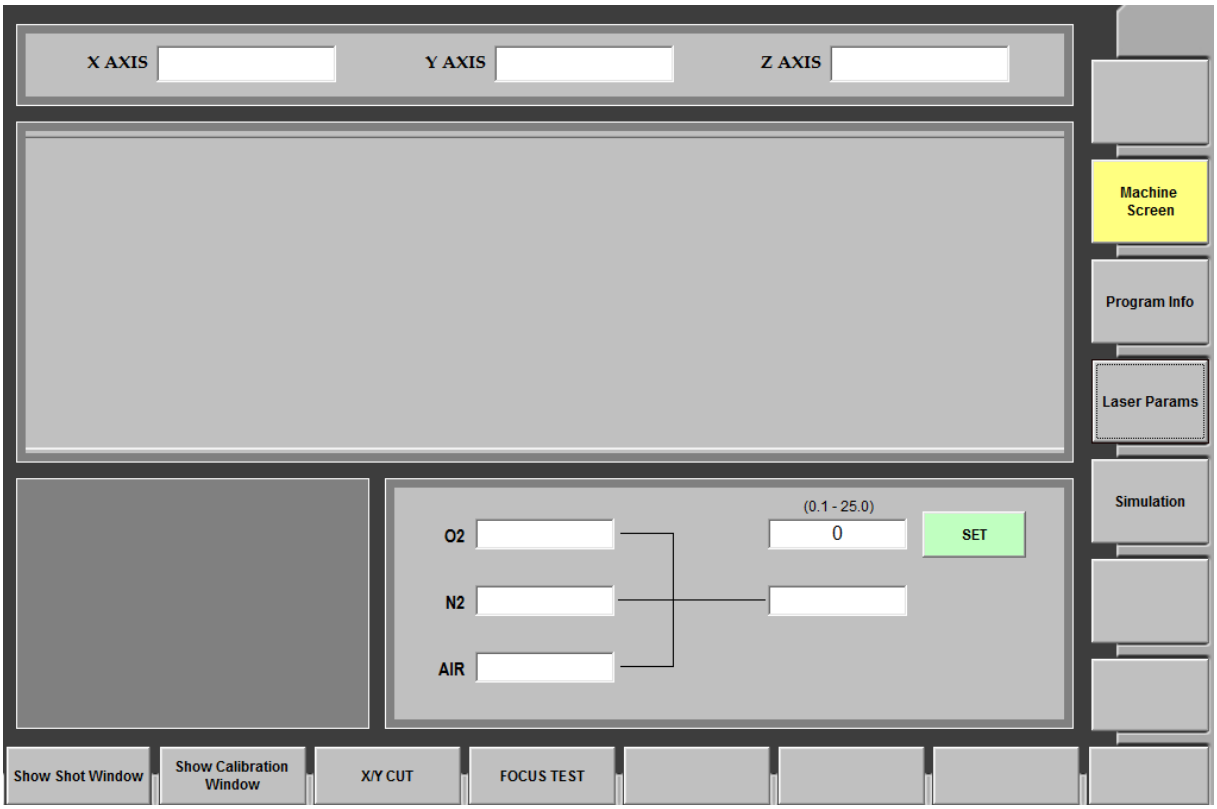
4.1 - DATABASE

There will be two databases present on the machine:

- DURMA database: is there only as a reference and can not be edited by the customer (read-only).
- Customer database: is initially a copy of the DURMA database and can be edited by the customer. New materials, thicknesses, etc. can be created.

4.2 – MACHINE SCREEN

The main machine screen looks as below:

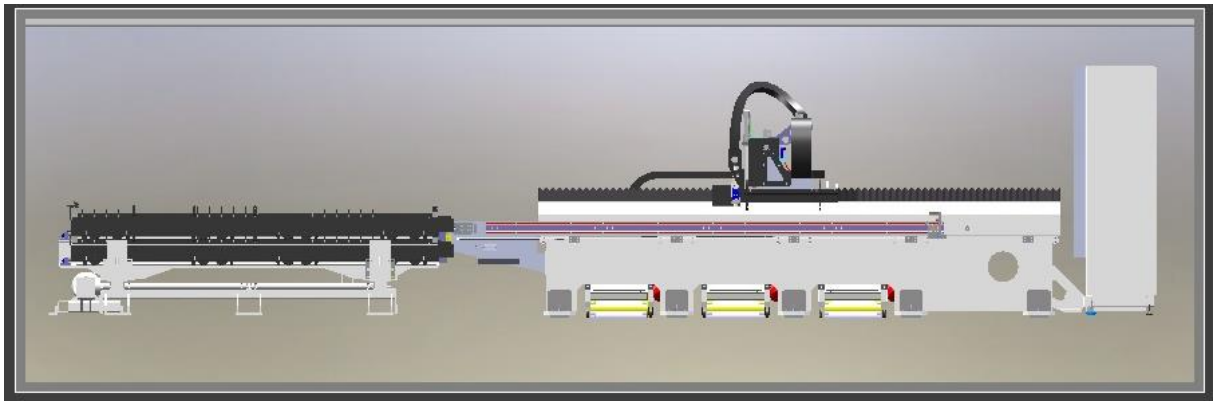


4.2.1 – AXIS POSITIONS

Axis positions are displayed:

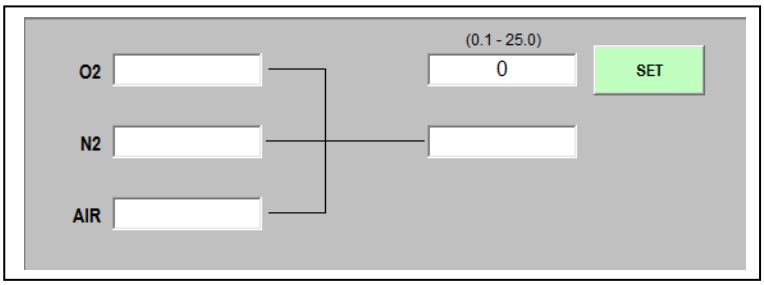
4.2.2 – TABLE STATUS

The status of the shuttle table and the table positions can be seen from the graphic screen:



4.2.3 – GAS PANEL

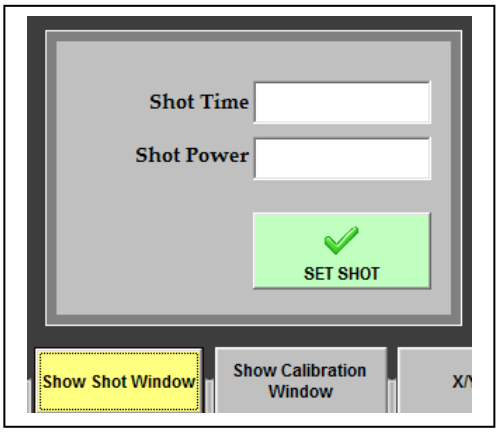
The input pressures for the different assist gasses can be seen on the gas panel. The feed-back pressure from the proportional valve regulating the assist gas is displayed as well.



The gas ystem can be tested by typing a value in the “set” box and clicking the “set” button.

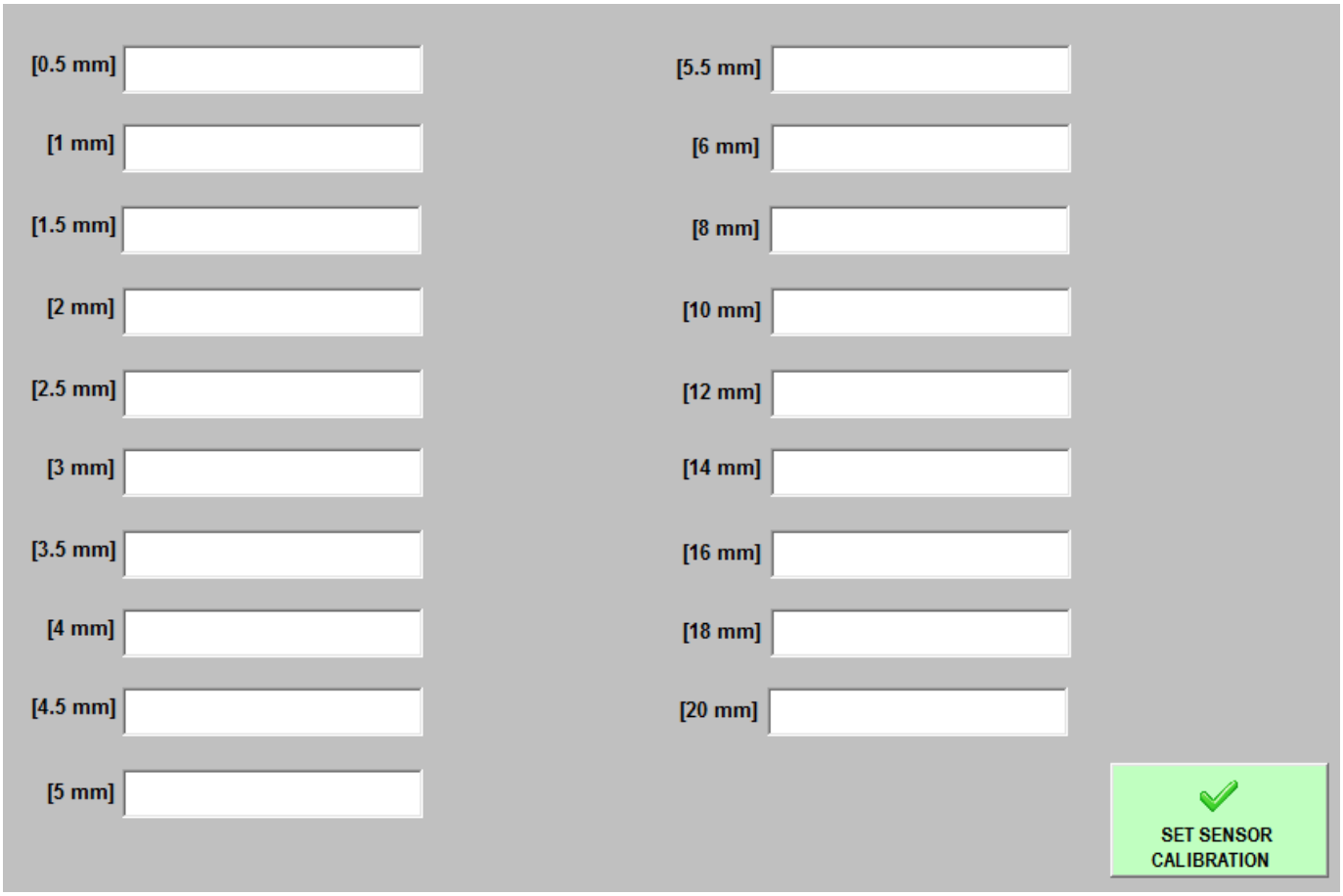
4.2.4 – SHOT PROGRAM

A program to generate a shot with the laser can be operated from the “shot window” button. The time for the shot and laser power must be typed in. The “set shot” button will fire the shot immediately.

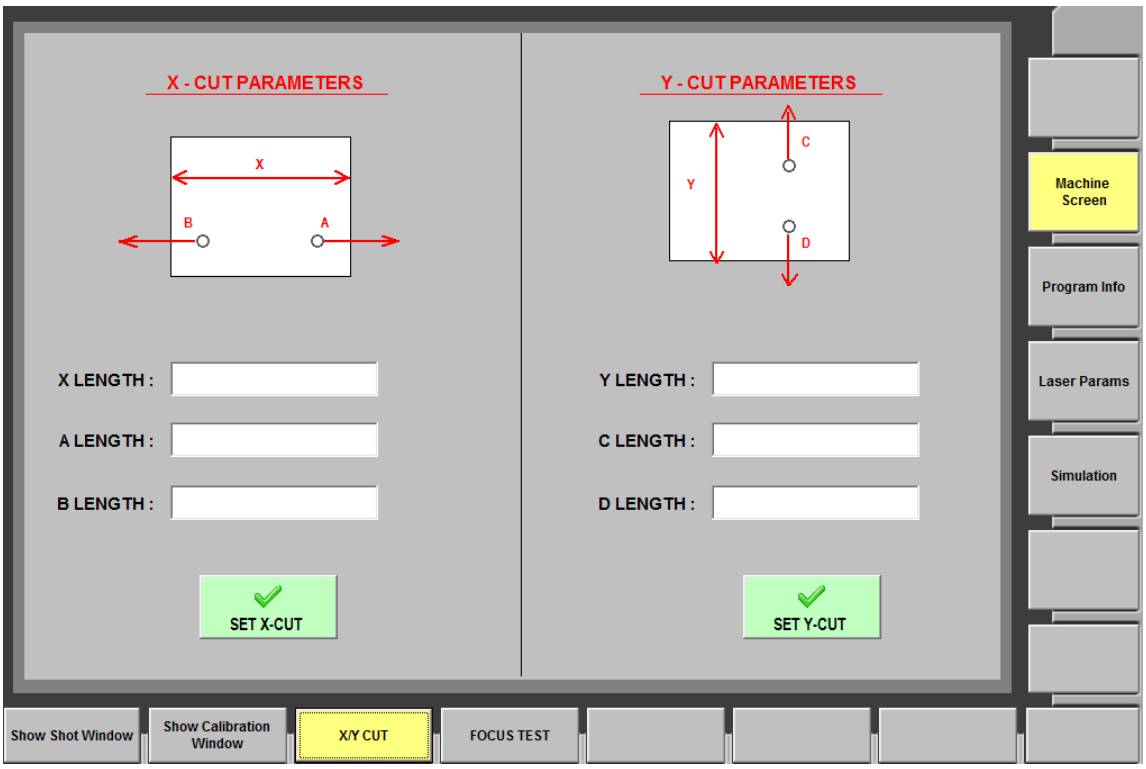


4.2.5 – SENSOR CALIBRATION

The capacitive distance sensor calibration procedure can be manually launched by pushing the “set sensor calibration” button. The feed-back voltage at different nozzle distances are displayed:



4.2.6 - X/Y-CUT



A manual cut in the X or Y-direction can be performed using the X/Y cut screen.
The procedure works as follows for a cut along the X-axis:

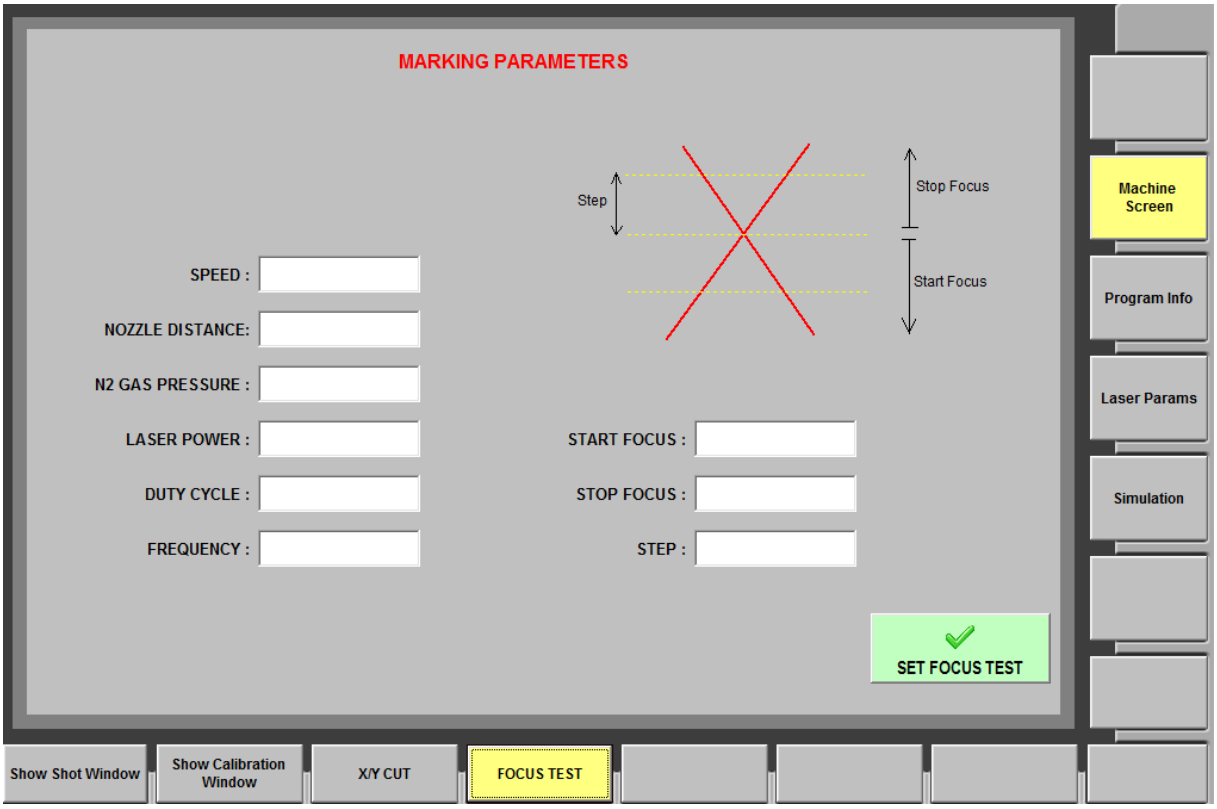
- From the actual position of the cutting head on the working area
- A distance “A” will be cut in the X- direction WİTHOUT the capacitive distance sensor. The cutting head distance is fixed!
- The head will go back the distance “A” in the X+ direction, still with the capacitive distance sensor not activated.
- The capacitive sensor is switched on again to cut in the X+ direction over a distance of “X-length”.
- The capacitive distance sensor will be switched off again to cut over the distance “B” in the X+ direction.
- Pushing the “Set X-cut” button will activate the procedure with the piercing and cutting parameters from the last selected program.

The procedure works as follows for a cut along the Y-axis:

- From the actual position of the cutting head on the working area
- A distance “C” will be cut in the Y- direction WİTHOUT the capacitive distance sensor. The cutting head distance is fixed!
- The head will go back the distance “C” in the Y+ direction, still with the capacitive distance sensor not activated.
- The capacitive sensor is switched on again to cut in the Y+ direction over a distance of “Y-length”.
- The capacitive distance sensor will be switched off again to cut over the distance “D” in the X+ direction.
- Pushing the “Set Y-cut” button will activate the procedure with the piercing and cutting parameters from the last selected program.

4.2.7 – FOCUS TEST

The zero-point of the lens can be tested with the following program:

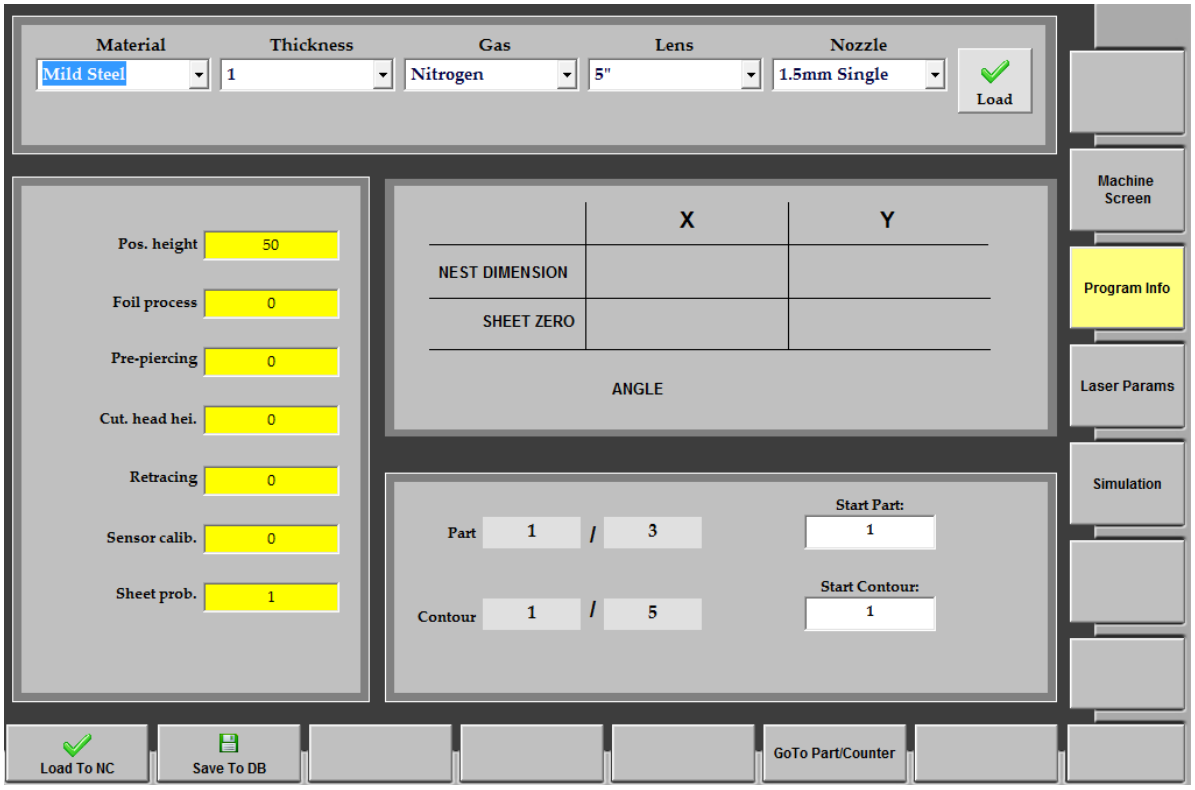


The test works as follows:

- From the actual cutting head position in the machine several lines will be marked in the Y-direction
- For each marking line the focus will be moved by an amount in mm set in “STEP”
- The first marking is with a focus “START FOCUS”
- The last marking is with a focus “STOP FOCUS”
- İn total there will be an amount of (“STOP FOCUS” – “START FOCUS”) / STEP marking lines
- After each marking line the head will move some mm in the X+ direction
- The procedure is started by pressing the “set focus test” button

The marking parameters can be set by speed, nozzle distance, N2 gas pressure, laser power, duty cycle and frequency.

4.3 – PROGRAM INFO



The general parameters are applied to the complete part program and are valid for all piercing and cutting technologies.

Parameter	Explanation
Focus off-set	The off-set value for the focus point. Changing the focus off-set will change the total focus applied in all cutting and piercing technologies accordingly.
Position height	The height of the cutting head movements between contours and/or parts.
Foil process	0: no action 1: will melt away the foil around every piercing point using the foil melt piercing technology before performing the actual piercing. 2: will melt away the foil on all the contours of the part using the foil melt cutting technology before actually piercing and cutting the part. Every part will first undergo the foil melting, then the actual piercing and cutting.
Pre-piercing	0: no action 1: will perform first all the piercings of the part, followed by the cutting. Between the piercings, the head will follow the part geometry for the movements.
Cutting head height	İf a part program is made for cutting non-metallic material where the capacitive distance sensor is not in use, this parameter will set the fixed distance at which the cutting head will remain for the cutting of the material in question.

Retracing	0: no action 1: if the process is interrupted by for example a nozzle-touch, the machine will automatically go back a distance along the cut path and cutting will automatically be started again.
Sensor calibration	0: no action 1: will automatically perform a quick capacitive distance sensor calibration at the start of the program 2: will make a full capacitive distance sensor calibration at the start of the program
Sheet probing	0: no action 1: will check that there is a sheet in the zero-corner of the nesting 2: will determine the position and orientation of the sheet at the start of the program 3: will determine the position, orientation and dimension of the sheet at the start of the program

4.3.1 – MANUEL DATABASE ENTRY

Normally the cutting and piercing parameters are read automatically from the part program. İf there is a need to activate other parameters, this can be done by the manual selection:

After selecting the database entry, load the parameters by pressing the “Load” button.

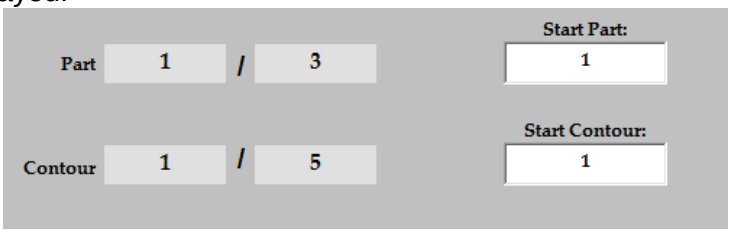
4.3.2 – NEST AND SHEET INFO

The dimension of the nest is read from the selected part program.

The sheet zero and angle of the sheet are displayed as well.

4.3.3 – PART AND CONTOUR COUNTER

The total amount of parts and contours are read from the selected program. During operation the actual contour and part which is cut is dispayed.

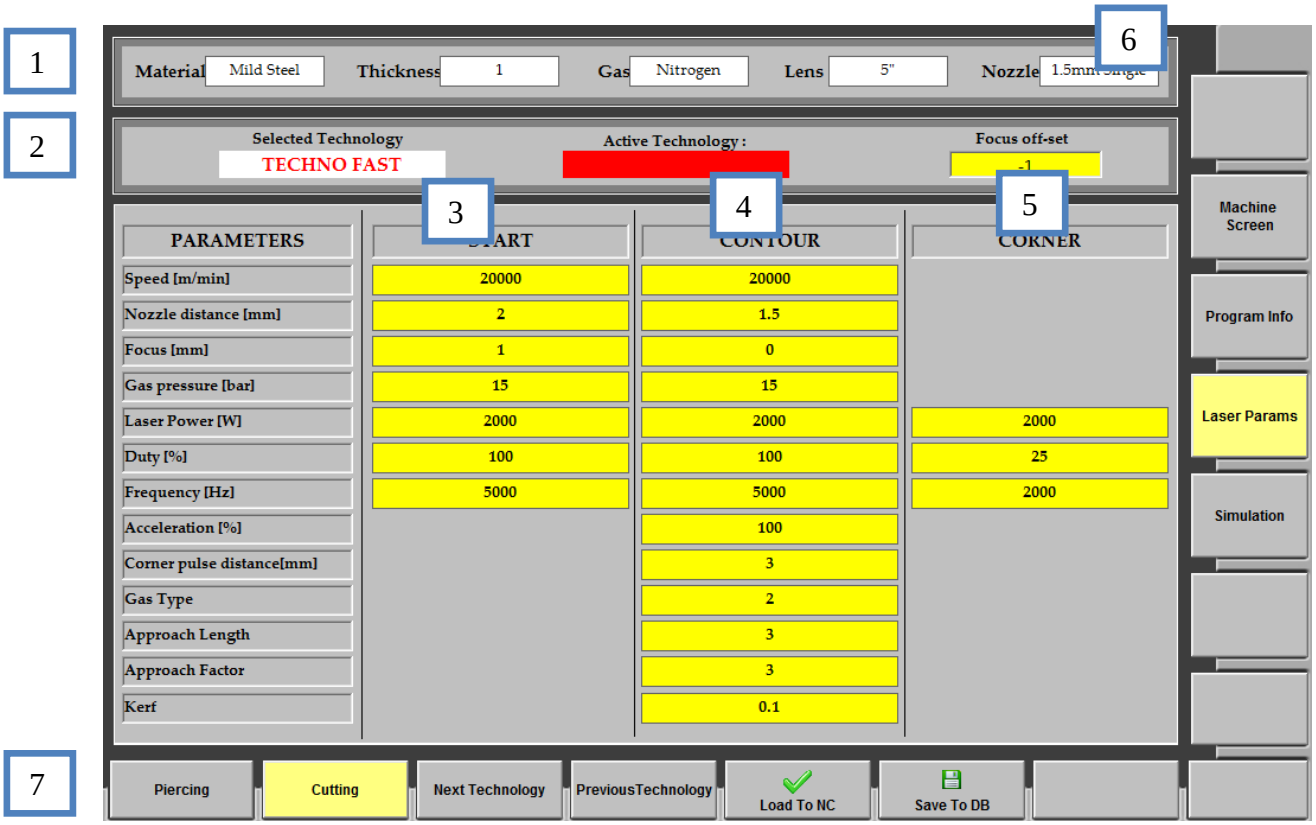


After an interruption of the program, the program can be restarted at a given part "Start Part" and a given contour "Start Contour".

The "Start Part" and "Start Contour" has to be loaded by pressing the GoTo Part/Counter button! Default the program will start with the first contour of the first part!
NOTE: programs made for high speed cutting without piercing technology cannot be restarted from different contours. Only part by part!

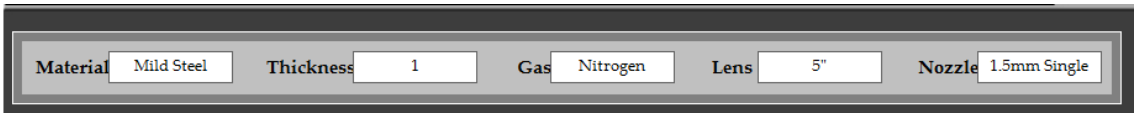
4.4 – CUTTING PAGE

The cutting parameter management is done from the screen as can be seen below:



İtem	Explanation
1	The database entry. Based on the information from the loaded part program, the corresponding material and thickness as well as the gas, lens and nozzle to use are displayed.
2	The technology indicator.
3	The start values of the parameters. These will be active after the piercing and on the lead-in.
4	The contour values of the parameters. These will be active on the actual geometry to cut, when the machine is running at the programmed cutting speed.
5	The corner values of the parameters. These will be active on all corners in the part, when the machine is slowing down to change the cutting direction.
6	General navigation buttons.
7	Cutting and piercing navigation buttons.

4.4.1 – DATABASE ENTRY



All piercing and cutting technologies are stored inside the database according to the material and the cutting head set-up necessary to cut the parts. The database can be browsed in the following order:

Select the material
Select the thickness
Select the gas type
Select the lens
Select the nozzle type

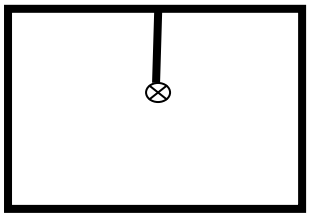
When a program is loaded in the NC memory and ready for execution, automatically the corresponding database entry will be selected.

4.4.1.1 - START, CONTOUR AND CORNER PARAMETERS

Parameter	Start	Contour	Corner
Speed [m/min]			
Nozzle distance [mm]			
Focus [mm]			
Gas pressure [bar]			
Laser power [W]			
Duty [%]			
Frequency [Hz]			
Acceleration [%]			
Corner pulse distance [mm]			
Gas Type			
Approach Length			
Approach Factor			
Kerf TECHNO FAST			

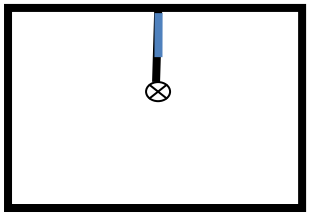
On a typical contour there will be different cutting conditions and each condition requires some set of parameters to guarantee an optimal transition between the cutting conditions.

This is illustrated by the following figure where there is the piercing point (cross) the lead-in (the vertical line) and the actual geometry to cut (the rectangle):

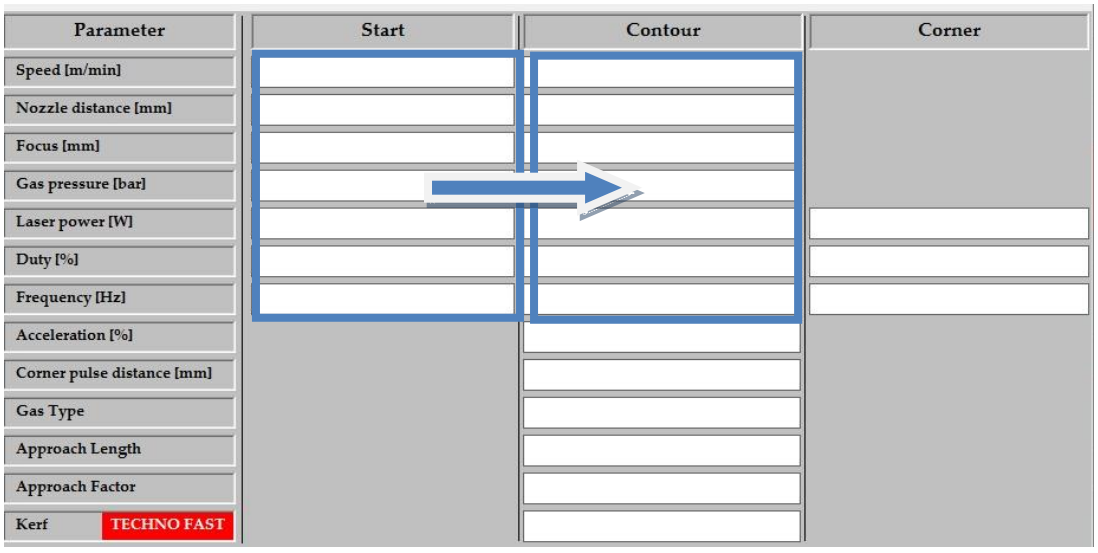


4.4.1.2 – START TO CONTOUR TRANSITION

After the piercing, the cutting process will be started on the lead-in and with the cutting parameters having the values given in the “Start” column. Over a certain distance these parameters will be varied towards the values given in the “Contour” colum. This will happen over a distance called “Approach length” as shown in the figure in blue:



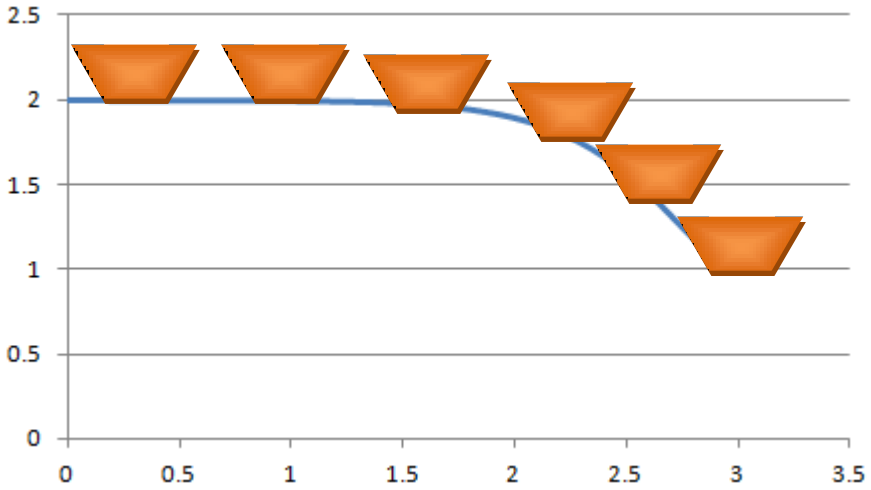
So during the cutting on the blue segment, the parameters will vary from the values in the “start” column to the values in the “contour column”:



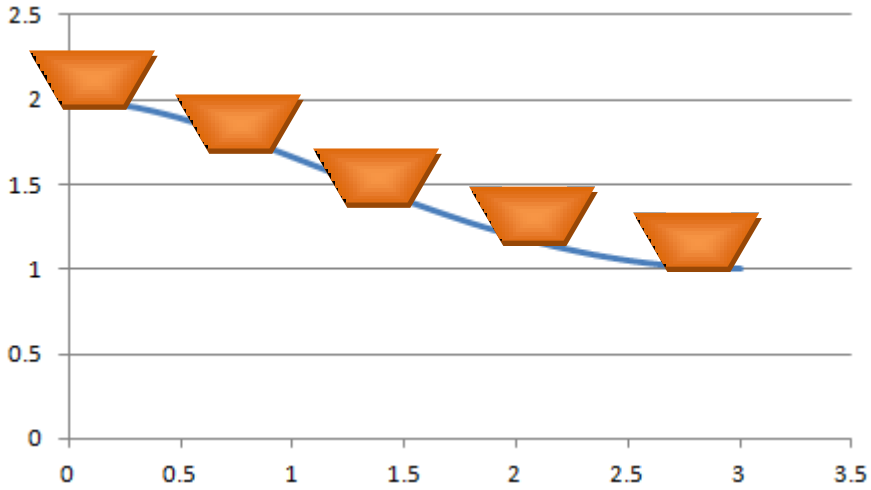
The way the parameters are changing over the approach length is defined by the parameter “approach factor”.

There are three types of approach:

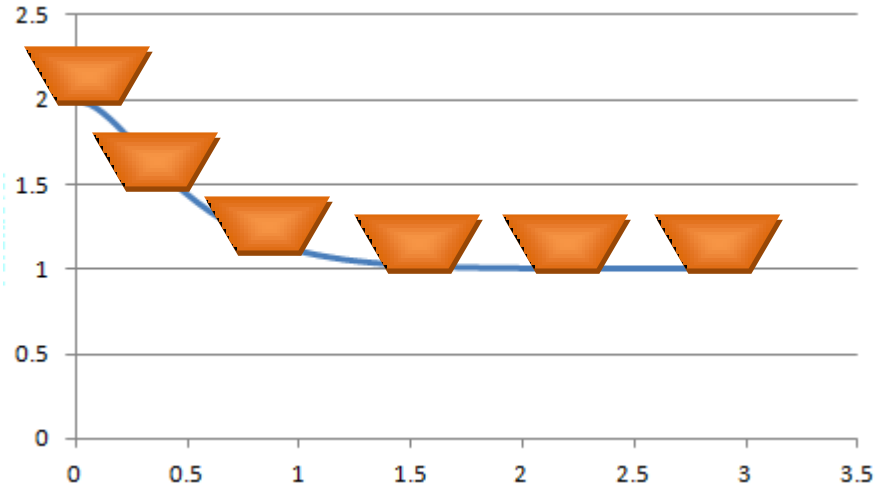
- Approach factor=1: “start” values remain active along most of the “approach length”, they change to “contour” values at the end of the approach. For example, if considering the nozzle distance change:



- Approach factor=2: “start” values gradually change to “contour” values at the end of the approach. For example, if considering the nozzle distance change:

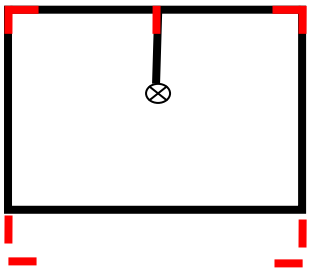


- Approach factor=3: “start” values change fast to “contour” values already at the beginning of the approach length. For example, if considering the nozzle distance change:

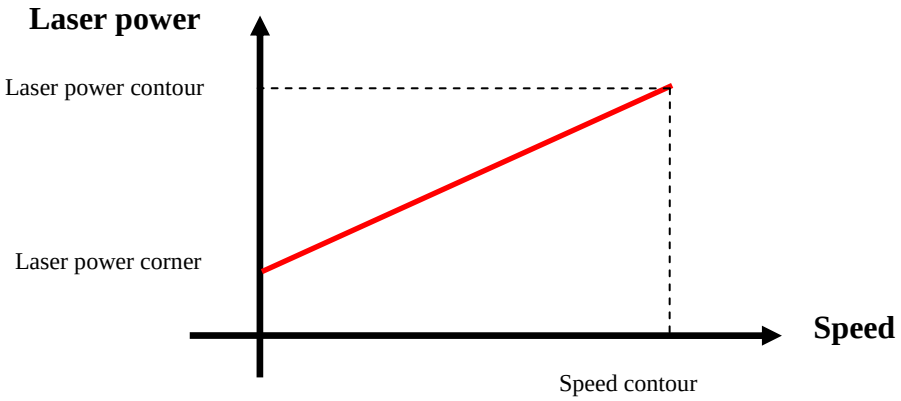


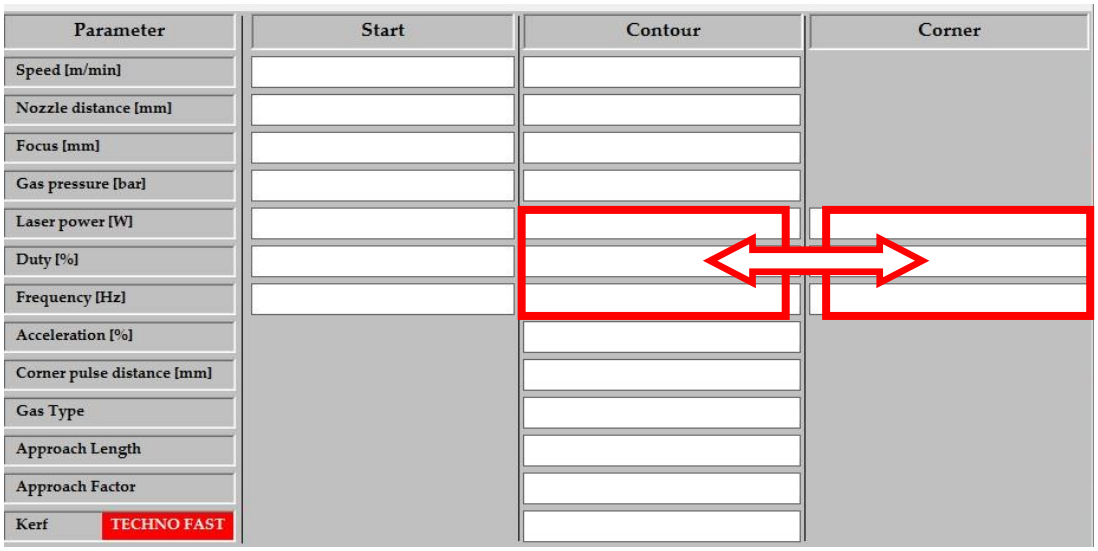
4.4.1.3 - CONTOUR TO CORNER AND CORNER TO CONTOUR TRANSITION

İf we consider the same example geometry another change in cutting condition will occur when the machine is decelerating towards a corner or accelerating after a corner. (Note: when there is a sharp corner on the contour, on the exact location of the corner the machine axis will be momentarily standing still.) Also here some of the parameters will be changed to adapt to the different cutting speeds: from the “contour” values to the “corner” values and vice versa. This will take place on the segments at a distance given by “corner pulse distance” before and after every corner on the part, see in red on the example:



This way the laser power and or pulse behaviour can be adapted to the axis velocity in order to optimize the cutting quality of corners. The parameters will change proportional with the cutting speed, for example the laser power:





4.4.2 – CUTTING PARAMETERS

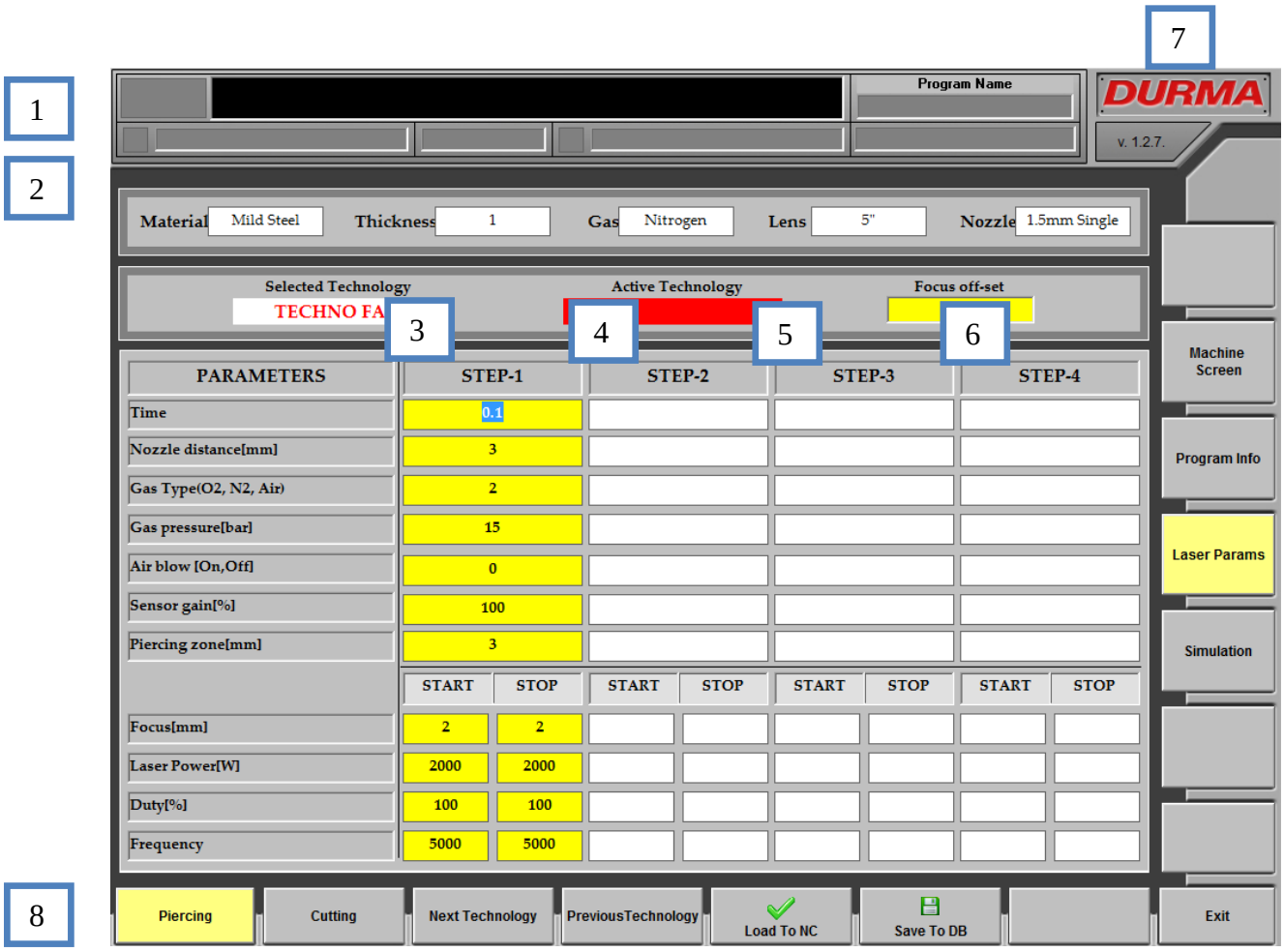
Parameter	Explanation
Speed	Cutting speed
Nozzle distance	Distance between the nozzle and the sheet surface. İs controlled by the capacitive distance sensor.
Focus	Specific additional focus for the cutting technology. The absolute position of the focus in respect to the sheet top surface is: FOCUS + FOCUS_OFF-SET. For cuttting heads with auto-focus this is automatically controlled.
Gas pressure	The cutting gas pressure controlled by the proportional gas valve.
Laser power	The laser power
Duty	The duty cycle of the laser controlled by the pulse generator. NOTE: when duty is 100% the laser works in continuous mode (CW)
Frequency	The frequency of the laser when working in pulsed mode (Duty <> 100%) as controlled by the pulse generator.
Acceleration	The acceleration of the machine during cutting.
Corner pulse distance	The distance before and after a corner (block end) where the transition function contour to corner is activated.
Gas type	The cutting gas: 1: Oxygen 2: Nitrogen 3: Air (optional)
Approach length	The distance on the lead-in where the start to contour transition is activated.
Approach factor	The way the start to contour transition takes place: 1: slow start 2: gradual ransition 3: fast start
Kerf	The width of the cutting gap. This is used to make the tool radius compensation on the machine.

4.4.3 - TECHNOLOGY NAVIGATION

Button	Explanation
Piercing	Go to the piercing page
Cutting	Go to the cutting page
Technology +	Go to the next cutting technology. Technology numbers are: 1: fast 2: big geometry 3: medium geometry 4: small geometry 5: special geometry 6: marking 7: foil cutting
Technology -	Go to the previous cutting technology.
Load to NC	Will load the applied changes to the parameters to the NC where they will become active on the next contour.
Save to DB	Will save the applied changes to the database.
DURMA DB	Loads the DURMA database parameters.

4.5 – PIERCING PAGE

The piercing parameter management is done from the screen as can be seen below:



İtem	Explanation
1	The database entry. Based on the information from the loaded part program, the corresponding material and thickness as well as the gas, lens and nozzle to use are displayed.
2	The technology indicator.
3	The parameters used in the first step of the piercing.
4	The parameters used in the second step of the piercing.
5	The parameters used in the third step of the piercing.
6	The parameters used in the fourth step of the piercing.
7	General navigation buttons.
8	Cutting and piercing navigation buttons.

4.5.1 - DATABASE ENTRY

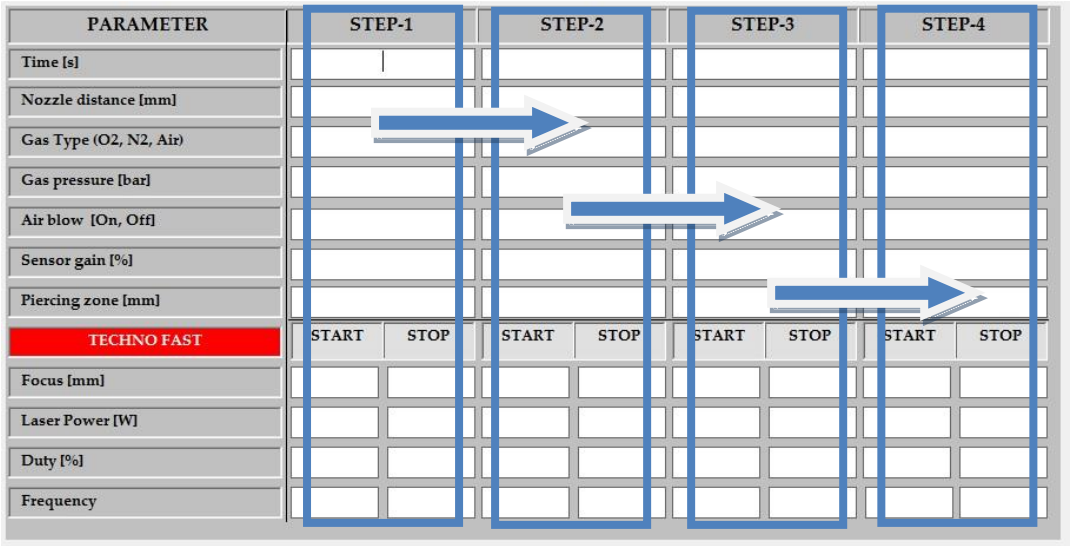
See the section in “Cutting page”.

4.5.2 – GENERAL PARAMETERS

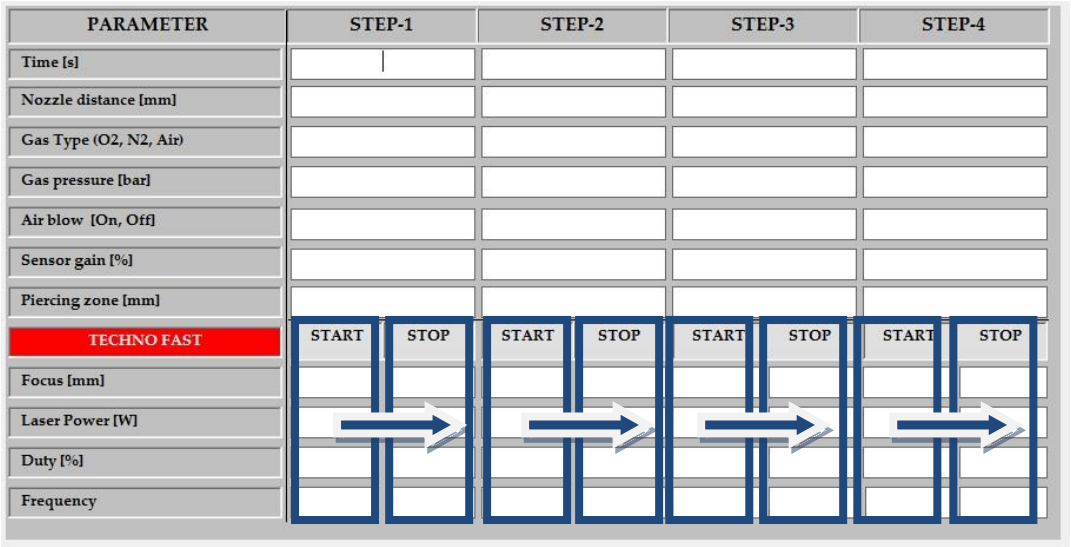
See the section in “Cutting page”.

4.5.3 – PIERCING STEPS

The piercing process can be made in a maximum of 4 steps. Each step can be parametrized independently and the entire process will be made sequentially: after one step is finished, the next is performed, etc.



During each step, some of the parameters can be ramped from “start” to “stop” values:



4.5.4 – PIERCING PARAMETERS

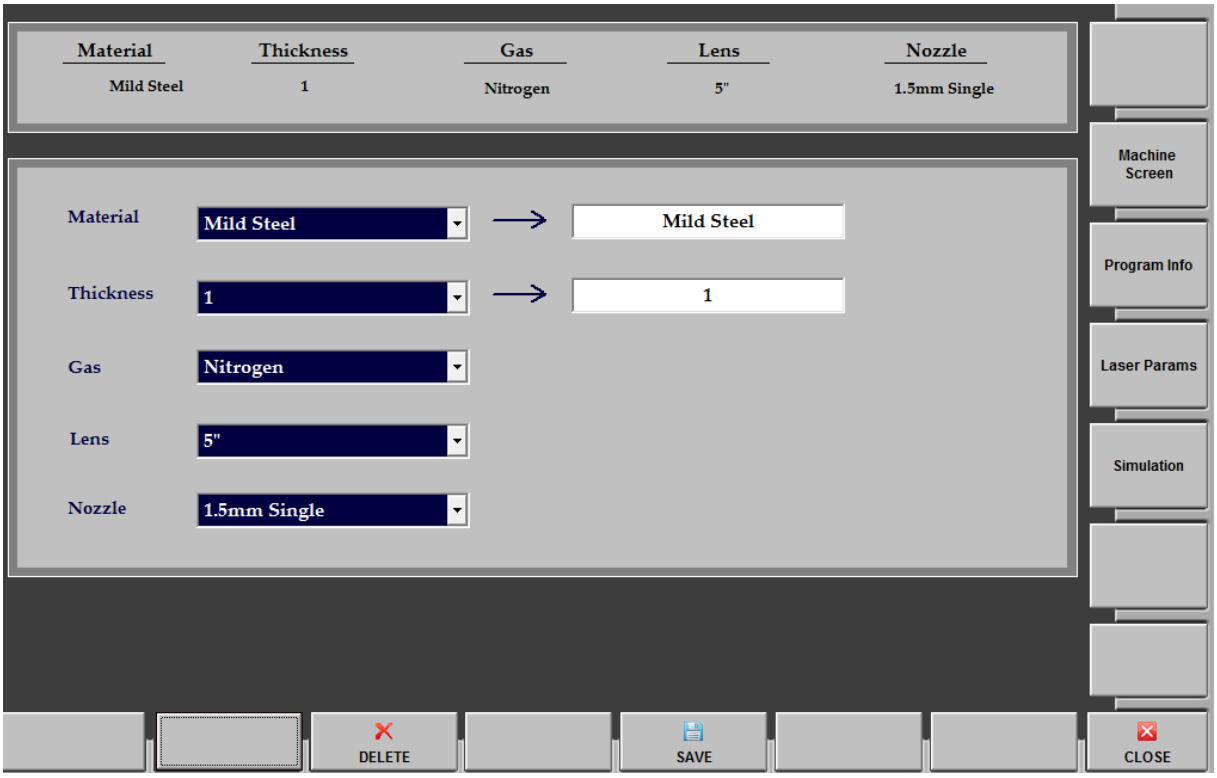
Parameter	Explanation
Time	The time of each step in the piercing process. NOTE: when the time of a step is set to zero, the piercing step will not be performed and the piercing process is finished.
Nozzle distance	Distance between the nozzle and the sheet surface. İs controlled by the capacitive distance sensor.
Gas type	The cutting gas: 1: Oxygen 2: Nitrogen 3: Air (optional)
Gas pressure	The cutting gas pressure controlled by the proportional gas valve.
Air blow	Will activate the air blow during the piercing step
Sensor gain	The sensitivity of the nozzle distance control can be lowered in a certain radius around the piercing hole.
Piercing zone	The radius around the piercing hole where the nozzle distance control sensitivity is lowered.
Focus	Specific additional focus for the cutting technology. The absolute position of the focus in respect to the sheet top surface is: FOCUS + FOCUS_OFF-SET. For cuttting heads with auto-focus this is automatically controlled.
Laser power	The laser power
Duty	The duty cycle of the laser controlled by the pulse generator. NOTE: when duty is 100% the laser works in continuous mode (CW)
Frequency	The frequency of the laser when working in pulsed mode (Duty <> 100%) as controlled by the pulse generator.

4.5.5 – TECHNOLOGY NAVIGATION

Button	Explanation
Piercing	Go to the piercing page
Cutting	Go to the cutting page
Technology +	Go to the next piercing technology. Technology numbers are: 1: fast 2: normal 3: fine 4: RESERVED 5: RESERVED 6: RESERVED 7: foil piercing
Technology -	Go to the previous piercing technology.
Load to NC	Will load the applied changes to the parameters to the NC where they will become active on the next contour.
Save to DB	Will save the applied changes to the database.
DURMA DB	Loads the DURMA database parameters.

4.6 – DATABASE PAGE

When the “Save to DB” buttin is pressed, the applied changes can be saved to the database and the screen below will appear.

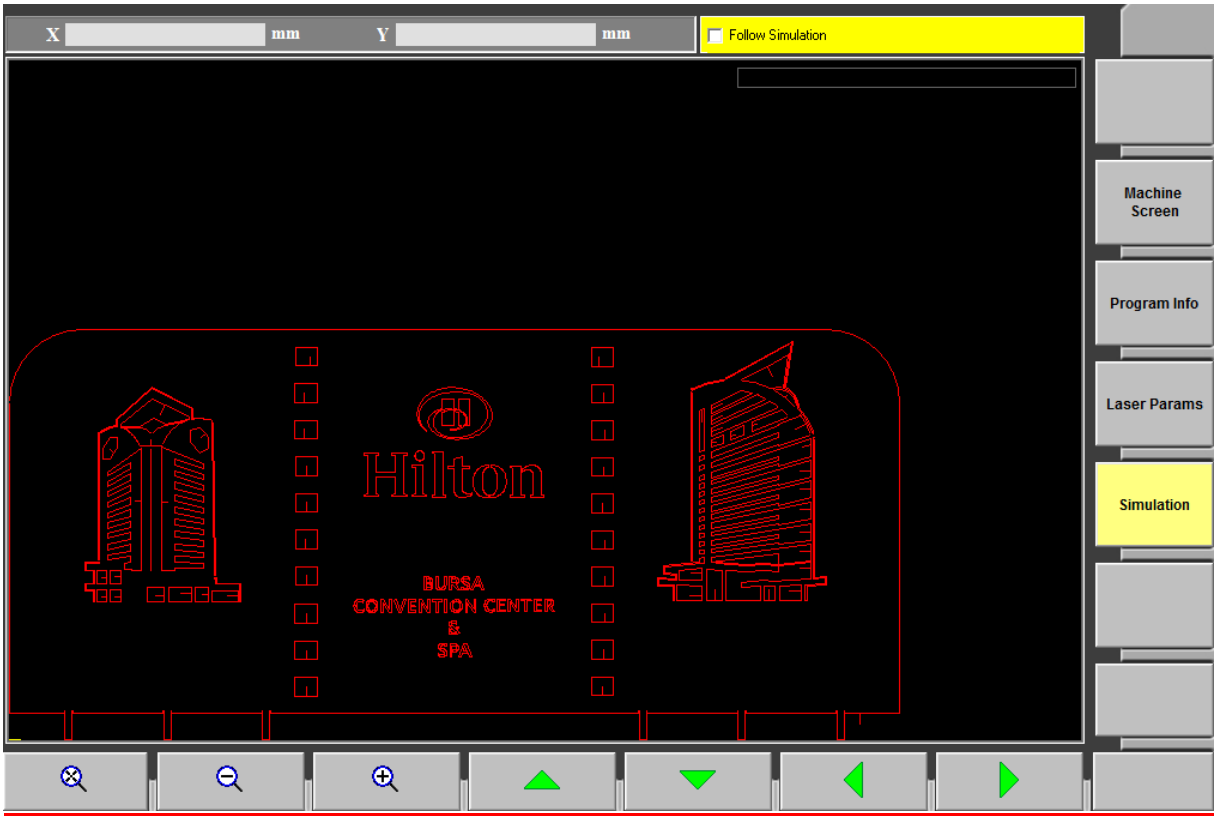


The parameters can be saved in different ways:

- Overwrite the exisiting database values
- Create a new material or thickness
- Save under a different laser tool: lens, gas or nozzle

The database entry can also be deleted.

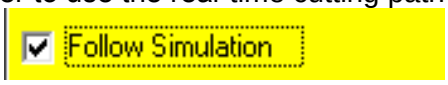
4.7 – SIMULATION PAGE



Online cutting can be followed on the simulation screen. Different colors on drawing have different meanings.

- Blue color shows : the parts/contours which are not cut yet.
- Green color shows : the parts/contours which will be cut at that moment
- Red color shows : the parts/contours which are already cut

The “follow simulation” will mark whether to use the real-time cutting path or not.



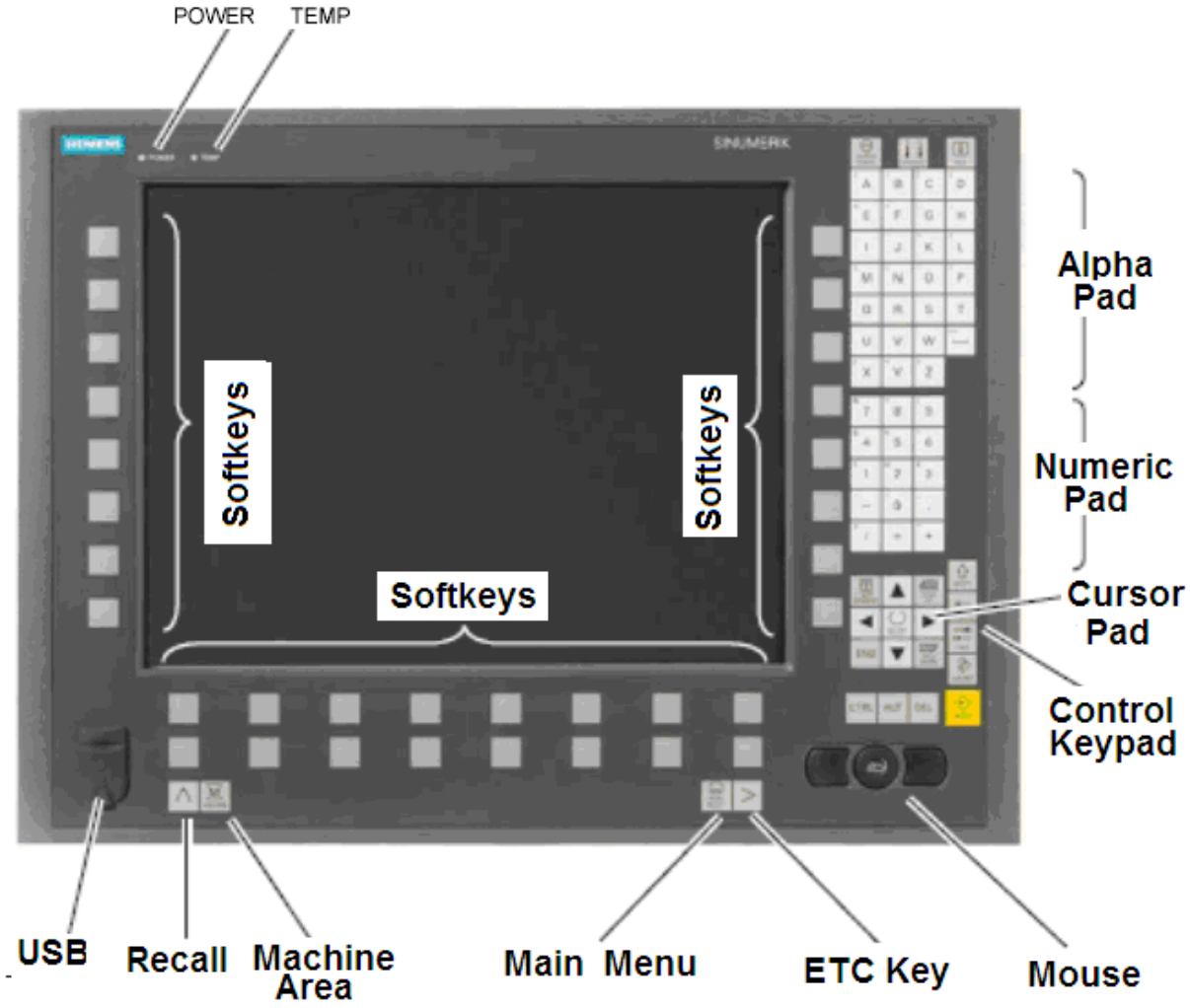
NOTE: real-time path following uses a lot of the PC resources!

CHAPTER 5 - CONTROLLER UNIT

5.1 - CONTROLLER UNIT 840D

Siemens 840D control unit;

OP015A is used as control unit.



- 15'' TFT flat color screen ve 1024 x 768 pixsel resulation.
- It consists of numerik, cursor and control butons.
- There are 2 x 8 vertical screen buttons and 2 x 8 horizontal screen buttons. Entegre Mouse
- There is USB connection in the front panel.

Changeable butons (Softkey)
This butons change according to selected menu.

Machine Buton (Machine)
To see the machine page directly.

Other Menu (Recall)
To reach other menus which are locatted. If you press one more time you can turn back.

Ext. Key
To see rest of the menu.

Main Menu (Menu select)
To reach all working menus. When you press second time, previous menu appears on the screan.
Working menus;

1- Machine
2- Parameters
3- Program
4- Services
5- Diagnosis
6- Start-up

Shift key
To use other function which is in the same button.

Switch over channel
To see the other channels if it is used more then one.

Alarm acknowledge key
To delete alarm from the screen.

Information
To reach information about alarm, PLC or something like this operation. When it appears on the screen that's mean information exists for that step or function.

Window selection key
To reach to next window if there are more than one window on the screan.

Cursor up

Previous page (Page up)
To pass previous page.

Next page (Page down)
To pass next page

Backspace
To delete

Space Buton (Blank)

Cursor left

Selection Key .To select an area to manupulate there. And also selected step made active or diactive by this buton.

Cursor right

Edit
To write a value to selected area.

End of line

Cursor down

Input key
To activate to edited value
To open or close folder
To open or close files

Delete Key
To delete values on selected area.

Tab key

Control key

Alt key

5.2 MACHINE CONTROL PANEL

Pictur e 18

Manu el (Jog): The axes can be moved in this mode and also tools can be changed.

MDA: Program can be writen by manually

Automatic mode: Part programs can be used automaticly in this mode

Referans (Ref. Point): to read axes ref. points

Positioning: This function is not used.

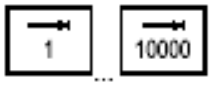
Reset: To finish to the active program.

Program stop (NC stop): To stop the program in any step.

Program start (NC start): To start to run the selected program.

Teach-in: this buton is not used.

Inc var: To go forward up to request in manual mode



Inc.: To go forward up to value that writen on the buton in manual mode.

To select X axis,

To select Y axis

To select Z axis

To select lens

,

to move selected axis in “+” or ” – “direction.

Feed rate: to control velocity of axes.

feed stop : To lock to axes movings.

feed start : To allow to axes moving.

Single block: After select this mode; selected program runs strike by strike. After all single strike the program stops then to pass to other strike NC start buton is pressed.

Z↑	Z axis goes to 0 (zero) position.
O_2	Open and close O2 gas when manual mode is active.
N_2	Open and close N2 gas when manual mode is active.
Air	Open and close AIR when manual mode is active.
DRY RUN	You can move only the axes in the programme without cutting. You have to select dryrun before cycle start. Otherwise you cannot go in to dry run while program is running.
SHUTTER	Open and close the guide laser in manual mode
TABLE FIX	Fix the table, it will not move by itself when manuel mode is active.
BACK DOOR	Opens the back door if your machine has.
FILTER	Runs the filter in manual mode. If the machine is in auto mode filter will run automatically. And it stops automatically, 1 minute later after cutting stopped.
POINTER ON	Opens the pointer.

Set 0 G57	Set the ZERO position of the axis. Set this position zero for the material to be cut.
GAS	You press this button and can change the active cutting gas output with nr. 7 potentiometer even cutting is in progress
Power	You press this button and can change the active cutting power output with nr. 7 potentiometer even cutting is in progress
NOZZLE DIST	You press this button and can change the nozzle distance with nr. 7 potentiometer even cutting is in progress
CONV FW.	Run the scrap conveyor to front direction
LENS	You can move the lens in manual mode by pressing this button and + - . When you power on the machine, you have to select jog-ref mode and select the lens with this button and you shoul press cycle start button for referancing the lens.

5.3 MACHINE BUTTON PANEL

Mod key: Key positions from left side to right side: Service 2, Service1, Automatic and Manuel. If the key position is Manuel, Machine can not go in to the automatic mode by pressing Machine Control Panel Auto button. The key have to be in automatic mode for running the machine

Activate the motor drivers and air pressure.

Deactivate the motor drivers and air pressure.

Used for Laser source Main power supply on/off.

This function is not used.

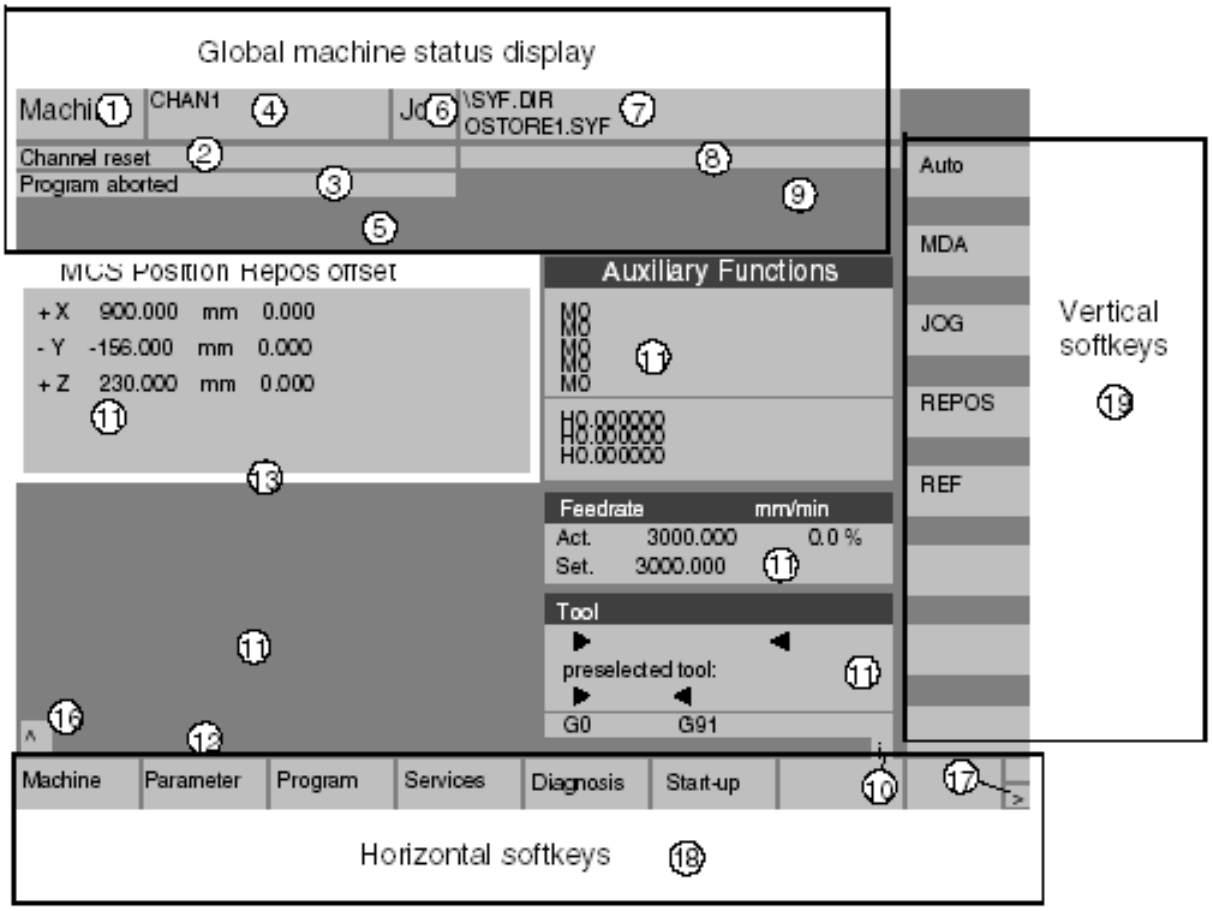
Illumination of inside of the machine is on/off

Used for machine reset . If machine is running, resets the program. If machine has an alarm clears it.

If machine has an alarm clears it.

Send the axes to the zero position already memorised.

5.4 SCREEN



1 Operation area : (Program,Machine,Parameters,Services,Diagnosis,Start-up)
2 Channel condition : Channel reset , channel interrupted , channel active
3 Program condition : Program aborted, program running , program stopped
4 Channel name
5 Alarm ve mesaj area
6 Working mode : Jog (manuel) , MDI, Auto
7 Selected program name
8 Channel using message
9 Channel condition indicates
10 Additional statements : İ information , ^ previous menu , > rest of the menu
11 Working window: to see active NC codes, to see working velocity, to see used tools , to see active steps in the program.
16 Call back functions (^)
17 Rest of the menu (>)
18 Horizantal buttons
19 Vertical buttons

5.5 CHANNEL OPERATION MESSAGES

1 stop : No NC ready
2 stop : No mode group ready
3 stop : Emergency stop active
4 stop : Alarm active with stop
5 stop : M0/M1 active
6 stop : Block ended in SBL mode
7 stop : NC stop active
8 wait : Read in enable missing
9 wait : Feed rate enable missing
10 wait : Dwell active
11 wait : Aux. Func. ackn. Missing
12 wait : Axis enable missing
13 wait : E xact stop not reached
14 wait : for positioning axis
15 wait : for spindle
16 wait : for other channel
17 wait : Feedrate override to 0%
18 stop : Error in NC block
19 wait : for NC block from external
20 wait : due to synact instruction
21 wait : Block search active
22 wait : NC spindle enable
23 wait : Axis feedrate value is 0
24 wait : for tool change acknowledgement
26 wait : for positioning kontrol
29 wait : for punching
30 wait : for safe operation
31 stop : No channel ready

5.6 MAIN MENUS (MENU SELECT)

Services: to transfer data, back up, program, to control panel or USB.

Loading part program into the control panel**:**

The part program, which was prepared in CAD-CAM program, can be loaded in two different way. By USB flash disk or ethernet connection.

By USB flash disk;

first of all this part program has to be loaded into USB flash disk and then :

‘’ Menü Select ‘’
‘’ Services ‘’
‘’ Data-in ‘’
‘’ Disk ‘’ to see to the USB.
Come to the program by arrows and press START buton.
Press ‘’ Yes ‘’ to confirm.

By ethernet connection:

First of all you have to set IP adresses of your PC as

IP adresses: 1 . 1 . 1 . 2
Subnet mask: 255 . 255 . 0 . 0
Workgroup :WORKGROUP

Connect your PC with the machine by an ethernet cable. After complate to program and generate to NC codes, save the NC codes into the machine in mpf file (840Dsystem “F”→dh→mpf.dir)

User name: auduser
Password : SUNRISE

Note**:** just english letters have to be used for program name and also no space has to be used in the name of the program.

Loading NC and PLC back up:

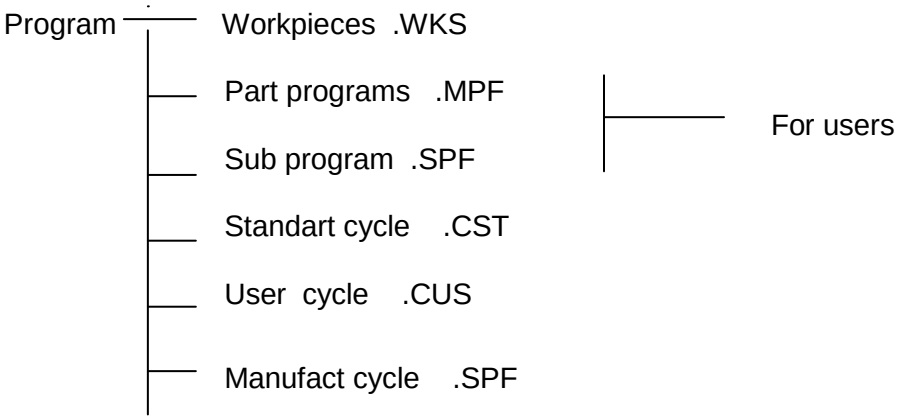
The same as loading part program operations, just back up is used instead of part program which is dispatch with the machine. So NC and PLC are loaded orderly. Due to this operation; X and Y axis must be in home position and also 1st tool must be selected.

Program: Harddisk consists of two different devices. NCU and Harddisk. Which contain part programs and system programs.

Select and edit program:

A part program, which is in the control unit, is selected and prepared to run as in the following.

- ‘’Auto’’ mode is selected
- Chanel must be reset condition, if not must be pressed to resed button.
- Press ‘’ Menü Select ’’.
- Press ‘’ Program ’’
- Press ‘’ Part Program ‘’
- After come to request program by arrows, press select program to chose it. (there is suppose to be X in the enable colomn in the line which is writen program name. If not it must be got enable through manage program.
- If you press input when you are on the request program, you can get inside the program editor.
- In editor; overwrite, mark block , copy block , delete , past block processes functions can be applied.



Change to name of the part program:

- ‘’Menü select’’
- ‘’ Program ‘’
- ‘’ Part program ‘’ come to the request program
- ‘’ Menage program ‘’
- ‘’ Rename ‘’
- write new name in the window which is appear on screen.

Delete a part program**:**

- ‘’Menü select’’
- ‘’ Program ‘’
- ‘’ Part program ‘’ come to the request program
- ‘’ Menage program ‘’
- ‘’ Delete ‘’
- press ‘’ Yes ‘’ so complete the operation.

CHAPTER 6 – POINTS TO BE CONSIDERED FOR IPG LASER

6.1 - GENERAL CONDITIONS

N	Characteristics	Min.	Typ.	Max.	Unit
1	Operating Ambient Temperature Range	5		45	°C
2	Humidity, Ambient Temperature Range ≤ 40°C	10		95	%
3	Storage Temperature without water	- 40		+ 75	°C

Dust concentration has to be max.15 mg/m^3
Grounding of IPG has to be 0,5 – 2 Ω
Speed of Ethernet has to be 100Mbit for remote connection.

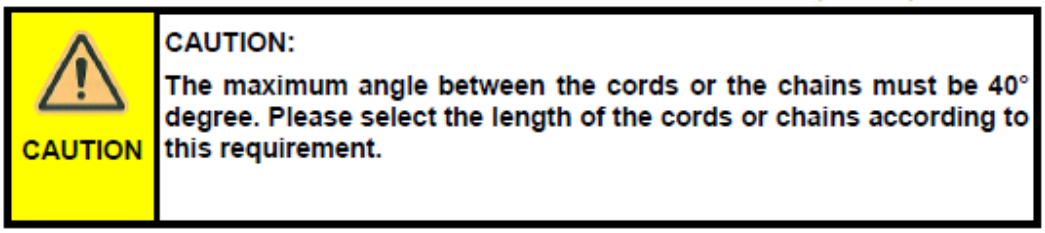
6.2 – POSITION

The laser must become brought in such a position that doors and side panels can be reached for service (1 meter space to each side). The length of supply and control lines must be arranged in a way that laser can be moved 1m.
Air chiller it is necessary that at least 1000 mm free space is between air inlet and the next wall.

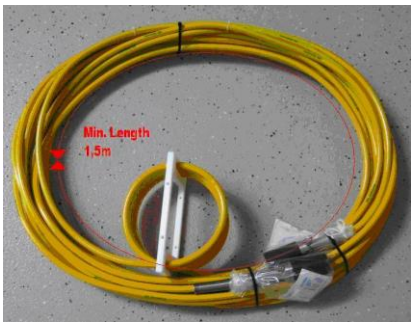
6.3 – TRANSPORT

If the laser arrives on a pallet it can be moved by a fork lifter (Picture 5-3).
On the upside of the laser transport eyes are fixed. With lifting equipment the laser can be lifted from the pallet. Take care of the barycentre and make sure the device is not tipping.

If the laser arrives in a box and is not placed on a pallet it must be removed from the box by a crane. Therefore the special mountings which are attached to the laser must be used.



6.4 - GENERAL FIBER HANDLING



6.5 - FIRST START UP

General switching on procedure

Please follow these instructions to switch on the laser to ensure proper operation.

(1) Turn the Main Disconnect switch of the laser to ON position.

(2) If an external chiller is used, turn the Main Disconnect switch to ON position.

(3) Ensure that all valves are open. If a water/water chiller is used ensure that the external water supply is present.

(4) If optics in an external Dust Free Enclosure is used, turn the Main Disconnect switch to ON position.

(5) If an external chiller is used, turn the Operation switch at the chiller from 0 to 1.

(6) Turn the key switch at the front side of the laser to TEST or ROBOT depending on the application. After turning this switch, you should wait for 10 second to turn new position.

General switching off procedure

After completion of the work switch of the laser following the procedure below:

(1) Switch off the laser emission.

(2) Switch off the main power supply.

CAUTION	If the laser is located in a place where there is a risk of frost, do NOT follow this instruction any further. Ensure that all valves of the system stay open. The tempered cooling water will prevent the system from frostiness caused damages.

(3) Turn the key switch at the front side of the laser to OFF position.

(4) If an external chiller is used, turn the Operation switch at the chiller from 1 to 0.

(5) If an external chiller is used, turn the Main Disconnect switch to OFF position.

(6) DO NOT turn the Main Disconnect switch of the laser to OFF position. It should remain in ON position.

CAUTION	**Ensure that the laser system (including external chiller and external DFE) is placed in a frost-free location.** **If this can not be guaranteed, the complete water must be removed from the system (laser, external DFE and external chiller) if the system is switched OFF for a long time and the heating can not stay in operation.**

6.6 - MAINTENANCE

IPG Laser recommends periodic maintenance by IPG Laser to ensure proper operation of the system.

8.1.1 Water leakage

Checkpoint	Water leakage
Method	Visual inspection
Clearance	Weekly
Expenditure of time	< 5 min.
Tools	Flashlight
Description	Open the doors of the laser and the chiller cabinet and look for water leaks, leaky connections, damaged pipes…

8.1.2 Water level

Checkpoint	Water level
Method	Visible inspection
Clearance	Weekly
Expenditure of time	5 – 15 min (incl. refilling)
Tools	-
Description	Check the water level of the TAB water and the DI water reservoir using the accordant level indicators.  Therefore open the rear door, right side of the laser (in case of integrated chiller) or the rear door of the chiller. If necessary refill TAB / DI water using the accordant filling nipple. For the external optics cooling circuit only DI water must be used!

8.1.3 Water filter

Checkpoint	Water filter
Method	Visual inspection
Clearance	Monthly check / annually exchange
Expenditure of time	20 min.
Tools	Wrench, 19mm / 23 mm
Description	Once per month the filter at the water input nipple should be checked and cleaned if necessary to ensure optimum water flow rate. Once per year the filter should be replaced. The filter is placed at the water input nipple at the rear side of the laser. Before removing the filter the chiller must be switched of and all valves should be closed. If the filter is very dirty the complete water should be changed. 

8.1.4 Cooling water quality

Checkpoint	DI water quality / conductivity
Method	Visual inspection
Clearance	Monthly
Expenditure of time	30 min.
Tools	-
Description	Check the DI water conductivity using LaserNet property page chiller. If the conductivity is higher than 15µS/cm a warning will rise. Replace the DI cartridge. For further information use the Chiller operational manual. DI cartridge can be ordered at IPG Laser.

8.1.5 Filter pad

Checkpoint	Filter pad at external chiller
Method	Visual inspection
Clearance	Monthly
Expenditure of time	20 min.
Tools	Screw driver
Description	Depending on the air quality of the facility the filter pad needs to be replaced more often. Only a clean filter pad will provide optimum air flow and cleanness for the chiller. Filter pads can be ordered at IPG Laser. 

****Do not open the front and rear doors of the laser case, if laser emission is ON.**
****Do not open the device. There are no user serviceable parts, equipment or assemblies in this product. All service and maintenance shall be performed by qualified IPG personnel.**

8.2 Laser parameters

LASER SAFETY GOGGLES

If the laser is operated in Service Mode all personnel near by the laser must wear laser safety goggles!

IMPORTANT ADVICE:

Only special trained personnel are allowed to carry out the maintenance work mentioned below.

8.2.1 Output power

Checkpoint	Output power
Method	Performance test
Clearance	Annually
Expenditure of time	2 hours
Tools	Power measurement device
Description	To check the output power ask IPG laser for more detailed performance instructions.

8.2.2 Beam quality

Checkpoint	Beam quality
Method	Performance test
Clearance	Annually
Expenditure of time	2 hours
Tools	Beam quality measurement device
Description	To check the beam quality ask IPG laser for more detailed performance instructions.

8.3 Service to be done by IPG

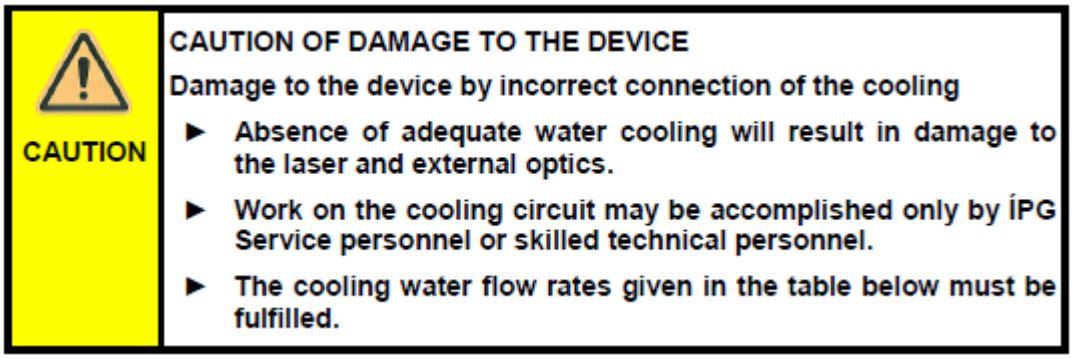
8.3.1 Laser Module exchange

Checkpoint	Laser module
Method	Performance test
Clearance	In case of damage
Expenditure of time	~ 3 hours
Tools	IPG Laser
Description	Please inform your provider about the module failure. For a preliminary analysis send the Log files and the Events file to Support.Europe@ipgphotonics or to your IPG Service representative.

8.3.2 Feeding fiber exchange

Checkpoint	Feeding fiber
Method	Performance test
Clearance	In case of damage
Expenditure of time	~ 3 hours
Tools	IPG Laser
Description	Please inform your provider about the feeding fiber failure. For a preliminary analysis send the Log files and the Events file to Support.Europe@ipgphotonics or to your IPG Service representative.

6.7 - WATER CONNECTIONS, FLOW RATES AND ADDITIVES



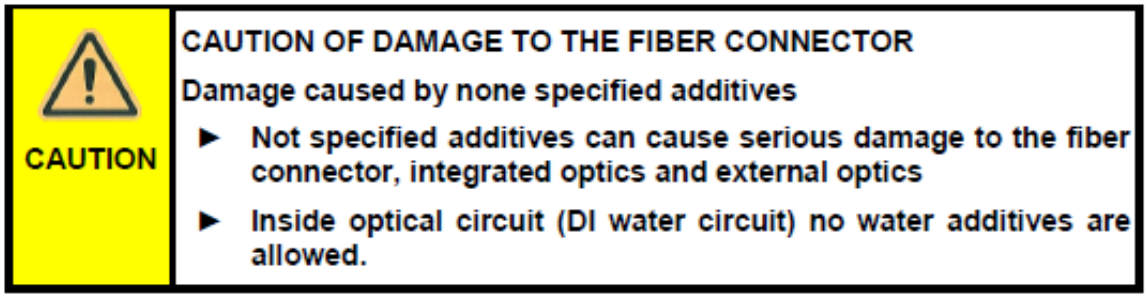
Lasers type YLS with power up to 2.5 kW only have one cooling circuit for laser and optics. DI water may be used only.
Lasers type YLS with power more than 2.5 kW have two cooling circuit. TAB water (drinking water quality) should be used for laser cooling. DI water should be used for optics cooling.

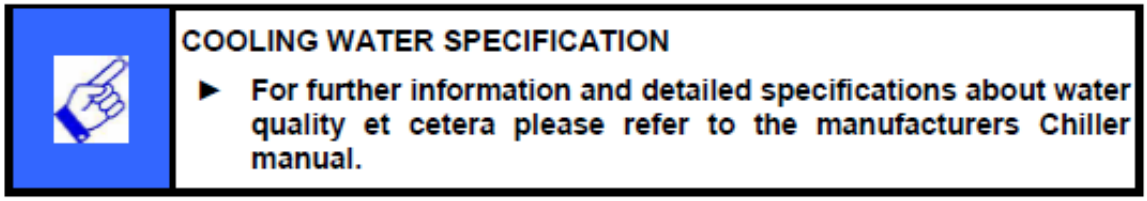
6.7.1 – COOLING WATER FLOW RATE

Laser power , kW	Minimum Laser cooling water flow , l/min	Optimal laser cooling water flow , l/min	Minimum DI water flow , l/min	Optimal DI water flow , l/min	TAB Water connection	DI Water connection
Type: YLS-compact						
1.0 kW	5	10	0.5	1.0	-	¾", ½"
1.2 kW	5	10	0.5	1.0	-	¾", ½"
2.0 kW	10	15	0.5	1.0	-	¾", ½"
2.5 kW	10	15	0.5	1.0	-	¾", ½"
Type: YLS						
1.0 kW	5	10	0.5	1.0	¾"	½"
2.0 kW	10	15	0.5	1.0	¾"	½"
3.0 kW	15	20	1.0	1.5	¾"	½"
4.0 kW	20	25	1.0	1.5	1"	½"
5.0 kW	20	30	1.0	1.5	1"	½"
6.0 kW	20	35	1.0	1.5	1"	½"
8.0 kW	20	40	1.5	2.0	1"	½"
10.0 kW	30	50	1.5	2.0	1"	½"

Table 5-1: water flow minimum requirements

If you heard about problems with bacterial polluted water or algae growth inside cooling systems in your company, we recommend using the long term biocide Nalco 77352 in the water circuit of the laser. Please follow the instructions given by the manufacturer. The list of suppliers you will find on www.Nalco.com.





6.7.2 - DEW POINT TEMPERATURE TABLE

There is a risk of condensation damage when laser is placed in a high temperature and humidity environment, while cooling water temperature is colder than the dew point of the surrounding air. The cooling water temperature must always be above the dew point temperature.

	Relative Humidity, %															
Air temp.	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
16°C				0	2	4	5	7	8	9	10	11	12	13	14	15
18°C			1	3	4	6	8	9	11	12	13	14	15	16	17	18
21°C		1	3	5	7	9	11	12	13	14	16	17	18	18	19	21
24°C		3	6	8	9	11	13	14	16	17	18	19	20	21	22	23
27°C	2	5	8	10	12	14	16	17	18	19	21	22	23	24	25	26
29°C	4	7	10	12	14	16	18	19	21	22	23	24	26	27	28	28
32°C	7	10	12	15	17	19	21	22	23	25	26	27	28	29	31	31
35°C	9	12	15	17	19	21	23	24	26	27	29	30	31	32	33	34
38°C	11	14	17	20	22	24	26	27	29	30	31	33	34	35	36	37

Table 5-2: Dew point temperature table (min. cooling water temp.)

**** Tab water particle size <500 µm**
**** DI water conductivity <10µS**

6.8 - OBLIGATION OF OPERATOR

It is the operators obligation that personnel working with the device
► is briefed in fundamental regulations of safe performance of work, accident prevention and operation of the device

► have read, understood and confirmed by signature reading chapter 2 Safety and Accident prevention in this user manual

► is briefed in laser safety regulations according to legal requirements

6.9 - OBLIGATION OF THE PERSONNEL

All personnel working with the device is obligated to
► Have received briefing in fundamental regulations of safe performance of work, accident prevention and operation of the device

► have read, understood and confirmed by signature reading chapter 2 Safety and Accident prevention in this user manual

► is briefed in laser safety regulations according to legal requirements
before start working with the device.

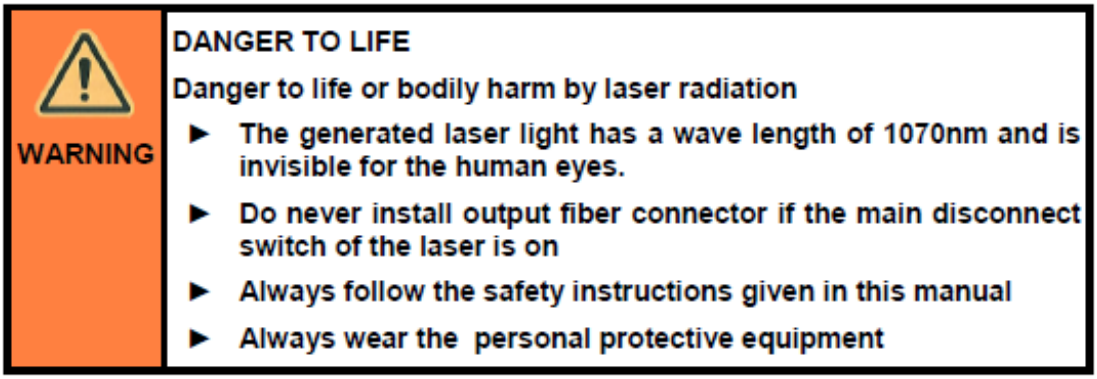
6.10 - PROTECTIVE EQUIPMENT

The protective equipment (adequate laser safety goggles for accordant power and wave length) must be provided by the operator (only necessary in case of maintenance – Service mode active).

Safety precautions during normal operation
Operating the device is allowed only when all safety installations are in function.
The device must be checked for visible damages and for damages of the safety installations once a week.

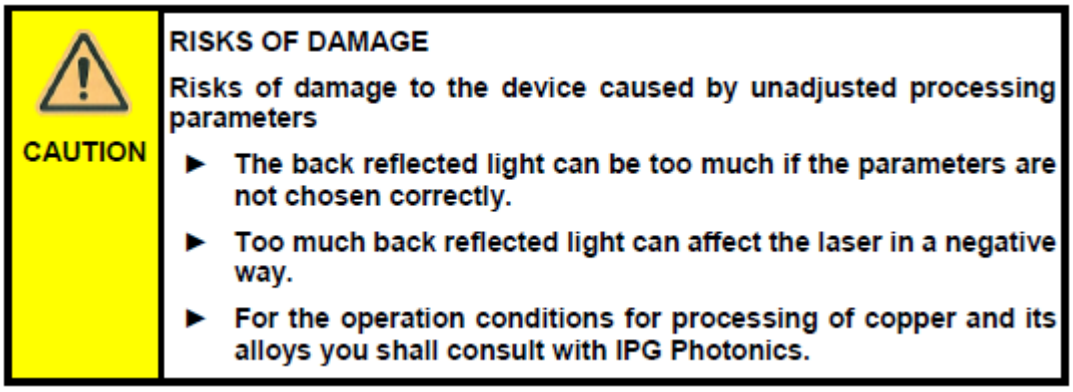
Safety instructions on maintenance, inspection, and installation work
As a basic rule, none of the cleaning or maintenance tasks may be performed until the device has come to a complete stop. The shutdown procedure described in the operating instructions must be observed. As soon as this work has been completed, all the safety devices and protective equipment must be mounted or installed according to their proper function.

The human eye is exceptionally jeopardised to this infrared (invisible) laser radiation due to the focusing effect of the pupils at the retina. Heating or even burning effects will occur at the retina which will cause degradation or even loss of eye-sight.
This level of light power is extremely dangerous. Despite radiation being invisible, the scattered beam may cause irreversible damage to the cornea. Laser safety eye wear is not provided with this instrument, but must be worn at all times while the laser is in operation.

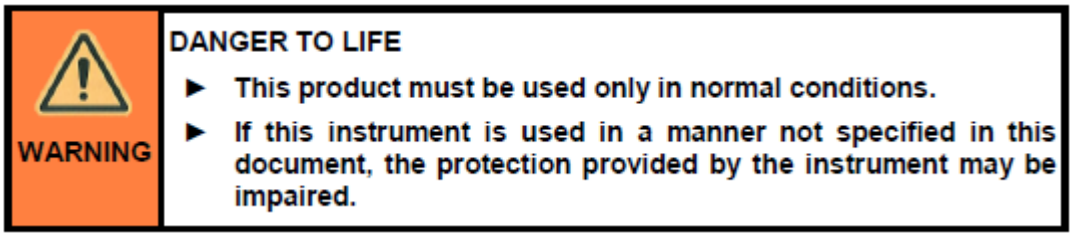


During maintenance work at the laser of class IV, all personnel must wear appropriate laser safety goggles. The laser safety goggles must match with the wavelength and the maximum output power of the laser.
Only qualified personnel is authorised to defeat the interlocks for maintenance work.
Exposure of the skin to high power laser beams can cause burns.
For the operation conditions for processing of copper and its alloys you shall consult with IPG Photonics.

NEVER look directly into output connector when laser is ON and make sure that the appropriate laser safety glasses are worn at all times while operating the product



The use of optics (Fibers, Beam Coupler, Beam Switch, process fibers, material processing head) which are not authorised by IPG Photonics or one of its subsidiaries respectively, will not be covered by warranty.



6.11 - MEANING OF THE LABELS