

Plasma Cutting Unit

Plasma 33 H

These operating instructions are intended to ensure safe and efficient work with the Plasma 33 H cutting unit.

Please read the instructions carefully prior to initial operation of the unit.

The information contained in this manual should be made available to all operational staff. Please keep the instructions always ready-to-hand, near the machine.

DECLARATION OF CONFORMITY

within the meaning of EC recommendation EMC 89/336/EEC, appendix I
respectively of EC recommendation 73/23/EEC, appendix III B

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We declare, that below mentioned current source corresponds to the safety requirements of the recommendations.

Name of unit: **Plasma Cutting Unit**

Type of unit: **Plasma 33 H**

Relevant
EC recommendations: EMC recommendation 89/336/EEC,
modified by recommendation 92/31/EEC

Low-voltage recommendation 73/23/EEC,
modified by recommendation 93/68/EEC

Applied
harmonized standards: EN 50 199
EMC product standard
for arc welding equipment

Especially: EN 60974-1
Arc welding equipment –
Welding power sources

Jäckle Schweiß- und Schneidtechnik GmbH



Reinhard Jäckle

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Subject to mistakes and technical modifications

BA – Nr.: 700.021.002

Version 1.03
February 2004

1. Some general information about plasma cutting

1.1 Operating principle

In a plasma torch, the air is heated to an extremely high temperature through an electric arc, thus forming an electroconductive plasma which allows the cutting current to flow from the electrode to the workpiece. The small-size bore of the cutting nozzle constricts the cutting current and produces a strongly concentrated plasma cutting jet. It causes the metal to melt very rapidly, and its highly kinetic energy ejects the molten metal from the kerf. A clean, clear cut is the result.

1.2 Advantages

Time saving due to high cutting speed in cutting thin sheet metal, if compared to oxy-fuel gas cutting, nibbling or sawing.

Heat build-up is kept at a reduced level due to the high cutting speed and a strongly concentrated plasma arc. Therefore, warping of the workpiece is very unlikely.

Ease of operation.

Low operating expenses due to compressed air being used as plasma gas.
Low energy - high efficiency.

1.3 Field of Application

The plasma cutting method is applicable on almost any conductive metal, ie. high alloy chrome nickel steels, any hardened and unhardened tool steels, constructional steels, nonferrous metals like aluminium and its compounds, brass, copper and even grey cast iron.

2. Safety Requirements

This cutting unit has been manufactured in accordance with the relevant international standards. However, improper use or manipulation of the machine may cause hazards.



- a) The unit is exclusively intended for plasma cutting processes. Service personnel must be duly informed of all safety rules.
- b) Electrical repair work must be carried out by qualified electricians.
- c) Always disconnect mains prior to servicing, maintenance, and repair work and before opening the casing.

The following safety instructions must be strictly observed:

2.1 Fumes

The plasma cutting process generates fumes and therefore the plasma cutting unit must be operated in areas with adequate ventilation or outdoors. In the case of enclosed working areas, a strong fume extraction system (preferably fitted below the cutting zone) should be provided.

The cutting area of the workpiece has to be cleaned and free of solvents and degreasing agents to prevent the formation of toxic gas.

The use of breathing equipment as well as a powerful extraction system and filtering of toxic gas and fumes is obligatory when cutting materials which are likely to develop toxic gases. Such materials include lead (also lead coatings), galvanized parts, cadmium, cadmium-plated bolts, beryllium (usually as an alloying constituent, ie. beryllium copper).

2.2 Radiation

The radiation from the arc may cause eye damage and skin burn. Therefore, eye protection should be worn in the form of a welder's shield or a helmet. The skin must be protected by adequate safety clothing (welder's gloves, leather apron, safety shoes).

Persons working close by should also be protected from the radiation of the arc.

2.3 Fire risk

Inflammable substances must be kept away from the cutting zone. There is a risk of igniting by sparks and hot slag.

2.4 Electrical hazard

Plasma cutting is carried out under high-tension conditions which require utmost precaution.

Any defective or damaged parts on the torch must be replaced immediately. When exchanging a part, always disconnect the unit (master switch in pos. 0). Only original spare parts may be used on the torch.

If any insulation damage is found on the hose pack or on the torch head, the operation of the unit is to be discontinued until the damage has been repaired.

2.5 Further conditions and provisions

Apart from the instructions given in this operating manual, the general safety standards, in particular the rules for prevention of accidents

BGV A2 (electrical installations and operating supplies) and
BGV D1 (welding, cutting and related working processes).

These rules may be obtained from

Carl Heymanns-Verlag KG (publisher)
Luxemburgerstraße 449
50939 Köln

Furthermore, we point out that in some operative ranges where, despite the observance of radiation limits, this cutting unit can cause electromagnetic interferences which are the responsibility of the user.

This means that in the domain of hospitals, for instance, the function of electromedical units, data-processing equipment and the like (ECG, PC etc.) may be impaired.

Before putting the cutting unit into service, please make sure to inform the authorities in charge of the above mentioned equipment. If you wish to apply for a special authorization as provided by the Law on Electromagnetic Compatibility of Technical Equipment, §3 section 4, regarding the use of this cutting unit, please address to your competent Authority.

If you wish to use the cutting unit in domestic areas, special precautions have to be taken as well.

Adequate assistance in evaluating the operative range and minimizing electromagnetic interferences (eg. use of screening lines) may be obtained from the Electromagnetic Compatibility Standards for Arc Welding Systems.

See EN 50 199, annex A1 and A2.

3. Brief description

Its operating principle is characterized by the following:

Compressed air serving as plasma gas and cooling medium for the plasma torch

A high-grade filter welding regulator together with a downstream micro filter are standard equipment on this unit.

The finely filtered, pressure-controlled air expands in the plasma torch body and serves, for one thing, as plasma gas and, for another, as a cooling medium for the torch body to protect against high thermic load.

HF-ignited pilot arc. A pilot arc which is initiated by a high-frequency spark starter ensures reliable ignition of the cutting arc even on lacquered workpieces. In addition, this appliance is suited for automatic cutting processes.

Automatic cutting process via control board.

Safety cut-out. In the event of a pilot-arc failure, the current source switches off after approx. 2 seconds to protect the operator from a build-up of no-load voltage.

Service friendly design.

All components are easy to change.

5. Control Elements

Master switch (Front panel)

Position "O": unit is switched off.

Position "I": unit is switched on.

Control lamp 'mains' (Front panel green)

is lit when unit is switched on.

6. Initial operation

6.1 Place of installation

The unit should not be exposed to moisture, welding spatter and the direct ray of sparks at grinding works.

6.2 Mains connection

Fit a power plug to the mains cable as indicated on the rating plate. The 3 phases (black, brown, blue) may be connected to L1, L2, L3 as you like.

4.3 Connecting the compressed air

Connect compressed air supply by rapid action hose coupling at the backside of the unit.

The mounted filter pressure reducer regulates the connected compressed air supply to the correct working pressure. Pay attention to a sufficient pressure and a sufficient flow quantity of the pressure air supply. Besides the air must be as free as possible from oil and water.

Warning! The water tanks must be emptied periodically.

The water tank empties automatically itself, when the air system becomes pressureless. If the machine is fixedly connected to a compressed air supply being continuously under pressure, the machine must be separated from the compressed air supply to empty the water tank.

4.4 Connecting the torch

The cutting torch is already connected to the unit in factory. Both parts are tested and delivered as one unit.

If the cutting torch must be exchanged later on, an expert must take off the housing bonnet and connect tightly the new torch at the corresponding connections. The blade terminals of the torch trip line may be plugged into the trip line socket as you like.

Warning! Pull power-supply plug prior to opening the casing of the plasma unit.

4.5 Equipping the torch

Fit the plasma nozzle into the torch.

Plasma nozzle and electrode are wear parts. A plasma nozzle with a badly burnt-out hole and an electrode with a large penetration crater involves worse cutting quality and striking characteristics. These parts must be exchanged by original wear parts.

At the exchange of wear parts take care that they are tightened fastly.

The cut may be done with distance nozzle as well as with plasma nozzle leaning on the workpiece.

4.6 Connecting the workpiece

Plug the workpiece cable into the socket for workpiece connection. Attach the workpiece clamp to a better-conducting part of the workpiece, i.e. not on paintwork or rust.

7. Cutting

7.1 Striking the pilot arc

Carry the cutting torch to the starting-place of the scheduled cut.

Press the torch trigger. After a short gas preflow (about 0,5 sec.) the pilot arc is ignited. When the pilot arc touches the workpiece, the cutting arc arises.

If the cutting arc does not arise the pilot arc automatically switches off after ca. 2 seconds.

Warning! Don't repeat igniting the pilot arc unnecessarily often without cutting. The pilot resistor may be overstressed and the wear parts of the torch are more stressed.

7.2 Cutting

For manual cutting operation pull the torch - lightly leaning on the workpiece - across the workpiece with constant speed.

It is important to observe the suitable cutting speed according to the material thickness for getting an optimal cut. If the cutting speed is too slow, the edge of cut doesn't get sharp in consequence of the intense input of heat. The optimal cutting current is achieved if the cutting beam leans lightly backwards during the cutting operation.

If the torch trigger is released, the cutting beam is extinguished and the current source switches off. The gas will continue to flow for ca. 1 minute in order to cool the torch. If the plasma beam tread out of the workpiece the current source switches off too.

Warning! Don't switch off the machine during the gas post-flow period as this could involve damages by torch overheating.

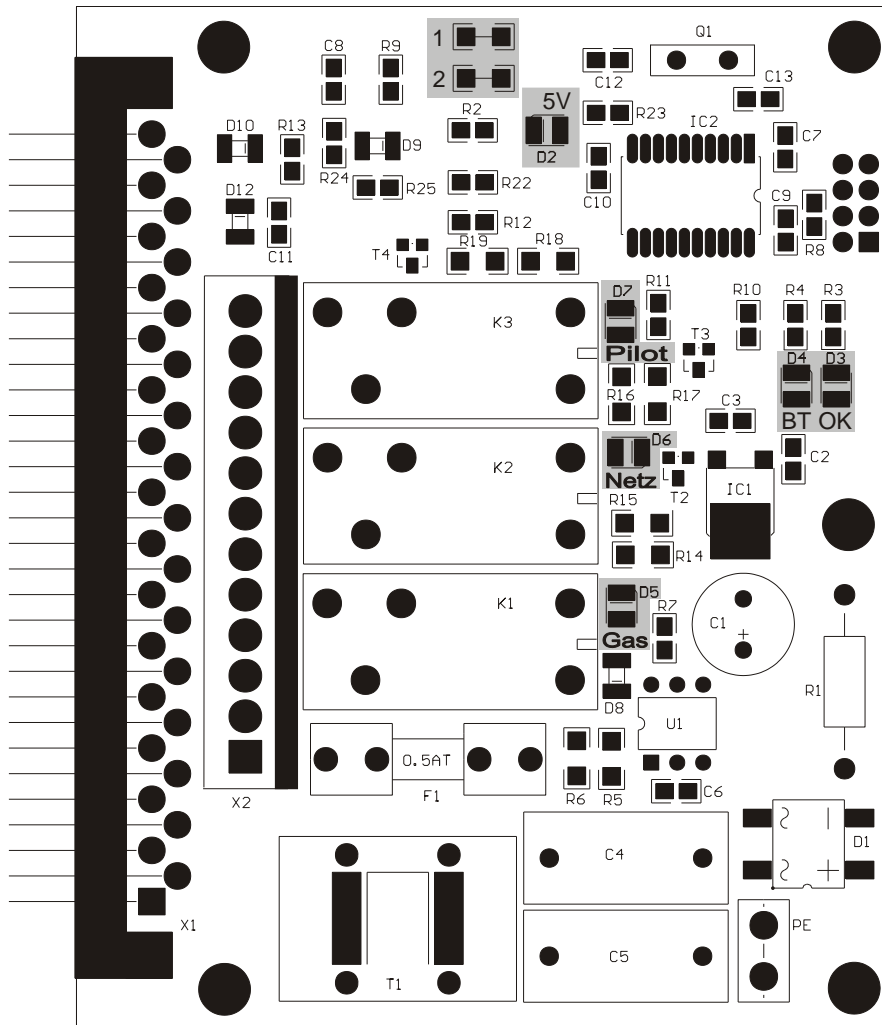
For hole piercing in manual cutting operation firstly hold the manual cutting torch sloped and then change into vertical position in order to reduce spatter formation on the plasma nozzle.

8. Service and Maintenance

This cutting unit should be serviced in regular intervals dependent on operating times and working place conditions.

- Check filter pressure reducer unit. Change cartridge, if required.
- Clean unit from inside by air-blasting according to degree of soiling.

9. Functional description of the control PCB



Picture 9.1 View on the PCB PL 3

The components in the grey fields have the following functions:

- The LED D2 ,5V' indicates the correct voltage on the PCB.
- The LED D3 ,OK' shows the normal function of the microprocessor.
- The LED D4 ,BT' shows the function of the torch trigger and the possible errors. They are described in the next chapter 'error messages'.
- The LED's D5 ,Gas', D6 ,Netz' and, D7 ,Pilot' are illuminated, when the relay next to the led is switched on by the microprocessor.

10. Error messages of the control PCB

The control PCB has the possibility to find some errors in the working cycle. These errors are shown below:

Errors in the machine:

The LED D4 ,BT‘ indicates why the microprocessor can not turn on the machine or why the machine is turned off.

The LED D4 ,BT‘ shows the errors by flashing.
There are 2 normal- and 4 error states:

Number of flashes	Description
Normal functions:	
no light	Torch trigger is not pressed
permanent light	Torch trigger is pressed
Error functions:	
1x flash	The cutting transformer has turned off, no cutting current
2x flash	The reed contact has turned off, no cutting current
3x flash	Reed contact is faulty, machine can not turn on
4x flash	Pilot time longer than 2 seconds, safety turn off

Every flashing sequence repeats after a short interrupt.

The error message (led flashing) is shown until the torch trigger is pressed again.

In normal function, the PCB always shows one of the possibilities in the error table.

Errors in the microprocessor:

If the microprocessor himself has a problem, the LED D3 ,OK‘ has no light or a permanent light.

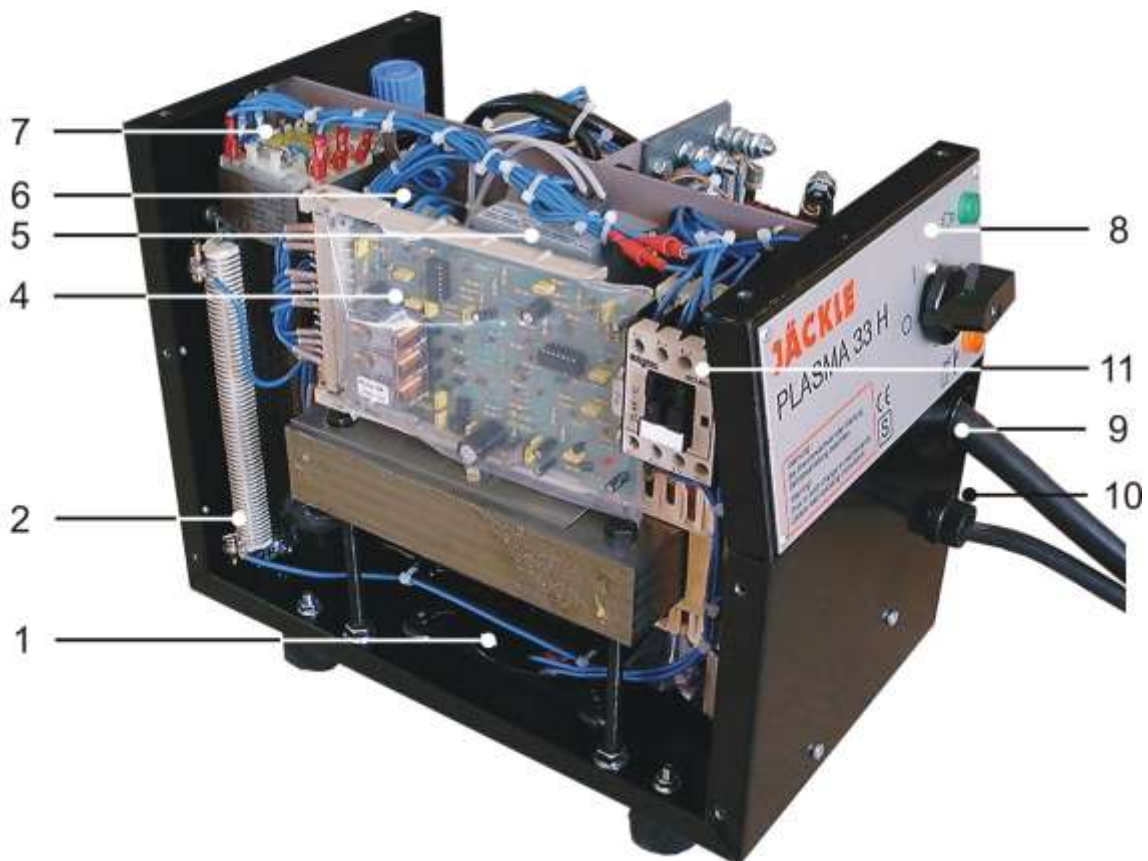
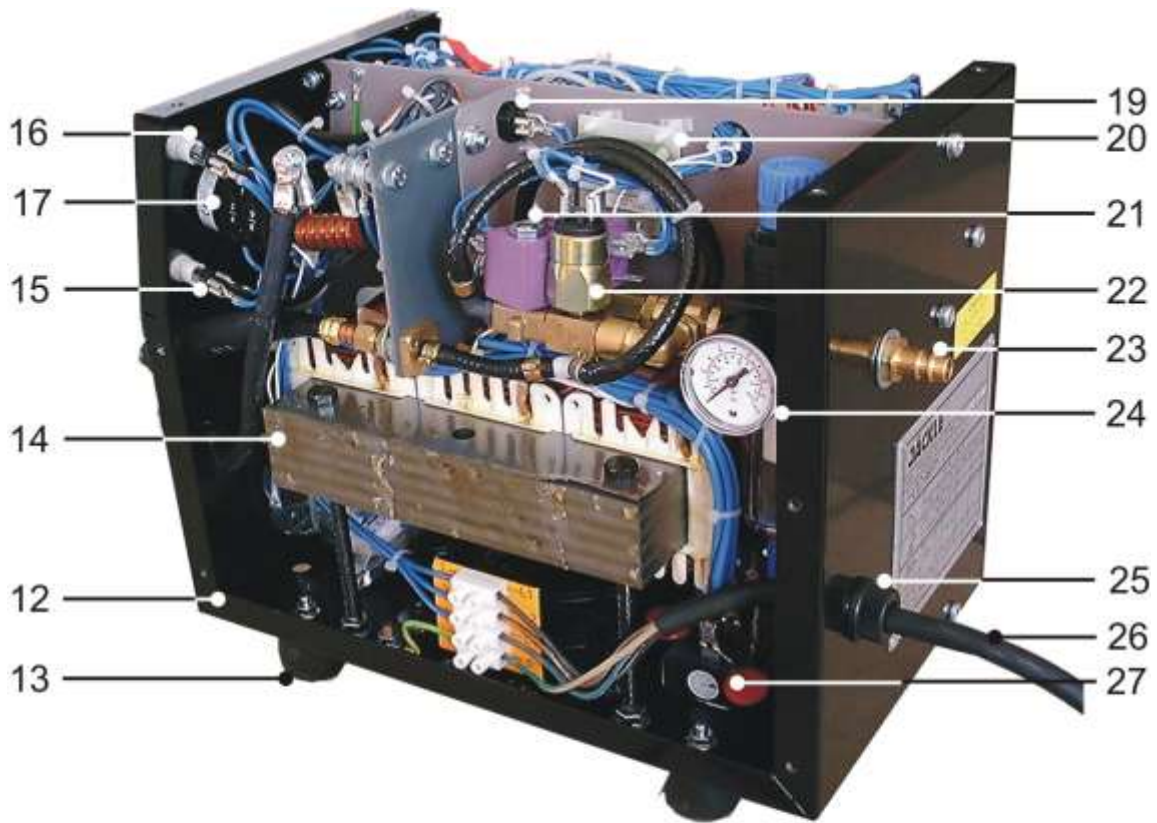
In normal function, the LED flashes with a frequency of 1Hz.

11. Trouble-Shooting

Warning! Defects at the electrical unit may only be repaired by a specialist.

Trouble	Cause	Remedy
Mains connected and main switch turned on / fan doesn't run	mains fuse is faulty	check mains fuse
	mains cable is interrupted	check mains cable
	fuse F1 at auxiliary transformer is faulty	change fuse F1 (2 A slow / 250 V)
Fan is running / mains lamp does not come on	light bulb is faulty	check / change light bulb
No function when torch trigger is pushed, even the contactor doesn't switch	parts at the torch head are incompletely mounted (safety circuit)	check torch head
	torch trigger defective	check torch trigger
	torch trigger control lead interrupted	check torch trigger control lead
Malfunction lamp comes on when torch trigger is pushed	insufficient pressure air supply	remove shortage of compressed air
	overheating of the machine	unit is ready for work again after ca. 5 minutes if fan is running
Mains contactor switches when torch trigger is pushed, but pilot arc doesn't arise	machine is running on 2 phases (mains fuse is faulty, one mains lead is interrupted)	check mains fuse check mains leads
	torch parts defective	check / change torch parts
Pilot arc is burning / cutting arc does not arise	workpiece lead not connected	attach the workpiece clamp to the workpiece
Cutting arc is burning / poor cutting quality or insufficient cutting power	bad earthing contact at the workpiece	check / clean earthing contact (rust, paintwork, oil, grease)
	insufficient pressure air supply	check pressure air supply
	plasma nozzle or electrode has burnt out	check / change plasma nozzle electrode
Cutting arc switches off	cutting speed too slow	see chapter 7.2 Cutting

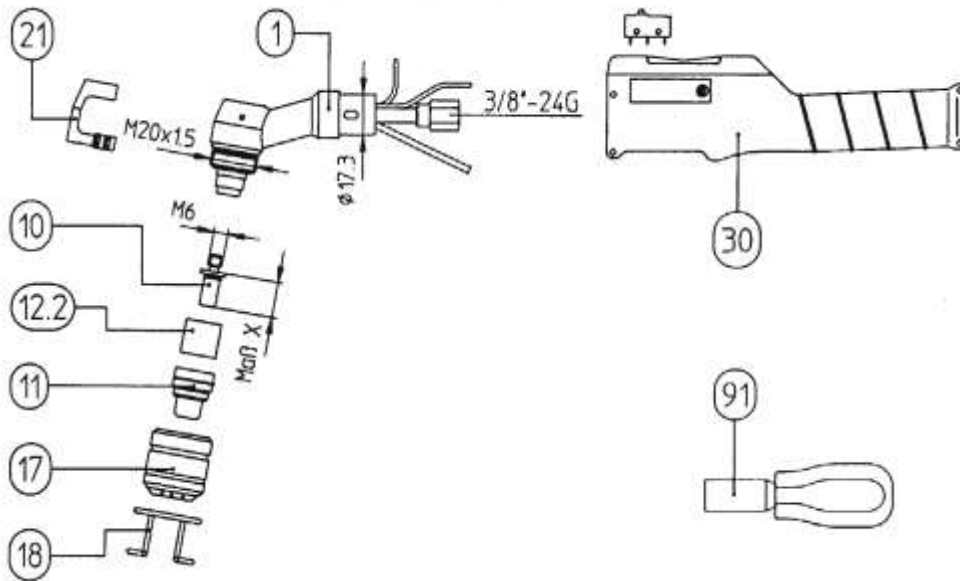
12. Spare Parts



Picture 12.1 Sideview

Item.	Description	Stocknumber
1	Fan 121mm	450.115.001
2	Pilot arc resistor LP 3-4 4,1 Ohm	452.040.011
4	P.C.board PL 3	600.008.017
	Fuse 1 A slow for P.C.board	464.010.005
	Current transformer	438.077.006
5	Ignition unit SIG 3.6 / 24 V	438.036.009
6	HF transformer	706.021.003
7	Aux. transformer 24/230/400 V	462.024.018
8	Front panel Plasma 33 H	304.021.008
9	Cable bushing SB 1093-14 diam. 28 mm	310.285.032
10	Work cable compl. 16 mm ² , 3,5 m long	702.160.006
11	Contacto DL 4K-10 / 24V	442.024.011
12	Housing compl., black coated	715.021.001
13	Rubber foot, diam. 35x32 mm	310.350.001
14	Cutting transformer Plasma 33 H compl. w. cable	706.021.001
	Thermoswitch 170°C (break) for cutting transformer	445.170.002
15	Plug-in socket yellow	712.024.004
16	Plug-in socket green	712.024.002
	Bulb 24 V	463.024.012
17	Main switch M225-645235	440.220.033
	Grip for main switch	440.225.051
18	Housing bonnet	715.021.007
	Case handle	305.179.005
19	2 channel blade terminal socket DC 68	410.002.020
20	HF terminating PCB P1-H	600.021.001
	Distance piece CBS - 9A for PCB	421.008.005
21	Solenoid valve, nom. diam. 2,5 / 24 V G 1/8	465.018.006
	Pressure reducing nozzle M 8 x 10 / diam. 1,3 mm	357.810.012
	Barrel nipple G 1/4 - 1/4 - M 8 for nozzle	357.144.015
	Elbow-type screwed socket G 1/8 - 6	354.186.016
	Tube 6x3 mm, black	356.006.022
22	Manometric switch 1-10 bar M 10x1	444.001.001
23	Nipple w. male rapid action coupling DN7,2-G1/4A	355.014.010
24	Filter press. reducer w. manom. G1/4, entrance right	351.140.004
	Filter element white for pressure reducer	351.140.028
	Water tank for pressure reducer	351.140.022
25	Screwed cable gland PG 11	420.011.002
26	Mains cable compl. 4 x 1,5 mm ² , 4m	704.015.006
27	Rectifier E50 DB 380/500-40 compl. w. 6 varistors	701.021.001

13. Spare parts torch PSB 31 HF S

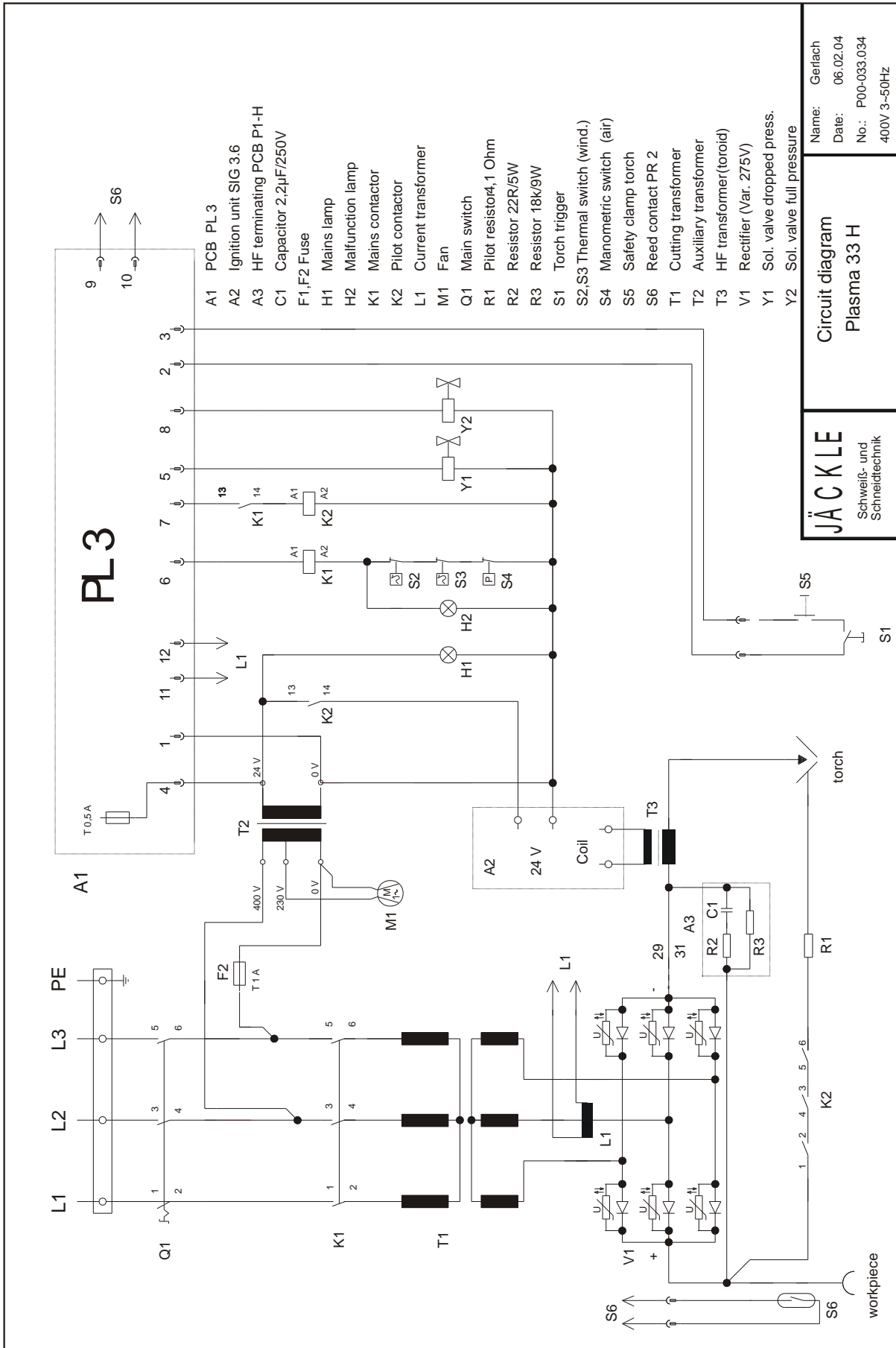


Item.	Description	Specifications	Part No..
	Plasma cutting torch PSB 31 HF S	4 m long, G 1/8	742.0178
	handle with single action switch		
1	Torch body PSB 31 S		742.0104
10	Electrode (ZR) diam. 6.8 mm	Dim. x= 16.0 mm	742.0017
11	Plasma nozzle diam. 1.0 mm		742.0011
12.2	Insulating sleeve for HF-version		742.0038
17	Cap		742.0004
18	Spring		742.0089
21	Safety clamp cpl.		742.0099
30	Handle with single action switch		742.0044
	consisting of:		
	Handle, left and right		742.0081
	Trigger		742.0041
	Pressure spring		742.0045
	Micro switch		185.0023
	Dowel pin 2x12		073.0004
	Screw M2,2x13		079.0006
91	Electrode wrench		743.0064

Warning:

Any service on the torch should be performed when the machine is switched off and disconnected from the power panel. Injury or death could occur otherwise.

14. Circuit diagram



JÄCKLE Schweiß- und Schneidtechnik	Circuit diagram Plasma 33 H
	Name: Geilach Date: 06.02.04 No.: P00-033.034 400V 3-50Hz

Circuit diagram Plasma 33H