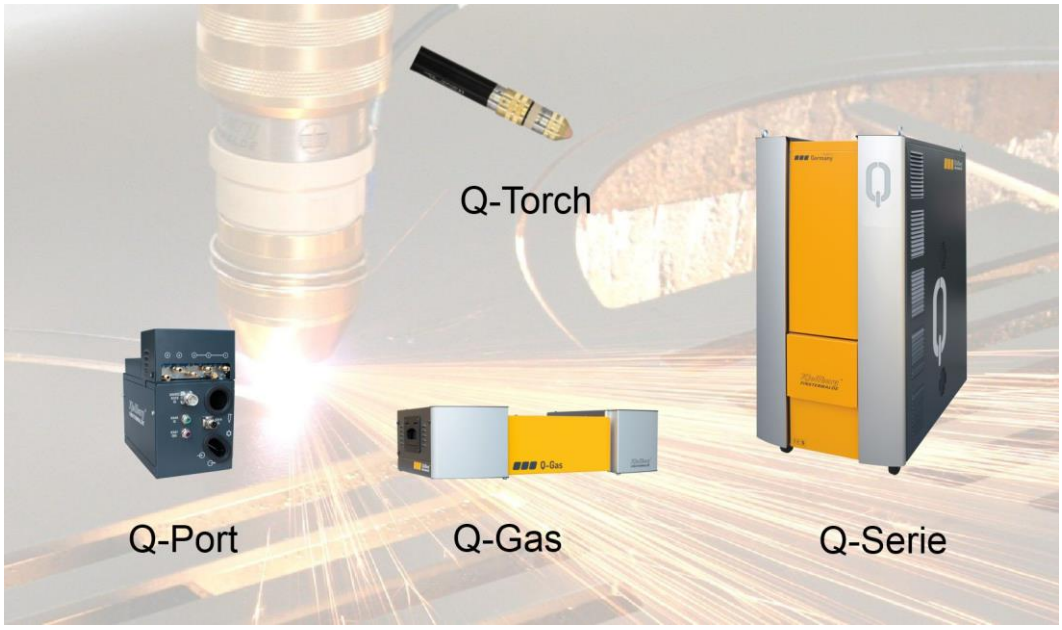
Kjellberg®
FINSTERWALDE

Instruction Manual



- Power source	**Q-Source**
- Plasma gas control unit	**Q-Gas**
- Plasma machine torch	**Q-Torch**
- Plasma torch connection unit	**Q-Port**

Art.-No.: .11.038.x02x

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Contents

1 General information

1.1 Warranty claim

We point out explicitly that only spare parts and consumables of Kjellberg original and Kjellfrost have to be used! Otherwise a warranty claim does not exist. Kjellberg Finsterwalde as manufacturer of the equipment can not make any guarantees for the safety of the equipment according to the valid regulations.

1.2 Standards and Directives

CE

The CE mark indicated on our plasma cutting and welding machines shows the conformity of our products with the latest effective European CE Directives.

IEC

Development and production take place according to the following standard:
IEC 60974 (EN 60974).

S

All plasma systems and welding systems are in possession of the S-mark and therefore applicable to work places with increased electrical endangerment.

ISO 9001

The production takes place according to DIN EN ISO 9001.

All products are manufactured under strict quality assurance control and proved by certificates and product-related test records.

1.3 Information to the instruction manual - target groups

Our products are of first-rate quality and high reliability and are in operational condition at any time. You fully will enjoy all these benefits, as long as you carefully observe these instructions for operation, maintenance and handling.

For any request you are kindly asked to quote model name and serial number.

ATTENTION

Please keep this instruction manual always carefully!
The instruction manual always must accompany the machine.

ATTENTION

For damages due to misuse or wrong service we will not take any responsibility!

ATTENTION

To avoid danger to yourself and others, work on the system may only be carried out by persons who have read and understood these operating instructions in full as well as were introduced to the correct handling.

Target groups for this instruction manual are:

Operator:

Persons recognising risks and avoiding endangerments by electricity with suitable training and suitable education by which they are enabled to operate the product and to execute basic maintenances and which are informed sufficiently and enabled with that by an authorised electrician.

Authorised electrician:

A qualified professional with sufficient training, knowledge and experience to enable him or her to identify and avoid any electrical hazards that may arise.

Work which may be executed only by authorised electrician is indicated clearly by warning signs and mandatory signs.

Kind of work	**Target group**	
	Operator	**Authorised electrician**
Connection and putting into operation		x
Operation of the machine	x	x
Maintenance:		
basic maintenance	x	
special marked maintenance		x
shut down at the end of the lifetime		x

1.4 Software terms of use

1.4.1 License information concerning open source software

1.4.1.1 Source code

Individual components of the plasma cutting unit contain open source software that is licensed by the rights holders as free software or open source software under the GNU General Public License (GPL), version 2 and version 3, or the GNU Lesser General Public License (LGPL), versions 2.1 and 3.0.

You can obtain the source code of these software components from us on a data carrier for a flat-rate. To do so, please contact our customer service at the e-mail address *service@kjellberg.de*, stating the product name, serial number and delivery date.

This offer is valid for three years from the date of delivery or for as long as spare parts or support for the product are offered.

1.4.1.2 License terms for the open source software

The license terms of the respective rights holders for the open source software are available on the Q-Desk

under [IP]/QDesk/licenses/.

The user receives a simple right of use for the open source software used from the respective rights holders under the terms and conditions which the applicable license terms provide for in each case.

The authors of the open source software have asked us to provide the following information in particular regarding the liability and warranty provisions of their license terms.

1.4.1.3 Disclaimer of warranty for the open source software

For license: GPL, versions 2 and 3

“There is no warranty for the program, to the extent permitted by applicable law. Except when otherwise stated in writing the copyright holders and/or other parties provide the program “as is” without warranty of any kind, either expressed or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. The entire risk as to the quality and performance of the program is with you. Should the program prove defective, you assume the cost of all necessary servicing, repair or correction.”

For license: LGPL versions 2.1 and 3.

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1.4.1.4 Limitation of liability for the open source software

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1.4.2 Notes on manufacturer's own software

INFORMATION

The term "manufacturer's own software" (proprietary software) refers to software of Kjellberg Plasma und Maschinen GmbH.

1.4.2.1 Wording of the software terms of use

On the Q-Desk

under [IP]/QDesk/licenses/,

you can find our own software terms of use for operation of this unit. Our software terms of use are exclusive. Deviating, conflicting or supplementary third party terms do not apply.

In no event do the provisions of our software terms of use limit the rights of use for the open source software. The relevant open source license terms take precedence.

1.4.2.2 Disclaimer of warranty and limitations of use

Modifications to proprietary software associated with a library licensed with LGPL 2.1 for the software recipient’s own requirements as well as reverse engineering and debugging of these modifications are hereby permitted. However, the knowledge acquired in this process may not be passed on to third parties. In addition, the circulation of modified versions of the software is not permitted. In any case, any warranty for the software expires if modifications have been made and no evidence can be provided that a complaint of defect would have occurred even without the modifications.

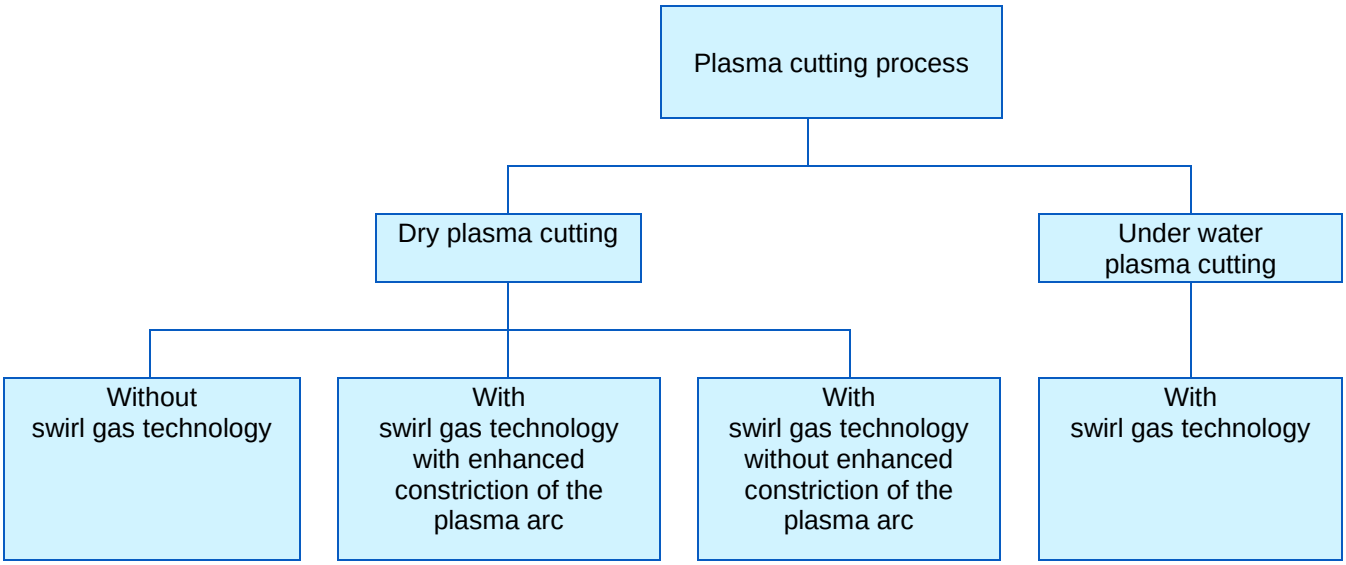
1.5 Plasma cutting as procedure

The plasma is defined as a gas having atoms and molecules which are partly split into ions and electrons and having therefore a high electrically conductivity.

In the plasma torch this gas becomes heated up extremely and leaves it through the nozzle with a high speed. Due to the high heat concentration all electrically conductive materials will melt and due to the high speed and pressure of the plasma arc the molten material will be blown away forming a very small kerf in the material.

The plasma arc hereby is transferred from the cathode, installed in the plasma torch and conducted to the negative pole of the plasma power source, to the workpiece (transferred arc).

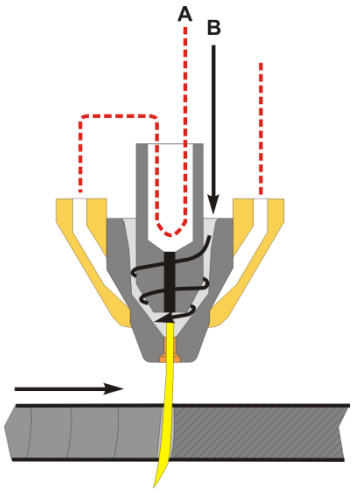
The plasma cutting is a technology for cutting of electrically conductive metals, like constructional steels, stainless steels, aluminium, copper, etc. It is suitable for straight, profile, template and bevel cutting. Thus semi-finished products such as sheet metal, sheet metal packages, tubes, profiles, blanks, forged forming parts, cast products and scrap metal can be thermally cut or worked.



Plasma cutting process

Dry-plasma cutting

without swirl gas



In plasma cutting without swirl gas the plasma arc hits the workpiece immediately after crossing the nozzle.

The nozzle can be damaged by Spatter and resulting double arcs.

A damage of the nozzle causes a poor cutting quality.

with swirl gas

A Coolant circuit
B Plasma gas
C Swirl gas

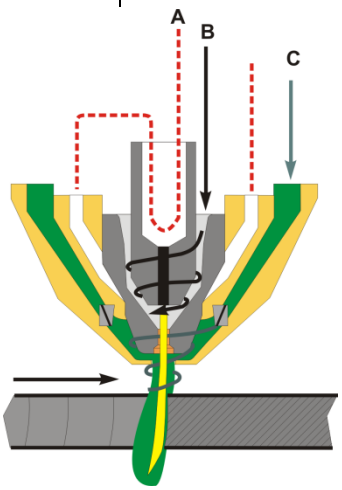
Plasma torches with swirl gas technology are using the swirl gas for shielding the plasma arc from the environment.

The nozzle of the plasma torch is protected against spatter by the swirl gas cap and the intermediately streaming swirl gas (vitally important while hole piercing).

By the possibility to vary also the swirl gas in composition and flow rate, the cutting quality can be improved further.

Under water-plasma cutting

with swirl gas



The under water plasma cutting process reduces the pollution of the environment by dust, aerosol, and noise level considerably in comparison to the dry plasma cutting process, in addition, ultraviolet radiation is filtered in the water.
The distortion of the cutting material is very low.

The energy consumption compared with the dry plasma cutting is however higher.

By using swirl gas technology the cutting process expires with high process stability. This guarantees also high cutting quality for under water cutting.

Dry plasma cutting process with **swirl gas without enhanced constriction** of the plasma arc	Dry plasma cutting process with **swirl gas with enhanced constriction** of the plasma arc (**HiFocus-technology**)
Angle deviations of the cutting surface are possible, especially at thin materials.	The new HiFocus-technology reduces the angle deviation of the cutting surface by an enhanced constriction and stabilization of the plasma arc.
At sheets up to 5 mm the angle deviation can amount 5 to 10 degrees.	The cutting surfaces in the thin sheet metal range are nearly rectangular, that results in much higher accuracy, comparable with laser cuts.
	Reworking of the metallic blank and dross free cutting surface is normally not necessary.

2 Safety instructions

ATTENTION

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

2.1 Explanation of the safety symbols

DANGER, WARNING and **CAUTION** are signal words, which describe a degree of exposure.

DANGER

DANGER describes an endangerment with a **high degree of risk**, when it is not avoided, it **results in death or a severe injury.**

WARNING

WARNING describes an endangerment with a **middle degree of risk**, when it is not avoided, it could **result in death or a severe injury**.

CAUTION

CAUTION describes an endangerment with a **low degree of risk**, when it is not avoided, it could **result in a slight or a moderate injury**.

The Safety information are developed after the SAFE-structure:

S … Symbol with signal word	**CAUTION**	
A … Art und Quelle der Restgefahr		**- Kind and source of the residual danger**
F … Folge bei Missachtung		**- Consequence at ignoring**
E … Entkommen		**- Escape**

Example:

CAUTION

Endangerment through free standing wheels by manual moving of the unit.
Foot injuries are possible.
Caution by the manual moving of the unit - use foot guard!

WARNING

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

Warning symbols (choice):

	**A black graphic symbol within a yellow triangle with a black edge defines a safety sign, which describes an endangerment.**
	**Warning of general hazard area**
	**Warning of dangerous electrical voltage!**
	**Warning of flammable substances, e.g. hydrogen**
	**Warning of oxidizing substances, e.g. oxygen**
	**Warning of explosive substances**
	**Warning of poisonous substances**
	**Warning of optical radiation**
	**Warning of electromagnetic radiation**
	**Warning of substances and mixtures that are hazardous to health**
	**Warning of gas cylinder**
	**Warning of hot surface**
	**Warning of slip danger**

Mandatory sign (choice):

	**A white graphic symbol within a blue circle defines a safety sign, which indicates that an action shall be carried out, in order to prevent an endangerment.**
	**General mandatory sign**
	**Use eye shield**
	**Use ear protection**
	**Use inhalation protection**
	**Use foot guard**
	**Use hand guard**
	**Use protective clothing**
	**Before opening disconnect the mains plug**
	**Consider instruction manual**
	**Pressure gas cylinder locked by linkage**

Prohibition sign (choice):

	**A black graphic symbol within a red circle with a red diagonal bar defines a safety sign, which indicates that an action shall be stopped or not be carried out.**
	**Smoking is forbidden**
	**Fire, open light and smoking are forbidden**
	**Contact is forbidden**
	**Meal and drinking are forbidden**
	**Do not use in housing areas**

Emergency sign (choice):

	**First aid**

Fire protection sign (choice):

	**Fire extinguisher**

Information is not a signal word that describes a degree of exposure.

▶	**INFORMATION** **The symbol signalised hints or special useful information.**

Warning label

The warning label is visibly attached on the power source.

The operator and the maintenance personnel must familiarize themselves with the meaning of the symbols before working at the unit.

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

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

3. Wear appropriate protective clothing (e.g. headgear, welding suit, possibly leather apron, gauntlet gloves, safety shoes).
The protective clothing must be isolating, dry and heavily inflammable.

4. The radiation of the plasma arc can lead to eye injuries and skin burns.
Eyes and skin must therefore be protected from the radiation of the plasma arc.
Glare protection is provided by safety goggles or welding shields, which must be equipped with sufficiently tinted protective lenses.
Noise can damage the hearing! During the plasma cutting operation suitable ear protection must be used.

5. Electric shock can kill! Live parts must not be touched.
Wear appropriate protective clothing (e.g. headgear, welding suit, possibly leather apron, gauntlet gloves, safety shoes). The protective clothing must be isolating, dry and heavily inflammable.
Opening the plasma unit may be carried out only by an advised electrician.
Before maintenance and repair work, always switch off the unit and disconnect it visibly from the mains!

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

7. Attached warning signs may not be removed, pasted over, painted over or covered up.

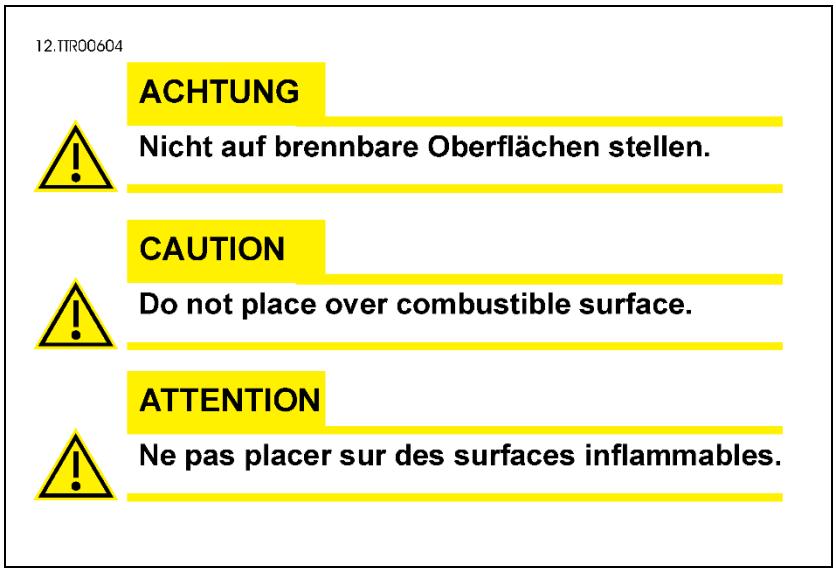


Abb. 1: Label under warning label

Further information and warning:

- to ensure stableness of the plasma unit, an inclination of 10° may not be exceeded
- connect the power source only with properly fitted protective conductor
- place the torch on an insulated place, to protect the operator against workpiece and ground potential
- keep dry the working area and all parts of the unit
- don't start the unit if components or parts are defective
- The plasma cutting machine has to be earthed and connected to the workpiece before switching on!
- switch off the unit before touching the plasma torch and prevent accidental restart
- arrange regular electric inspections (by an authorized electronics engineer)
- keep doors and flaps closed as long as the unit is connected to the power supply
- never avoid or suspend the safety interlock (for example door-, gas nozzle- and protection cap safety switch)
- do not cut closed containers
- The plasma cutting system may be used only for the appointed use. It may not be used e.g. to defrost frozen pipes.
- Do not touch the torch head, the workpiece or the water (if water table is used) when the plasma unit is working.
- Inflammable objects (e.g. lighters, matchsticks) may not be carried by the operator at the body.
- it can come to injuries caused by contacting sharp edges of the workpiece

2.2 Endangerment by high contact voltage

WARNING

Warning of dangerous electric voltage
Electric shock can be deadly. Further personal and material damages can result from impact.
Before maintenance and repair work and before opening the device (e.g. for troubleshooting) it has to be switched off, visibly disconnected from the mains and secured against being switched on again!
Opening the plasma unit may be carried out only under responsibility of a qualified electrician!

Before starting the machine connect the workpiece cable and earth the workpiece!

2.3 Working in environments with increased electric endangerment

The plasma cutting system is built in compliance with valid standards EN 60974-1 and therefore applicable in environments with increased hazard of electric shock.

The conditions for fulfilling these requirements are given by design measures in the plasma cutting system:

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

- The machine cannot be switched on as long no torch is attached or the attached torch isn't assembled completely.
- Opening the control circuit effects switching off the open circuit voltage, which drops down within the prescribed time below the limit

Therefore the plasma cutting system is S-marked and applicable in environments with increased hazard to electric shock.

ATTENTION

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

2.4 Endangerment by high voltage ignition

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

⚠ WARNING

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

⚠ WARNING

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

2.5 Endangerment by electromagnetic fields

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

WARNING

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

WARNING

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

General

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

Recommendations for assessment of the area (EN 60974-10)

Before installing the equipment the user shall make an assessment of potential electromagnetic problems in the surrounding area, and shall take the following into account:

- Other supply cables, control cables, signalling and telephone cables; below and adjacent to the installation
- Radio and television transmitters and receivers
- Computer and other control equipment
- Safety devices, e.g. protections for industrial equipment
- Health of the people around, wearing pacemakers or hearing aids and other body implants
- Equipment for calibration and measuring
- Immunity of other equipment in the environment. The user shall ensure that other additional protection measures in the environment are compatible
- Time of day that cutting has to be carried out.

The size of the observed surrounding area depends on the design of the building and other activities taking place there. The range can extend over the property boundary.

Recommendations of methods to minimize disturbances

If disturbances are detected it may be necessary to carry out further precautions, such as those:

- Filtering of the mains supply
- Shielding the mains cable of the permanently installed plasma cutting (safe contact is necessary between shielding and housing)
- Regular maintenance of the plasma cutting installation
- All cover plates, service openings and flaps have to be closed before starting the unit
- No alternations on adjustments and settings should be done at the plasma unit whitout the acceptance of the producer
- Cutting cables should be kept as short as possible and closely together or take course close to the bottom
- Potential equalization of all metallic components should be considered inside and adjacent to the installation. The operator should be insulated from all metallic components.
- Earthing of the workpiece
- Selective screening of all other cables and equipment

ATTENTION

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

2.6 Endangerment by heat and light radiation

The radiation of the plasma arc can lead to eye injuries and skin burns.
Eyes and skin must therefore be protected from the radiation of the plasma arc.

Safety measures:

- Wear appropriate protective clothing (e.g. headgear, welding suit, possibly leather apron, gauntlet gloves, safety shoes). The protective clothing must be isolating, dry and heavily inflammable.
- Glare protection is provided by safety goggles or welding shields, which must be equipped with sufficiently tinted protective lenses.
- The cutting area should be prepared so that reflections and transmission of ultraviolet light is reduced:
  - use of protective walls
  - arranging painting of walls with dark colour

ACHTUNG

When planning the cutting area please note that persons must not be present in the danger zone of the plasma torch during the start of the cutting process and no persons may be exposed to the dazzling effect of the plasma arc unprotected!

ATTENTION

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

2.7 Endangerment by gases, smoke and types of dust

Due to the plasma process itself hazardous substances may be produced. To avoid risks on health the following must be arranged:

- Keep cutting place well ventilated
- Remove fumes, smoke and dust by exhaustion devices
- Removed all chlorinated and other solvents from the cutting area because they could form phosgene gas when exposed to ultraviolet radiation
- Ensure that toxic limits become not exceeded

ATTENTION

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

WARNING

Danger by gases and fumes when cutting galvanized material
Health damage by inhalation of these gases and fumes
Carry special breathing mask when cutting galvanized material!

ATTENTION

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

2.8 Endangerment by oxyhydrogen

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

⚠ WARNING

Danger of formation of highly explosive oxyhydrogen

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

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

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

2.8.1 Plasma cutting of aluminium

ATTENTION

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

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

2.8.2 Plasma cutting in connection with water

If you use process gases, which contains hydrogen,for plasma cutting in connection with water, there may lead to formation of highly explosive oxyhydrogen.

For water tables with level control it has to be ensured, that:

- nitrogen is used instead of compressed air for regulating the level.

For water tables without level control it has to be ensured, that:

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

ATTENTION

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

2.9 Endangerment by noise

Plasma cutting generates process-related noise that can cause hearing damage.
The sound level to which exposed persons are subjected is influenced by many factors,

such as:

- the distance from the sound source (plasma arc),
- the technological process (dry cutting, underwater plasma cutting, etc.),
- the process parameters (cutting current, cutting voltage, etc.),
- the nature of the cutting table (dimension, orientation of the blades, water table, etc.),
- Geometry of the workspace (size, ceiling height, window areas, reflective properties of the walls, etc.)
- and more.

The actual noise exposure is highly dependent on the environment of the plasma cutting system and on the exposure time of the noise and can only be determined on site by the system operator himself or by an expert service provider.

Depending on the technological process and the process parameters, the following sound pressure levels were measured with the plasma cutting units of the Q-Series under laboratory conditions:

Process: Dry plasma cutting, Mild steel				
cutting current*	material thickness	sound pressure level at a distance of:		
		1 m*	3 m**	6 m**
[A]	[mm]	[dB(A)]	[dB(A)]	[dB(A)]
20	1	80	70	64
45	3	91	81	75
60	6	85	75	69
100	10	87	77	71
150	15	90	80	74
200	20	104	94	88
300	30	101	91	85
400	50	107	97	91
450	80	114	104	98

* … Reference value, measured at a distance of 1 m * … calculated

Fig. 2: Sound pressure level during dry plasma cutting

ATTENTION

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

ATTENTION

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

2.10 Endangerment by spatter

During plasma cutting and hole piercing sparks, slag and hot metal are produced. The risk of burns and fire exists!

To avoid endangerments the following has to be arranged:

- removal of all potential flammable materials from the cutting area, at least in a distance of 10 m
- cool down freshly cut material before handling or storing
- make fire extinguishers available in the cutting area

2.11 Handling of pressure reducer

ATTENTION

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

ATTENTION

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

WARNING

For the plasma cutting process compressed gases are used.

To avoid endangerments following instructions have to be taken:

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

2.12 Handling of the coolant "Kjellfrost"

(only valid for units with liquid cooled torches)

WARNING

Warning against the use of unsuitable and conductive coolants and antifreeze.

Electric shock can be deadly. Further personal and material damages can result from impact.

Therefore, make sure to use exclusively the coolant and corrosion protection agent "Kjellfrost" for Kjellberg plasma cutting units!

For all liquid- cooled plasma torches Kjellberg Finsterwalde is using the coolant „Kjellfrost", suitable as anti-freezer as well.

„Kjellfrost" contains anti- corrosive inhibitors. Thereby all the components of the cooling device are protected effective against corrosion.

Please notice following items particularly:

- „Kjellfrost" is classified as a hazardous substance in sense of the standard for hazardous substances, but not in the sense of the standard for the transportation of hazardous substances.
- Danger dominant ingredient: Ethylenglykol (Ethandiol)
- Never add water to the „Kjellfrost" (for dilution or filling up). Only pure „Kjellfrost" has to be used for filling up!
- The safety data sheet can be requested when required kjellfrost@kjellberg.de.

ATTENTION

When using other coolants, there is a risk of cooling channels becoming clogged with corrosion. This means that the performance parameters of the plasma cutting system can no longer be maintained and the plasma torch can be destroyed.

⚠ CAUTION

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

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

First aid

- after swallowing

  Don’t bring up, clean the mouth, drink much water, open the window for fresh air and call the doctor , present packing or label.
- after eye contact

  Clean the eyes with much flowing water some minutes and call the doctor
- after skin contact

  Quickly clean it with much water and soap

WARNING

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

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

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

WARNING

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

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

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

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

ATTENTION

Fire-fighting measures against ethanediol-fires

Suitable extinguishing agents:

- water spray
- alcohol resistant foam
- carbon dioxide (CO_2)
- extinguishing powder

  Fight larger fires with water spray or alcohol resistant foam.

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

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

Special protective measures:

Do not inhale explosion gases or combustion gases.

Additional information:

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

3 Maintenance

WARNING

Warning of dangerous electric voltage
Electric shock can be deadly. Further personal and material damages can result from impact.
Before maintenance and repair work and before opening the device (e.g. for troubleshooting) it has to be switched off, visibly disconnected from the mains and secured against being switched on again!
Opening the plasma unit may be carried out only under responsibility of a qualified electrician!

3.1 Maintenance general

3.1.1 Intervals of maintenance

Following measures have to be taken in regular intervals:

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

3.1.2 Cleaning

3.1.2.1 Cleaning of the power source

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

In the same way all components of the system have to be cleaned.

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

For ensuring an effective cooling, filter mattes, if existing, should be cleaned in water (approx. 40°C) by using standard mild detergents.

Manual cleaning is useful as well (beating; exhausting; with compressed air, e.g.)

3.1.2.2 Cleaning of the gas supply

Filter regulators and micro filters have to be cleaned weekly. Resulted condensation has to be drained; filter inserts have to be replaced in time.

The small filter screws inside the gas connectors of the plasma gas control units have to be inspected every 4 to 6 months, and cleaned if necessary. For that reason the pressure reducers of the gas cylinders have to be closed and the respective gas hose removed from the control unit. The filter screws only can be taken out by a small screw driver.

3.1.3 Electrical revision

ATTENTION

The electrical revision of the plasma cutting system and the disposal of the noticed defects have to be carried out according to the statutory provisions via electrical specialist!

According to existing regulation an electrical revision of the plasma cutting system has to be arranged:

- after 6 months, if the installation is changing the location permanently
- after one year, if the installation remains on the place

a) The visual inspection should concentrate to following conditions and ensuring, that,

- the power source is in a good condition
- the touch protection to parts functionally not activated is granted
- main fuses or overcurrent protections are matching the line cross section
- lines and cables are correct placed, fastened and connected (check the contact points)
- cables and wirings are undamaged and have no burn marks

b) By measurement has to be proofed that the protection against excessive touch potential of parts functionally not activated is granted (test of protective conductor):

The transition resistance between marked protective conductor connection of the plasma cutting system and all touchable metallic, not alive parts has to be < 0.1 Ohm if line cross section is > 6 mm^2 (otherwise pay attention to EN 60204-1) < 0.1 Ohm

c) The insulating capacity of winding and line insulation has to be proofed:

- insulation value between windings and housing (protective connector terminal) > 2.5 MOhm (dry and cold condition)
- insulation value between primary and secondary coils of the transformer T1 > 5 MOhm (dry and cold condition)

3.1.4 Plasma machine torch

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

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

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

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

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

⚠ CAUTION

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

⚠ WARNING

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

ATTENTION

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

3.2 Maintenance special

3.2.1 Gas pressure test

When using oxygen and hydrogen, it is especially important to check the gas line system. An unnoticed gas leakage may have serious consequences.

Carry out a monthly gas pressure test according to point 1 and 2 for all used process gases:

1.	Check the gas supply lines from the supply to the gas console
	• Make sure that the plasma system is switched off or is in standby mode. • By this the closed input solenoid valves of the gas console prevent the gases from entering the machine. • Open the cylinder valve and the stop valve at the pressure reducer of the gas to be checked. • Close the cylinder valve again and monitor the pressure of the enclosed gas at the manometer of the pressure reducer. The pressure must remain at the set value for at least 3 minutes. • In case of a pressure drop, the cause must be determined and immediately eliminated. After that, the gas pressure test must be carried out once again. • Record the process properly. • In case of a supply via a ring line you should proceed analogously.
2.	Automatic internal gas pressure test
	• At regular intervals, the plasma system carries out an automatic gas pressure test of all gas lines between the input solenoid valves of the gas console and the solenoid valves of the torch. • In case of an impermissible pressure loss the corresponding error message will be displayed.

⚠ WARNING

Only regularly performed gas pressure tests are the guarantee for a safe operation of the gas supply system!

Because of the existing risk of fire and explosion by oxygen, hydrogen and inflammable gas mixtures, the gas pressure test has to be carried out carefully and proofed by protocol.

3.2.2 Preventive periodic maintenance - component change plan

WARNING

Warning of dangerous electric voltage
Electric shock can be deadly. Further personal and material damages can result from impact.
Before maintenance and repair work and before opening the device (e.g. for troubleshooting) it has to be switched off, visibly disconnected from the mains and secured against being switched on again!
Opening the plasma unit may be carried out only under responsibility of a qualified electrician!

ATTENTION

Consistent adherence to the specified maintenance measures is necessary to ensure high availability of the system.

Depending on the existing individual operating conditions of the user, it may make sense to carry out preventive periodic maintenance with component replacement according to the following plan in addition to these maintenance measures.

For a detailed list of maintenance measures with current operating hours and consumables information, please refer to the "Maintenance" page of the Q-Desk.

component *Article No.*	**pos.**	**pcs.**	**time interval**					
			1 year or 1000 h	**2 years or 2000 h**	**3 years or 3000 h**	**4 years or 4000 h**	**5 years or 5000 h**	**6 years or 6000 h**
coolant “Kjellfrost -15°C“ *.12.62330*			**X**	**X**	**X**	**X**	**X**	**X**
or **coolant “Kjellfrost -25°C“** *.12.62350*			**X**	**X**	**X**	**X**	**X**	**X**
sieve insert *.10.639.585.1*	**01.23**	**1**	**X**	**X**	**X**	**X**	**X**	**X**
Air contactor - auxiliary contactor (Q0, Q4) *.10.161.751.24*	**04.04**	**1**	**X**	**X**	**X**	**X**	**X**	**X**
Suppressor element diode 11BGX78 225 (for Q0,Q4) *.10.161.748*	**04.08**	**1**	**X**	**X**	**X**	**X**	**X**	**X**

component *Article No.*	pos.	pcs.	time interval					
			1 year or 1000 h	2 years or 2000 h	3 years or 3000 h	4 years or 4000 h	5 years or 5000 h	6 years or 6000 h
Air contactor - main contactor (Q1) *Q1500: .10.161.761.24DC* *Q3000: .10.161.730.24* *Q1500+, Q3000+, Q4500: .10.161.731.24*	**01.18**	**1**				**X**		
auxiliary contact (Q1) *.10.161.705*	**01.17**	**1**				**X**		
Air contactor - pilot contactor (Q2) *.10.161.722.26*	**04.09**	**1**	**X**	**X**	**X**	**X**	**X**	**X**
auxiliary contact (Q2) *.10.161.703*	**04.10**	**1**	**X**	**X**	**X**	**X**	**X**	**X**
Air contactor – contactor "flying cutting" (Q3) *.10.161.722.26*	**04.09**	**1**	**X**	**X**	**X**	**X**	**X**	**X**

component *Article No.*	pos.	pcs.	time interval					
			1 year or 1000 h	2 years or 2000 h	3 years or 3000 h	4 years or 4000 h	5 years or 5000 h	6 years or 6000 h
coolant pump, complete, mounted (M16) **.11.038.3002..320**	**01.20**	**1**						**X**
torch hose package *by manufacturer or authorised service*						**X**		
Fan - cover for circuit boards (M17, Ø 125 mm) *.11.038.3002..905*	**01.11**	**1**					**X**	
Filter medium 125 x 125 x 8 mm F100S (for M17) *.10.140.724*	**01.12**	**1**	**X**	**X**	**X**	**X**	**X**	**X**
fan - heat exchanger (M13-M15, Ø 172 mm) *.11.038.3002..349*	**03.06**	**3**					**X**	
fan - inverter module (M1-M9, Ø 172 mm) *.11.038.3002..658*	**04.20**	**per 3**					**X**	
fan – PCB A3 inverter module (Ø 119mm) *.11.412.3002..720*	**05.20**	**per 1**					**X**	
fan – PCB A2 inverter module (Ø 119mm) *.11.412.3002..725*	**05.21**	**per 1**					**X**	
capacitor 7600 µF µF – intermediate circuit (C1, C2) *671.100.028*	**05.22**	**per 2**						**X**
coolant and gas cable *condition depending*								**X**

Fig. 3: preventive periodic maintenance / component change plan Q-Source

The time interval begins on the seventh year all over again (7th year as 1 year, 8 years as 2nd year, etc.).

4 Customer information on repair processing

To ensure effective processing of repair orders, please take note of the following:

INFORMATION

Ship without accessories where possible

- Please send only the components suspected to be defective without any additional accessories.
  We do not require workpiece cables, gas hoses, operating instructions, spare parts, custom fittings etc. for the repair.
- The only accessories required are those that have or could have contributed to the defect in the device, for example a torch, remote control set etc.

INFORMATION

Detailed description of the error

Please provide a detailed description of the error on the repair order.
Accurate information helps us to identify the error, reducing both repair times and costs.

INFORMATION

Plasma torches

Please send us defective plasma torches with the consumables unchanged - exactly as the torch was loaded at the time of the error.
Defective consumables provide us with important information on the sources of errors.

INFORMATION

Stable packaging and secure shipping

- Please package the devices and components in suitably sized containers and use non-flaking and non-shredding materials for padding.
- If using styrofoam, ensure that no polystyrene chips can get into the gas or cooling water connections on the devices and components.
- For previously opened devices, please always ensure that the housing and carrying handles have been firmly refastened to all mounting points on the devices. If they are not, there is a risk that the stability of the housing will be insufficient for transport and that additional damage to the device may ensue.
- When sending devices weighing more than 20 kg, make sure to use a shipping company that uses pallets during transportation. This is because shipments sent as parcels are often damaged in transit.

5 Disposal

5.1 Disposal of the packing material

	packing material
plasma unit	wooden pallet or solid wooden box
plasma components and accessories	wooden pallet
consumables	plastic box (package and keeping)

If packing materials are not needed for repacking or for a possibly necessary storage of the units between intervals of normal use, the materials can properly be recycled and disposed on the basis of regional applicable regulations by a waste management company.

5.2 Disposal of the units after decommissioning

The units of the company Kjellberg Finsterwalde are products which can properly be recycled or disposed after placing out of operation on the basis of regional applicable regulations by a waste management company.

Attention!!

This device is marked with the symbol of the crossed out dustbin. This means that this device need not be disposed of together with the domestic rubbish.

Use the locally available possibilities for the separate free return of electrical old equipment.

6 Power source Q-Source

according to the version delivered

6.1 Technical data

Art.- no.:	Q 1500 / Q 1500 plus (.11.038.1021 / .11.038.3021)
primary side:	
mains voltage U_1*:	3~ +PE 400 V ±10 %, 50/60 Hz
connecting load (100 % DC):	max. 35 kVA (depending on cutting parameters)
fuse, slow:	T 63 A
mains cable, cross section Cu:	4 x 16 mm²
power factor cos phi:	0,92 at 150 A
efficiency:	0,86
cutting side:	
open circuit voltage (OCV) U_0:	400 V
cutting current I_S:	20 - 150 A
marking current I_M:	5 - 60 A
arc voltage U_S (100 % DC):	82 - 185 V
cutting power P_S:	0,4 - 21 kW
duty cycle X:	100 % at 150 A
pilot arc current I_{PB}:	10 - 50 A
workpiece cable, cross section Cu:	1 x 25 mm²
cathode cable, cross section Cu:	1 x 50 mm²
characteristic:	drooping (CC)
ignition process:	pilot arc ignition by high voltage ignition unit
dimensions (lxbxh):	1150 x 695 x 1460 mm (with undercarriage „castors and wheels“)
weight m:	239 kg / 280 kg
protection class:	IP21S
heat resistance class:	F
cooling:	Air cooled by built-in fan
torch cooling:	internal circulating cooling
coolant:	coolant mixture with integrated corrosion protection - „Kjellfrost -15 °C“ (anti freeze protection up to -15 °C) or - „Kjellfrost -25 °C“ (anti freeze protection up to -25 °C)
volume coolant box:	ca. 17 l
pressure:	8 bar bei 5 l/min
*… more voltages, see chapter “mains connection“	

Fig. 4: Technical data Q 1500/ Q 1500 plus

Art.- no.:	Q 3000 / Q 3000 plus (.11.038.2021 / .11.038.4021)
primary side:	
mains voltage U_1*:	3~ +PE 400 V ±10 %, 50/60 Hz
connecting load (100 % DC):	max. 72 kVA (depending on cutting parameters)
fuse, slow:	T 125 A
mains cable, cross section Cu:	4 x 35 mm²
power factor cos phi:	0,93 at 300 A
efficiency:	0,89
cutting side:	
open circuit voltage (OCV) U_0:	400 V
cutting current I_S:	20 - 300 A
marking current I_M:	5 - 60 A
arc voltage U_S (100 % DC):	82 - 200 V
cutting power P_S:	0,4 - 60 kW
duty cycle X:	100 % at 300 A
pilot arc current I_{PB}:	10 - 50 A
workpiece cable, cross section Cu:	1 x 70 mm²
cathode cable, cross section Cu:	2 x 50 mm²
characteristic:	drooping (CC)
ignition process:	pilot arc ignition by high voltage ignition unit
dimensions (lxbxh):	1150 x 695 x 1460 mm (with undercarriage „castors and wheels“)
weight m:	297 kg / 317 kg
protection class:	IP21S
heat resistance class:	F
cooling:	Air cooled by built-in fan
torch cooling:	internal circulating cooling
coolant:	coolant mixture with integrated corrosion protection - „Kjellfrost -15°“ (anti freeze protection up to -15°C) or - „Kjellfrost -25°“ (anti freeze protection up to -25°C)
volume coolant box:	ca. 17 l
pressure:	8 bar at 5 l/min
*… more voltages, see chapter “mains connection“	

Fig. 5: Technical data Q 3000/ Q 3000 plus

Art.-no.:	Q 4500 (.11.038.5021)
primary side:	
mains voltage U_1*:	3~ +PE 400 V ±10 %, 50/60 Hz
connecting load (100 % DC):	max. 109 kVA (depending on cutting parameters)
fuse, slow:	T 180 A
mains cable, cross section Cu:	4 x 50 mm²
power factor cos phi:	0,93 at 450 A
efficiency:	0,89
cutting side:	
open circuit voltage (OCV) U_0:	400 V
cutting current I_S:	20 - 450 A
marking current I_M:	5 - 60 A
arc voltage U_S (100 % DC):	82 - 200 V
cutting power P_S:	0,4 - 90 kW
duty cycle X:	100 % at 450 A
pilot arc current I_{PB}:	10 - 50 A
workpiece cable, cross section Cu:	2 x 70 mm²
cathode cable, cross section Cu:	3 x 50 mm²
characteristic:	drooping (CC)
ignition process:	pilot arc ignition by high voltage ignition unit
dimensions (lxbxh):	1150 x 695 x 1460 mm (with undercarriage „castors and wheels“)
weight m:	354 kg
protection class:	IP 21S
heat resistance class:	F
cooling:	Air cooled by built-in fan
torch cooling:	internal circulating cooling
coolant:	coolant mixture with integrated corrosion protection - „Kjellfrost -15°“ (anti freeze protection up to -15°C) or - „Kjellfrost -25°“ (anti freeze protection up to -25°C)
volume coolant box:	ca. 17 l
pressure:	8 bar bei 5 l/min
*… more voltages, see chapter “mains connection“	

Fig. 6: Technical data Q 4500

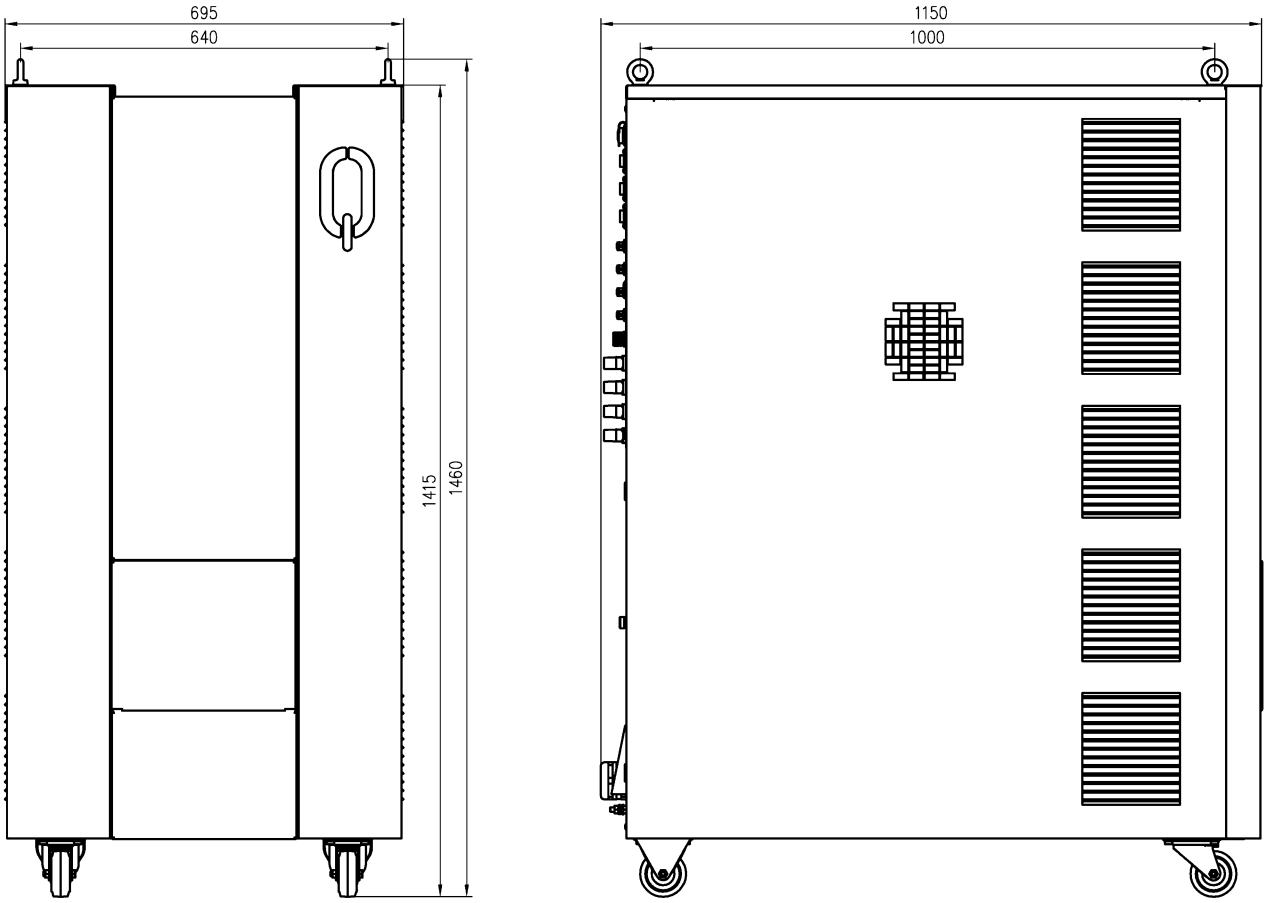


Fig. 7: Dimension diagram

6.2 Technical description

ATTENTION

Only plasma torches of the types Q-Torch 45xx of Kjellberg Finsterwalde are determined for use with power sources Q 1500, Q 1500 plus, Q 3000, Q 3000 plus and Q 4500 by EN 60974-1.

Exclusive these plasma torches forms a safety-related unit with the named power sources in accordance with EN 60974-7!

6.2.1 Setup

- all components of the plasma power source are mounted into a rugged housing, which is movable by hand as well as transportable with the crane
- the entry vents for cooling air are arranged at the front, side and bottom
- at the rear panel are:
  - the connectors for the workpiece and cathode cable,
  - the mains cable entry,
  - the outlet vents for cooling air
  - the CNC-interface,
  - the connectors for the torch connection unit Q-Torch with an integrated high voltage ignition unit
  - the connectors for the plasma gas control unit and reserve

6.2.2 Electronic control

- optimal process sequence by microprocessor control of the power source:
  automatic monitoring
  - the individual phases of the cutting process and
  - all important processes of the plasma cutting (torch cooling, ignition time, pilot arc time, etc.)
- the electronic control made possible:
  - an optimal process control by a fast regulation of the cutting current
  - fast starting cuts through very short transition periods
  - optimal hole piercing through adjustable current rising
  - adjustable current down slope at corner-signals
- Q-Desk/PC digital display of operating conditions and possible process errors by means:
  - display of the preset current (setpoint) at the cutting break
  - display of the cutting voltage and current (actual value) during the cutting and marking process
  - display of the volume flow, temperature and level of the coolant,
- flexible adjustment of the ignition process to the necessary conditions with the help of the microprocessor control
- increased electrical efficiency in the current source by soft-switch inverter technology with microprocessor control

6.2.3 Special parameters of the power source

- stepless adjustable cutting current from 5 – **300** A (100 % ED)
- stepless adjustable marking current for optimal process adaptation to the marking job: 5 - 50 A
- interface for the control of the plasma unit from 2D- and 3D-CNC-guiding system, like gas cutting machines, tube cutting machines and robots:
  - interface X302 and X304
  - interface EtherCAT
- connecting possibility of a PC for the diagnosis during service
- the operational radius of the device is 15 m, 25 m, 35 m, 45 m or 55 m, depending on the intermediate hose package used
- marking, notching and punching also for coated metallic materials when using the automatically gas console Q-Gas 4500
- special torches are available on request.

6.3 Plasma marking, Plasma notching, Plasma punching

(Only apply to current sources and gas consoles which support marking.)

	definition
Plasma marking (marking)	Marking of electrically conductive materials by means of plasma beam
Plasma notching (notching)	Marking of electrically conductive materials by means of plasma beam with a larger penetration depth
Plasma punching (punching)	Marking of electrically conductive materials by means of plasma beam with a larger penetration depth in a point (punctual notching)

The penetration depth at the punching among other things gets certain also through the residence time of the torch over the centre punch point and with that by the control of the guiding system or the robot

The application of the "FineFocus Principle“ offers numerous technological advantages for the marking process.

These especially are:

- small marking lines
- low heat input
- low distortion
- high marking speed
- excellent marking quality

The direct transferred plasma arc enables the marking of all electrically conductive materials with no regard to thickness and quality (Mild steels, high alloyed steels and special alloys). Aluminium is less well suitable due to its specific material properties for marking.

The marking process is applicable at all kind of material, like sheet metal, tubes, profiles, forged and casted parts, laminated sheet packages, scrap metal products and cast iron products.

	marking gas	material	penetration depth	electrical power	comment
marking	Ar	Mild steels, high alloyed steels special alloys	+	+	very good marking quality for all materials except aluminium
notching	N_2	mild steel	++	++	larger penetration depth as with plasma gas Ar
notching+	Air		+++	+++	larger penetration depth as with plasma gas Ar and N_2
punching	punctual punching (see notching and notching+)				

Fig. 8: used gases for marking and notching (punching)

INFORMATION

The marking record can be used without consumable part changes; however, the optimal marking quality is not achieved by it in every case.

INFORMATION

The permanent change between cutting of mild steel (with plasma gas O_2) and marking (with marking gas Ar) may reduce the lifetime of the O_2 cathode to 30%.
In this case argon becomes alternatively recommended nitrogen or air instead of the marking gas.

INFORMATION

The use of an Ar/H_2 cathode is recommended for long marking processes with marking gas argon :

- for plasma torch Q-Torch 4500: cathode E042, E052 or E065
- for plasma torch Q-Torch 4510: cathode E042, E052 or E065

6.4 Putting into operation

6.4.1 Check, placement and transport

- Please check the delivery directly on the basis of the order and delivery documents on completeness and correctness. In the case of incompleteness or deviations please inform the supplier and the carrier immediately.
- Please check the delivery immediately on damages. Damages have to be announced immediately to the carrier and supplier.
  A damage report has to be generated.

The Unit is designed for a service in explosion-proofed rooms or in the free air by using a roofing under following conditions:

ambient temperature:	-10 °C to +40 °C	
transport- and storage temperature:	-15 °C to +55 °C	when first filling with coolant „Kjellfrost -15 °C“ **standard filling**
	-25 °C to +55 °C	when first filling with coolant „Kjellfrost -25 °C“
relative moisture:	max. 90 % at 20 °C	
	max. 50 % at 40 °C	

Fig. 9: operational conditions

Place the power source so that the air flow is not blocked. The unit is to be set up in such a way that the cooling air can enter and escape unhindered by the ventilation openings. A free distance of at least 250 mm should be kept around all 4 sides of the unit.

The unit has to be installed horizontally.

At maintenance work a distance of approx. 1000 mm should be kept around all 4 sides of the unit.

Avoid that dust (especially metallic particles), acid damp, corrosive substances and gases can enter the unit. The lifetime and the function of the plasma cutting will be influenced.

The plasma cutting system is designed acc. to the requirements of the protection class IP 21S (DIN EN 60529), that means:

- Protected against access to hazardous parts with a finger.
- Protected against solid foreign bodies, 12.5 mm and larger.
- Protected against dripping water.

It is possible to load the unit by forklift.

WARNING

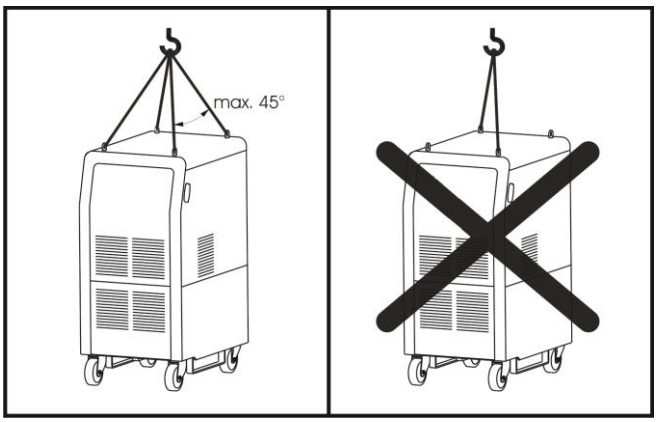
Danger of tilting at the loading by the fork truck!

Further personal and material damages can result, please note the rules of conduct when dealing with a forklift.

The power source has to be taken from the side, pay attention to the load centre.

WARNING

Endangerment at the crane transportation by falling down of the unit.
Further personal and material damages can result.
For crane transportation all four lifting eyes have to be used! The angle between the ropes or chains should not exceed 45°! Pay attention for the weight of the unit!



For crane transportation lifting eyes are provided.

Fig. 10: crane transport

CAUTION

Endangerment through free standing wheels by manual moving of the unit.
Foot injuries are possible.
Caution by the manual moving of the unit - wear food guards!

6.4.2 Installation

6.4.2.1 Mains connection

ATTENTION

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

INFORMATION

Low-interference routing of signal and communication cables

If possible, do not lay any signal and communication cables in the immediate area of other current-carrying cables, e. g. mains cable, workpiece cable, cathode cable.

Use the shortest possible signal and communication cables.

If the signal and communication cables are longer than required, do not lay them coiled up.

The information relates to signal and communication cables at the following connections:
X306, X307, X308, X309, X340, X342, X343, (X344), X302, X304

The plasma power source can be delivered by default for the connection to the mains voltage with mains cable (5 m long). The mains cable version mentioned in the following table is only a recommendation. The mains cable has to be connected in compliance with the applicable regulations to a circuit breaker.

You have to add the main fuses to the power switches according to the following table:

Mains voltage U_1 (+ 10% / - 10%)	I_{1max}	Fuse, slow	Mains cable, cross section Cu	AWG*	Article number of power source
3~ 380 V, 50/60 Hz	53 A	63 A	4 x 16 mm²	5	.11.038.1021/ .11.038.3021
3~ 400 V, 50/60 Hz	51 A				
3~ 415 V, 50/60 Hz	49 A				.11.038.1022/ .11.038.3022
3~ 440 V, 50/60 Hz	46 A				
3~ 460 V, 50/60 Hz	44 A				.11.038.1023/ .11.038.3023
3~ 480 V, 50/60 Hz	42 A				

Q 1500/ 1500plus

Mains voltage U_1 (+ 10% / - 10%)	I_{1max}	Fuse, slow	Mains cable, cross section Cu	AWG*	Article number of power source
3~ 380 V, 50/60 Hz	110 A	125 A	4 x 35 mm²	1	.11.038.2021/ .11.038.4021
3~ 400 V, 50/60 Hz	105 A				
3~ 415 V, 50/60 Hz	101 A				.11.038.2022/ .11.038.4022
3~ 440 V, 50/60 Hz	95 A				
3~ 460 V, 50/60 Hz	91 A				.11.038.2023/ .11.038.4023
3~ 480 V, 50/60 Hz	87 A				

Q 3000/ 3000plus

Mains voltage U_1 (+ 10% / - 10%)	I_{1max}	Fuse, slow	Mains cable, cross section Cu	AWG*	Article number of power source
3~ 380 V, 50/60 Hz	165 A	180 A	4 x 50 mm²	1/0	.11.038.5021
3~ 400 V, 50/60 Hz	157 A				
3~ 415 V, 50/60 Hz	151 A				.11.038.5022
3~ 440 V, 50/60 Hz	143 A				
3~ 460 V, 50/60 Hz	136 A				.11.038.5023
3~ 480 V, 50/60 Hz	131 A				

Q 4500

*American Wire Gauge

If the mains cable is provided by the customer, it has to be selected according to the national and local regulations. The current load of the mains cable must correspond to the rated current of the mains fuse at a permitted operating temperature at the conductor of 90°C.

The mains cable has to be inserted by the cable connection at the rear panel and to connect to the mains terminal clamps (L1, L2, L3 and ⏚).

The installation has to be executed by qualified technical staff.

⚠ WARNING

Warning of dangerous electric voltage
The power switch has to be in the "OFF position" by the connection of the main cable and all other installations!

6.4.2.2 Workpiece connection / current return line / potential equalisation

INFORMATION

Low-interference routing of signal and communication cables

If possible, do not lay any signal and communication cables in the immediate area of other current-carrying cables, e. g. mains cable, workpiece cable, cathode cable.

Use the shortest possible signal and communication cables.

If the signal and communication cables are longer than required, do not lay them coiled up.

The information relates to signal and communication cables at the following connections:
X306, X307, X308, X309, X340, X342, X343, (X344), X302, X304

Power source side:
The workpiece cable is connected to the workpiece terminal M 10 behind the door in the rear panel of the power source.

Workpiece side:

- At plasma units, which are equipped with a workpiece cable with clamp, the connection occurs directly and firmly to the workpiece, at the component or at the device at which the cutting current is carried out (for example cutting table).
- At plasma units, which are equipped with a workpiece cable with cable lug, the connection occurs directly and firmly to a M10- thread terminal of the device, at which the cutting is carried out (for example cutting table).

You have to pay attention in each case to metallic contact!

WARNING

It is not allowed to use conductive parts of building, like steel construction, pipes, track ways or similar devices for conducting the power back to the plasma cutting system, as far cutting is not performed at those parts!

6.4.2.3 Potential equalisation, Earthing

INFORMATION

Low-interference routing of signal and communication cables

If possible, do not lay any signal and communication cables in the immediate area of other current-carrying cables, e. g. mains cable, workpiece cable, cathode cable.

Use the shortest possible signal and communication cables.

If the signal and communication cables are longer than required, do not lay them coiled up.

The information relates to signal and communication cables at the following connections:
X306, X307, X308, X309, X340, X342, X343, (X344), X302, X304

General information

ATTENTION

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

ATTENTION

Between workpiece and cutting table must be a good electrical contact!

The potential equalisation of the entire system is the responsibility of the operator and has to be carried out by an electrician *).

When integrating components of other manufacturers into the plant complex (e.g. cutting table, guiding system), it is necessary to follow the specific information given by those other manufacturers.

Protective potential equalisation

The protective potential equalisation for all relevant components of the complex is used as basic provision in case of a failure. It protects persons against electric shock in case of indirect contact *).

Functional potential equalisation

The functional potential equalisation is used in order to reduce the effects that an insulation fault as well as electric and electromagnetic disturbances might have on the operation of the plant.
Normally, the functional potential equalisation is realised by a connection with the protective conductor system. If, however, the electric interference level on the protective conductor system is too high so that the proper operation of the complex is no longer guaranteed, there is the option to install a separate earthing conductor which serves as additional functional earthing (see picture below. [2])).

Potential equalisation and protective conductor guidance

The potential equalisation has to be done in star shape by the shortest possible wires (preferably copper wires) with the largest possible cross section. We recommend a conductor cross section Cu of at least 25 mm² *). The wires have to be marked with the two-colour combination GREEN-YELLOW *).

The potential equalisation between plasma cutting unit, gas console, PBA and cutting table or guiding system is the responsibility of the operator. For this purpose, the plasma cutting unit, the gas console and the PBA are each equipped with a thread bolt size M8. The wires are not part of the delivery content.

The following picture shows an example of potential equalisation and protective conductor guidance. Depending on the configuration of the plant, there may be deviations from this example.

*) Cf. also EN 60204-1 (IEC 60204-1)

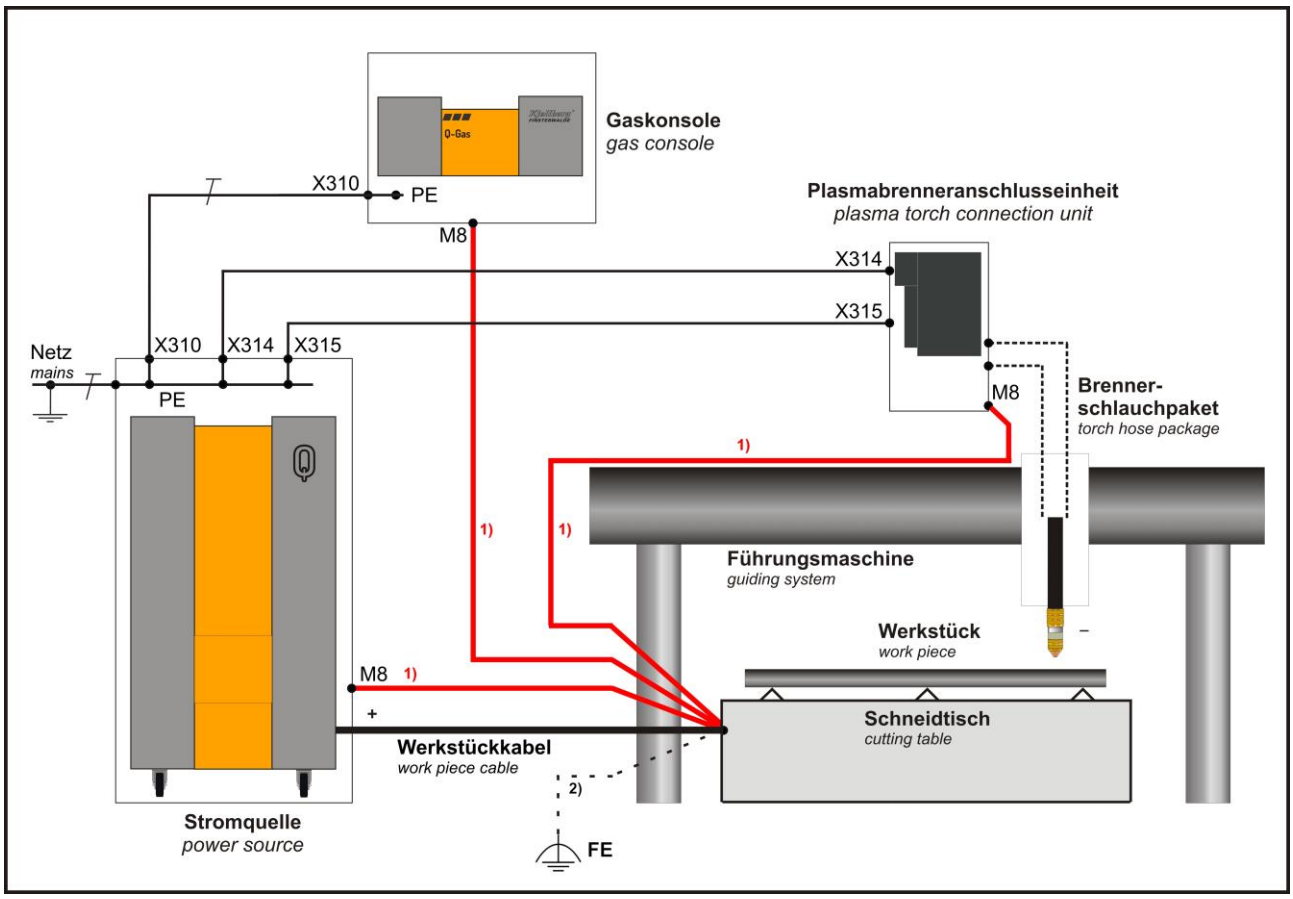


Fig. 11: Potential equalisation and protective conductor guidance, example

Footnote/Term	Explanation	Note
⏚	Symbol for protective earth PE	
⏚	Symbol for functional earth (FE)	
1)	Installation by operator	Wires are not part of the delivery content
2)	External wire for additional functional earthing	

6.5 Front wall

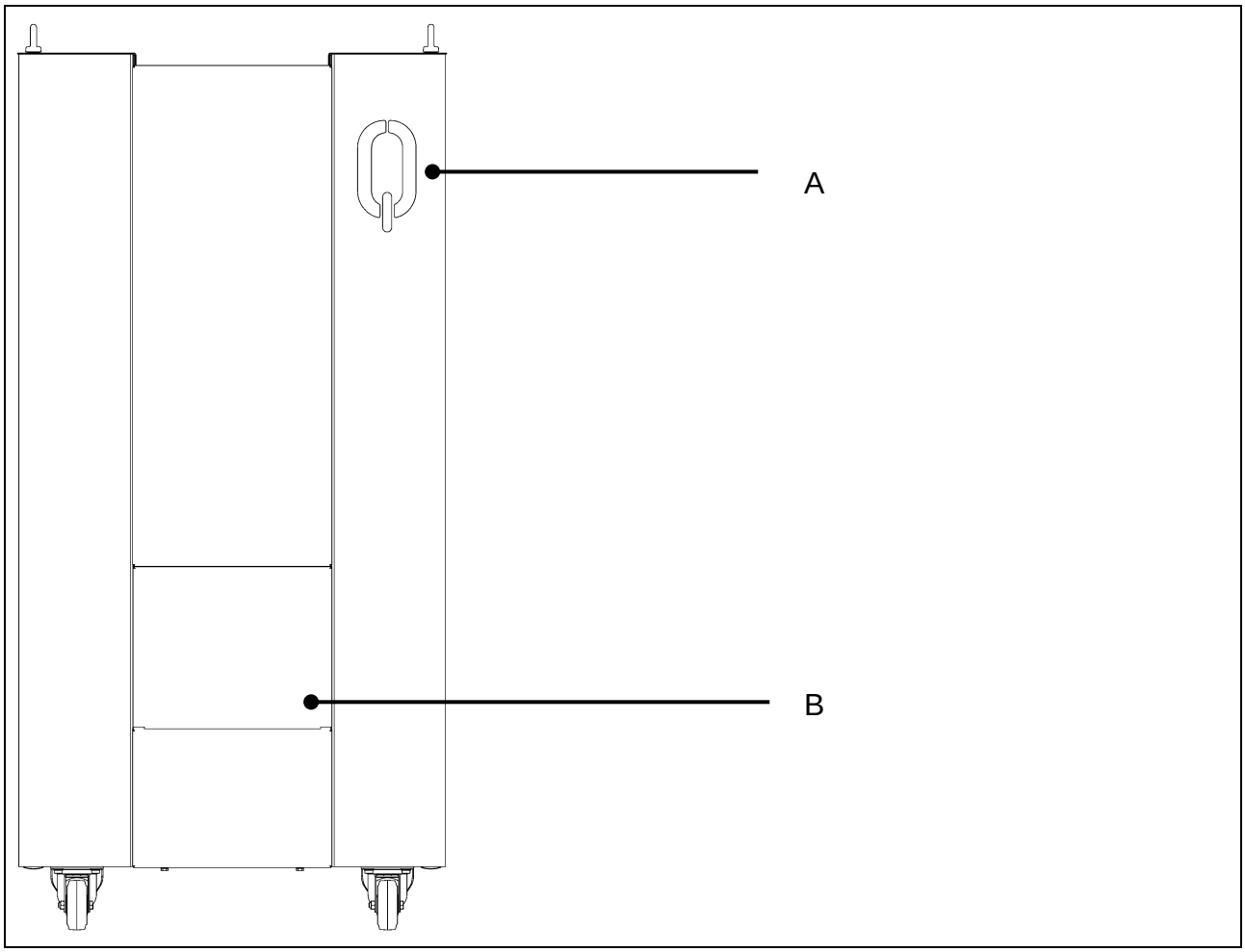


Fig. 12: Display element of power source

A	**Display element Q-LED** **indicates status of the plasma cutting unit**		
	colour	**status**	**comment**
	white	initialization	Switching on of the plasma cutting unit
	blue pulsating	standby	control unit ON/ power unit OFF
	blue	ready	process ready
	green	process ON	cutting / marking process ON
	yellow	error	e. g. coolant fill level too low
	red pulsating	danger	e. g. main contactor does not switch off e. g. emergency stop not executed
	white pulsating	service	e. g.“Wait for data set change” e. g. fill with coolant
	cyan	system - update	Update process of the system

	B	**Flap** **detailed view see figure below**			
		1	X303	Connection “Service USB“	socket USB-A
		2	X305	Connection “Service ETH“	socket RJ-45
		3	green button “refill coolant“		
		4	yellow button “drain coolant“		

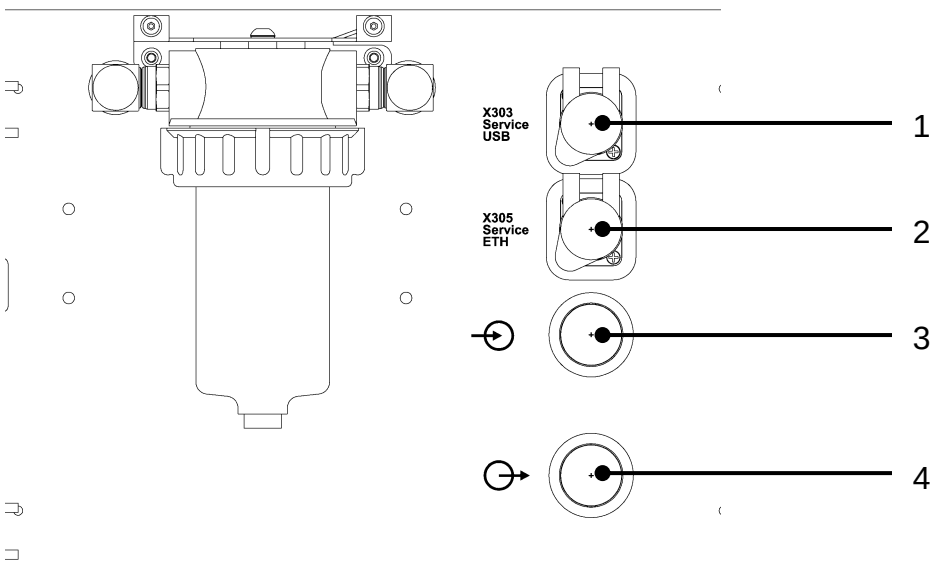


Fig. 13: B – Connections behind the flap

6.6 Filling up and draining off the coolant

The coolant circuit is to be filled with "Kjellfrost -15 °C" (frost-resistant up to -15 °C) or "Kjellfrost -25 °C" (frost-resistant up to -25 °C). In addition to frost protection, these coolants with specially developed corrosion protection are also used for increasing the lifetime of the pump and seals as well as for increasing the service life of the coolant channels of the plasma torch. Therefore, please use exclusively the coolant „Kjellfrost“! The use of simple, standard antifreeze may cause the failure of the plasma system within a very short time.

The volume of the coolant tank amounts to approx. 17 l.

Refilling the coolant

1.	Plasma torch and hose package must be connected.
2.	The power source must be in the state ready or error: cooling level min (E 142)
3.	Open the flap at the front of the power source, by reaching into the flap at the bottom right and open the magnetic lock by pulling..
4.	Remove the end of the hose and put it into a full Kjellfrost canister.
5.	Press the green button „refill coolant“ (S5) briefly. The green button lights up.

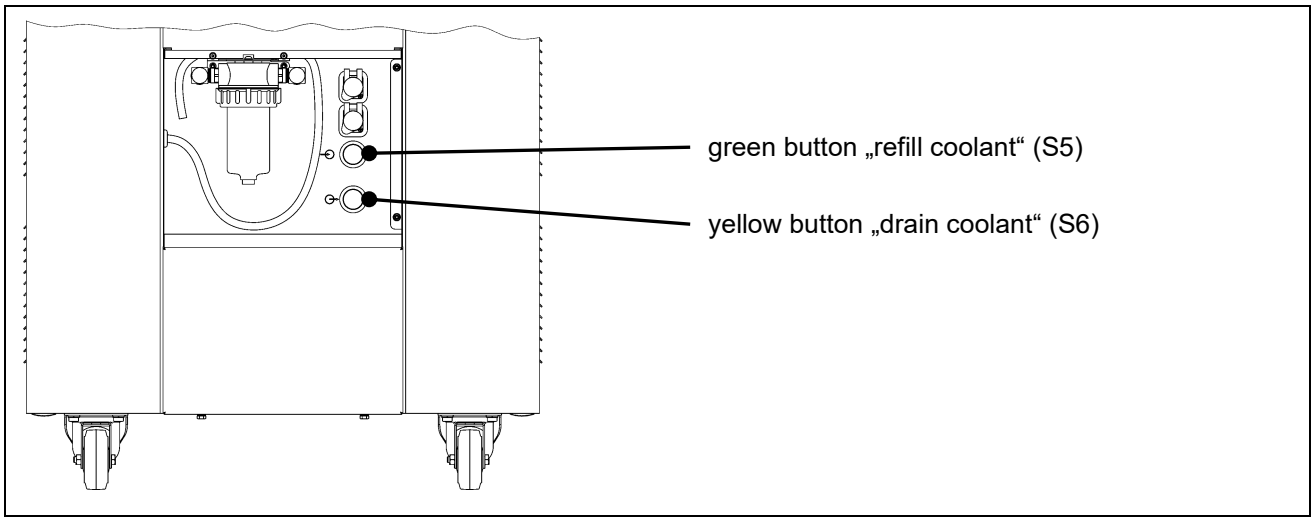


Fig. 14: Coolant flap

6.	The power source is in state service and the coolant tank is filled via the hose package and the plasma torch by means of the coolant pump
7.	As soon as the tank is filled completely, the pump switches off automatically and the green button flashes.
8.	Complete refilling by pressing the green button for at least 2 seconds. The green button goes off and the power source changes to state ready. If the button is pressed for less than 2 seconds, the refilling process starts again (see step 6).
9.	Store the hose back into the starting position and close the flap.

Automatic termination:

- If the Kjellfrost canister is empty before the tank is filled completely, the pump switches off automatically after 3 s. The green button flashes.
- Replace the empty canister by a full one
  and continue refilling: continue with step 5 or
- Finish refilling: continue with step 8

Manual termination:

- You can also manually terminate the refilling process by briefly pressing the green button. The green button flashes.
- Continue refilling: continue with step 5 or
- Finish refilling: continue with step 8

Draining the coolant

1.	Plasma torch and hose package must be connected.
2.	The power source must be in the state ready or error: cooling level min (E 142)
3.	Open the flap at the front of the power source, by reaching into the flap at the bottom right and open the magnetic lock by pulling..
4.	Remove the end of the hose and put it into an empty collecting container with a capacity of at least 20 liters.
5.	Press the yellow button „drain coolant“ (S6) briefly. The yellow button lights up.
6.	The power source is in the state service and the tank runs empty without the coolant pump.
7.	When the tank is empty, the yellow button flashes for 2 seconds and then goes off. The power source changes to the state error: cooling level min (E 142). The green button flashes.
8.	If you want to refill new coolant now, continue with step 4 of refilling the coolant.
9.	If you don’t want to refill coolant, switch off the power source.
10.	Store the hose back into the starting position and close the flap.

Manual termination (i. e. collecting container full):

- You can also terminate the draining process manually by briefly pressing the yellow button.
  The yellow button flashes.
- Continue draining: continue with step 5 or
- Finish draining by pressing the yellow button for at least 2 seconds.
  The yellow button goes off and the power source changes to state ready.
  If the button is pressed for less than 2 seconds, the draining process starts again (see point 6).

6.7 Rear wall

All connecting and control cables will be placed to the rear panel of the power source.
Voltage and current-carrying parts and the fuses are accessible only after opening the cover plate, which is protected by a safety contact.

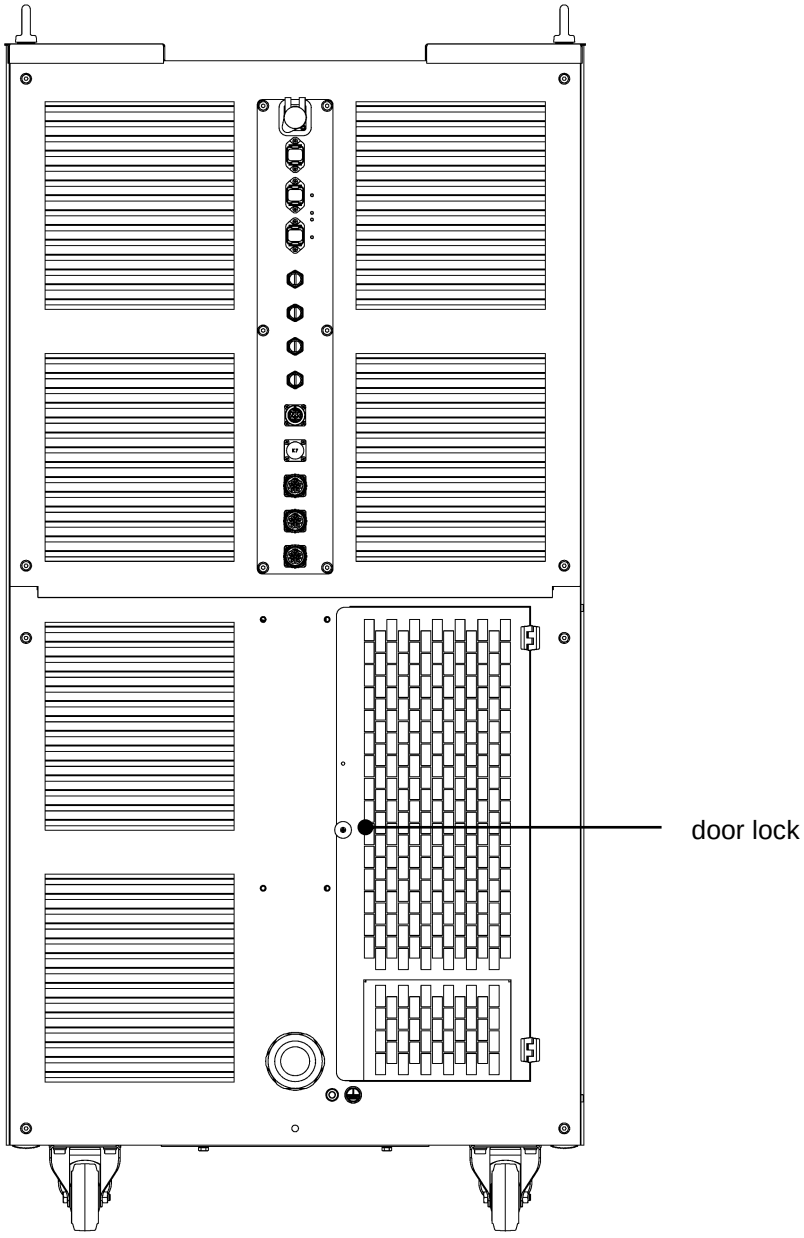


Fig. 15: rear panel

INFORMATION

Please note that you can open the door in the rear wall of the power source, which is secured with a door lock, only with a cross-tip screwdriver!
To do this, insert the cross-tip screwdriver into the opening and turn it to the left! Then the door opens easily.

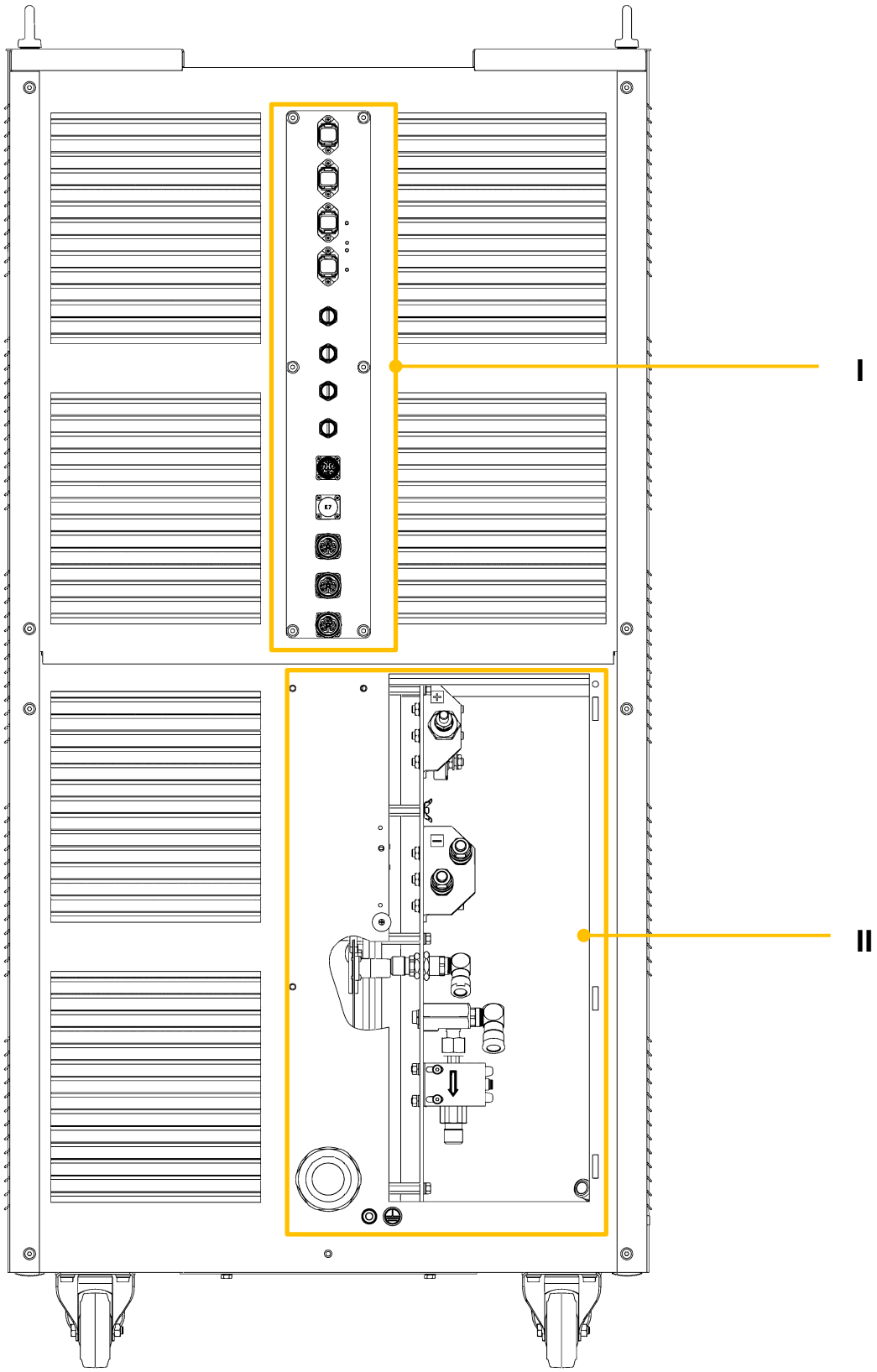


Fig. 16: Rear panel of the power source

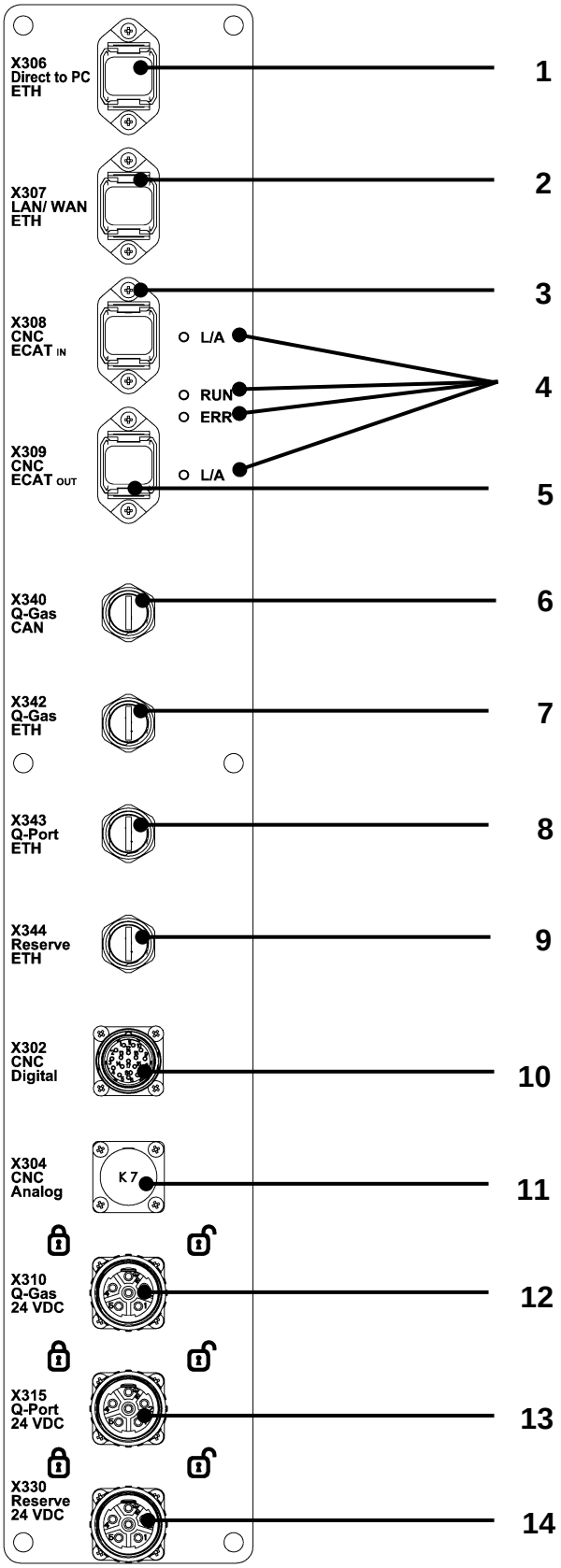


Fig. 17: upper connections (I)

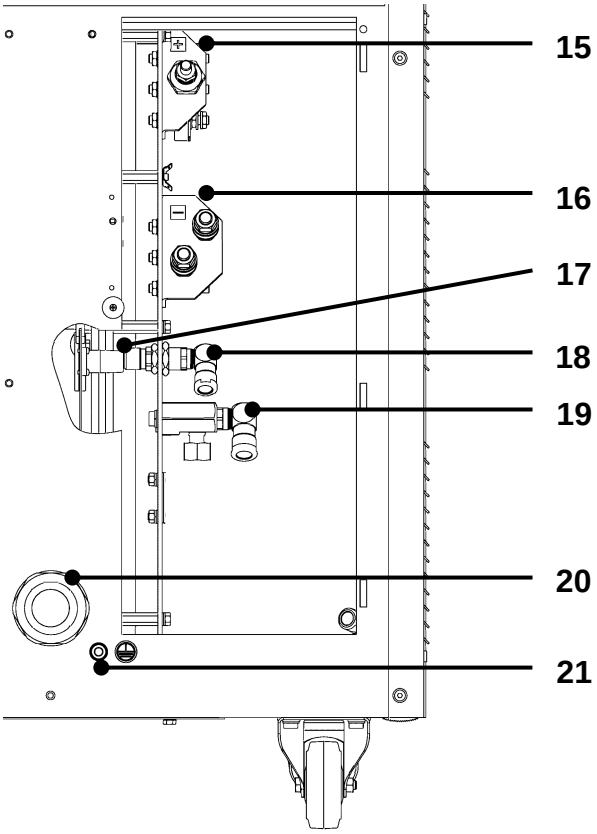


Fig. 18: lower connections (II)

Fig. 19: If necessary, set the cable lugs of the cathode leads (connection 16) against each other.

upper connections				
1	X306	Connector Direct to PC Ethernet		RJ-45 socket
2	X307	Connector LAN/ WAN Ethernet		RJ-45 socket
3	X308	Connector CNC EtherCAT IN		RJ-45 socket
4	(X308/ X309)	EtherCAT LED-display (further information see chapter „LED display“) *(L/A (Link/Activity))*		
	green	*<L/A> LED (<IN> Port)*	*Displays the input status*	
	green	*<RUN> LED*	*Displays the operating status*	
	red	*<ERR> LED*	*Displays the error status*	
	green	*<L/A> LED (<OUT> Port)*	*Displays the output status*	
5	X309	Connector CNC EtherCAT OUT		RJ-45 socket
6	X340	Connector Q-Gas CAN		M12 5-pol. socket
7	X342	Connector Q-Gas Ethernet		M12 8-pol. socket
8	X343	Connector Q-Port Ethernet		M12 8-pol. socket
9	X344	Connector reserve Ethernet		M12 8-pol. socket
10	X302	Connector CNC digital		M23 17-pol. socket
11	X304	Connector CNC analogue		M17 6-pol. socket
12	X310	Connector Q-Gas 24 VDC		M17 5-pol. socket
13	X315	Connector Q-Port 24 VDC		M17 7-pol. socket
14	X330	Connector reserve 24 VDC		M17 5-pol. socket
lower connections				
15	+	Workpiece connection		terminal M10
16	-	Cathode connection		terminal M12 (2x)
17	X314	Connector Q-Port pilot		M17 3-pol. socket
18	blue	Connector coolant supply		Ø 12 socket
19	red	Connector coolant return		Ø 14 socket
20		Mains cable entry		M63x1,5
21		Terminal earthing		terminal M8

Following components are suitable for the connection to the power source

- the torch connection unit Q-Port
- the gas console Q-Gas for the adjustment and the dosage of the process gases

EtherCAT LED display

L/A (Link/Activity)

<L/A> LED (<IN> Port)	Displays the input status		
	Colour	**LED status**	**Description**
	green	OFF	Port not connected or no power applied to device
		blinking	Port connected and communication active.
		ON	Port connected, but no communication
<RUN> LED	Displays the operating status		
	Colour	**LED status**	**Description**
	green	OFF	INIT (initialization status) or no power applied to device
		blinking (200 ms ON, 200 ms OFF)	PREOP (pre-operational status)
		single flash (200 ms ON, 1000 ms OFF)	SAFEOP (safe-operational status) Communication of cyclic data transfer running. Input values available, output values written to the device but not updated on device output.
		ON	OP (operational status)
<ERR> LED	Displays the error status		
	Colour	**LED status**	**Description**
	red	OFF	No error or no power applied to device
		blinking (200ms ON, 200 ms OFF)	Error occured (see error parameter)
		single flash (200 ms ON, 1000 ms OFF)	Slave device application has changed theEtherCAT state autonomously, due to local error (see error parameter).
		double flash (200 ms ON, 200 ms OFF, 200 ms ON, 1000 ms OFF)	An application watchdog timeout has occured. Sync Manager Watchdog timeout or communication timeout occurred.
		ON	A critical communication or application controller error has occured. Application controller is not responding any more (PDI (Process data interface) Watchdog Timeout detected by ESC (EtherCAT-Slave-Controller)).
<L/A> LED (<OUT> Port)	Displays the output status		
	Colour	**LED status**	**Description**
	green	OFF	Port not connected or no power applied to device
		blinking	Port connected and communication active.
		ON	Port connected, but no communication

6.8 Switching ON the power source

The power source is switched ON by the guiding machine via the X302.

INFORMATION

It is not possible to operate the power source without emergency stop signal from the guiding system!

6.8.1 Switching ON the control unit

When the control unit is switched on, all PCBs and the router boot. It is switched on by applying a voltage of 24 V DC via X302:16 (+24 V/CNC) and X302:17 (GND/CNC), thus activating an auxiliary contactor (Q0) with a power consumption of 3.2 W. During the booting routine, the Q-LED shows a white light. After completion of the booting routine, the system switches to status “STANDBY” (STANDBY (0x0011)) and the Q-LED flashes blue.

6.8.2 Errors and warnings

In case of an error, the present status is terminated and the unit changes to the status “ERROR” (ERROR (0xEEEE)). An error code according to the error table () is displayed on the Q-Desk and transmitted via EtherCAT. Depending on the error code, the Q-LED shows a yellow or red light.

Unlike errors, warnings do not result in the termination of the present status. Warnings are also displayed on the Q-Desk and transmitted via EtherCAT.

6.8.3 Configuration

According to the IM_Q-Desk manual, the following settings can be made via web interface during initial commissioning:

- system time
- control mode (manual / EtherCAT)
  explicit device id / station alias (EtherCAT)
- network configuration
  DHCP server / DHCP client / static IP
- remote maintenance
- Complex name

6.8.4 Switching ON the power unit

The power unit can only be switched on if a Q-Torch is connected and equipped with consumables and the safety circuit (emergency stop, door switch) is closed.

By applying the signal “power unit ON“ (X302:4; rx_power_unit_on := 1) from the guiding system, the plasma unit changes from the status “STANDBY” (STANDBY (0x0011)) to status “READY“ (READY (0x0002)).
At the same time, the coolant pump (M16)**,** main contactor (Q1), power supply (T12) and pilot contactor (Q2) are switched on. The coolant flow and the nozzle voltage are checked, and a software enable signal is sent to release the switching on of the main contactor. Additionally, the Q-Torch is checked for connection, authenticity and safety.

The signal “main contactor" (X302:15; tx_main_contactor_on = 1) is passed to the guiding system. After completion of the switch-on procedure, the plasma unit changes to the status
“WAIT“ (RECORD_NUMBER_WAIT (0x0013)) and the Q-LED flashes white.

6.9 Cutting operation

WARNING

It is not allowed to operate the unit with any of the housing cover plates not in place! It is hazardous to the operator and other people in the area, and prevents the equipment from properly cooling the components!

Before cutting can start the following steps have to be taken:

Inspection of the plasma torches:

- the torch must be in a correct and undamaged condition
- the inserted consumables must match the intended cutting technology and have to be in a good shape

Inspection of the plasma power source:

- the mains fuse are of the required size (see chapter “Technical data of plasma machine”)
- the workpiece cable is correct connected (see chapter “connection / current return line”)

Inspection of the installed plasma gas unit:

The gas supply system is correct installed, connections are safe and tight (see chapter „connection of gas supply” – instruction manual of plasma gas unit).

INFORMATION

Please make sure that the doors of the Q-Source and Q-Port are closed!

INFORMATION

Please make sure that the emergency stop circuit is closed!

6.9.1 Loading the data set

In the status "Waiting for data set" (RECORD_NUMBER_WAIT (0x0013)), a data set is selected (Q-LED pulsates white). This is done either via the cutting data finder of the Q-Desk or by transmission of the required parameters via EtherCAT.

The following minimum data set information is required:

- rx_db_data_version [7040:4]
- rx_db_number [7040:5]
- rx_record_number_KJ [7040:1].

Further, variations of the setpoints for cutting currents 1 and 2 and the gas pressures are possible within permissible limits. After allocation of the data set information, the change of the data set is initiated with the respective command:

command_set [7000:1] := RECORD_NUMBER_CHANGE (0x0001)

Together with the loaded data set, the gases are selected according to the gas combination and the lines are rinsed (Q-LED pulsates white).

After the gas purge, the plasma unit changes to the status „READY“ (READY (0x0002)) (Q-LED shows a blue light).

The signal “ready for cutting“ (X302:10; tx_ready_for_cutting = 1) is transmitted to the guiding system.

A new data set can be selected at any time while the plasma unit is in the status "READY" (READY (0x0002)).

6.9.2 Initial position finding

The plasma cutting unit offers the function of an electric initial positioning. This can be done either during the status “RECORD NUMBER CHANGE“ (RECORD_NUMBER_CHANGE (0x000E)), or after a change of a data set in status “READY“ (READY (0x0002)) or during an extended gas pre-flow time.
The contact between plasma torch and workpiece is indicated with the signal “initial positioning” (X302:11; tx_initial_positioning = 1).

6.9.3 Cutting

WARNING

Do not level the plasma torch towards the eyes or other parts of the body!

Do not touch the nozzle, because there is an electrical hazard by the high voltage ignition and a risk of burns from the pilot arc!

Avoid “flash burn” of the eyes by wearing safety glasses!

The cutting process is preceded by a gas pre-flow. It is possible to set the gas pre-flow manually with the signal “gas ON“ (X302(6); rx_gas_on := 1) for a maximum time of 3 minutes. This is necessary, for example, for the UWP technology. When the cutting process is started with the signal “current ON” (X302(5); rx_current_on := 1), the gas pre-flow is carried out automatically.

After setting the signal “current ON” (X302(5); rx_current_on := 1), a voltage is applied between cathode and nozzle. The electronic ignition unit now creates short high-voltage pulses which results in the ignition of the plasma arc.

First, the plasma arc closes the pilot circuit and burns between cathode and nozzle. This current flow is indicated by the signal “current ON“ (tx_current_on = 1). The gas flow presses the arc out of the nozzle until it transfers to the workpiece. The main circuit is now closed.

The main arc is ramped up to the nominal current. Meanwhile, the signal “ready for moving” (X302(12); tx_ready_for_moving = 1) is sent and the arc pierces the material. The guiding system starts with the movement along the cutting contour.

It is possible to specify two setpoints for the cutting current. The cutting always starts with cutting "cutting current 1" (rx_reference_value_cutting_current_1). During the cutting process, it is possible to switch to "cutting current 2" (rx_reference_value_cutting_current_2). The command used in this case is command "REFERENCE_VALUE_CURRENT_2" (0x0003).

The command "REFERENCE_VALUE_CURRENT_1" (0x0002) is used to switch back to cutting current 1. This switching of the cutting current can, for example, be used for a current reduction at corners or also for a current increase.

The change between the cutting currents is carried out ramp-wise. The ramp time is determined with the parameter "main arc slope" (rx_reference_value_main_arc_slope).

For finishing the cutting process, the signal “current ON” must be set to “0” (X302(5); rx_current_on := 0). The current is ramped down until the plasma arc is interrupted. The signal “ready for moving” returns the value “0” (X302(12); tx_ready_for_moving = 0).

If the signal “gas ON" is set to “0” immediately (X302(6); rx_gas_on := 0), there will be a minimum gas post-flow time of 3 s. This can be extended to up to 3 min. During the gas post-flow time, it is possible to ignite again.

6.9.4 Steps of the cutting process

		X302 see SP2	or EtherCAT
1.	Set signal "standby"	24 V DC on X302:16 (+24 V/CNC) X302:17 (GND/CNC)	
2.	Configure, if necessary: restart	control mode: manual	control mode: EtherCAT
3.	Set signal "plasma unit ON"	X302:4	rx_power_unit_on := 1
4.	Select data record	via cutting data finder of the Q-Desk	rx_db_data_version [7040:4] rx_db_number [7040:5] rx_record_number_KJ [7040:1].
5.	Wait for signal "ready for cutting"	X302:10	tx_ready_for_cutting = 1
6.	Optional: Set signal "gas ON"	X302:6	rx_gas_on := 1
7.	Optional: Wait for signal "initial positioning"	X302:11	tx_initial_positioning = 1
8.	Set ignition height		
9.	Set signal "current ON"	X302:5	rx_current_on := 1
10.	Wait for signal "ready for moving"	X302:12	tx_ready_for_moving = 1
11.	Set pierce height and wait for pierce time		
12.	Set cutting height and cutting speed		
13.	Cutting		
14.	Reset signal "current ON"	X302:5	rx_current_on := 0
15.	Reset signal „gas ON“ or: Start cutting again (continue with point 7)	X302:6	rx_gas_on := 0

INFORMATION

Use the signals "Emergency stop 1" X302 (2) and "Emergency stop 2" X302 (3) only for the emergency stop function and never for control purposes!

Standby function - energy saving mode

The plasma cutting unit has an automatic standby function in accordance with EU directives.

The function ensures that the unit switches to standby mode after 20 minutes after the end of a cutting process without any changed control commands in order to save energy.

Restarting from CNC:

Switch off the plasma cutting unit from the CNC control panel – and switch it on again immediately.

The variation of the auto-standby time is possible via the web interface (Q-Desk).

ATTENTION

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

Under water plasma cutting - conductivity of water

INFORMATION

For safe ignition of the plasma arc during UWP cutting, the maximum value of the electrical conductivity of the water in the cutting table must not exceed 1500 µS/cm!

Flying cutting start

(possible by selecting the data set):

- switch ON torch (ignite pilot arc) 10 to 20 mm before the edge of the workpiece.
- move the plasma torch to the workpiece edge.
- If the pilot arc touches the workpiece, the main arc is established.
- In the case of thinner plates, an initial speed which is reduced compared to the maximum cutting speed is required.
- The height between swirl gas cap and workpiece should be in a range of 1 to 4 mm. The relevant torch height for the particular application are listed in the cutting charts.

Hole piercing

WARNING

Upcoming hot material can lead to endangerments (risk of burns and fire)!

- when hole piercing above the workpiece the height for ignition has to be adjusted, depending on the plate thickness (values are given in the cutting chart)
- after the ignition of the pilot arc the main arc establishes immediately
- the torch should start movement simultaneously with the ignition to reduce the danger of damaging torch parts. Upcoming material can effect nozzle, swirl gas nozzle or nozzle gas
- for thicker materials the following procedure is recommended:
  - adjust ignition height acc. cutting chart (1.2 - 2 x cutting height)
  - pierce delay acc. cutting chart
  - lift torch during main arc slightly to avoid that spatter can damage the torch head
  - after the material is pierced through the torch returns to the optimum cutting height

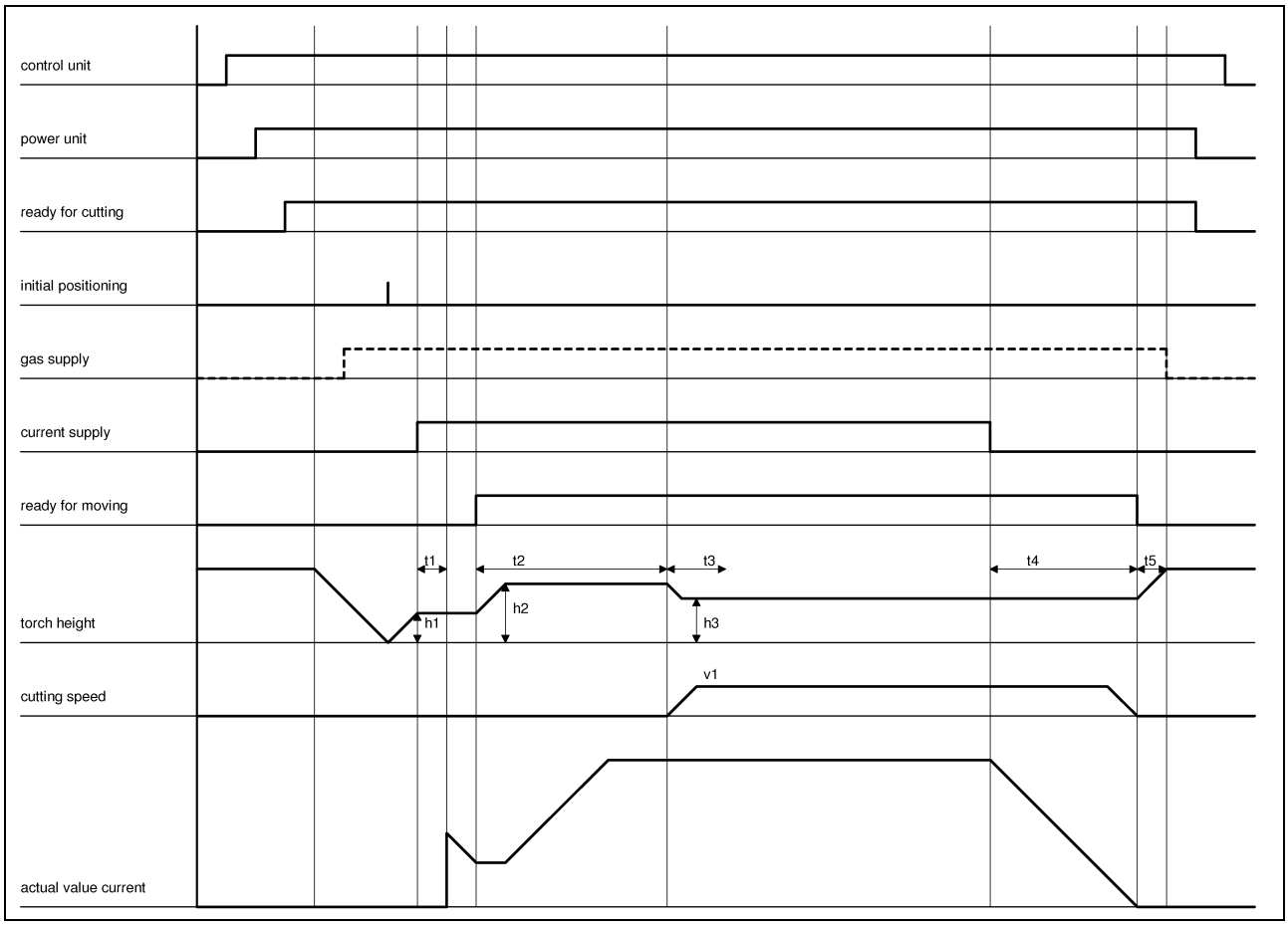


Fig. 20: schematic diagram of a cutting process with height control system

Adjustment parameters	
h1	ignition height of plasma torch
h2	pierce height = elevated torch height at hole piercing (at larger material thickness)
h3	cutting height
t1	gas pre-flow time
t2	pierce time
t3	teach delay time
t4	downslope time
t5	gas post-flow time
v1	cutting speed

6.10 Switching OFF the power source

The power unit is switched off by the guiding system by switching off the signal „plasma unit ON“ (X302**:**4; rx_power_unit_on := 0) , see SP2.
The supply voltage for the control unit remains on. The plasma unit is now in the status “STANDBY” (STANDBY (0x0011)).
By switching off the 24 V DC to X302:16 (+24 V/CNC) / X302:17 (GND/CNC), the control unit is also switched off.

INFORMATION

The main control unit is equipped with a voltage maintenance circuit which enables a controlled shutdown of the systems. When doing a restart of the control unit, the waiting time between switching off and switching on should not be less than 10 s

6.11 Combination of the power source with CNC-controls of the guiding systems and robots

INFORMATION

Use the signals "Emergency stop 1" X302 (2) and "Emergency stop 2" X302 (3) only for the emergency stop function and never for control purposes!

The required control cables for the coupling are to be provided by the operator.

Potential-free switching contacts on the user side must be designed for a switching current of at least 500 mA DC and a switching voltage of 24 V.

If relays are controlled on the user side, they must be provided with a free-wheeling diode.

Variant 1: EtherCAT (preferred variant)

The coupling is done via the connections provided in the rear wall:

see section rear panel, upper connections (I)				
3	X308	Connection CNC EtherCAT IN	RJ-45 socket	
4	X309	Connection CNC EtherCAT OUT		
10	X302	Connection CNC Digital only: X302 (1) +24 V/1 X302 (2) emergency stop 1 X302 (3) emergency stop 2 X302 (16) Standby, 24 V / CNC X302 (17) GND / CNC	17-pol. socket	see wiring diagram "Q-Source - CNC interface" (... SP2)

Variant 2: digital and analogue

Coupling takes place via the connections provided in the rear wall:

see section rear panel, upper connections (I)				
10	X302	Connection CNC digital	17-pol. socket	see wiring diagram "Q-Source - CNC interface" (... SP2)
11	X304	Connection CNC analogue	6-pol. socket	

6.12 Information for trouble shooting

If during the operation malfunctions are registered the cutting has to be stopped and the reason to be found out.

⚠ WARNING

Warning of dangerous electric voltage
Electric shock can be deadly. Further personal and material damages can result from impact.
Before maintenance and repair work and before opening the device (e.g. for troubleshooting) it has to be switched off, visibly disconnected from the mains and secured against being switched on again!
Opening the plasma unit may be carried out only under responsibility of a qualified electrician!

The plasma sequence control of the plasma cutting system is displaying certain warnings and error codes, if during service or operation warnings or errors are noticed.
In this case appear the corresponding warning or error messages at Q-Desk/PC and display of guiding system via Ethernet and EtherCAT and additionally the respective LED light at rear panel of power source.
The description of these warnings and errors and the rectification is given in the following chart:

Error code	Meaning	Elimination
W0	no warning	
W1	Torch could not be identified.	Attach a compatible torch. Check connection LP_Port-Control (X7). Restart the system.

Error code	Meaning	Elimination
E0	no error	
E100	communication EtherCAT - M2MI	Check EtherCAT connection from/to CNC, check EtherCAT connection from/to PCB M2MI, check EtherCAT status using the LEDs on X308/X309 (instruction manual -> EtherCAT LEDs) or/ and check the configuration and status of the EtherCAT master (control system)
E101	communication CAN - M2MI	Restart the Q-Source, check 24 V DC supply, check CAN connection from/to PCB M2MI
E102	communication CAN - Q-Gas	Restart the Q-Source, check 24 V DC supply, check CAN connection from/to PCB Q-Gas
E103	communication CAN - Q-Port	Restart the Q-Source, check 24 V DC supply, check CAN connection from/to PCB Q-Port
E104	communication CAN - Q-Torch	Restart the Q-Source, check 24 V DC supply, check CAN connection from/to PCB Q-Port
E105	communication CAN - Module 1	Restart the Q-Source, check 24 V DC supply, check CAN connection from/to Module 1
E106	communication CAN - Module 2	Restart the Q-Source, check 24 V DC supply, check CAN connection from/to Module 2
E107	communication CAN - Module 3	Restart the Q-Source, check 24 V DC supply, check CAN connection from/to Module 3
E109	communication database	Restart the Q-Source
E110	communication Ethernet - M2MI	Restart the Q-Source, check Ethernet connection from/to PCB M2MI and router
E111	communication Ethernet - plasma control (PC)	Restart the Q-Source, check Ethernet connection from/to PCB PC and router
E112	communication Ethernet - Q-Port	Restart the Q-Source, check Ethernet connection from/to PCB Q-Port and router
E113	communication Ethernet - Q-Gas	Restart the Q-Source, check Ethernet connection from/to PCB Q-Gas and router
E114	no cathode voltage in process	Check cathode cable and pilot cable X314 from/to Q-Source and Q-Port.
E115	emergency stop 2 no emergency stop 1	Check signal "e-stop 1" from CNC

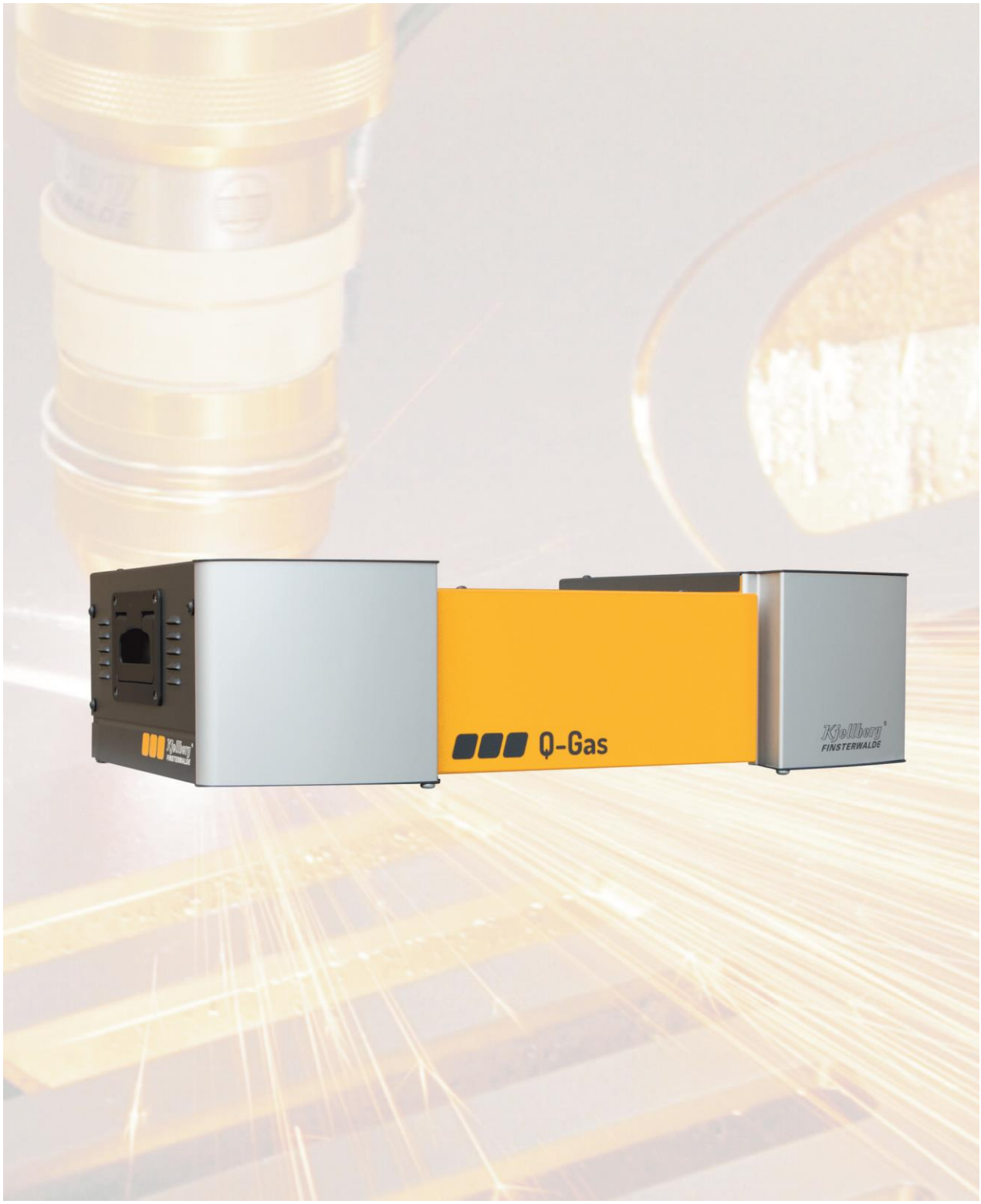
Error code	Meaning	Elimination
E116	emergency stop 1 no emergency stop 2	Check signal "e-stop 2" from CNC
E117	no signal “door switch” - Q-Source	Close door from Q-Source
E118	no signal “door switch” - Q-Port	Close door from Q-Port
E119	no +24 V/2 - Q-Source	Check power supply T12
E120	emergency stop activated	Check emergency-stop from CNC
E121	signal “power unit ON” in error end	Deactivate signal "power unit ON"
E124	cathode voltage in cutting break	**Contact the service**
E125	torch short circuit cathode - nozzle	Check consumables, check pilot cable X314 from/to Q-Source and Q-Port
E126	pilot plug not plugged in	Check pilot plug X3 (Q-Port), check pilot cable X314 from/to Q-Source and Q-Port
E127	max. pilot time exceeded	Check workpiece cable, check ignition height
E128	max. ignition time exceeded	Check PCB HF (Q-Port)
E129	main arc interruption	Check cutting height
E130	pilot arc interruption	Check ZG, check consumables
E131	max. gas test time exceeded	Deactivate signal "gas test"
E132	leak in cutting break - PG1	Check PG1 for leak
E133	leak in cutting break - PG2	Check PG2 for leak
E134	leak in cutting break - WG1	Check WG1 for leak
E135	leak in cutting break - WG2	Check WG2 for leak
E136	deviation in process - PG1	Check inlet pressure from PG1
E137	deviation in process - PG2	Check inlet pressure from PG2
E138	deviation in process - WG1	Check inlet pressure from WG1
E139	deviation in process - WG2	Check inlet pressure from WG2
E140	coolant temperature too high	Leave to cool down the Q-Source
E142	coolant level too low	Fill up coolant
E143	main contactor ON	Check main contactor
E144	main contactor OFF	Check main contactor
E145	max. “gas ON” time exceeded	Deactivate signal "gas ON"
E146	“current ON” in process-/error end	Deactivate signal "current ON"
E147	deviation in process - ZG	Check inlet pressure from ZG
E148	transfer arc interruption	Check ZG, check cutting height

Error code	Meaning	Elimination
E149	communication CAN - plasma control (PC)	Restart the Q-Source, check 24 V DC supply, check CAN connection from/to PCB PC
E151	temperature too high - Module 1	Leave to cool down the Q-Source
E152	primary voltage too high - Module 1	Check main voltage
E153	primary voltage too low - Module 1	Check main voltage
E154	intermediate circuit voltage too high - Module 1	**Contact the service**
E155	intermediate circuit voltage too low - Module 1	**Contact the service**
E159	error end - Module 1	
E160	arc interruption in upslope phase	Check cutting height
E161	arc interruption in downslope phase	Check cutting height
E162	current in cutting break - Module 1	**Contact the service**
E163	current in cutting break - Module 2	**Contact the service**
E164	current in cutting break - Module 3	**Contact the service**
E166	coolant flow too low	Check coolant hoses, check correct seat of the torch head, check consumables
E168	defective relay A1:K15 emergency stop 1	Check PCB PC K15
E169	defective relay A1:K16 emergency stop 2	Check PCB PC K16
E170	Torch identification failed	**Contact the service**
E171	no data set loaded	Transmit valid data set number
E172	leak in cutting break - ZG	Check ZG for leak
E173	no configuration loaded	Restart the Q-Source
E176	data set with invalid gas code selected	**Choose a valid data set.**
E177	voltage AS-Card error - Module 1	Check automatic fuse F1 C63A, check fuse F1 - F3 (PCB E-INLE), check fuse F1 (PCB AS-Card)
E178	wrong control mode (manual/ECAT)	Activate manual modus or EtherCAT
E179	record number change not allowed	Transmit data set change on ready status again
E180	check of torch safety interrupted	Lift torch from workpiece
E182	temperature too high - Module 2	Leave to cool down the Q-Source
E183	primary voltage too high - Module 2	Check main voltage
E184	primary voltage too low - Module 2	Check main voltage
E185	intermediate circuit voltage too high - Module 2	**Contact the service**

Error code	Meaning	Elimination
E186	intermediate circuit voltage too low - Module 2	Contact the service
E190	error end - Module 2	
E192	temperature too high - Module 3	Leave to cool down the Q-Source
E193	primary voltage too high - Module 3	Check main voltage
E194	primary voltage too low - Module 3	Check main voltage
E195	intermediate circuit voltage too high - Module 3	**Contact the service**
E196	intermediate circuit voltage too low - Module 3	**Contact the service**
E200	error end - Module 3	
E211	voltage error on AS-CARD - Module 2	Check automatic fuse F2 C63A, check fuse F1 - F3 (PCB E-INLE), check fuse F1 (PCB AS-Card)
E212	voltage error on AS-CARD - Module 3	Check automatic fuse F3 C63A, check fuse F1 - F3 (PCB E-INLE), check fuse F1 (PCB AS-Card)
E214	communication Ethernet - GUIDE	Restart the Q-Source, check Ethernet connection from/to PCB GUIDE and router
E216	Terms and Conditions of Business not accepted	Confirm Terms and Conditions
E217	incompatible unit components	**Contact the service**
E218	wrong voltage version - Module 1	**Contact the service**
E219	wrong voltage version - Module 2	**Contact the service**
E220	wrong voltage version - Module 3	**Contact the service**
E222	no main contactor released	**Contact the service**
E223	no coolant pressure switch signal	**Contact the service**
E224	no data base loaded	Transmit valid data base version/-number.

Error code	Meaning	Elimination
E225	error checking SD* (no USB stick found)	Connect valid USB stick
E226	error creating folder	**Contact the service**
E227	error when mounting a USB stick	
E228	file creating error	
E229	file writing error	
E230	sync call error	
E231	file comparing error	
E232	file deleting error	
E233	unmounting error	
E234	failed to delete folder	
E235	error when setting the RTC / date	
E236	process not started with "gas ON"	Set the signal "gas ON" at beginning of the process
E237	communication CAN - GUIDE	Restart the Q-Source, check 24 V DC-supply, check CAN connection from/to pcb GUIDE
E238	update routine (setup) on M2MI failed	Restart the Q-Source, upload update again, restart the Q-Source
E239	update routine (setup) on PC failed	
E240	update routine (setup) on Q-Gas failed	
E241	update routine (setup) on Q-Port failed	
E242	update routine (setup) on Guide failed	
E243	transmission error update to M2MI	Check ethernet connection, restart the Q-Source, upload update again, restart the Q-Source
E244	transmission error update to PC	
E245	transmission error update to Q-Gas	
E246	transmission error update to Q-Port	
E247	transmission error update to GUIDE	
E248	timeout error	Check ethernet connection
E249	update: programs could not be stopped	Check CAN connection
E250	update: bundle not valid	Possible transmission error, request the bundle again, transfer the bundle to the Q-Source

Error code	Meaning	Elimination
E251	update: bundle setup error in plasma control (PC)	Restart the Q-Source, install the update again, in case of repeated error: **Contact the service**
E252	update: programs not valid	Do not switch off the Q-Source, **Contact the service**
E253	update: selected bundle could not be found	Refresh page
E254	update: no ethernet connection to M2MI	Check ethernet connection
E255	update: no ethernet connection to PC	
E256	update: no ethernet connection to Q-Gas	
E257	update: no ethernet connection to Q-Port	
E258	update: no ethernet connection to GUIDE	
E259	signal "Gas ON" set	Disable signal "gas ON"
E260	service program not started	Restart the Q-Source
E261	main contactor not enabled; coolant flow too low	**Contact the service**
E262	main contactor not enabled, difference between cathode voltage and nozzle voltage too low	
E263	main contactor not enabled; nozzle voltage limit exceeded	
E264	Connection to the software module for internal data management could not be established	Switch off the Q-Source, Wait 10 min. before restarting the Q-Source. In case of repeated error: **Contact the service.**
E265	No live data received from the sequence control in the software module for internal data management	Switch off the Q-Source, Wait 10 min. before restarting the Q-Source. In case of repeated error: **Contact the service.**
E266	Gas test not allowed	Load the data set Try the gas test again.
E267	Update: Too little memory on the board (PC)	Delete the update bundle via Q-Desk. Install the update again. In case of repeated error: **Contact the service.**



7 Plasma gas control unit Q-Gas (Gas console)

7.1 Technical data

Art.-No.:	Q-Gas (.11.825.1300/ .11.825.1300A)			
Operating voltage				
Solenoid valves:	24 V DC			
Dimensions (lxbxh):	700 x 424 x 190 mm			
Weight:	approx. 23 kg			
Connectable gases:	Air	Argon	Oxygen	Nitrogen
Purity:	[1])	99,996 %	99,5 %	99,999%
Information:	dirt, oil and water free		dirt, oil and water free	
Filter / fine filter:	[2])		[3])	
Flow rate, max.:	65 Nl/min	50 Nl/min	65 Nl/min	150 Nl/min
Inlet pressure, max.:	12,0 bar	12,0 bar	12,0 bar	12,0 bar
Inlet pressure, min.:	9,5 bar	9,5 bar	9,5 bar	9,5 bar
Connection:	G1/4“	G1/4“	G1/4“	G1/4“
Usage as:	PG1, PG2	PG1, PG2	PG2, WG1	PG1, PG2, WG2
Connectable gases:	Air	Forming gas N_2/H_2 (95/5) %	Hydrogen	
Purity:	[1])		99,95%	
Information:	dirt, oil and water free			
Filter / fine filter:	[2])			
Flow rate, max.:	100 Nl/min	100 Nl/min	50 Nl/min	
Inlet pressure, max.:	12,0 bar	12,0 bar	12,0 bar	
Inlet pressure, min.:	6,5 bar	9,5 bar	10,5 bar	
Connection:	G1/4“	G3/8“LH	G3/8“ LH	
Usage as:	WG2	WG2	PG3	

[1])	Requirements to air quality ISO 8573-1:2010 [1:4:1]					
	max. size of particles:	0.1 – 0.5 µm	0.5 – 1 µm	1 - 5 µm		category 1
	number of particles:	≤ 20.000	≤ 400	≤ 10		
	max. pressure dew point:	+3 °C				category 4
	max. rest oil content:	0.01 mg/m³				category 1
[2])	Air: 5/0.01 µm, 17 bar					
[3])	O_2: 40/0.01 µm, 40 bar					

Fig. 21: Technical data

Art.-No.:	Q-Gas O_2 4500 (.11.825.1301/ .11.825.1301A)		
Operating voltage			
Solenoid valves:	24 V DC		
Dimensions (lxbxh):	700 x 424 x 190 mm		
Weight m:	approx. 23 kg		
Connectable gases:	Air	Argon	Oxygen
Purity:	[1])	99,996 %	99,5 %
Information:	dirt, oil and water free		dirt, oil and water free
Filter / fine filter:	[2])		[3])
Flow rate, max.:	65 Nl/min	50 Nl/min	65 Nl/min
Inlet pressure, max.:	12,0 bar	12,0 bar	12,0 bar
Inlet pressure, min.:	9,5 bar	9,5 bar	9,5 bar
Connection:	G1/4“	G1/4“	G1/4“
Usage as:	PG1, PG2	PG1, PG2	PG2, WG1
Connectable gases:	Nitrogen	Air	
Purity:	99,999%	[1])	
Information:		dirt, oil and water free	
Filter / fine filter:		[2])	
Flow rate, max.:	150 Nl/min	100 Nl/min	
Inlet pressure, max.:	12,0 bar	12,0 bar	
Inlet pressure, min.:	9,5 bar	6,5 bar	
Connection:	G1/4“	G1/4“	
Usage as:	PG1, PG2, WG2	WG2	

[1])	Requirements to air quality ISO 8573-1:2010 [1:4:1]				
	max. size of particles:	0.1 – 0.5 µm	0.5 – 1 µm	1 - 5 µm	category 1
	number of particles:	≤ 20.000	≤ 400	≤ 10	
	max. pressure dew point:	+3 °C			category 4
	max. rest oil content:	0.01 mg/m³			category 1
[2])	Air: 5/0.01 µm, 17 bar				
[3])	O_2: 40/0.01 µm, 40 bar				

Fig. 22: Technical data

7.2 Technical description

The plasma gas control unit is needed when adjusting and dosing the plasma and swirl gases (process gases) according to operation.

It contains all switching and control elements for the gas flow of the process gases: gas connections, push switches, solenoid valves, also the flow measurements and adjustment equipments.

The adjustment of the required gas parameters occurs through the selection of the suitable record from the CNC.

The plasma gas console must only be set up in the standard position!

Standard position

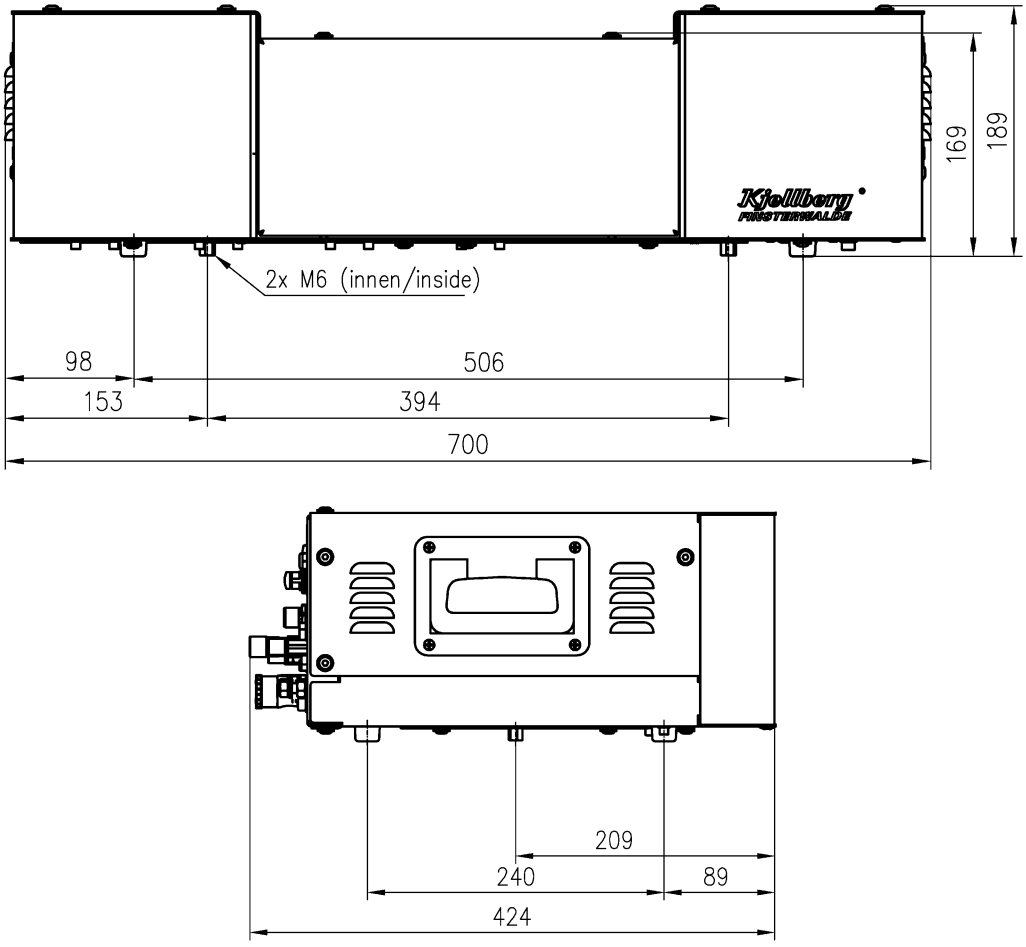


Fig. 23: Dimension diagram

ATTENTION

The component should be positioned so that the cooling air can enter and exit unhindered through the vents. An enclosure of the components is not allowed!

7.3 Connection of the Q-Gas

Connect the Q-Gas through a 5+1-pole control cable with the plasma unit by interface X310 **(14)**. The gas supply hoses for the plasma gas and swirl gas have to be fitted to connectors **(6)** to **(12)**. The connectors **(1)** to **(5)** are provided for the supply hoses to the torch connection unit Q-Port.

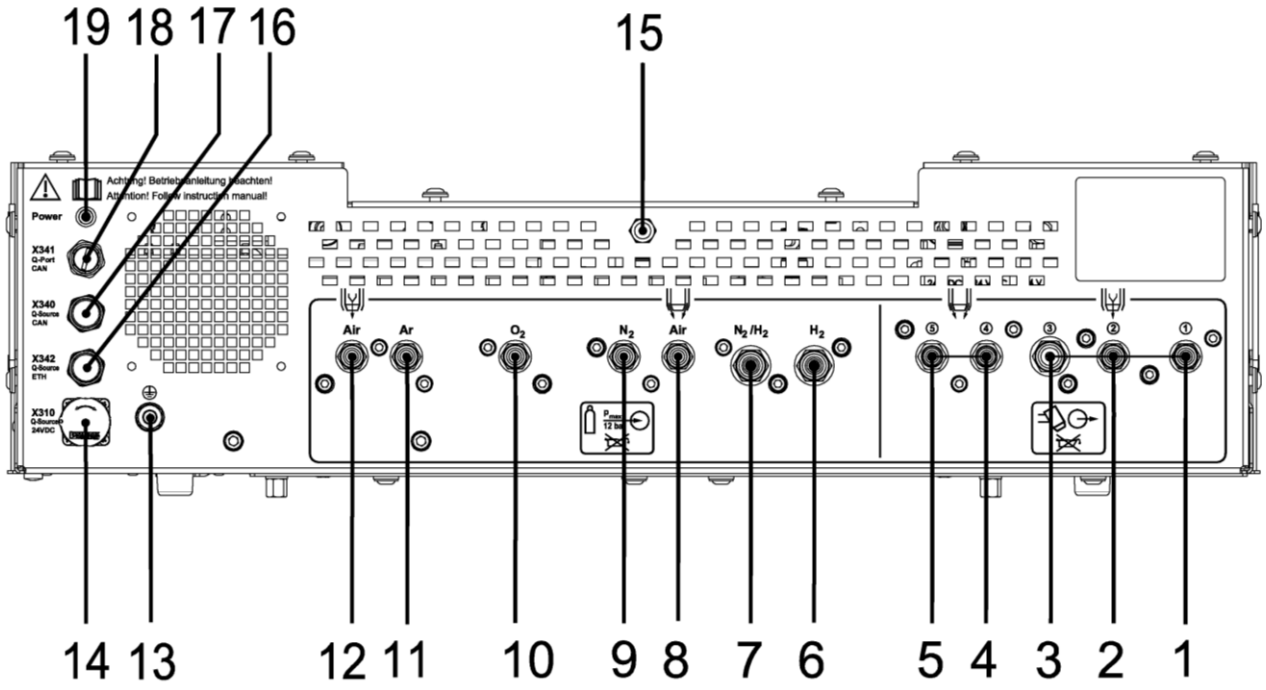


Fig. 24: rear connections of Q-Gas 4500

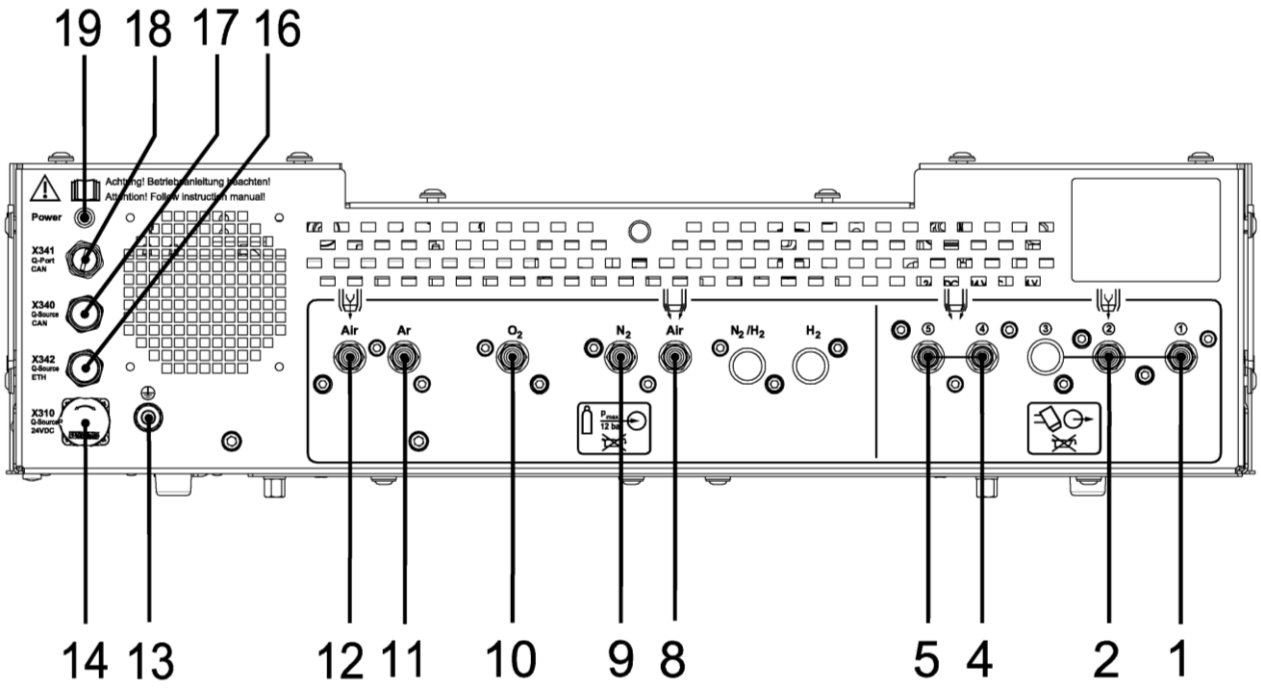


Fig. 25: rear connections of Q-Gas O_2 4500

1	Outlet ignition gas to Q-Port	1	G1/4“
2	Outlet cutting gas to Q-Port	2	G1/4“LH
3	Outlet cutting gas/swirl gas to Q-Port	3	G3/8“LH
4	Outlet swirl gas to Q-Port	4	M12x1
5	Outlet swirl gas to Q-Port	5	M12x1
6	Inlet plasma gas/swirl gas	H2	G3/8“LH
7	Inlet plasma gas/swirl gas	N2/H2	G3/8“LH
8	Inlet swirl gas	Air	G1/4“
9	Inlet plasma gas/ swirl gas	N2	G1/4“
10	Inlet plasma gas/ swirl gas	O2	G1/4“
11	Inlet plasma gas	Ar	G1/4“
12	Inlet plasma gas	Air	G1/4“
13	Ground terminal		M8
14	Connection X310 – Q-Source 24 V DC		5+1-pol. plug
15	Silencer		G1/8“
16	Connection X342 – Q-Source Ethernet		8-pol. plug
17	Connection X340 – Q-Source CAN		5-pol. plug
18	Connection X341 – Q-Port CAN		5-pol. socket
19	Power-LED – “power ON“		

Connections 3, 6, 7 and 15 are not used in Q-Gas O2.

7.4 Connection of the gas hoses between plasma gas control unit and Q-Port

The length of the gas hoses for the connection of the components of the plasma cutting complex have to arranged according to the system configuration. The following hoses are used:

		Air	Ar	H_2	N_2	N_2/H_2	O_2	Autogenous hose 4 x 3,5	Connectors
1 Plasma gas	PG1	x	x		x			blau	G1/4“ - G1/8“
2 Plasma gas	PG2	x			x		x	blau	G1/4“LH - G1/8“
3 Plasma gas, swirl gas	PG3; WG2			x				rot	G3/8“LH - G1/8“LH
4 Swirl gas	WG1; WG2				x		x	blau	M12x1 - G1/8“
5 Swirl gas	WG2	x				x		blau*	M12x1 - G1/8“

Fig. 26: required hoses

The designations “1” up to “5” are located on the back wall of the plasma gas control unit and at the end of the respective hoses.

** if included in the delivery*

7.5 Connection of the gas supply

ATTENTION

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

ATTENTION

Concerning the necessary plasma and swirl gases and the regulated pressures are considered at the cutting charts.

ATTENTION

The quality of the plasma gases must be maintained (see chapter “Technical data”). Using unclean gases can lead to dual arcs, increased deterioration of the nozzles and cathodes and damage to the torch and at the plasma gas console.

In order to protect against coarse dirt, all the plasma gas console and plasma torches are fitted with fine filters. These filters can be removed using a small screwdriver and cleaned when necessary.

WARNING

The maximum input pressure must not exceed 1.2 MPa (12 bar), however it must be at least 0.15 MPa (1,5 bar) more than the designated operating pressure in the cutting chart!

Follow the conditions for using gas cylinders and the manufacturer's instructions of pressure reducers.

The connections for the plasma gas supply hoses can be found at the rear of the plasma gas console (see upper Fig.).

7.5.1 Plasma gases

Plasma gas		Colour of the gas hose	Marking	Connectors	Number
Air	Air	black	grey	**G1/4“**	**2**
Oxygen	O_2	blue		**G1/4“**	**1**
Argon	Ar	black		**G1/4“**	**1**
Hydrogen	H_2	red		**G3/8“LH**	**1**
Nitrogen	N_2	black	green	**G1/4“**	**1**
Forming gas	N_2/H_2	red	green	**G3/8“LH**	**1**

Abb. 27: Overview of the gas hoses

Air

Requirements to air quality ISO 8573-1:2010 [1:4:1]				
max. size of particles:	0.1 – 0.5 µm	0.5 – 1 µm	1 - 5 µm	category 1
number of particles:	≤ 20.000	≤ 400	≤ 10	
max. pressure dew point:	+3 °C			category 4
max. rest oil content:	0.01 mg/m³			category 1

Gas supply using compressed air bottle:

- Check cylinder valve to see if clean (free from oil and grease) and clean if necessary
- Open the cylinder valve for a short time to blow out dust
- Connect air pressure-reducer to cylinder
- Using the black coloured and grey marked gas hoses G1/4”-G1/4”, connect the pressure-reducer to the filter / fine-filter and the filter / fine-filter to the plasma gas console “Air” gas connector
- Open the cylinder valve and adjust the pressure between min. 9,5 bar (at WG = Air min. 6,5 bar) and max. 12 bar, displayed on the manometer

Gas supply using ring mains or compressor:

- The use of an oil and water separator and a cold drier is recommended
- This is to be connected between the ring mains or compressor and the plasma gas console
- If an oil-free compressor is used, the oil separator can be omitted
- Using the black coloured and grey marked gas hoses G1/4”-G1/4”, connect the pressure-reducer to the filter / fine-filter and the filter / fine-filter to the plasma gas console “Air” gas connector
- Adjust the gas pressure on the compressor so that a pressure between min. 9,5 bar (at WG = Air min. 6,5 bar) and max. 12 bar is fitted

Oxygen

WARNING

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

Install the fine-filter between the gas supply and the plasma gas console!

- Check cylinder valve to see if clean (free from oil and grease) and clean if necessary
- Open the cylinder valve for a short time to blow out dust
- Connect oxygen pressure-reducer with explosion protection to the gas supply (cylinder, ring mains)
- Using the blue coloured gas hose G1/4”-G1/4”, connect the pressure-reducer to the filter / fine-filter and the filter / fine-filter to the plasma gas console "O_2" gas connector.
- Open the valve and adjust the gas pressure on the pressure-reducer so that the pressure shown on the plasma gas console manometer is the same as shown on the cutting chart for flowing gas

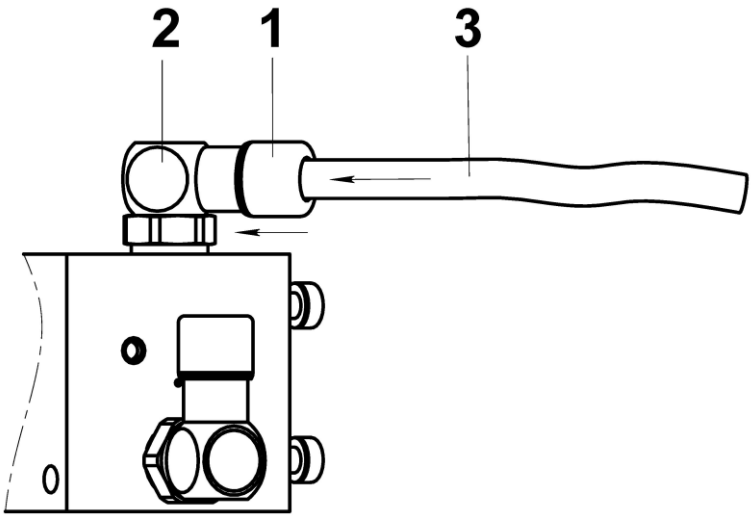
Argon, hydrogen, nitrogen, forming gas

- Check the cylinder valve on cleanliness (must be free of oil and grease) and if necessary clean it.
- Open the cylinder valve shortly for blowing out the dust.
- Connect the pressure-reducer for the appropriate gases to the gas cylinder.
- Using the black coloured gas hose G1/4”, connect the argon pressure-reducer to the plasma gas console “**Ar**” gas connector
- Using the black / green coloured gas hose G1/4”, connect the nitrogen pressure-reducer to the plasma gas console “**N_2**” gas connector
- Using red gas hose G3/8“LH connect the hydrogen pressure-reducer to the plasma gas console "**H_2**" gas connector
- Using red / green coloured gas hose G1/4” connect the hydrogen pressure-reducer to the plasma gas console "**N_2/H_2**" gas connector
- Open the valve and adjust the gas pressure on the pressure-reducer so that the manometer of the gas cylinder rests an inlet pressure according to the cutting charts

7.6 Handling of plug connections within the device

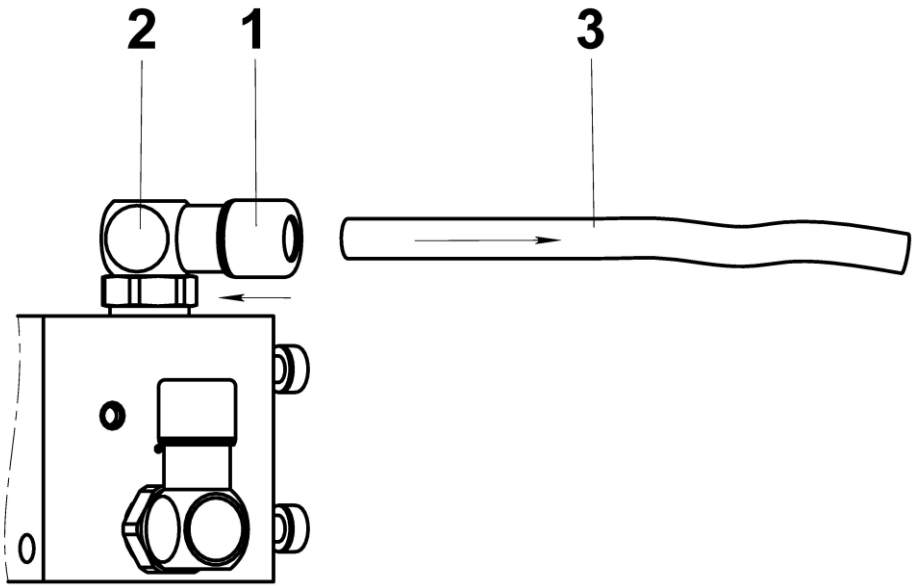
7.6.1 Mounting

- Press the release sleeve (1) in the direction of the plug connection (2).
- Insert the end of the hose (3) into the plug connection until it stops.
- Then snap the release sleeve back to the starting position.



7.6.2 Dismantling

- Press the release sleeve (1) in the direction of the plug connection (2).
- Pull the hose end (3) out of the plug connection.
- Then snap the release sleeve back to the starting position.



8 Plasma machine torch Q-Torch

according to the version delivered

8.1 Technical data

Art.-no.:		Q-Torch 4510 (.11.858.401)
		Plasma torch with quick change head (Version with bayonet coupling)
Current carrying capacity, max.		
Cutting current, IS:		450 A
Pilot arc current, IPb:		40 A
Duty cycle		100 %
Ignition		high voltage ignition (max. 17 kV) by pilot arc
Clamping diameter		50.8 mm
Torch cooling		Coolant mixture • „Kjellfrost -15 °C“ (freezing protection up to -15 °C) or • „Kjellfrost -25 °C” (up to -25 °C) with integrated corrosion protection
Flow rate coolant		3,5 – 6,0 l/min (depending on used consumables) at max. 7.5 bar
Plasma gases		Air, O_2 and Ar, N_2, H_2 and mixtures of this gases (for quality, pressure and flow rate see particular plasma gas regulate unit or plasma gas control unit)
Swirl gases		Air, O_2 and N_2 and mixtures of this gases (for quality, pressure and flow rate see particular plasma gas regulate unit or plasma gas control unit)
Length of the hose set:		1.5 m
Terminals		
Coolant return with cathode cable	KMR	G3/8“
Coolant supply	KMV	PU-hose AD10 x NW6 bl
Pilot cable	PI	pilot plug 4 mm
Control cable	SL	M12 8-pol.plug
Plasma gases	PG	
Ignition gas	ZG	PU-hose AD6.0 x NW4 sw
Cutting gas	SG	PU-hose AD6.0 x NW4 bl
Exhaust	E	PU-hose AD6.0 x NW4 ge
Swirl gas	WG	PU-hose AD6.0 x NW4 gn
Initial positioning contact	eEF	blade receptacle 6.3x0.8 mm
Weight		1.2 kg (change head) 0.8 kg (Shaft without hose set) 3.8 kg (Shaft + 1.5 m hose set)

Fig 28: Technical data

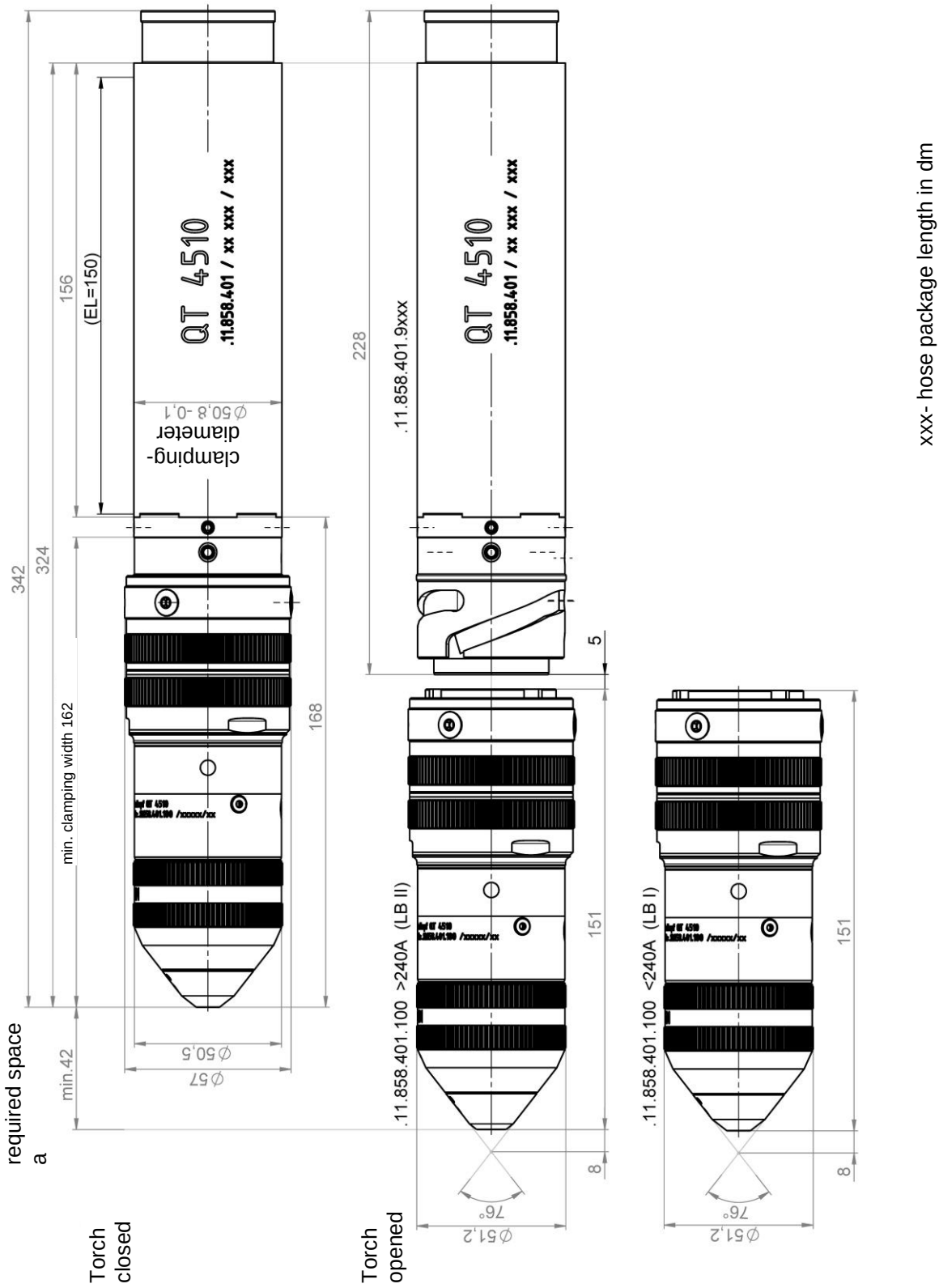


Fig. 29: Dimension diagram

8.2 Technical description

ATTENTION

Only plasma torches of the types Q-Torch 45xx of Kjellberg Finsterwalde are determined for use with power sources Q 1500, Q1500 plus, Q 3000, Q 3000 plus and Q 4500 by EN 60974-1.

Exclusive these plasma torches forms a safety-related unit with the named power sources in accordance with EN 60974-7!

The plasma machine torch consists of the torch head, the torch shaft, the hose set and the consumables.

The plasma torches are suitable for cutting with the plasma gases air (air), oxygen (O_2), argon (Ar), nitrogen (N_2), hydrogen (H_2) and their mixtures.

Swirl gases can be air (air), oxygen (O_2) and nitrogen (N_2) or their mixtures and forming gas.

The cutting current is transferred to the cathode by a flexible copper cable, which is inserted in the insulating coolant return hose. The pilot current is transferred to the nozzle via a pilot cable.

The nozzle is fixed in the nozzle holder by a detachable nozzle cap. The coolant circulates between nozzle and nozzle cap, a special cooling tube ensures an effective cooling of the cathode. This system ensures an efficient cooling of all thermally stressed torch parts.

Mounting and dismounting of consumables, see corresponding point.

INFORMATION

The torch has an indirect cooling of the protection cap.

ATTENTION

Before using a plasma torch it is necessary to ensure that the torch is equipped with the suitable parts for the selected plasma gases and cutting procedure! After each consumable change, a “gas test” process (approx. 20 s) by the guide machine or the Q Desk / PC is required to blow out all residual coolant which can damage the torch during the high-voltage ignition!

ATTENTION

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

ATTENTION

The integrated initial positioning contact of the torch can not be used for the under water initial positioning!

8.3 Connection of the plasma torch to Q-Torch

WARNING

Before opening the torch connection unit, the plasma cutting system has to be switched OFF via guiding system and disconnected visibly from the mains!

INFORMATION

- Guide or lay the hose pack of the plasma torch as straight as possible.
  Avoid multiple bends and offsets. Adjust the mounting position of the Q-Port accordingly.
  Each bend shortens the casing of the hose package and can lead to kinking of the hoses.
- The minimum bending radius of the hose package is 150 mm. It shall not be exceeded during installation or during operation..
- If necessary, catch heavy or long hose packages (> 3m).
- Catch hose packages since a hose package length> 1.5 m additionally, if they are exposed to large accelerations (eg robot applications).

The plasma torch has to be fastened to the support of the guiding system by using an adequate insulation. A special torch holder is available from Kjellberg Finsterwalde.

The plasma torches are connected to the connectors on and in the Q-Port. The following connections shall be established:

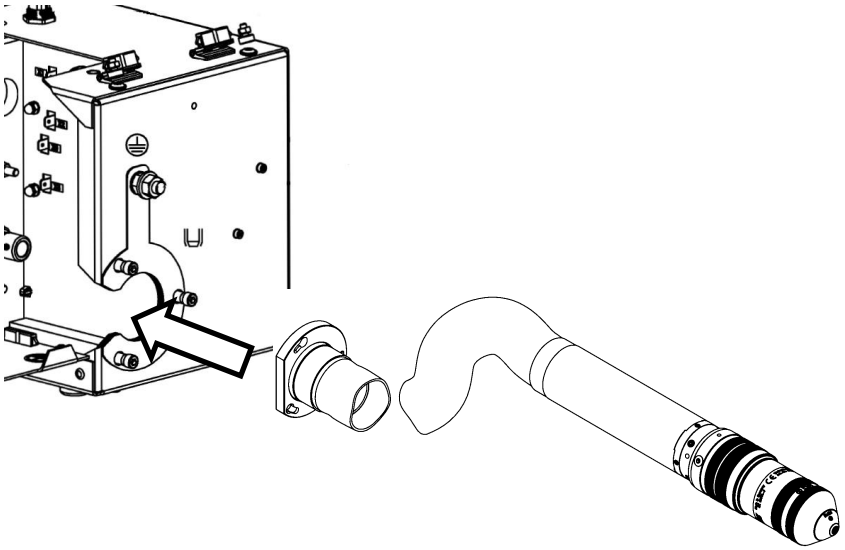
Q-Torch 4510

- Screw connections
  - coolant return (WR) G3/8“
- plug connection
  - coolant supply (WV) PU-hose AD10 x NW6 bl
- electr. plug connections
  - pilot cable (PI) pilot plug 4 mm
  - control cable (SL) M12 8-pol. plug
  - initial positioning contact (eEF) blade receptable 6.3x0.8 mm

Lead the plasma gas hoses and the swirl gas hoses through the corresponding openings of side wall on the outside and insert these with colored coding sleeves on the corresponding plug connections of the torch connection unit

- Plug connector for fluids
  - plasma gas 1 (PG1) / ignition gas (ZG) PU-hose AD6.0 x NW4 sw
  - plasma gas 2 PG2) / cutting gas (SG) PU-hose AD6.0 x NW4 bl
  - swirl gas (WG) PU-hose AD6.0 x NW4 gn
  - Exhaust (E) PU-hose AD6.0 x NW4 ge

Relieve the hose assembly via the flange and the hose fitting, which are screwed to the Q-port with M5 screws (hexagon socket 4). (See figure below)



Ensure good electrical contact of the flange with the housing in order to optimally shield the high frequency generated during the ignition process.

8.4 Consumables and their exchange

WARNING

In order to change consumables, the plasma cutting system shall be switched OFF and secured against any accidental start. An unauthorised start-up is prevented by e.g. visibly isolating the poewer source from the mains!

WARNING

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

ATTENTION

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

Used or damaged consumables shall be replaced in due time (Reference: visible change of the cutting quality).

The life time of the cathode depends on the cutting time, the number of ignitions and the cutting current.

WARNING

If an above the wear limits driven cathode produce a damage of the plasma torch, leaking coolant can impact glowing dross.

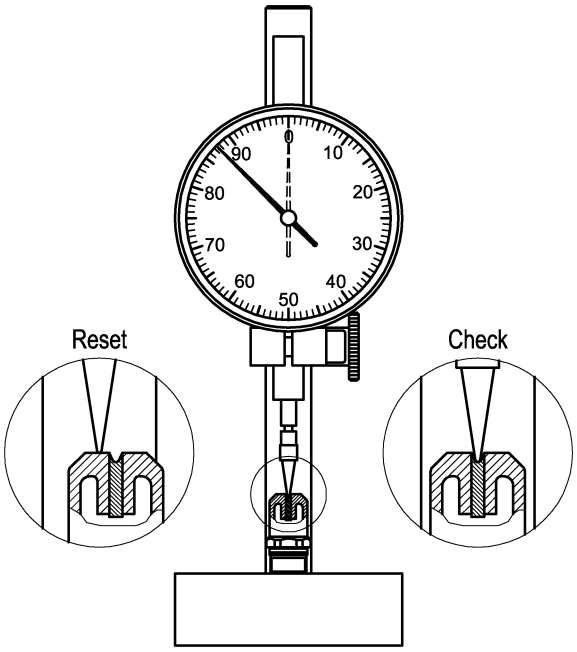
Leaking coolant "Kjellfrost" additional with influence of extreme heat causes a very fast vaporisation of water portions and an increasing concentration of the component ethanediol.

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

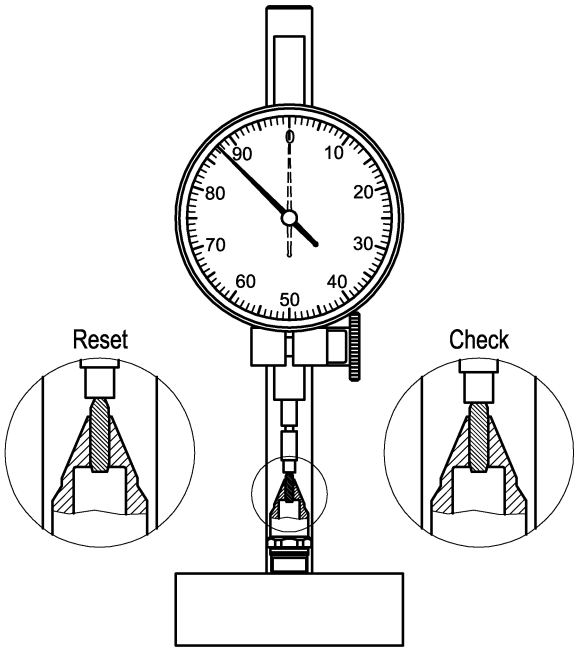
Absorb leaked or slopped coolant "Kjellfrost" with liquid-binding material (sand, diatomite, oil binder, acid binder, universal binder) immediately.
Dispose the absorbed material according to official regulations.

cathode	article no.	cutting range	plasma gas	position no.	plasma unit	max. cathode burn-back [mm]	
						for quality cut	max.*)
E005	.11.858.401.350	≤ 150 A	N_2	xx.02	Q 1500 Q 1500 plus Q 3000 Q 3000 plus Q 4500	1,30	1,80
E012	.11.858.411.320	≤ 100 A	O_2			1,50	1,80
E015	.11.858.411.350	≤ 150 A				1,50	1,80
E016	.11.858.411.360	200 A				1,50	1,80
E022	.11.858.421.320	300 A	O_2 u. N_2			1,30	1,80
E023	.11.858.421.330		O_2			1,70	2,00
E025	.11.858.421.350	400 A				1,70	2,00
E032	.11.858.431.320	300 A				1,70	2,00
E042	.11.858.441.520	≤ 80 A	N_2/H_2			< 0,50	0,50
E044	.11.858.441.540		N_2			1,30	1,80
E052	.11.858.451.520	≤ 150 A	Ar/H_2			< 0,50	0,50
E065	.11.858.461.550	≤ 450 A	Ar/H_2			< 1,50	1,50
*) … Attention: A higher cathode burn-back can lead to the destruction of the torch.							

Fig. 30: max. cathode burn-back



Control with sharp meter feeler .16.004.810.2



Control with flat meter feeler .16.004.810.8
Reset only with unused cathode

Fig. 31: Ascertaining of the cathode wear with the cathode dial indicator Art.-Nr. .36.000.015

The life time of the nozzle mainly depends on the cutting time, the number of ignitions and the handling of the torch (performance of hole piercing, upcoming spatter, etc.).

Be sure that the consumables are suitable for the intended cutting procedure.

The consumables shall be replaced with great care and only with tools which are part of the delivery.

ATTENTION

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

ATTENTION

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

apply to plasma torch:

Q-Torch 4510

ATTENTION

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

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

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

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

8.4.1 Plasma machine torch Q-Torch 4510

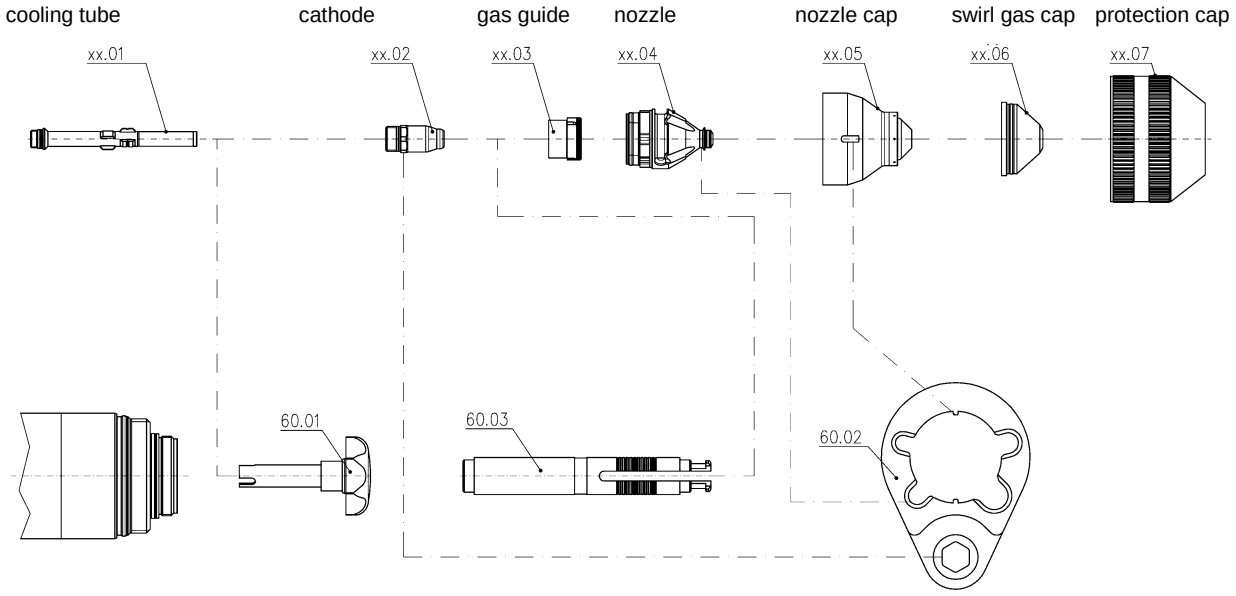


Fig. 32: Tools for changing consumables

The multifunctional torch tool (60.02) is to:

- screw and unscrew the cathode by means of hexagon 11 mm,
- pull out the nozzle by means of the engraved notches 6 mm, 7 mm and 8 mm and
- screw and unscrew the nozzle cap by means of opening Ø 37 mm.

Dismounting of used consumables

Before dismounting the consumables of the torch please insert the change head in the “Station for the change head” (see chapter “Dismantling of the change head”) and remove with the aid of compressed air the coolant from the change head.

1. Manually unscrew the protection cap (xx.07) together with the swirl gas cap (xx.06).

   (Press out swirl gas cap from protection cap.)

2. Unscrew nozzle cap (xx.05) by aid of a multifunctional torch tool (60.02).

3. Take out the nozzle (xx.04) together with the gas guide (xx.03) by aid of a multifunctional torch tool (60.02).

4. Pull out the gas guide (xx.03) from the nozzle (xx.04) by aid of the specific wrench (60.03).

5. Unscrew the cathode (xx.02) by aid of a multifunctional torch tool (60.02).

6. Remove the cooling tube (xx.01) using the socket wrench (60.01) when changing technology or changing data set in accordance with the cutting data.

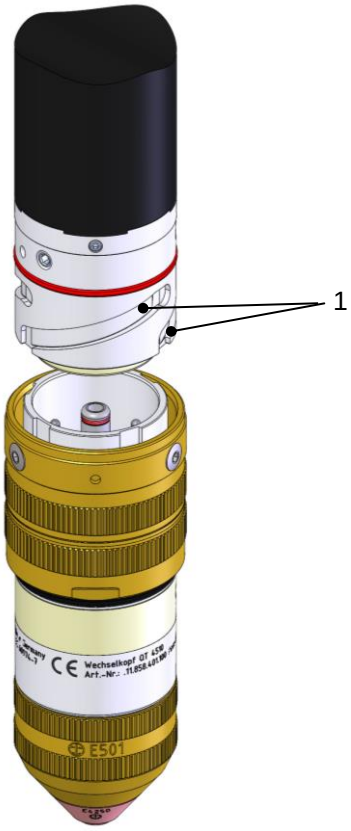
Mounting of new consumables

1. Screw in the cooling tube (xx.01) by aid of a socket wrench (60.01).
2. Screw in the cathode (xx.02), tighten the cathode with the multi-function torch tool (60.02).
3. Insert the gas guide (xx.03).
4. Insert the nozzle **(xx.04)** into the torch head (see picture on next page). Turn the nozzle such that the nozzle's wide groove is positioned exactly above the oval opening in the torch head. Then insert the nozzle until stop. Now the nozzle is locked and cannot be turned anymore.
5. Put on the nozzle cap (xx.05), tighten the nozzle cap with the multi-function torch tool (60.02).
6. Press the swirl gas cap (xx.06) into the protection cap (xx.07) and tighten it together by hand.

O-rings only need replacement in case of deformation or damage.

ATTENTION

When changing the consumables, make sure that the used consumables are dry and clean.
Before mounting the protection cap, remove any coolant residues and dirt that may be present.
For this purpose, use a soft absorbent cloth or compressed air for careful cleaning.
Check the correct position of the O rings.



ATTENTION

In case of contamination, make sure to clean the grooves (1) of the bayonet catch regularly.

Check the cleanliness of the grooves especially before and after the UWP cutting process to avoid sticking of the torch head.

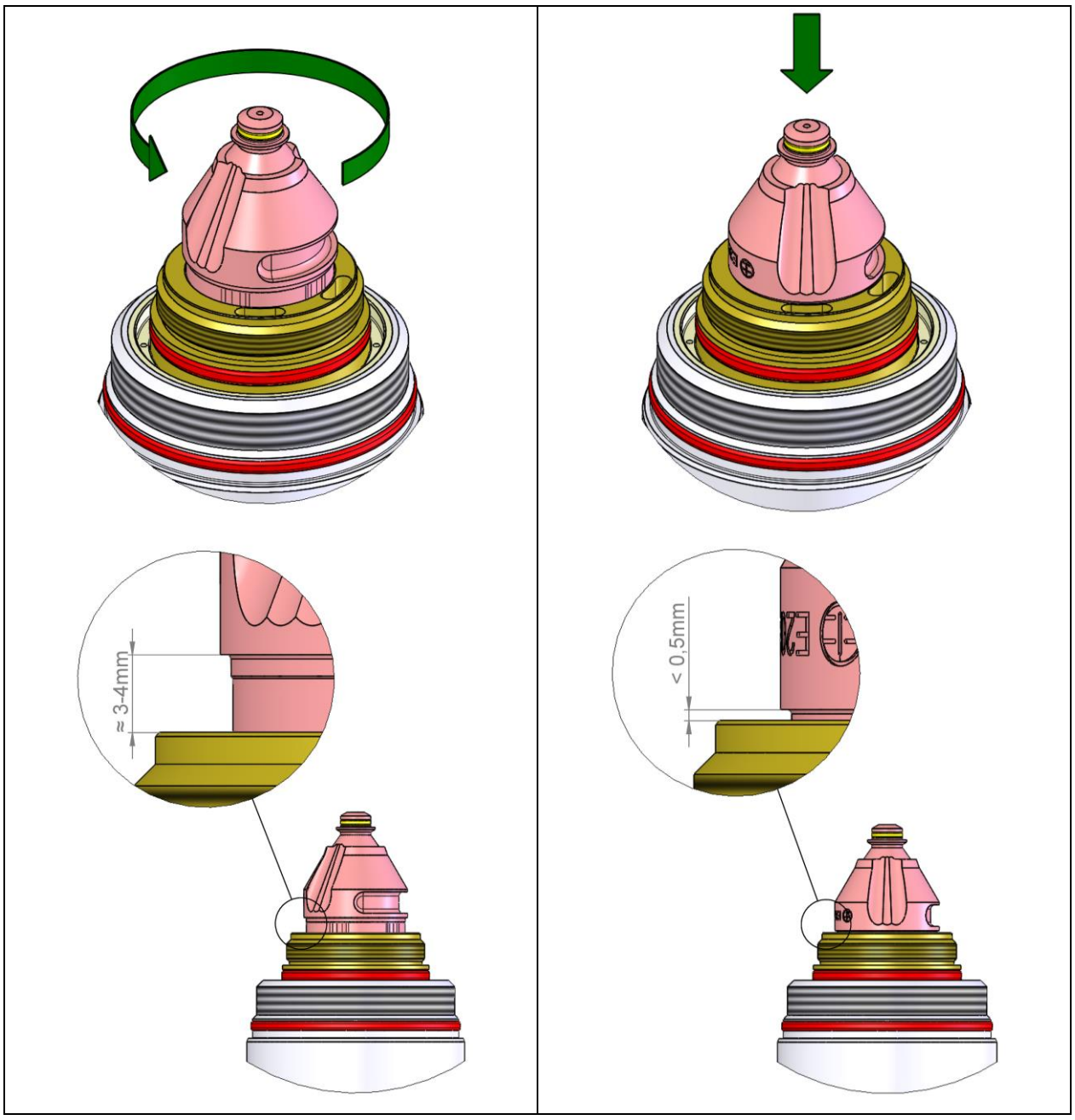


Fig. 33: Insert the nozzle into the torch head

INFORMATION

Please make sure that you push the nozzle into the nozzle receiving of the torch with your hand.

The nozzle cap is used only for fixing the nozzle in the nozzle holder.

Pressing down the nozzle with the nozzle cap can cause may damage it!

This is especially true for the plastic nozzle cap.

8.4.2 Replacement of the current socket, current plug and location pin in the torch shaft

⚠ CAUTION

Maintenance and repair work at the current socket, current plug and location pin of the plasma torches may be carried out only by the service department or authorised repair shops of the company Kjellberg Finsterwalde!

8.4.3 Operation of the torch after consumable change

When re-starting the plasma unit after the consumable change, proceed as follows:

1. After switching ON the power source, use the guiding system:
   - automatic short gas test activated
   - no coolant shall leak from the plasma torch (bide until the disappearance of the air bubbles in coolant hoses)
2. Choose the automatic time of gas test on the guiding system or Q-Desk:
   - drain residual coolant from the plasma torch
   - coolant drops can damage the torch during ignition

8.5 Information for using of the change heads

8.5.1 Dismantling of the change head

WARNING

Before starting any installation or maintenance work the power source has to be switched off by guiding system and visibly disconnected from the mains (unplug mains cable)!

CAUTION

Endangerment by edges and gaps

There may be hand injuries.

Be careful when assembling and disassembling the change head by hand. Use the hand guard!

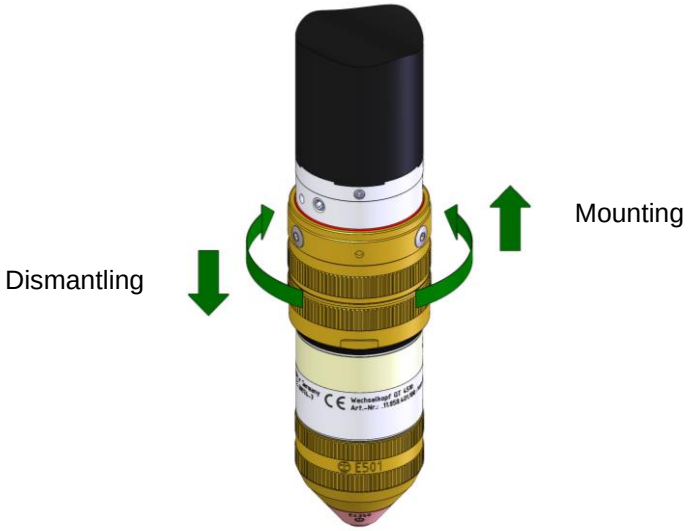
ATTENTION

Do not drop the change head, it could be damaged!

The change head is a high-quality precision part and must therefore be handled with care. To prevent damages, it is recommended to store the change head not being used in the optionally available “Parking station for the change heads”.

8.5.1.1 Dismantling of the change head Q-Torch 4510

1. Solving of the change head possible with one hand, due to the 120 ° movement.
2. Remove the change head according to the following figure.



3. Torch head should be placed on a smooth pad and secured against rolling away.
   It is recommended to use the “Station for change head”.

Please use for storage of the change head the “Station for the change heads”.

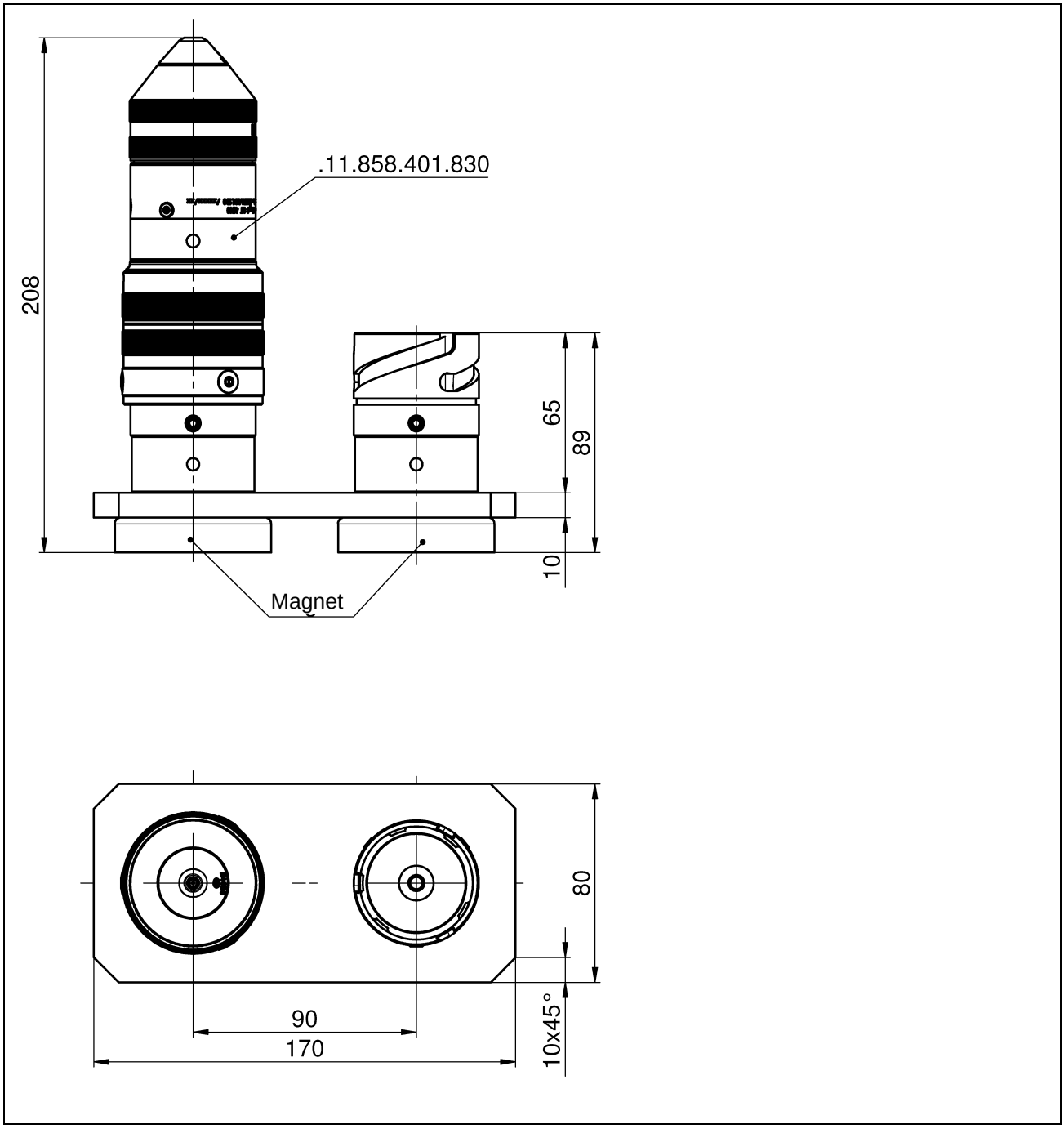


Fig. 34: Parking station .11.858.401.830 suitable for change head Q-Torch 4510

8.5.2 Maintenance of the change head

Plasma torch:	Q-Torch 4510
Drawing of the spare parts lists:	.11.858.**4**01.E0

The position numbers indicated in the sections below, e.g. (01.08), refer to the spare parts drawings above. You will find these spare parts drawings in the appendix „Spare parts lists“.

In order to increase the lifetime of the o-rings we recommend the occasional use of an exclusively oxygen-suitable lubricant:

- Please apply the lubricant only to the o-rings marked with # in the following picture!
- Please wet the o-rings only slightly with the lubricant!
- Please make sure that no lubricant enters the nipples and borings!
- An oxygen-suitable lubricant (e.g. lubricant for O_2 LC 40 Fluid, article no. .10.616.104) can be obtained from Kjellberg Finsterwalde.

ATTENTION

The use of lubricant for o-rings:

- Please wet the o-rings with oxygen-suitable lubricant only!
- The use of other oils and fats may eventually destroy the quick-change head / plasma torch!
- Please apply lubricant only to those o-rings marked or mentioned accordingly!
- Under no circumstances shall lubricant be applied to the o-rings of the consumables which are subject to high thermal load!

8.5.2.1 Control of the O-rings

Check of the outer o-rings

- 1 x o-ring 28 x 2.0 (01.08)
- 1 x o-ring 42 x 2.0 (01.09)

Please replace the o-rings in case of damage or wear.

Check of the inner o-rings

This list includes only those o-rings that are subject to wear during mounting and demounting of the quick-change head:

- 2 x o-ring 6 x 1.5 (01.12) at KMV-plug **(01.13)** and current-plug KMR **(01.14)**, if necessary dismantling of the plug, use socket wrench **(60.20)** for current- /KMV-plug for the mounting / dismounting.
- 2 x o-ring 4.5 x 1.5 (01.22) at nipple WG and PG **(01.24)** required dismantling of the nipple, use torque screwdriver **(60.10)** with hexagonal insert SW6 **(60.14)** at montage with changed o-ring and tighten with 30cNm.
- 2 x o-ring 6 x 1.5 (01.17) at insulating bush PI and insulating bush EF **(01.19)**, required dismantling of the socket, use torque screwdriver **(60.10)** with hexagonal insert SW8 **(60.13)** at montage with changed O-ring and tighten with 60cNm.

Q-Torch 4510

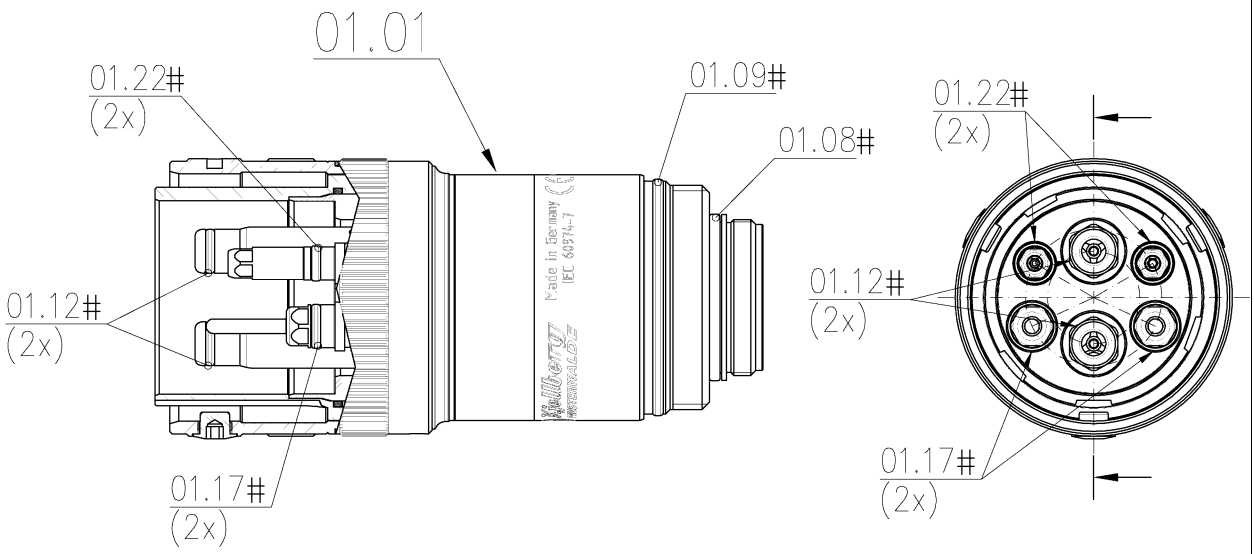


Fig. 35: Inner and outer o-rings of the change head

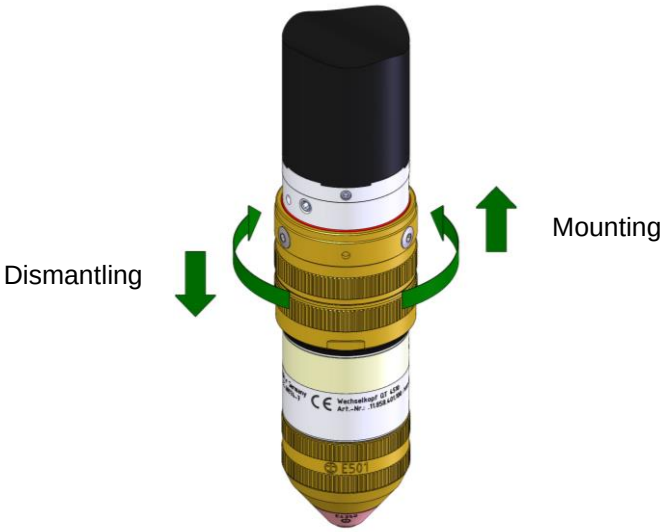
8.5.3 Add on of the change heads

ATTENTION

Remove the residual coolant from the torch interface (head and shaft) before assembly the change head, for example through the blowing out with compressed air!
Please wear safety goggles!

8.5.3.1 Dismantling of the change head Q-Torch 4510

1. Turn the change head 120 ° (a half turn), according to the following figure, until the noticeable mechanical stop.



ATTENTION

If the torch head cannot be screwed completely on the torch shank (noticeable mechanical stop) it must be controlled whether all inside components are free of impurity and all O-rings are okay. In the case of doubt the contact of the torch has to be cleaned with compressed air. Please wear safety goggles! Afterwards connect the change head without using FORCE with the shaft!

9 Plasma torch connection unit Q-Port

9.1 Technical data

Art.-no.:	Q-Port (.11.820.260)
Operating voltage	24 V DC
Dimensions (lxbxh):	363 x 196 x 318 mm
Weight:	7,5 kg

Fig. 36: Technical data

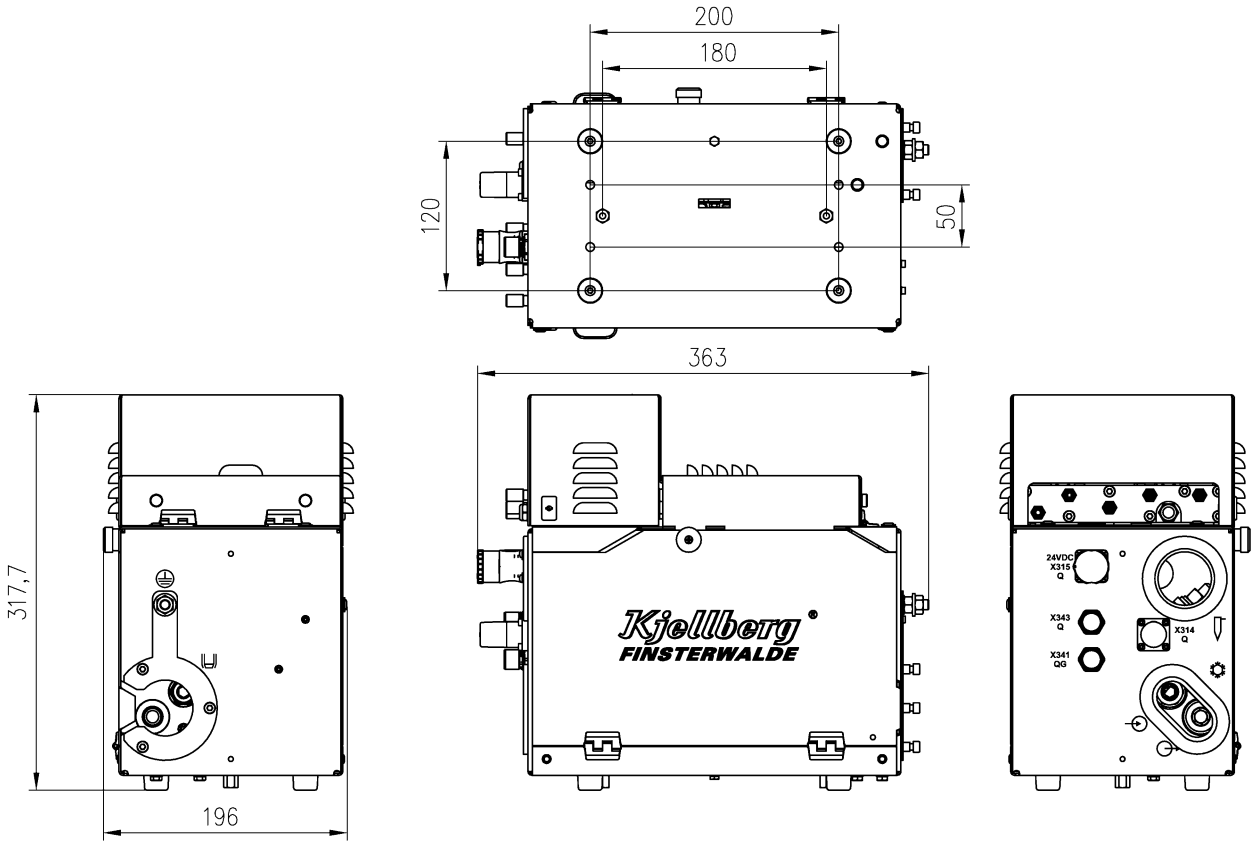


Fig. 37: Dimension diagram

9.2 Technical description

The torch connection unit Q-Port 4500 is the intersection between the plasma torch and the power source. The plasma ignition unit is located in the Q-Port.

After opening the safety-contact protected angle flap the connectors for coolant supply, nozzle and coolant return, cathode are accessible. The connectors for the plasma gases and the swirl gases are placed At the top of the Q-Port.

INFORMATION

Please note that you can open flap of the Q-Port, which is secured with a door lock, only with a cross-tip screwdriver!
To do this, insert the cross-tip screwdriver into the opening and turn it to the left! Then the door opens easily.

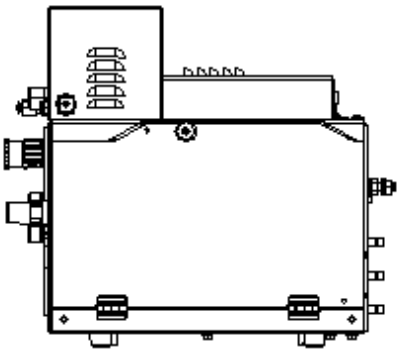
9.3 Allowed fitting positions

ATTENTION

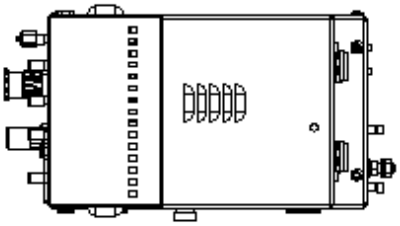
Make sure to use only one permissible installation position!

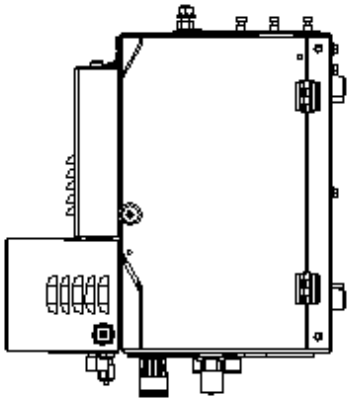
Otherwise, there is a risk that coolant accidentally escaping when loosening the hose assembly will run over the high-voltage ignition device.

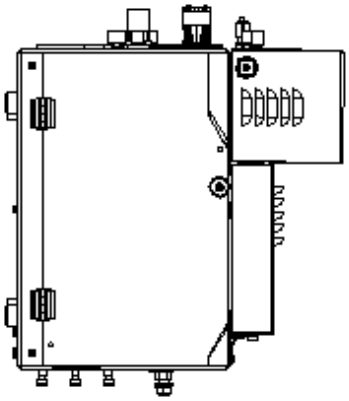
Standard fitting position



other possible fitting positions







9.4 Connection of the Plasma torch connection unit

The Q-Port has to be fixed to the guiding system or to a robot. For the correct fastening the bottom plate of the Q-Port is furnished with two distance pieces (with threads M6 inside/outside).

Two attachment variants result:

1. with distance pieces at the supplied condition
2. with turned distance pieces

The connectors for the coolant and the cathode cable are located in the Q-Port. If several cathode cables are available, please use both cathode connections.

You can connect the control cable X314, supply cable X315 and Ethernet X343 of the power source Q, as well as the control cable CAN X341 of the Q-Gas on the outside of the Q-Port.

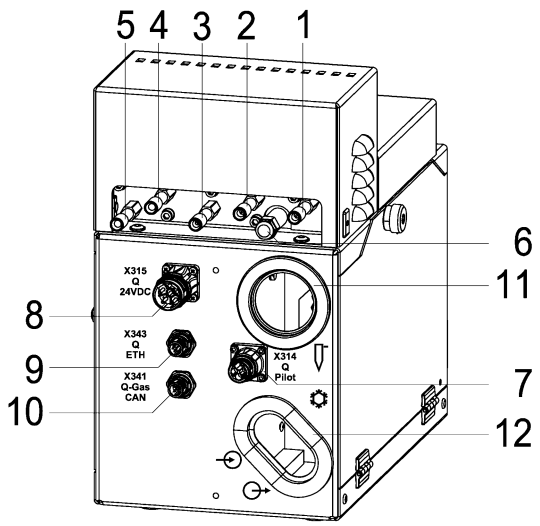
The numbered connecting hoses for the gas supply have to be installed gas proof to the respective connectors 1 - 4.

Connect the plasma torch to the output side, analog to the hose package at the input side. The hoses and cables can be inserted laterally into the Q-Port.

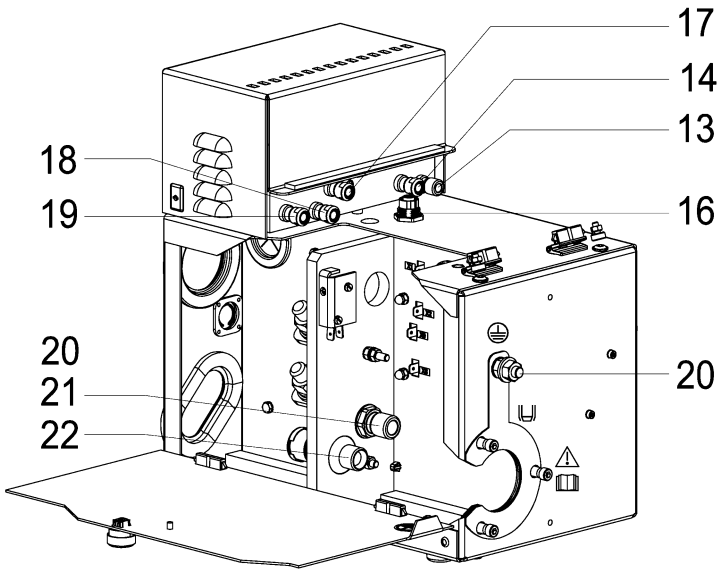
Insert the coolant supply hose (PU-hose AD10 x NW6, blue hose) to the plug connection and screw on the coolant return hose (G3/8‘‘, black hose).

Insert the pilot plug and the initial positioning contact. Insert the gas hoses (color coded) according to the color on the plug connections AD6.0 x NW4. Relieve the hose assembly via the flange and the hose fitting, which are screwed to the Q-Port with M5 screws (hexagon socket 4). The contact is used for shielding, so proper contact must be ensured.

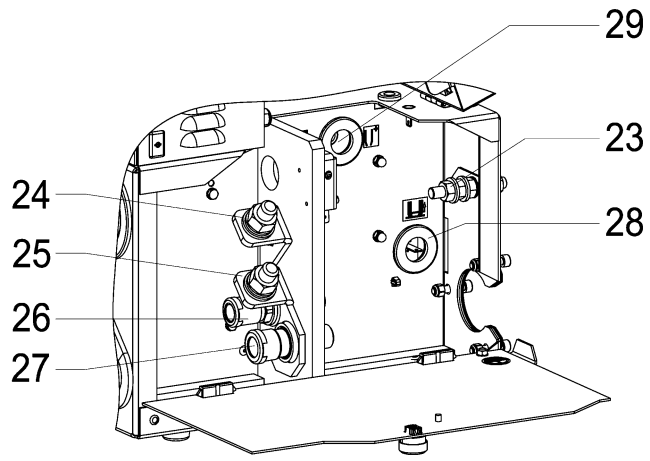
After finishing the installation work close the covers, otherwise the door switch avoids starting of plasma power source!



1	Connector 1 ignition gas			from Q-Gas	G1/8"
2	Connector 2 cutting gas			from Q-Gas	G1/8"
3	Connector 3 cutting gas			from Q-Gas	G1/8"LH
4	Connector 4 swirl gas			from Q-Gas	G1/8"
5	Connector 5 swirl gas - not used			from Q-Gas	
6	Exhaust with silencer		(exh)		
7	Connector control cable	socket X314	(pilot)	from Q-Source	
8	Connector supply cable	socket X315	(24 V DC)	from Q-Source	
9	Connector Ethernet	socket X343	(ETH)	from Q-Source	
10	Connector CAN	socket X341	(CAN)	from Q-Gas	
11	Opening cathode cable(s)			from Q-Source	
12	Opening coolant return hose and coolant supply hose			from / to Q-Source	



13	Connector swirl gas - not used	(WG-b)		
14	Connector swirl gas	(WG-a)	to Q-Torch	PU-hose AD6,0 x NW4 green
15	not used			
16	Connector torch valves + socket X321 BDA	(valves)	to Q-Torch	8-pol. M12, A-coded
17	Connector cutting gas	(SG)	to Q-Torch	PU-hose AD6,0 x NW4 blue
18	Connector of exhaust hose	(exh)	to Q-Torch	PU-hose AD6,0 x NW4 yellow
19	Connector of ignition gas	(ZG)	to Q-Torch	PU-hose AD6,0 x NW4 black
20	Connector of grounding conductor	(PE)		M8
21	Connector of coolant supply hose		to Q-Torch	PU-hose AD10 x NW6 blue
22	Connector of coolant return hose and cathode cable		from Q-Torch	G3/8"

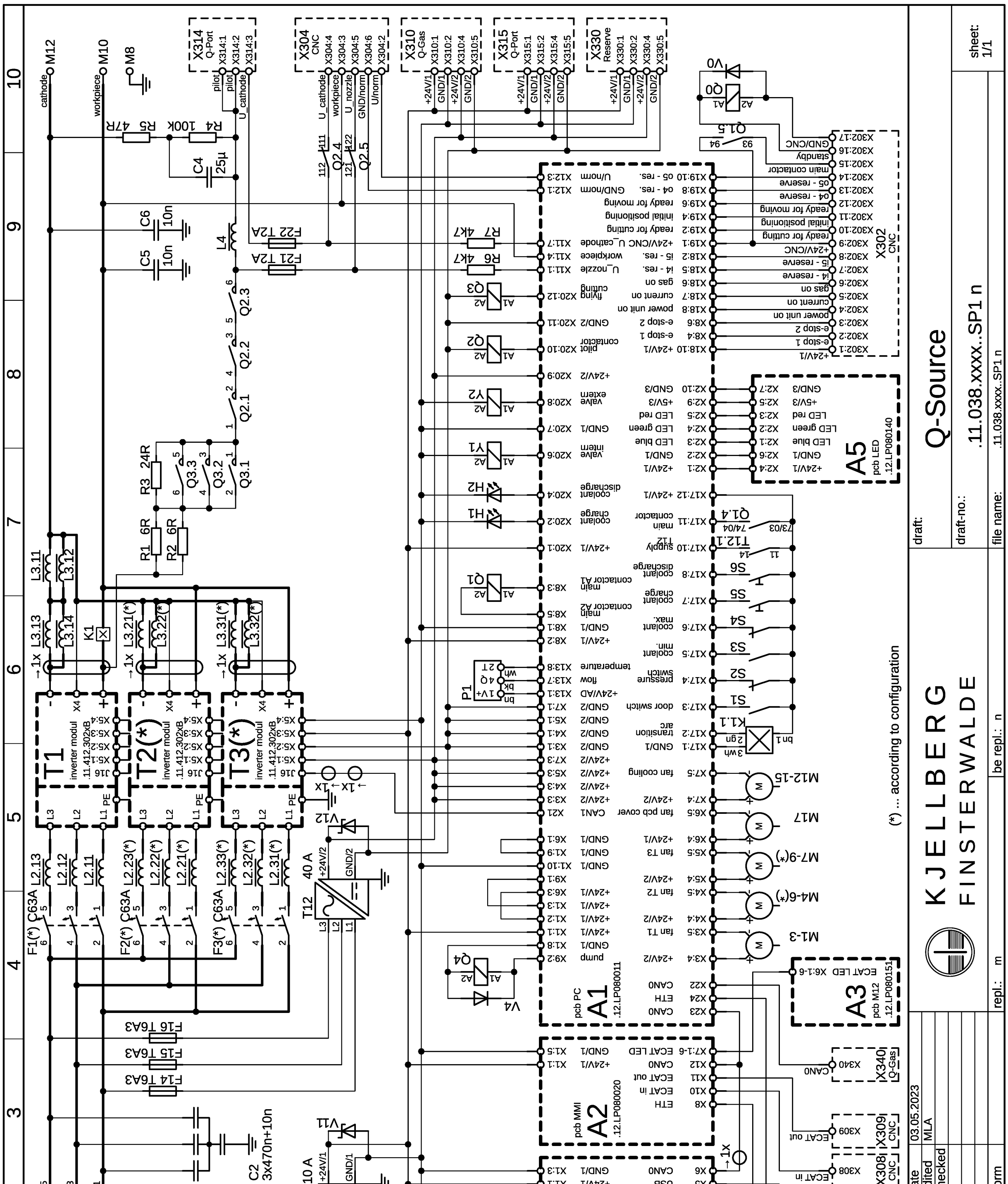


23	Connector of grounding conductor (inside) - not used		M8
24	Connector of cathode cable(s) (inside) place cable lugs against each other if necessary	from Q-Source	M12
25	Connector of cathode cable(s) (inside) place cable lugs against each other if necessary	from Q-Source	M12
26	Connector of coolant supply hose	from Q-Source	PU-hose AD12 x NW8 blue
27	Connector of coolant return hose	to Q-Source	PU-hose AD14 x NW8 black
28	Connector initial positioning contact (inside)	from Q-Torch	flat plug 6,3 x 0,8 mm
29	Pilot connector	to Q-Torch	round plug Ø 4,0 mm

Fig. 38: Connections of Q-Port

10 Wiring diagrams

for plasma cutting unit Q-Source	drawing number
wiring diagrams of power source	.11.038.30xx..SP1
	.11.038.30xx..SP2
	.11.038.30xx..SP3
	.11.038.30xx..SP4
wiring diagram gas console	.11.825.130xA.SP1
wiring diagram plasma torch connecting unit	.11.820.26xA.SP1
wiring diagram plasma torch	.11.858.x01.SP1
wiring diagram inverter module	.11.412.3xxx..SP1


Q-Source
.11.038.xxxx..SP1 n
KJELLBERG
FINSTERWALDE
(*) ... according to configuration
Change for special voltage 380V, 415V or 460V
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.11.038.xxxx..SP1

Code	Beschreibung	Description
A	**Leiterplatte**	**printed circuit board**
A1	LP Plasma Control (PC)	PCB plasma control (PC)
A2	LP M2MI	PCB M2MI
A3	LP M12	PCB M12
A4	Router	router
A5	LP LED	PCB LED
A6	LP Guide	PCB guide
C	**Kondensator**	**capacitor**
C1	3 x 0,47 µF Netzfilter	3 x 0,47 µF line filter
C2	3 x 0,47 µF + 10 nF Netzfilter	3 x 0,47 µF + 10 nF line filter
C4	25 µF Puffer, Pilotstrom	25 µF pilot current buffer
C5	10 nF Filter	10 nF filter
C6	10 nF Filter	10 nF filter
F	**Sicherung**	**fuse**
F1	C 63 A Invertermodul T1	C 63 A inverter module T1
F2	C 63 A Invertermodul T2	C 63 A inverter module T2
F3	C 63 A Invertermodul T3	C 63 A inverter module T3
F11,12,13	T 6,3 A Netzteil T11	T 6,3 A power supply T11
F14,15,16	T 6,3 A Netzteil T12	T 6,3 A power supply T12
F21	T 2 A Kathodenspannung	T 2 A cathode voltage
F22	T 2 A Düsenspannung	T 2 A nozzle voltage
H	**LED**	**LED**
H1	24 V DC, grün, Kühlmittel auffüllen	24 V DC, green, coolant charge
H2	24 V DC, weiß, Kühlmittel ablassen	24 V DC, white, coolant discharge
K	**Relais**	**relays**
K1	2 A DC, 1Ö, Übergangsbogen	2 A DC, 1nc, transfer arc
L	**Drossel**	**choke**
L1	Entstördrossel, Netzstrom	suppressor choke, line current
L2.11-13	Primärdrossel, Invertermodul T1	primary choke, inverter module T1
L2.21-23	Primärdrossel, Invertermodul T2	primary choke, inverter module T2
L2.31-33	Primärdrossel, Invertermodul T3	primary choke, inverter module T3
L3.11-14	Sekundärdrossel, Invertermodul T1	secondary choke, inverter module T1
L3.21-22	Sekundärdrossel, Invertermodul T2	secondary choke, inverter module T2
L3.31-32	Sekundärdrossel, Invertermodul T3	secondary choke, inverter module T3
L4	Entstördrossel, Pilotstrom	suppressor choke, pilot current

.11.038.xxxx..SP1

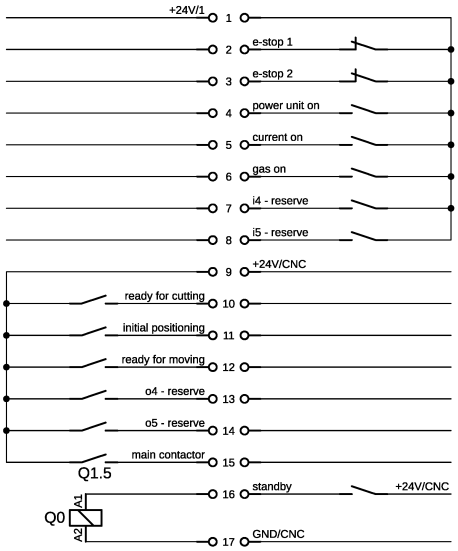
Code	Beschreibung	Description
M	**Motor**	**motor**
M1-3	Lüfter Invertermodul T1	fan inverter module T1
M4-6	Lüfter Invertermodul T2	fan inverter module T2
M7-9	Lüfter Invertermodul T3	fan inverter module T3
M12-15	Lüfter Wärmetauscher	fan heat exchanger
M16	Pumpe Kühlkreislauf	pump coolant circuit
M17	Lüfter Leiterplatte	fan printed circuit board
P	**Messung**	**measurement**
P1	Temperatur + Durchfluss vom Kühlmittel	temperature + flow of coolant
Q	**Schütz**	**contactor**
Q0	24 V DC, 3S, Hilfsschütz	24 V DC, 3no, auxiliary contactor
Q1	24 V DC, 3S + 2S, Hauptschütz	24 V DC, 3no+2no, main contactor
Q2	24 V DC, 3S + 2Ö, Pilotschütz	24 V DC, 3no+2nc, pilot contactor
Q3	24 V DC, 3S, fliegend Anschneiden	24 V DC, 3no, flying cutting
Q4	24 V DC, 3S, Kühlmittelpumpe	24 V DC, 3no, coolant pump
R	**Widerstand**	**resistor**
R1	6 Ω Vorwiderstand, Pilotwiderstand	6 Ω, pilot resistor
R2	6 Ω Vorwiderstand, Pilotwiderstand	6 Ω, pilot resistor
R3	24 Ω Vorwiderstand, Pilotwiderstand	24 Ω, pilot resistor
R4	100 kΩ Entladewiderstand	100 kΩ, discharging resistor
R5	47 Ω Ladewiderstand	47 Ω, charging resistor
R6	4,7 kΩ Vorwiderstand, Düsenspannung	4,7 kΩ, series resistor nozzle voltage
R7	4,7 kΩ Vorwiderstand, Kathodenspannung	4,7 kΩ, series resistor cathode voltage
R8	100 kΩ Entladewiderstand	100 kΩ discharging resistor
R9	100 kΩ Entladewiderstand	100 kΩ discharging resistor
S	**Schalter**	**switch**
S1	Schalter, 1S, Türschalter	switch, 1no, door switch
S2	Schalter 1S, Druckschalter	switch, 1no, pressure switch
S3	Schalter 1S, Kühlmittel max.	switch, 1no, coolant min.
S4	Schalter 1S, Kühlmittel min.	switch, 1no, coolant max.
S5	Taster, 1S, grün, Kühlmittel auffüllen	button, 1no, green coolant charge
S6	Taster, 1S, weiß, Kühlmittel ablassen	button, 1no, white coolant discharge

.11.038.xxxx..SP1

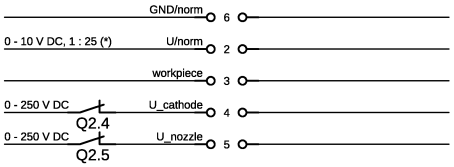
Code	Beschreibung	Description
T	**Energieumwandler**	**power supply**
T1	Invertermodul, Master	inverter module, master
T2	Invertermodul, Slave	inverter module, slave
T3	Invertermodul, Slave	inverter module, slave
T11	Netzteil, +24 V/1	power supply, +24 V/1
T12	Netzteil, +24 V/2	power supply, +24 V/2
T16	Pumpenspannung	pump voltage
V	**Diode**	**diode**
V1	Freilaufdiode, Überspannungsschutz	flyback diode, overvoltage protection
V4	Freilaufdiode, Überspannungsschutz	flyback diode, overvoltage protection
V11	Suppressordiode, Überspannungsschutz	suppressor diode, overvoltage protection
V12	Suppressordiode, Überspannungsschutz	suppressor diode, overvoltage protection
X	**Klemmen**	**terminal**
X302	17-pol. Buchse, Anschluss CNC Digital	17-pol. socket, connection CNC Digital
X303	USB-A Buchse, Anschluss Service USB	USB-A socket, connection Service USB
X304	6-pol. Buchse, Anschluss CNC Analog	6-pol. socket, connection CNC Analog
X305	RJ-45 Buchse, Anschluss Service Ethernet	RJ-45 socket, connection Service Ethernet
X306	8-pol. Buchse, Anschluss Q-Desk Ethernet	8-pol. socket, connection Q-Desk Ethernet
X307	RJ-45 Buchse, Anschluss CNC Ethernet	RJ-45 socket, connection CNC Ethernet
X308	RJ-45 Buchse, Anschluss CNC EtherCAT IN	RJ-45 socket, connection CNC EtherCAT IN
X309	RJ-45 Buchse, Anschluss CNC EtherCAT OUT	RJ-45 socket, connection CNC EtherCAT OUT
X310	5-pol. Buchse, Anschluss Q-Gas, 24 VDC	5-pol. socket, connection Q-Gas, 24 VDC
X314	3-pol. Buchse, Anschluss Q-Port, Pilot	3-pol. socket, connection Q-Port, Pilot
X315	7-pol. Buchse, Anschluss Q-Port, 24 VDC	7-pol. socket, connection Q-Port, 24 VDC
X330	5-pol. Buchse, Anschluss Reserve 24 VDC	5-pol. socket, connection reserve, 24 VDC
X340	5-pol. Buchse, Anschluss Q-Gas CAN	5-pol. socket, connection Q-Gas CAN
X342	8-pol. Buchse, Anschluss Q-Gas Ethernet	8-pol. socket, connection Q-Gas Ethernet
X343	8-pol. Buchse, Anschluss Q-Port Ethernet	8-pol. socket, connection Q-Port Ethernet
X344	8-pol. Buchse, Anschluss Reserve Ethernet	8-pol. socket, connection reserve Ethernet
Y	**Ventil**	**valve**
Y1	2/2 Wege intern	2/2 way intern
Y2	2/2 Wege extern	2/2 way extern

Q-Source — CNC - Control

X302 CNC Digital



X304 CNC Analog



X307 CNC ETH

X308 CNC ECAT in

X309 CNC ECAT out

(*) ... according to configuration

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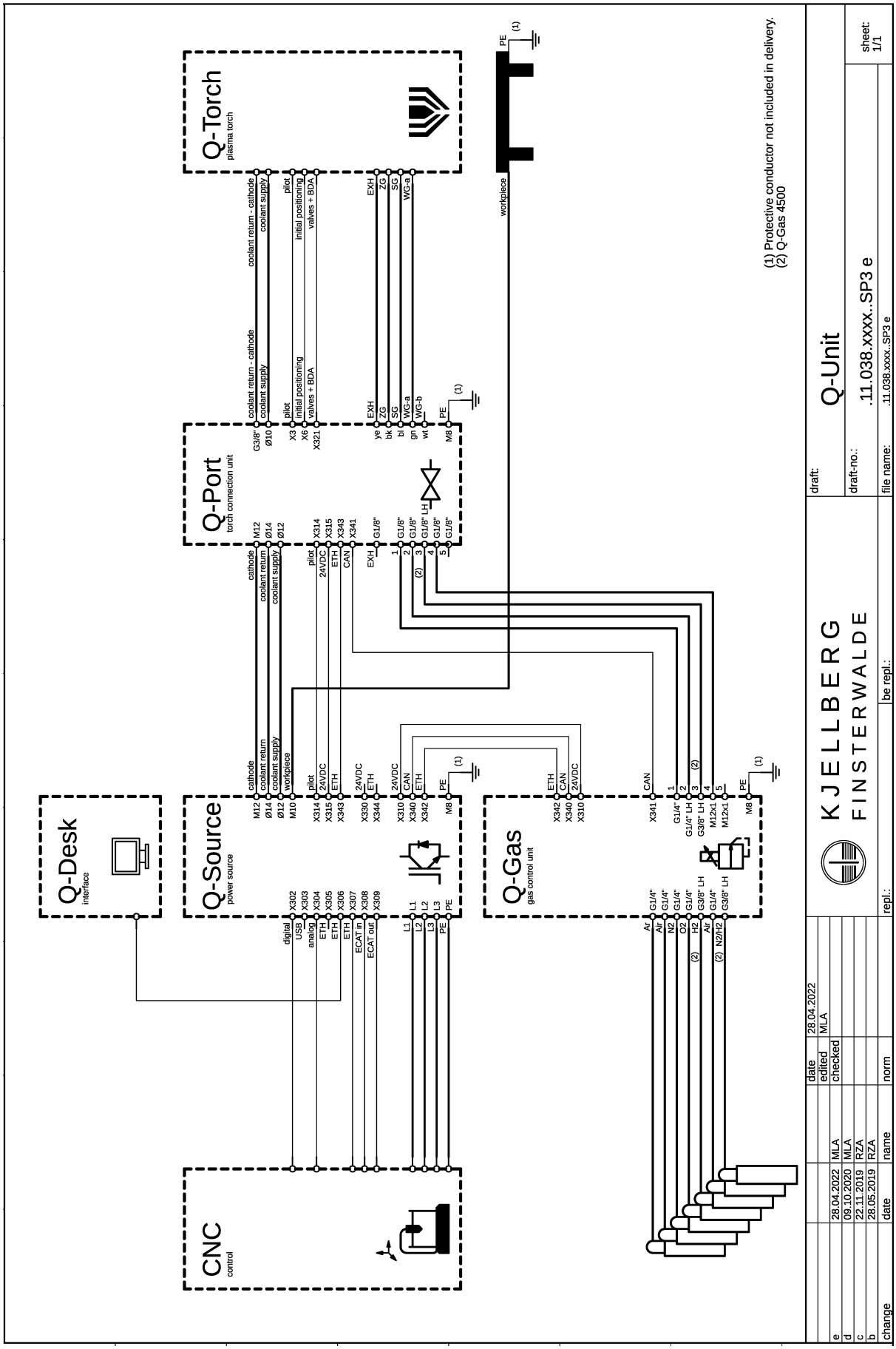
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plasma torch
CNC
control
workpiece
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KJELLBERG FINSTERWALDE
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b 28.05.2019 RZA
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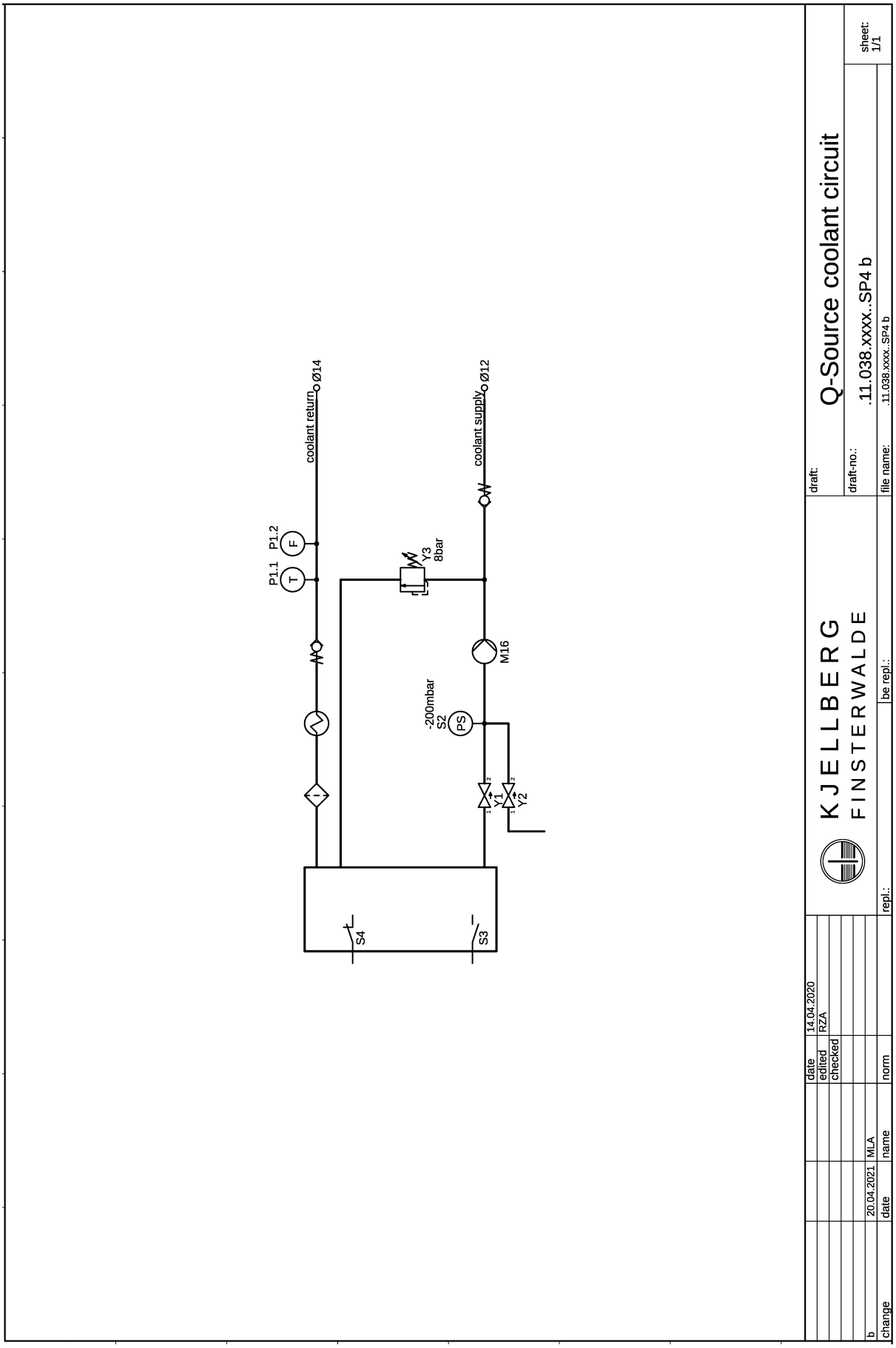
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S2
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Y2
S4
S3
KJELLBERG
FINSTERWALDE
Q-Source coolant circuit
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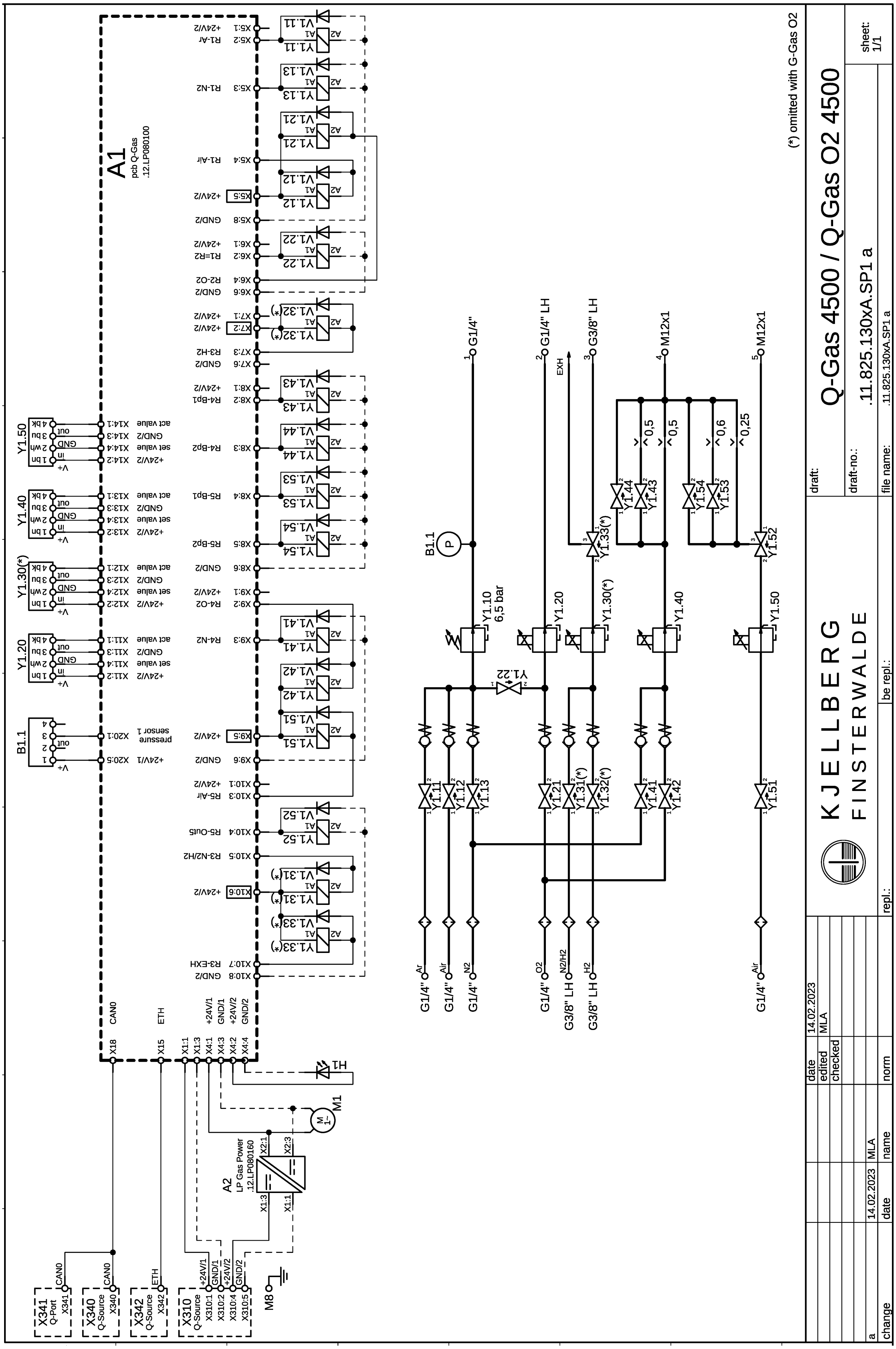
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Q-Gas 4500 / Q-Gas O2 4500
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F I N S T E R W A L D E
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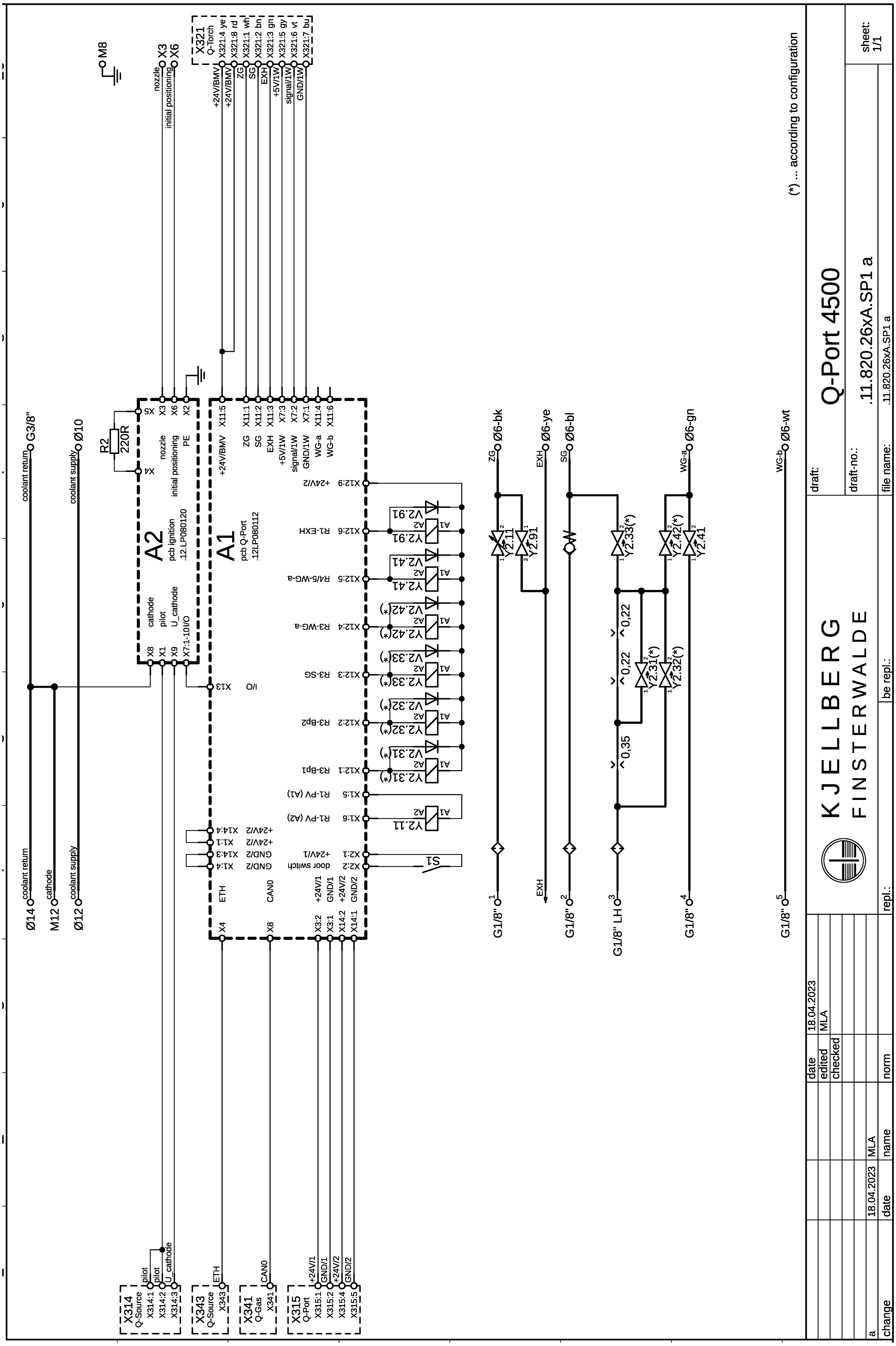
.11.825.130xA.SP1

Code	Beschreibung	description
A	**Leiterplatte**	**printed circuit board**
A1	LP Gas Control	PCB Gas Control
A2	LP Gas Power	PCB Gas Power
B	**Transmitter**	**Transmitter**
B1.1	Drucktransmitter ZG	Pressure transmitter ZG
H	**LED**	**LED**
H1	24 V DC, grün, +24 V/2	24 V DC, green, 24V/2
M	**Motor**	**motor**
M1	Lüfter, Gehäuse	fan, case
T	**Energieumwandler**	**power supply**
T1	Netzteil, +24 V/2	power supply, +24V/2
X	**Klemmen**	**terminal**
X310	5-pol. Stecker, Anschluss Q-Source 24 VDC	5-pol. plug, connection Q-Source 24 VDC
X340	5-pol. Stecker, Anschluss Q-Source CAN	5-pol. plug, connection Q-Source CAN
X341	5-pol. Buchse, Anschluss Q-Port CAN	5-pol. socket, connection Q-Port CAN
X342	8-pol. Stecker, Anschluss Q-Source Ethernet	8-pol. plug, connection Q-Source Ethernet

.11.825.130xA.SP1

Code	Beschreibung	description
Y	**Ventil**	**valve**
Y1.10	Regelventil, Regler 1	control valve, controller 1
Y1.11	2/2 Wege R1-Ar	2/2 way R1-Ar
Y1.12	2/2 Wege R1-Luft	2/2 way R1-Air
Y1.13	2/2 Wege R1-N2	2/2 way R1-N2
Y1.20	Regelventil, Regler 2	control valve, controller 2
Y1.21	2/2 Wege R2-O2	2/2 way R2-O2
Y1.22	2/2 Wege R1=R2	2/2 way R1=R2
Y1.30	Regelventil, Regler 3	control valve, controller 3
Y1.31	2/2 Wege R3-N2/H2	2/2 way R3-N2/H2
Y1.32	2/2 Wege R3-H2	2/2 way R3-H2
Y1.33	3/2 Wege R3-ENTL	3/2 way R3-EXH
Y1.40	Regelventil, Regler 4	control valve, controller 4
Y1.41	2/2 Wege R4-N2	2/2 way R4-N2
Y1.42	2/2 Wege R4-O2	2/2 way R4-O2
Y1.43	2/2 Wege R4-Bp1	2/2 way R4-Bp1
Y1.44	2/2 Wege R4-BP2	2/2 way R4-Bp2
Y1.50	Regelventil, Regler 5	control valve, controller 5
Y1.51	2/2 Wege R5-Luft	2/2 way R5-Air
Y1.52	3/2 Wege R5-Out5	3/2 way R5-Out5
Y1.53	2/2 Wege R5-Bp1	2/2 way R5-Bp1
Y1.54	2/2 Wege R5-Bp2	2/2 way R5-Bp2


Q-Port 4500
.11.820.26xA.SP1 a
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KJELLBERG
FINSTERWALDE
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pcb Q-Port
.12LP080112
A2
pcb ignition
.12LP080120
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MLA
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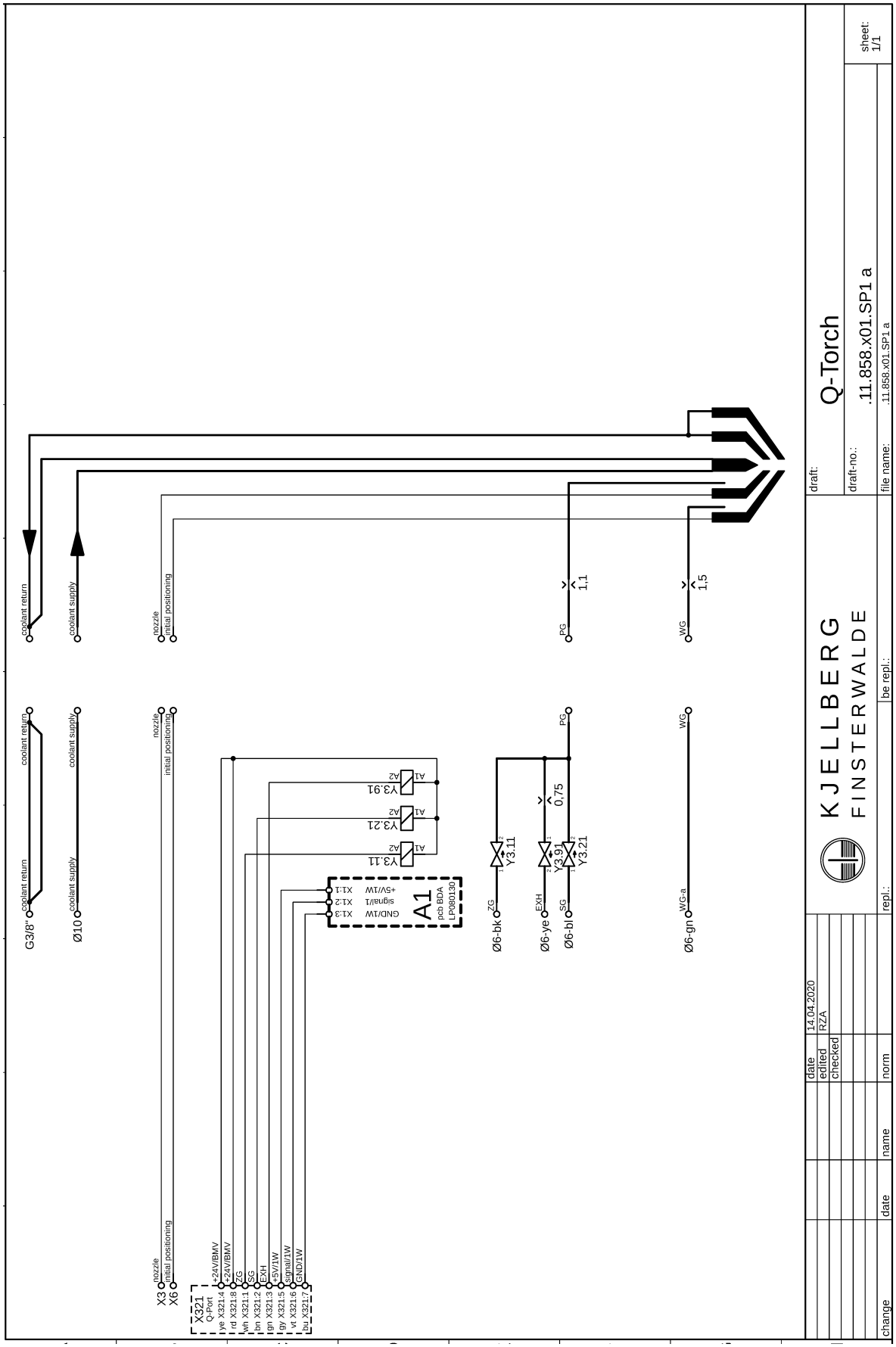
.11.820.26xA.SP1

Code	Beschreibung	description
A	**Leiterplatte**	**printed circuit board**
A1	LP Q-Port	PCB Q-Port
A2	LP Ignition	PCB ignition
R	**Widerstand**	**resistor**
R2	220 R Ladewiderstand	220 R charging resistor
S	**Schalter**	**switch**
S1	Schalter, 1S, Türschalter	switch, 1no, door switch
X	**Klemmen**	**terminal**
X314	3-pol. Stecker, Anschluss Q-Source Pilot	3-pol. plug, connection Q-Source pilot
X315	7-pol. Stecker, Anschluss Q-Source 24 VDC	7-pol. plug, connection Q-Source 24 VDC
X321	8-pol. Buchse, Anschluss Q-Torch Ventile	8-pol. socket, connection Q-Torch valves
X341	5-pol. Stecker, Anschluss Q-Gas CAN	5-pol. plug, connection Q-Gas CAN
X343	8-pol. Stecker, Anschluss Q-Source Ethernet	8-pol. plug, connection Q-Source Ethernet
Y	**Ventil**	**valve**
Y2.11	Proportionalventil R1-PV	control valve R1-PV
Y2.31	2/2 Wege R3-Bp1	2/2 way R3-Bp1
Y2.32	2/2 Wege R3-Bp1	2/2 way R3-Bp2
Y2.33	2/2 Wege R3-SG	2/2 way R3-SG
Y2.41	2/2 Wege R4/5-WG-a	2/2 way R4/5-WG-a
Y2.42	2/2 Wege R3-WG-a	2/2 way R3-WG-a
Y2.91	2/2 Wege R1-ENTL	2/2 way R1-EXH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coolant supply
nozzle
initial positioning
G3/8"
Ø10
X3
X6
X321
Q-Port
+24V/BMV
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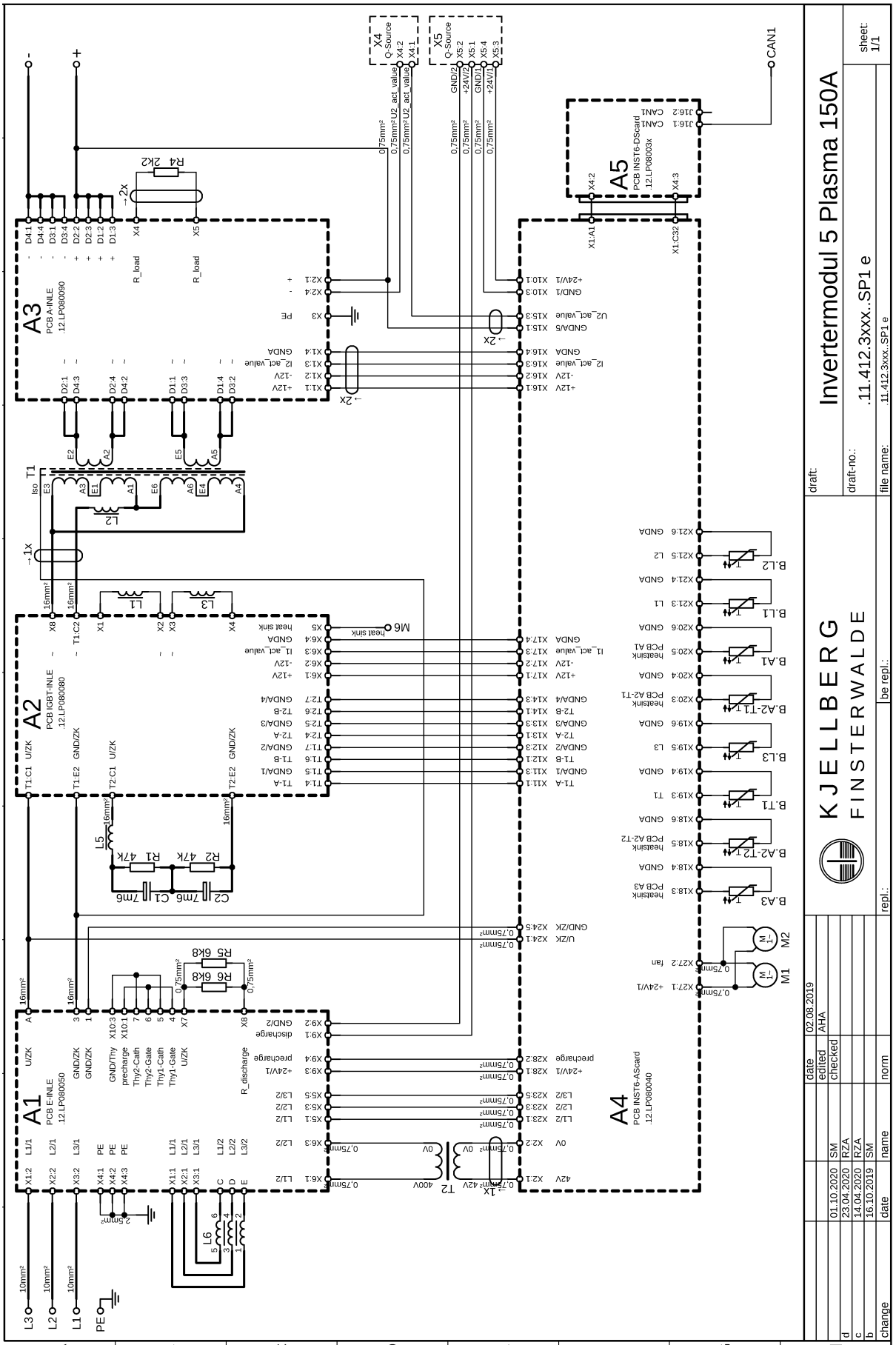
+24V/BMV
rd X321.8
ZG
wh X321.1
SG
bn X321.2
EXH
gn X321.3
+5V/1W
gy X321.5
signal/1W
vt X321.6
GND/1W
bu X3217
A1
pcb BDA
LP080130
GND/1W X1.3
signal/1 X1.2
+5V/1W X1.1
Y3.11
Y3.21
Y3.91
A1
A2
Ø6-bk
Ø6-ye
Ø6-bl
Ø6-gn
ZG
EXH
SG
WG.a
PG
WG
0,75
1,1
1,5
KJELLBERG
FINSTERWALDE
Q-Torch
.11.858.x01.SP1 a
draft:
draft-no.:
file name:
.11.858.x01.SP1 a
sheet:
1/1
date
edited
checked
14.04.2020
RZA
change
date
name
norm
repl.:
be repl.:

.11.858.x01.SP1

Code	Beschreibung	description
A	**Leiterplatte**	**printed circuit board**
A1	LP BDA	PCB BDA
Y	**Ventil**	**valve**
Y3.11	2/2 Wege ZG	2/2 way SG
Y3.21	2/2 Wege SG	2/2 way SG
Y3.91	2/2 Wege ENTL	2/2 way SG


A1
PCB E-INLE
.12.LP080050
A2
PCB IGBT-INLE
.12.LP080080
A3
PCB A-INLE
.12.LP080090
A4
PCB INST6-AScard
.12.LP080040
A5
PCB INST6-DScard
.12.LP08003x
T1
T2
L1
L2
L3
L5
L6
R1 47k
R2 47k
R4 2k2
R5 6k8
R6 6k8
C1 7m5
C2 7m5
B.L2
B.L1
B.A1
B.A2-T1
B.L3
B.T1
B.A2-T2
B.A3
M1
M2
M6
CAN1
X4 Q-Source
X5 Q-Source
draft:
Invertermodul 5 Plasma 150A
draft-no.:
.11.412.3xxx..SP1 e
sheet:
1/1
file name:
.11.412.3xxx..SP1 e
repl.:
be repl.:
KJELLBERG FINSTERWALDE
date
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02.08.2019
AHA
01.10.2020 SM
23.04.2020 RZA
14.04.2020 RZA
16.10.2019 SM
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date
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.11.412.3xxx..SP1

Code	Beschreibung	Description
A	**Leiterplatte**	**printed circuit board**
A1	LP E-INLE (Eingang-Inverter Leistungsteil)	PCB E-INLE (input-inverter power section)
A2	LP IGBT-INLE (IGBT-Inverter Leistungsteil)	PCB IGBT-INLE (IGBT-inverter power section)
A3	LP A-INLE (Ausgang-Inverter Leistungsteil)	PCB A-INLE (output-inverter power section)
A4	INST6-AScard (Invertersteuerung6-Analog Signal card)	INST6-AScard (inverter control6-analogue signal card)
A5	INST6-DScard (Invertersteuerung6-Digital Signal card)	INST6-DScard (inverter control6-digital signal card)
B	**Sensor**	**sensor**
B.A1	NTC, Kühlkörper LP A1	NTC, heatsink PCB A1
B.A2-T1	NTC, Kühlkörper LP A2-T1	NTC, heatsink PCB A2-T1
B.A2-T1	NTC, Kühlkörper LP A2-T2	NTC, heatsink PCB A2-T2
B.A3	NTC, Kühlkörper LP A3	NTC, heatsink PCB A3
B.L1	NTC, Drossel L1	NTC, choke L1
B.L2	NTC, Drossel L2	NTC, choke L2
B.L3	NTC, Drossel L3	NTC, choke L3
B.T1	NTC, Transformator T1	NTC, transformer T1
C	**Kondensator**	**capacitor**
C1	Zwischenkreiskondensator 7,6 mF	DC link capacitor 7,6 mF
C2	Zwischenkreiskondensator 7,6 mF	DC link capacitor 7,6 mF
L	**Drossel**	**choke**
L1	Hilfsdrossel LP A2-T1	auxiliary choke PCB A2-T1
L2	Hilfsdrossel Transformator T1	auxiliary choke transformer T1
L3	Hilfsdrossel LP A2-T2	auxiliary choke PCB A2-T2
L5	Hilfsdrossel Zwischenkreis	auxiliary choke DC link
L6	Entstördrossel Netzstrom	suppressor choke, main current
M	**Motor**	**motor**
M1	Lüfter LP A3	fan PCB A3
M2	Lüfter LP A2	fan PCB A2

.11.412.3xxx..SP1

Code	Beschreibung	Description
R	**Widerstand**	**resistor**
R1	47 kΩ Symmetrierwiderstand	47 kΩ symmetry resistor
R2	47 kΩ Symmetrierwiderstand	47 kΩ symmetry resistor
R4	2,2 kΩ Lastwiderstand	2,2 kΩ load resistor
R5	6,8 kΩ Entladewiderstand	6,8 kΩ discharging resistor
R6	6,8 kΩ Entladewiderstand	6,8 kΩ discharging resistor
T	**Energieumwandler**	**power supply**
T1	Transformator Sekundärkreis	transformer secondary circuit
T2	Transformator Steuerkreis	transformer control circuit
X	**Klemmen**	**terminal**
X4	2-pol. Stecker, Anschluss Q-Source U2	2-pol. plug, connection Q-Source U2
X5	4-pol. Stecker, Anschluss Q-Source 24 VDC	4-pol. plug, connection Q-Source 24 VDC

11 Spare parts lists

for the plasma cutting unit
Q-Source
with plasma gas console:
Q-Gas 4500
with plasma machine torch
Q-Torch 4510
with plasma torch connection unit
Q-Port 4500

Dear customer,

with the plasma cutting system you have purchased a quality product from
the Kjellberg Finsterwalde Plasma und Maschinen GmbH.

When ordering spare parts, please mention the complete article no. of the torch and also the complete designation with article no. of the spare parts according to this list.
This information is required to be able to fulfil your wishes at short notice.

We reserve ourselves for technical reasons conditioned changes in the quantity production.

Claims of whatever kind can’t be derived from this spare parts list. Please direct your order straight to us or to your contractor.

For more information we are always at your disposal.

11.1 Spare parts list Q-Source

.11.038.1021 (Q 1500) 28.08.2023

pos	article no.	designation	code	pcs.
01.00	.16.500.368	Front wall		1
01.01	.10.504.638	Q-Profile design element		1
01.02	.10.110.317	pressure button	S5,S6	2
01.03	.10.110.311	LED green 24VAC/DC	H1	1
01.04	.10.110.319	Button cap, green	(S5,H1)	1
01.05	.10.110.322	LED white 24 V AC/DC	H2	1
01.06	.10.110.323	Button cap, yellow	(S6,H2)	1
01.07	.10.108.425	Lamp socket ML BA9s 250V/2W	(H1,H2)	2
01.08	.10.504.607	Holding magnet M4		2
01.09	.12.LP080140	PCB080140-B design element	A5	1
01.10	.10.256.801	Countersunk screw DIN 7991-M4x40-8.8 vz		4
01.11	.11.038.3002..905	Fan 125 mm with plug connection	M17	1
01.12	.10.140.724	Filter medium125 x 125 x 8 mm F100S	(M17)	1
01.13	.10.535.610	Protective grid LZ 30 P		1
01.14	.11.038.3002..352	Level switch 200 VDC, 0.5A	S3,S4	2
01.15	.10.190.029	Suppressor choke	L4	1
01.16	.10.190.031	Filter 3x470n(275 V)+10n(250 V)	C1,C2	1
01.17	.10.161.701	Contact for G481 20 for typ CF/BF	(Q1)	1
01.17	.10.161.706	Support (Side mounting)		1
01.18	.10.161.761.24DC	Contactor BF65C00 24VDC	Q1	1
01.19	.10.190.036	toroidal choke RK80 3x3mH/60A/10qmm	L1	1
01.20	.11.038.3002..320	Pump compl., mounted	M16	1
01.21	.11.038.3002..320.1	Pump complete, without engine	(M16)	1
01.21	.11.038.3002..320.2	Overflow valve completely, mounted	(M16)	1
01.21	.11.038.3002..320.3	Pressure switch completely, mounted	(M16)	1
01.21	.10.640.194.2	Motor 0,18 kW, 230 V, 50 Hz	(M16)	1
01.22	.10.639.585	Filter housing plastic 3/8"		1
01.23	.10.639.585.1	Sieve insert		1
01.24	.10.639.783	Dual solenoid valve block 3/8"	Y1,Y2	1
01.25	.11.038.3002..350	Coolant tank 20L, mounted		1
01.26	.10.129.104	Resistor 6 OHM 5A 200W 29x300	R1,R2	2
01.27	.10.129.108	Resistor 24 Ohm 5A 400W 29x300 10%	R3	1

.11.038.1021 (Q 1500) 28.08.2023

pos	article no.	designation	code	pcs.
02.00	.16.500.369	Rear wall		1
02.01	.10.164.596	USB implementation reversible nickel	X306	1
02.02	.10.164.597	Cover SCD-W black	(X306)	1
02.03	.10.164.759	Flange RJ45	X307,X308,X309	3
02.04	.12.LP080151	PCB080151 M12 adapter 1 + ECAT LEDs	A3	1
02.05	.12.LP080154	PCB080154 M23 adapter-LP	X302	1
02.06	.10.164.755	Device connector M17 socket straight 6+PE-pol	X304	1
02.07	.10.164.809	Dust protection cap device connector M17	(X304)	1
02.08	.10.164.853	Device connector M23 plug straight 5+PE-pol	X310,X315,X330	3
02.09	.10.109.503	Micro switch with plunger	S1	1
02.10	.10.504.604	Flex fastener 9.5		1
02.11	.10.603.008R	Cable gland M63x1.5 27-48mm		1
02.12	.10.603.017	Nut M 63x1.5		1
02.13	.11.038.3002..455	Choke L0	L2.xx	3
02.14	.11.038.3002..005	Strain relief, mounted		1
02.15	.10.502.576	Gable clip SQ-10, 9,5 - 12 mm		1
02.16	.10.502.577	Gable clip SQ-17 LGR		5
02.17	.10.502.578	Gable clip SQ-20, 20-23 mm		2
02.18	.10.502.579	Nut SQ M6		8
02.19	.11.038.3002..450	Choke L4	L3.xx	8

.11.038.1021 (Q 1500) 28.08.2023

pos	article no.	designation	code	pcs.
03.00	.16.500.505	Power source, left side		1
03.01	.10.184.763	Spring catch		2
03.02	.10.108.105	Current sensor 3 A completely assembled	K1	1
03.03	.10.148.924	Flow meter G1/2A	P1	1
03.04	.10.501.005	Non-return valve G3/8" A,		2
03.05	.10.615.060	Heat exchanger 290x598x80mm		2
03.06	.11.038.3002..349	Fan 172mm with plug connection	M13,M14,M15	3
03.07	.10.190.384	Autotransformer E120/53 480V/60Hz 230V/2,5A	T16	1
03.08	.11.038.3002..906	MRX 3 LAN- router, configured	A4	1
03.09	.10.102.036	Switched-mode power supply 240W 24V 10A	T11	1
03.10	.10.102.038	Switched-mode power supply 960W 24V 40A	T12	1
03.11	.10.500.168	Angled screw-in connectionG3/8 AD12, 1x sealing ring		1
03.12	.10.500.157	Angled screw-in connectionG3/8 AD14, 2x sealing ring		1
03.13	.10.504.885	Gasket EPDM 65 3mm Dm.18/10		1
03.14	.10.500.169	Screw-on connection straight, G1/2-I, 12/9		1

.11.038.1021 (Q 1500) 28.08.2023

pos	article no.	designation	code	pcs.
04.00	.16.500.504	Power source, right side		1
04.01	.12.LP080011	PCB080011-E Plasma Control	A1	1
04.02	.12.LP080020	PCB080020-E M2M-Interface	A2	1
04.03	.12.LP080180	PCB080180-B Guide	A6	1
04.04	.10.161.751.24	Contactor 3-pol. NO 11BG0601D024	Q0, Q4	2
04.05	.10.189.305	G-Fuse T 2 A, 6.3x32 mm 500 V	F21,F22	4
04.06	.10.189.309	G-Fuse T 6.3A, 6.3x32mm 500V	F11,F12,F13,F14,F15,F16	6
04.07	671.100.025	Capacitor B - 25 MFD - VIS M8	C4	1
04.08	.10.161.748	Suppressor element diode	(Q0,Q4)	2
04.09	.10.161.722.26	Contactor BF25 01 24V DC, 25A 3 pol.	Q2,Q3	2
04.10	.10.161.703	Auxiliary contact G481 02 for type CF/BF	(Q2)	1
04.12	.10.164.079	Terminal strip 70 qmm		3
04.13	.10.190.031	Filter 3x470n(275 V)+10n(250 V)	C1,C2	1
04.14	.10.580.585	Castor LE 80K		2
04.15	.10.164.138	Protective terminal WK4 SL/U		3
04.16	.10.164.190	Protective terminal 10qmm 9700 A		1
04.17	.10.164.194	Protective terminal 16qmm		1
04.18	.10.580.586	Fixed castor B 80K		2
04.19	.11.038.3002..655	Fan assembly for centre partition, mounted	M1-M3	1
04.20	.11.038.3002..658	module-fan 172mm with plug connection	M1-M3	3

.11.038.1021 (Q 1500) 28.08.2023

pos	article no.	designation	code	pcs.
05.00	.16.500.506	Power module		1
05.00	.11.412.3021B	Inverter module 5 Plasma 150 A 380-400V/50-60Hz	T1	1
05.00	.11.412.3022B	Inverter module 5 Plasma 150 A 415-440V/50-60Hz	T1, alternative	1
05.00	.11.412.3023B	Inverter module 5 Plasma 150 A 460-480V/50-60Hz	T1, alternative	1
05.01	.12.LP080031.1	PCB080031.1-A INST6 DS-Card 380-400V	T1/A5	1
05.01	.12.LP080032.1	PCB080032.1-A INST6 DS-Card 415-440V	T1/A5, alternative	1
05.01	.12.LP080033.1	PCB080033.1-A INST6 DS-Card 460-480V	T1/A5, alternative	1
05.02	.12.LP080040	PCB080040-B INST6 AS-Card	T1/A4	1
05.03	.12.LP080050	PCB080050-B E-INLE	T1/A1	1
05.04	.12.LP080080	PCB080080-A IGBT-INLE	T1/A2	1
05.05	.12.LP080090	PCB080090-A A-INLE	T1/A3	1
05.06	.10.190.021	Mains transformer 400V/42V 0,8A, 50/60 Hz	T1/T2	1
05.07	.10.190.036	toroidal choke RK80 3x3mH/60A/10qmm	T1/L6	1
05.08	.101.40.111	resistor 1K2 50,00 W 5% TK 50		2
05.09	.101.40.148	resistor 2K2 50,00 W 5% TK 50		1
05.10	.11.412.3002..011	NTC with plug connector		4
05.11	.11.412.3002..100	Transformer module Plasma 150A	T1/T1	1
05.12	.11.412.3002..460	Choke L5	T1/L5	1
05.13	.11.412.3002..470	Choke L1 module	T1/L1	1
05.14	.11.412.3002..480	Choke L2	T1/L2	1
05.15	.11.412.3002..490	Choke L3 module	T1/L3	1
05.16	.11.412.3002..510	Secondary rectifier, mounted		1
05.17	.11.412.3002..520	IGBT-assembly 2 center		1
05.18	.11.412.3002..530	IGBT-assembly 1 outside		1
05.19	.11.412.3002..540	Primary rectifier mounted		1
05.20	.11.412.3002..720	Fan mounted	T1/M1	1
05.21	.11.412.3002..725	Fan mounted	T1/M2	1
05.22	671.100.028	Capacitor 7600 µF 400 V 77x131,M12X16	T1/C1, T1/C2	2
05.23	671.100.028.1	Resistor 47k 11W 5% axial 10x50mm	T1/R1, T1/R2	2

.11.038.202x (Q 3000) 28.08.2023

pos	article no.	designation	code	pcs.
01.00	.16.500.368	Front wall		1
01.01	.10.504.638	Q-Profil design element		1
01.02	.10.110.317	pressure button	S5,S6	2
01.03	.10.110.311	LED green 24VAC/DC	H1	1
01.04	.10.110.319	Button cap, green	(S5,H1)	1
01.05	.10.110.322	LED white 24 V AC/DC	H2	1
01.06	.10.110.323	Button cap, yellow	(S6,H2)	1
01.07	.10.108.425	Lamp socket ML BA9s 250V/2W	(H1,H2)	2
01.08	.10.504.607	Holding magnet M4		2
01.09	.12.LP080140	PCB080140-B design element	A5	1
01.10	.10.256.801	Countersunk screw DIN 7991-M4x40-8.8 vz		4
01.11	.11.038.3002..905	Fan 125 mm with plug connection	M17	1
01.12	.10.140.724	Filter medium125 x 125 x 8 mm F100S	(M17)	1
01.13	.10.535.610	Protective grid LZ 30 P		1
01.14	.11.038.3002..352	Level switch 200 VDC, 0.5A	S3,S4	2
01.15	.10.190.029	Suppressor choke	L4	1
01.16	.10.190.031	Filter 3x470n(275 V)+10n(250 V)	C1,C2	1
01.17	.10.161.705	Contactor G350	(Q1)	1
01.18	.10.161.730.24	Contactor B145 24V AC/DC, 3 pol.	Q1	1
01.19	.10.190.035	Ring core choke R102 3x1,5mH / 200A	L1	1
01.20	.11.038.3002..320	Pump compl., mounted	M16	1
01.21	.11.038.3002..320.1	Pump complete, without engine	(M16)	1
01.21	.11.038.3002..320.2	Overflow valve completely, mounted	(M16)	1
01.21	.11.038.3002..320.3	Pressure switch completely, mounted	(M16)	1
01.21	.10.640.194.2	Motor 0,18 kW, 230 V, 50 Hz	(M16)	1
01.22	.10.639.585	Filter housing plastic 3/8"		1
01.23	.10.639.585.1	Sieve insert		1
01.24	.10.639.783	Dual solenoid valve block 3/8"	Y1,Y2	1
01.25	.11.038.3002..350	Coolant tank 20L, mounted		1
01.26	.10.129.104	Resistor 6 OHM 5A 200W 29x300	R1,R2	2
01.27	.10.129.108	Resistor 24 Ohm 5A 400W 29x300 10%	R3	1

.11.038.202x (Q 3000) 28.08.2023

pos	article no.	designation	code	pcs.
02.00	.16.500.369	Rear wall		1
02.01	.10.164.596	USB implementation reversible nickel	X306	1
02.02	.10.164.597	Cover SCD-W black	(X306)	1
02.03	.10.164.759	Flange RJ45	X307,X308,X309	3
02.04	.12.LP080151	PCB080151-A M12 adapter 1+ ECAT LEDs	A3	1
02.05	.12.LP080154	PCB080154-B M23 adapter-LP	X302	1
02.06	.10.164.755	Device connector M17 socket straight 6+PE-pol	X304	1
02.07	.10.164.809	Dust protection cap device connector M17	(X304)	1
02.08	.10.164.853	Device connector M23 plug straight 5+PE-pol	X310,X315,X330	3
02.09	.10.109.503	Micro switch with plunger	S1	1
02.10	.10.504.604	Flex fastener 9.5		1
02.11	.10.603.008R	Cable gland M63x1.5 27-48mm		1
02.12	.10.603.017	Nut M 63x1.5		1
02.13	.11.038.3002..455	Choke L0	L2.xx	3
02.14	.11.038.3002..005	Strain relief, mounted		1
02.15	.10.502.576	Gable clip SQ-10, 9,5 - 12 mm		1
02.16	.10.502.577	Gable clip SQ-17 LGR		5
02.17	.10.502.578	Gable clip SQ-20, 20-23 mm		2
02.18	.10.502.579	Nut SQ M6		8
02.19	.11.038.3002..450	Choke L4	L3.xx	8

.11.038.202x (Q 3000) 28.08.2023

pos	article no.	designation	code	pcs.
03.00	.16.500.505	Power source, left side		1
03.01	.10.184.763	Spring catch		2
03.02	.10.108.105	Current sensor 3 A completely assembled	K1	1
03.03	.10.148.924	Flow meter G1/2A	P1	1
03.04	.10.501.005	Non-return valve G3/8" A		2
03.05	.10.615.065	Heat exchanger 290x598x160mm		2
03.06	.11.038.3002..349	Fan 172mm with plug connection	M13,M14,M15	3
03.07	.10.190.384	Autotransformer E120/53 480V/60Hz 230V/2,5A	T16	1
03.08	.11.038.3002..906	MRX 3 LAN- router, configured	A4	1
03.09	.10.102.036	Switched-mode power supply 240W 24V 10A	T11	1
03.10	.10.102.038	Switched-mode power supply 960W 24V 40A	T12	1
03.11	.10.500.168	Angled screw-in connectionG3/8 AD12, 1x sealing ring		1
03.12	.10.500.157	Angled screw-in connectionG3/8 AD14, 2x sealing ring		1
03.13	.10.504.885	Gasket EPDM 65 3mm Dm.18/10		1
03.14	.10.500.169	Screw-on connection straight, G1/2-I, 12/9		1

.11.038.202x (Q 3000) 28.08.2023

pos	article no.	designation	code	pcs.
04.00	.16.500.504	Power source, right side		1
04.01	.12.LP080011	PCB080011-E Plasma Control	A1	1
04.02	.12.LP080020	PCB080020-E M2M-Interface	A2	1
04.03	.12.LP080180	PCB080180-B Guide	A6	1
04.04	.10.161.751.24	Contactor 3-pol. NO 11BG0601D024	Q0, Q4	2
04.05	.10.189.305	G-Fuse T 2 A, 6.3x32 mm 500 V	F21,F22	2
04.06	.10.189.309	G-Fuse T 6.3A, 6.3x32mm 500V	F11,F12,F13,F14,F15,F16	6
04.07	671.100.025	Capacitor B - 25 MFD - VIS M8	C4	1
04.08	.10.161.748	Suppressor element diode	(Q0,Q4)	2
04.09	.10.161.722.26	Contactor BF25 01 24V DC, 25A 3 pol.	Q2,Q3	2
04.10	.10.161.703	Auxiliary contact G481 02 for type CF/BF	(Q2)	1
04.11	.10.147.821	Circuit breaker P3, 63A,400V	F1,F2,F3	3
04.12	.10.164.079	Terminal strip 70 qmm		3
04.13	.10.190.031	Filter 3x470n(275 V)+10n(250 V)	C1,C2	1
04.14	.10.580.585	Castor LE 80K		2
04.15	.10.164.138	Protective terminal WK4 SL/U		3
04.16	.10.164.078	Protective terminal 70qmm		1
04.17	.10.164.300	Protective terminal 35qmm small		1
04.18	.10.580.586	Fixed castor B 80K		2
04.19	.11.038.3002..655	Fan assembly for center partition, mounted	M1-M6	1
04.20	.11.038.3002..658	modul-fan 172mm with plug connection	M1-M6	3

.11.038.202x (Q 3000) 28.08.2023

pos	article no.	designation	code	pcs.
05.00	.16.500.506	Power module		1
05.00	.11.412.3021B	Inverter module 5 Plasma 150 A 380-400V/50-60Hz	T1, T2	2
05.00	.11.412.3022B	Inverter module 5 Plasma 150 A 415-440V/50-60Hz	T1, T2, alternative	2
05.00	.11.412.3023B	Inverter module 5 Plasma 150 A 460-480V/50-60Hz	T1, T2, alternative	2
05.01	.12.LP080031.1	PCB080031.1-A INST6 DS-Card 380-400V	TX/A5	1
05.01	.12.LP080032.1	PCB080032.1-A INST6 DS-Card 415-440V	TX/A5, alternative	1
05.01	.12.LP080033.1	PCB080033.1-A INST6 DS-Card 460-480V	TX/A5, alternative	1
05.02	.12.LP080040	PCB080040-B INST6 AS-Card	TX/A4	1
05.03	.12.LP080050	PCB080050-B E-INLE	TX/A1	1
05.04	.12.LP080080	PCB080080-A IGBT-INLE	TX/A2	1
05.05	.12.LP080090	PCB080090-A A-INLE	TX/A3	1
05.06	.10.190.021	Mains transformer 400V/42V 0,8A, 50/60 Hz	TX/T2	1
05.07	.10.190.036	toroidal choke RK80 3x3mH/60A/10qmm	TX/L6	1
05.08	.101.40.111	resistor 1K2 50,00 W 5% TK 50		2
05.09	.101.40.148	resistor 2K2 50,00 W 5% TK 50		1
05.10	.11.412.3002..011	NTC with plug connector		4
05.11	.11.412.3002..100	Transformer module Plasma 150A	TX/T1	1
05.12	.11.412.3002..460	Choke L5	TX/L5	1
05.13	.11.412.3002..470	Choke L1 module	TX/L1	1
05.14	.11.412.3002..480	Choke L2	TX/L2	1
05.15	.11.412.3002..490	Choke L3 module	TX/L3	1
05.16	.11.412.3002..510	Secondary rectifier, mounted		1
05.17	.11.412.3002..520	IGBT-assembly 2 center		1
05.18	.11.412.3002..530	IGBT-assembly 1 outside		1
05.19	.11.412.3002..540	Primary rectifier mounted		1
05.20	.11.412.3002..720	Fan mounted	TX/M1	1
05.21	.11.412.3002..725	Fan mounted	TX/M2	1
05.22	671.100.028	Capacitor 7600 µF 400 V 77x131,M12X16	TX/C1, TX/C2	2
05.23	671.100.028.1	Resistor 47k 11W 5% axial 10x50mm	TX/R1, TX/R2	2

.11.038.302x, .11.038.402x, .11.038.502x (Q 1500 plus, Q 3000 plus, Q 4500) 28.08.2023

pos	article no.	designation	code	pcs.
01.00	.16.500.368	Front wall		1
01.01	.10.504.638	Q-Profil design element		1
01.02	.10.110.317	pressure button	S5,S6	2
01.03	.10.110.311	LED green 24VAC/DC	H1	1
01.04	.10.110.319	Button cap, green	(S5,H1)	1
01.05	.10.110.322	LED white 24 V AC/DC	H2	1
01.06	.10.110.323	Button cap, yellow	(S6,H2)	1
01.07	.10.108.425	Lamp socket ML BA9s 250V/2W	(H1,H2)	2
01.08	.10.504.607	Holding magnet M4		2
01.09	.12.LP080140	PCB080140-B design element	A5	1
01.10	.10.256.801	Countersunk screw DIN 7991-M4x40-8.8 vz		4
01.11	.11.038.3002..905	Fan 125 mm with plug connection	M17	1
01.12	.10.140.724	Filter medium125 x 125 x 8 mm F100S	(M17)	1
01.13	.10.535.610	Protective grid LZ 30 P		1
01.14	.11.038.3002..352	Level switch 200 VDC, 0.5A	S3,S4	2
01.15	.10.190.029	Suppressor choke	L4	1
01.16	.10.190.031	Filter 3x470n(275 V)+10n(250 V)	C1,C2	1
01.17	.10.161.705	Contactor G350	(Q1)	1
01.18	.10.161.731.24	Contactor B180 24V AC/DC, 3 pol.	Q1	1
01.19	.10.190.035	Ring core choke R102 3x1,5mH / 200A	L1	1
01.20	.11.038.3002..320	Pump compl., mounted	M16	1
01.21	.11.038.3002..320.1	Pump complete, without engine	(M16)	1
01.21	.11.038.3002..320.2	Overflow valve completely, mounted	(M16)	1
01.21	.11.038.3002..320.3	Pressure switch completely, mounted	(M16)	1
01.21	.10.640.194.2	Motor 0,18 kW, 230 V, 50 Hz	(M16)	1
01.22	.10.639.585	Filter housing plastic 3/8"		1
01.23	.10.639.585.1	Sieve insert		1
01.24	.10.639.783	Dual solenoid valve block 3/8"	Y1,Y2	1
01.25	.11.038.3002..350	Coolant tank 20L, mounted		1
01.26	.10.129.104	Resistor 6 OHM 5A 200W 29x300	R1,R2	2
01.27	.10.129.108	Resistor 24 Ohm 5A 400W 29x300 10%	R3	1
01.28	.10.504.624	Slot nut E-Nut, M6, ESD		1
01.29	.10.504.633	Slot nut F-Nut, M6, ESD		1
01.30	.10.504.625	Slot nut E-Nut, M8, ESD		1

pos	article no.	designation	code	pcs.
02.00	.16.500.369	Rear wall		1
02.01	.10.164.596	USB implementation reversible nickel	X306	1
02.02	.10.164.597	Cover SCD-W black	(X306)	1
02.03	.10.164.759	Flange RJ45	X307,X308,X309	3
02.04	.12.LP080151	PCB080151-A M12 adapter 1+ ECAT LEDs	A3	1
02.05	.12.LP080154	PCB080154-B M23 adapter-LP	X302	1
02.06	.10.164.755	Device connector M17 socket straight 6+PE-pol	X304	1
02.07	.10.164.809	Dust protection cap device connector M17	(X304)	1
02.08	.10.164.853	Device connector M23 plug straight 5+PE-pol	X310,X315,X330	3
02.09	.10.109.503	Micro switch with plunger	S1	1
02.10	.10.504.604	Flex fastener 9.5		1
02.11	.10.603.008R	Cable gland M63x1.5 27-48mm		1
02.12	.10.603.017	Nut M 63x1.5		1
02.13	.11.038.3002..455	Choke L0	L2.xx	3
02.14	.11.038.3002..005	Strain relief, mounted		1
02.15	.10.502.576	Gable clip SQ-10, 9,5 - 12 mm		1
02.16	.10.502.577	Gable clip SQ-17 LGR		5
02.17	.10.502.578	Gable clip SQ-20, 20-23 mm		2
02.18	.10.502.579	Nut SQ M6		8
02.19	.11.038.3002..450	Choke L4	L3.xx	8

.11.038.302x, .11.038.402x, .11.038.502x (Q 1500 plus, Q 3000 plus, Q 4500) 28.08.2023

pos	article no.	designation	code	pcs.
03.00	.16.500.505	Power source, left side		1
03.01	.10.184.763	Spring catch		2
03.02	.10.108.105	Current sensor completely assembled	K1	1
03.03	.10.148.924	Flow meter G1/2A	P1	1
03.04	.10.501.005	Non-return valve G3/8" A, RVGG08		2
03.05	.10.615.065	Heat exchanger 290x598x160mm		2
03.06	.11.038.3002..349	Fan 172mm with plug connection	M13,M14,M15	3
03.07	.10.190.384	Autotransformer E120/53 480V/60Hz 230V/2,5A	T16	1
03.08	.11.038.3002..906	MRX 3 LAN- router, configured	A4	1
03.09	.10.102.036	Switched-mode power supply 240W 24V 10A	T11	1
03.10	.10.102.038	Switched-mode power supply 960W 24V 40A	T12	1
03.11	.10.500.168	Angled screw-in connectionG3/8 AD12, 1x sealing ring		1
03.12	.10.500.157	Angled screw-in connectionG3/8 AD14, 2x sealing ring		1
03.13	.10.504.885	Gasket EPDM 65 3mm Dm.18/10		1
03.14	.10.500.169	Screw-on connection straight, G1/2-I, 12/9		1

pos	article no.	designation	code	pcs.
04.00	.16.500.504	Power source, right side		1
04.01	.12.LP080011	PCB080011-E Plasma Control	A1	1
04.02	.12.LP080020	PCB080020-E M2M-Interface	A2	1
04.03	.12.LP080180	PCB080180-B Guide	A6	1
04.04	.10.161.751.24	Contactor 3-pol. NO 11BG0601D024	Q0, Q4	2
04.05	.10.189.305	G-Fuse T 2 A, 6.3x32 mm 500 V	F21, F22	2
04.06	.10.189.309	G-Fuse T 6.3A, 6.3x32mm 500V	F11, F12, F13, F14, F15, F16	6
04.07	671.100.025	Capacitor B - 25 MFD - VIS M8	C4	1
04.08	.10.161.748	Suppressor element diode	(Q0, Q4)	2
04.09	.10.161.722.26	Contactor BF25 01 24V DC, 25A 3 pol.	Q2,Q3	2
04.10	.10.161.703	Auxiliary contact G481 02 for type CF/BF	(Q2)	1
04.11	.10.147.821	Circuit breaker P3, 63A,400V	F1,F2,F3	3
04.12	.10.164.079	Terminal strip 70 qmm		3
04.13	.10.190.031	Filter 3x470n(275 V)+10n(250 V)	C1,C2	1
04.14	.10.580.585	Castor LE 80K		2
04.15	.10.164.138	Protective terminal WK4 SL/U		3
04.16	.10.164.078	Protective terminal 70qmm		1
04.17	.10.164.300	Protective terminal 35qmm small		1
04.18	.10.580.586	Fixed castor B 80K		2
04.19	.11.038.3002..655	Fan assembly for center partition, mounted	M1-M9	1
04.20	.11.038.3002..658	modul-fan 172mm whith plug connection	M1-M9	3

.11.038.302x, .11.038.402x, .11.038.502x (Q 1500 plus, Q 3000 plus, Q 4500) 28.08.2023

pos	article no.	designation	code	pcs.
05.00	.16.500.506	Power module		1
05.00	.11.412.3021B	Inverter module 5 Plasma 150 A 380-400V/50-60Hz	T1, T2, T3	1
05.00	.11.412.3022B	Inverter module 5 Plasma 150 A 415-440V/50-60Hz	T1, T2, T3, alternative	1
05.00	.11.412.3023B	Inverter module 5 Plasma 150 A 460-480V/50-60Hz	T1, T2, T3, alternative	1
05.01	.12.LP080031.1	PCB080031.1-A INST6 DS-Card 380-400V	TX/A5	1
05.01	.12.LP080032.1	PCB080032.1-A INST6 DS-Card 415-440V	TX/A5, alternative	1
05.01	.12.LP080033.1	PCB080033.1-A INST6 DS-Card 460-480V	TX/A5, alternative	1
05.02	.12.LP080040	PCB080040-B INST6 AS-Card	TX/A4	1
05.03	.12.LP080050	PCB080050-B E-INLE	TX/A1	1
05.04	.12.LP080080	PCB080080-A IGBT-INLE	TX/A2	1
05.05	.12.LP080090	PCB080090-A A-INLE	TX/A3	1
05.06	.10.190.021	Mains transformer 400V/42V 0,8A, 50/60 Hz	TX/T2	1
05.07	.10.190.036	toroidal choke RK80 3x3mH/60A/10qmm	TX/L6	1
05.08	.101.40.111	resistor 1K2 50,00 W 5% TK 50		2
05.09	.101.40.148	resistor 2K2 50,00 W 5% TK 50		1
05.10	.11.412.3002..011	NTC with plug connector		4
05.11	.11.412.3002..100	Transformer module Plasma 150A	TX/T1	1
05.12	.11.412.3002..460	Choke L5	TX/L5	1
05.13	.11.412.3002..470	Choke L1 module	TX/L1	1
05.14	.11.412.3002..480	Choke L2	TX/L2	1
05.15	.11.412.3002..490	Choke L3 module	TX/L3	1
05.16	.11.412.3002..510	Secondary rectifier, mounted		1
05.17	.11.412.3002..520	IGBT-assembly 2 center		1
05.18	.11.412.3002..530	IGBT-assembly 1 outside		1
05.19	.11.412.3002..540	Primary rectifier mounted		1
05.20	.11.412.3002..720	Fan mounted	TX/M1	1
05.21	.11.412.3002..725	Fan mounted	TX/M2	1
05.22	671.100.028	Capacitor 7600 µF 400 V 77x131,M12X16	TX/C1, TX/C2	2
05.23	671.100.028.1	Resistor 47k 11W 5% axial 10x50mm	TX/R1, TX/R2	2

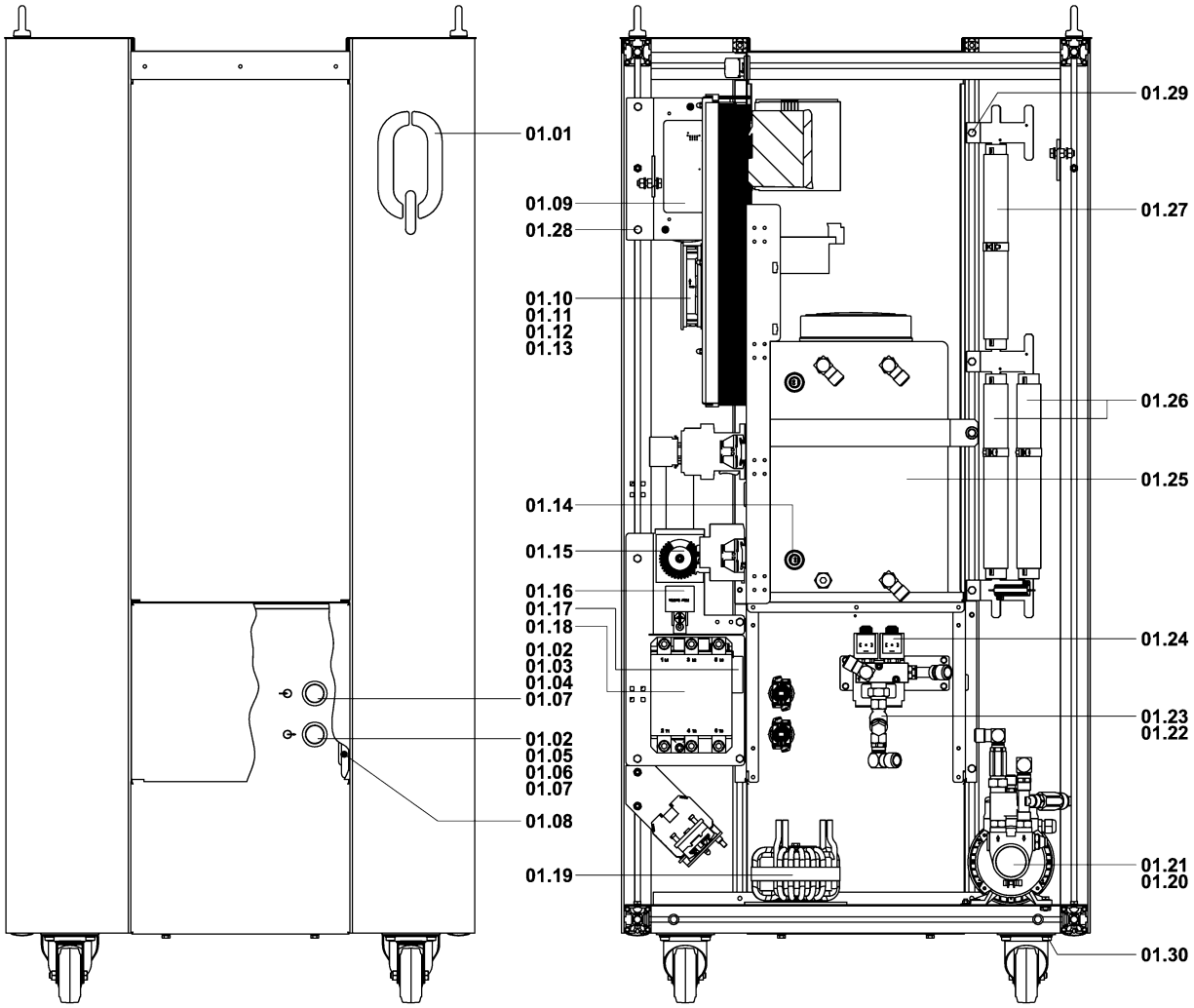
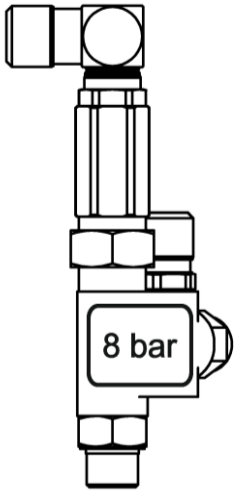
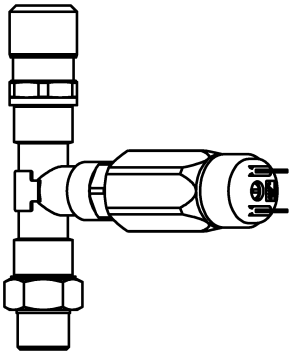


Fig. 39: front panel of Q



01.21	.11.038.3002..320.2	Overflow valve completely, mounted



01.21	.11.038.3002..320.3	Pressure switch completely, mounted

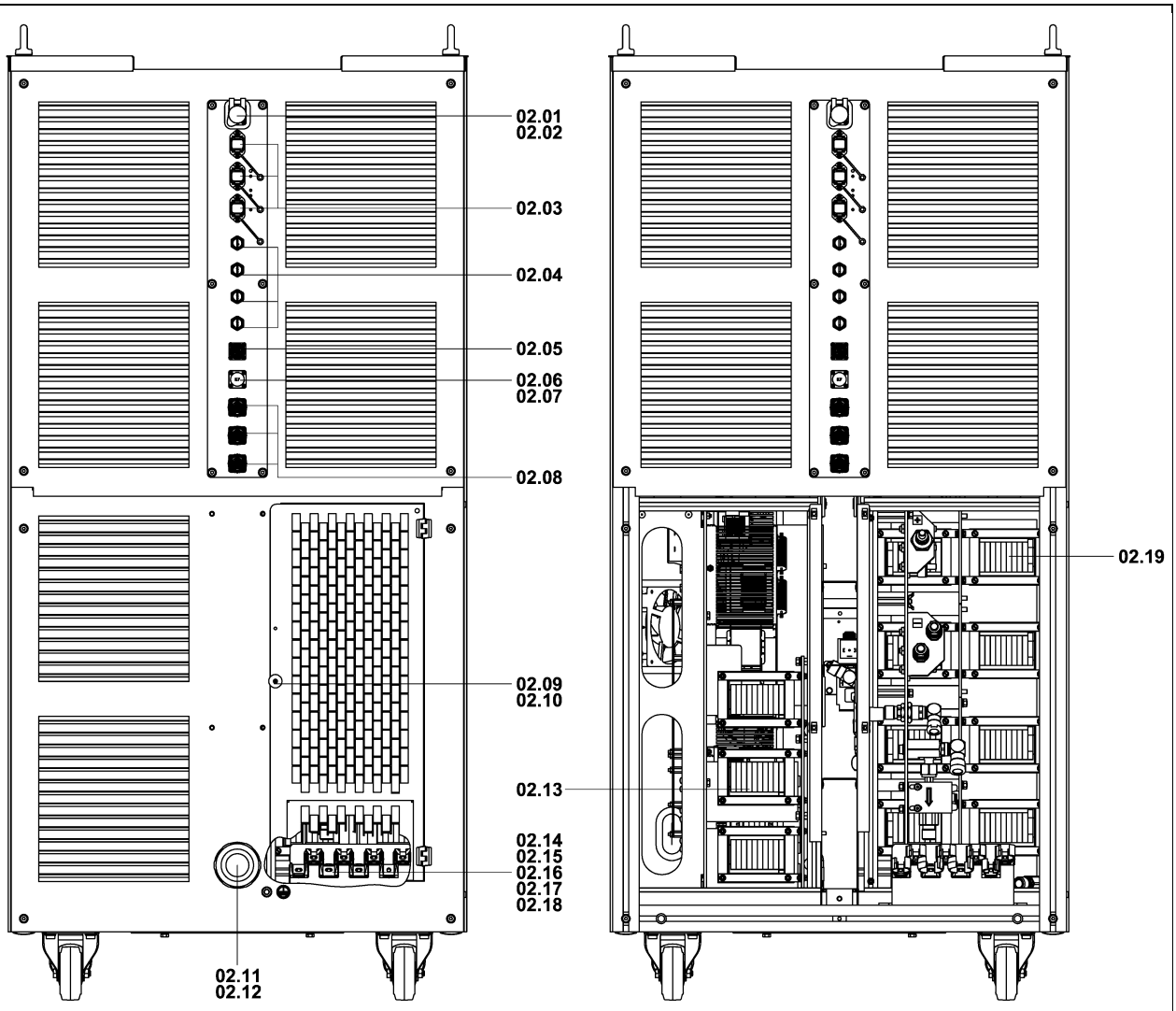


Fig. 40: rear panel of Q

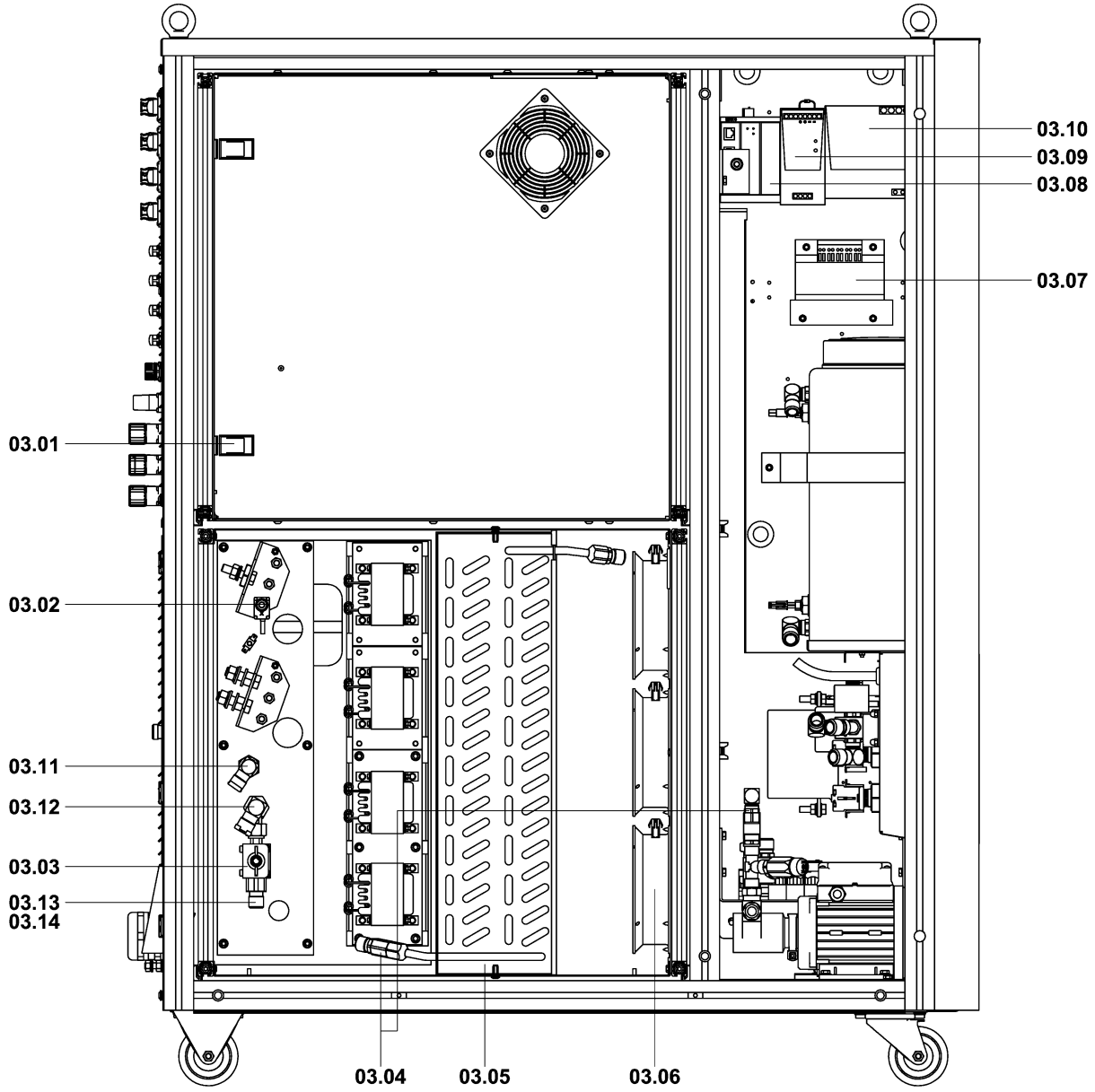
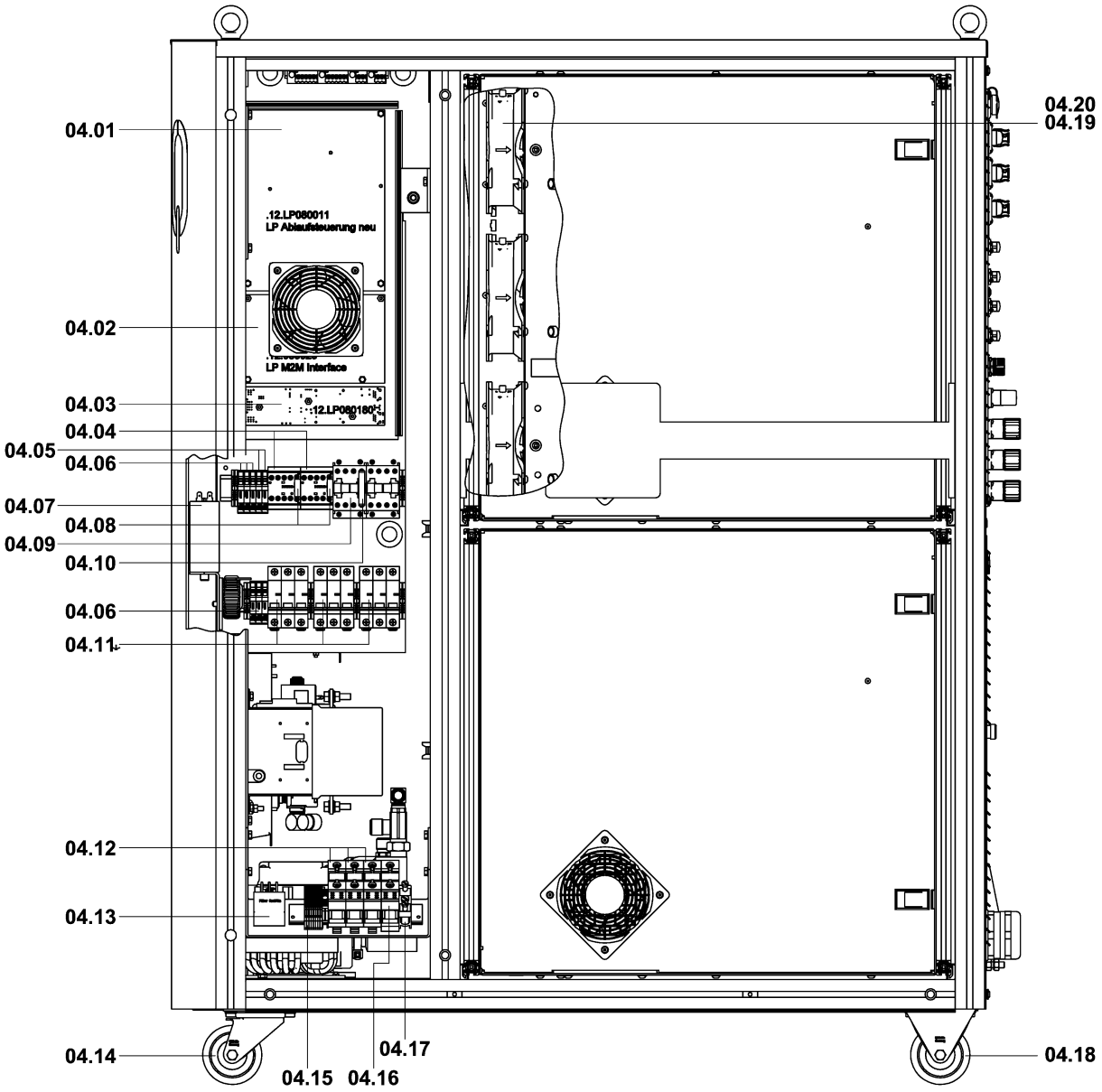


Fig. 41: left side view of the Q



* corresponding to delivery version

Fig. 42: right side view of the Q

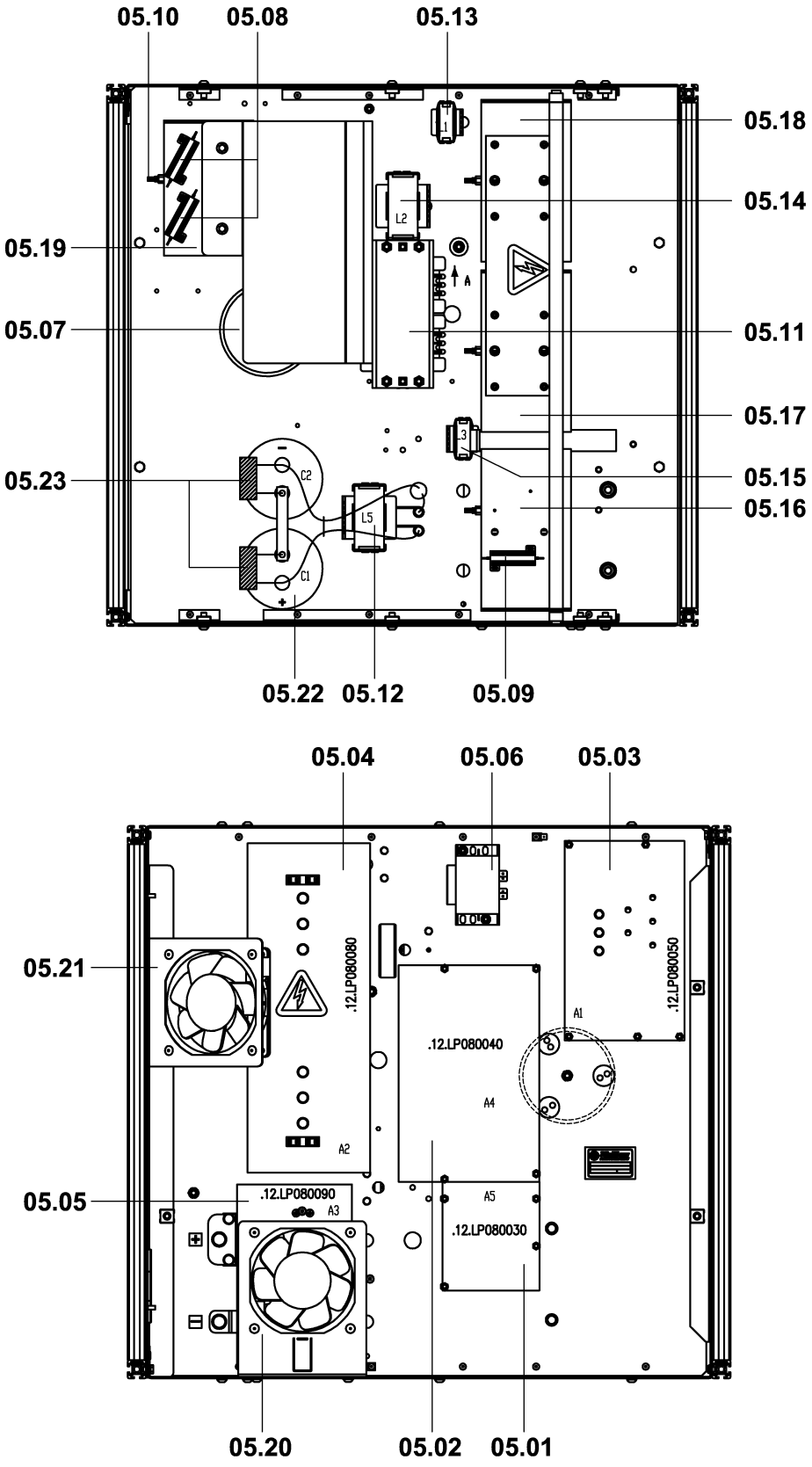


Fig. 43: control unit of Q

11.2 Spare parts list Q-Gas 4500

.11.825.1300A 28.08.2023

pos	article no.	designation	code	pcs.
01.01	.10.102.081	elec. gas pressure regulator SY04 CS, NW 1,2	Y1.20, Y 1.30, DR2, DR3	2
01.02	.10.102.082	elec. gas pressure regulator SY04 CS, NW 2,0	Y1.40, Y1.50, DR4, DR5	2
01.03	.10.105.625	LED dia. 5mm green 24 VAC metall housing	H1	1
01.04	.10.163.904	Acoustical filter 1/8"		1
01.05	.10.184.827	Distance bolt M6x10 , I/A galvanised		4
01.06	.10.184.799	Insulator		5
01.07	.10.500.129	Angle screw in connections M5 SW8 AD6		1
01.08	.10.500.132	Angle screw in connections swiveling SW13 G1/8"		16
01.09	.10.500.133	Angle screw in connections swiveling SW17 G1/4"		1
01.10	.10.500.144	Straight screw joint G1/4" SW5		1
01.11	.10.500.145	Straight screw joint G1/8, 6/4		4
01.12	.10.502.670	Straight screw joint G1/8"x 6 mm IG		1
01.13	.10.500.919	Sleeve nut G1/8"		1
01.14	.10.504.600	Folding handle with recessed tray, with spring loaded return		2
01.15	.10.504.598	Hinge SNAP-LINE (1,2-1,5) 180° SW		2
01.16	.10.504.867	Rubber foot 4,5 x 20 x 12		4
01.17	.10.535.614	Fan 92 x 92 x 25 mm 24 V DC 2,9 W 73,1 m3/h	M1	1
01.18	.10.639.756.4	Screw nut		15
01.19	.10.639.771	Pilot solenoid valve 24 V DC OLAB 10 VA	Y1.11-1.13, Y1.21, Y1.22, Y1.31, Y1.32, Y1.41-1.44, Y1.51, Y1.53, Y1.54	14

.11.825.1300A 28.08.2023

pos	article no.	designation	code	pcs.
01.20	.10.639.775	Pilot solenoid valve 3/2-way 24 V DC 5 W	Y1.33	1
01.21	.10.639.780	Solenoid valve 3/2-way 24 V DC NW 2,0mm	Y1.52	1
01.22	.11.825.1300..810	Gas inlet QG-4500, mounted	Y1.11-1.13, Y1.21, Y1.22, Y1.31, Y1.32, Y1.41, Y1.42, Y1.51	1
01.23	.11.825.1300AT840.1	manual pressure regulator for ignition gas, tested; 6,5 bar	B1, DR1, Y1.10	1
01.24	.11.825.1300..850	Gas outlet QG-4500, mounted	Y1.33, Y1.43, Y1.44, Y1.52-1.54	1
01.25	.11.825.1300..910	DC/DC converter unit QG4500,	T1	1
01.26	.11.825.1300..983	Insulating plate pressure regulator LGV		4
01.27	.12.29270	Filter M5x22		5
01.28	.12.49050	Filter M 8 X 25, 9T2228		2
01.29	.12.LP080100	PCB080100 Gas Control	A1	1
01.30	.12.LP080152	PCB080152 M12_adapter 2	X340, X341, X342	1
01.31	.12.TTR00561	TTR-label choke assembly primary L1-L3		1
01.32	.16.010.314.7	Controller phyCore-r2-AM335x-2		1
01.33	.16.010.715	MicroSD Card, AF4GUD3A-WAAXX, 4GB		1
01.34	.12.117.130	Cone fitting for sleeve nut G1/8" with M5i		1
01.35	.10.639.588	Filter insert for pressure regulator 1/8"	Y1.20 - Y1.50, DR2 - DR5	1
02.00	.10.508.019	Polyamide plastic hose 6/4 mm blue		1
02.01	.10.508.020	Polyamide plastic hose 6/4mm red		1
02.02	.10.508.021	Polyamide plastic hose 6/4 mm black		1
02.03	.10.508.023	Polyamide plastic hose 6/4mm green		1
02.04	.10.508.024	Polyamide plastic hose 6/4 mm grey		1

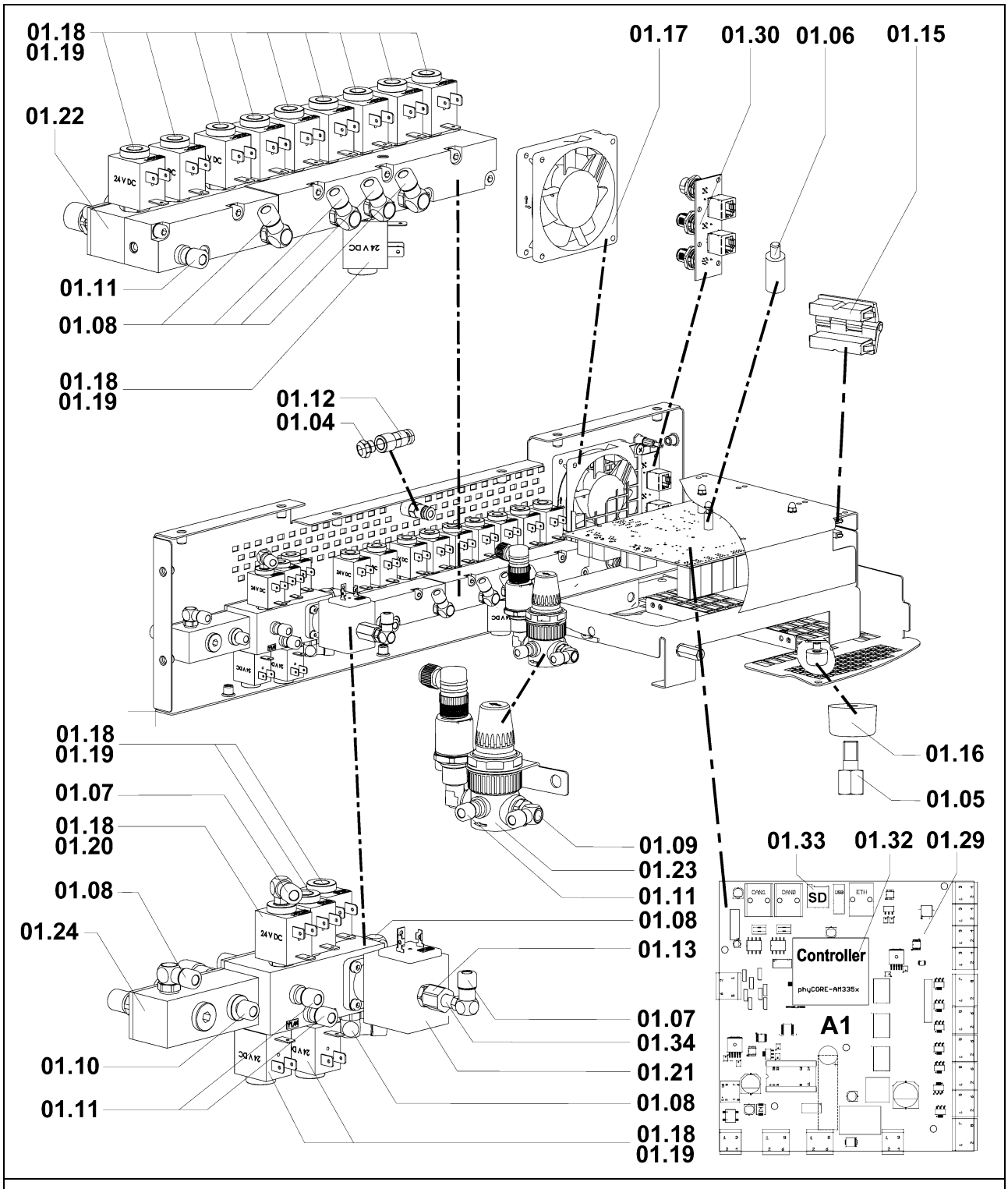


Fig. 44: Overview Q-Gas 4500, part 1

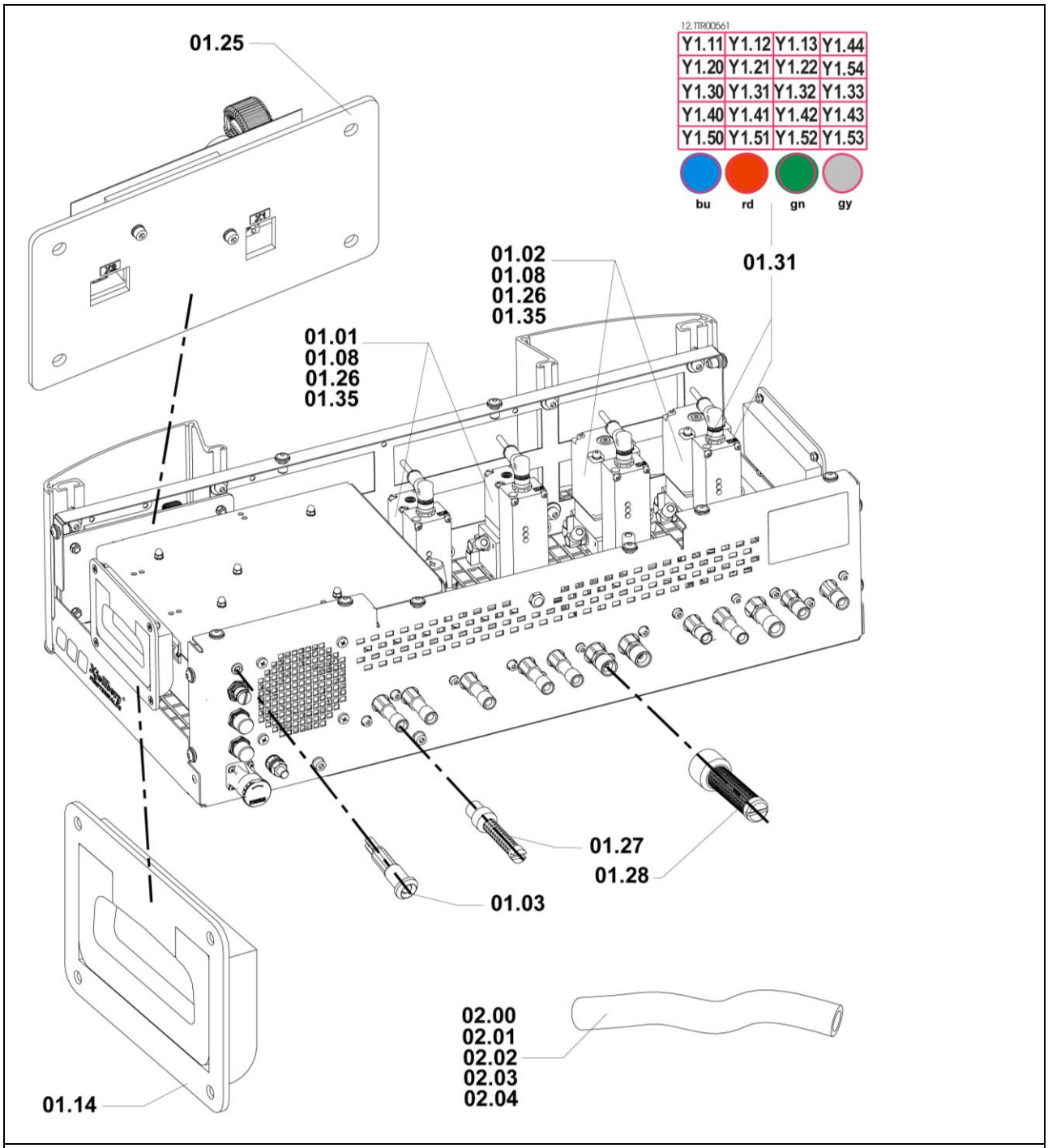


Fig. 45: Overview Q-Gas 4500, part 2

11.3 Spare parts list Q-Gas O_2 4500

.11.825.1301A 28.08.2023

pos	article no.	designation	code	pcs.
01.01	.10.102.081	elec. gas pressure regulator SY04 CS, NW 1,2	Y1.20, DR2	1
01.02	.10.102.082	elec. gas pressure regulator SY04 CS, NW 2,0	Y1.40, Y1.50, DR4, DR5	2
01.03	.10.105.625	LED dia. 5mm green 24 VAC metall housing	H1	1
01.04	.10.184.778	Cover cap Dm 9,5-10,5 sw		1
01.05	.10.184.827	Distance bolt M6x10 , I/A galvanised		4
01.06	.10.184.799	Insulator		5
01.07	.10.184.785	Cover cap Dm 7,6 - 9,0mm sw		2
01.08	.10.500.132	Angle screw in connections swiveling SW13 G1/8"		13
01.09	.10.500.133	Angle screw in connections swiveling SW17 G1/4"		1
01.10	.10.500.144	Straight screw joint G1/4" SW5		1
01.11	.10.500.145	Straight screw joint G1/8, 6/4		2
01.12	.10.184.776	Cover cap Dm 17-18 DP-687 SW		3
01.13	.10.500.919	Sleeve nut G1/8"		1
01.14	.10.504.600	Folding handle with recessed tray, with spring loaded return		2
01.15	.10.504.598	Hinge SNAP-LINE (1,2-1,5) 180° SW		2
01.16	.10.504.867	Rubber foot 4,5 x 20 x 12		4
01.17	.10.535.614	Fan 92 x 92 x 25 mm 24 V DC 2,9 W 73,1 m3/h	M1	1
01.18	.10.639.756.4	Screw nut		12
01.19	.10.639.771	Pilot solenoid valve 24 V DC OLAB 10 VA	Y1.11-1.13, Y1.21, Y1.22, Y1.41-1.44, Y1.51,	12

.11.825.1301A 31.03.2023

pos	article no.	designation	code	pcs.
01.20	.10.184.772	Cover cap Dm 12,7 DP-500 SW		3
01.21	.10.639.780	Solenoid valve 3/2-way 24 V DC NW 2,0mm	Y1.52	1
01.22	.11.825.1301..810	Gas inlet QG-O2, mounted	Y1.11-1.13, Y1.21, Y1.22, Y1.41, Y1.42, Y1.51	1
01.23	.11.825.1300AT840.1	manual pressure regulator for ignition gas, tested; 6,5 bar	B1, DR1, Y1.10	1
01.24	.11.825.1301..850	Gas outlet QG-O2, mounted	Y1.43, Y1.44, Y1.52-1.54	1
01.25	.11.825.1300..910	DC/DC converter unit QG4500,	T1	1
01.26	.11.825.1300..983	Insulating plate pressure regulator LGV		3
01.27	.12.29270	Filter M5x22		5
01.28	.12.LP080100	PCB080100 Gas Control	A1	1
01.29	.12.LP080152	PCB080152 M12_adapter 2	X340, X341, X342	1
01.30	.12.TTR00602	TTR-label QG O2 - codes / lettering		1
01.31	.16.010.314.7	Controller phyCore-r2-AM335x-2		1
01.32	.16.010.715	MicroSD Card, AF4GUD3A-WAAXX, 4GB		1
01.33	.10.500.129	Elbow screw fitting M5 SW8 AD6		1
01.34	.12.117.130	Cone fitting for sleeve nut G1/8" with M5i		1
01.35	.10.639.588	Filter insert for pressure regulator 1/8"	Y1.20, Y1.40, Y1.50, DR2,DR4,DR5	1
02.01	.10.508.019	Polyamide plastic hose 6/4 mm blue		1
02.02	.10.508.021	Polyamide plastic hose 6/4 mm black		1
02.03	.10.508.023	Polyamide plastic hose 6/4mm green		1
02.04	.10.508.024	Polyamide plastic hose 6/4 mm grey		1

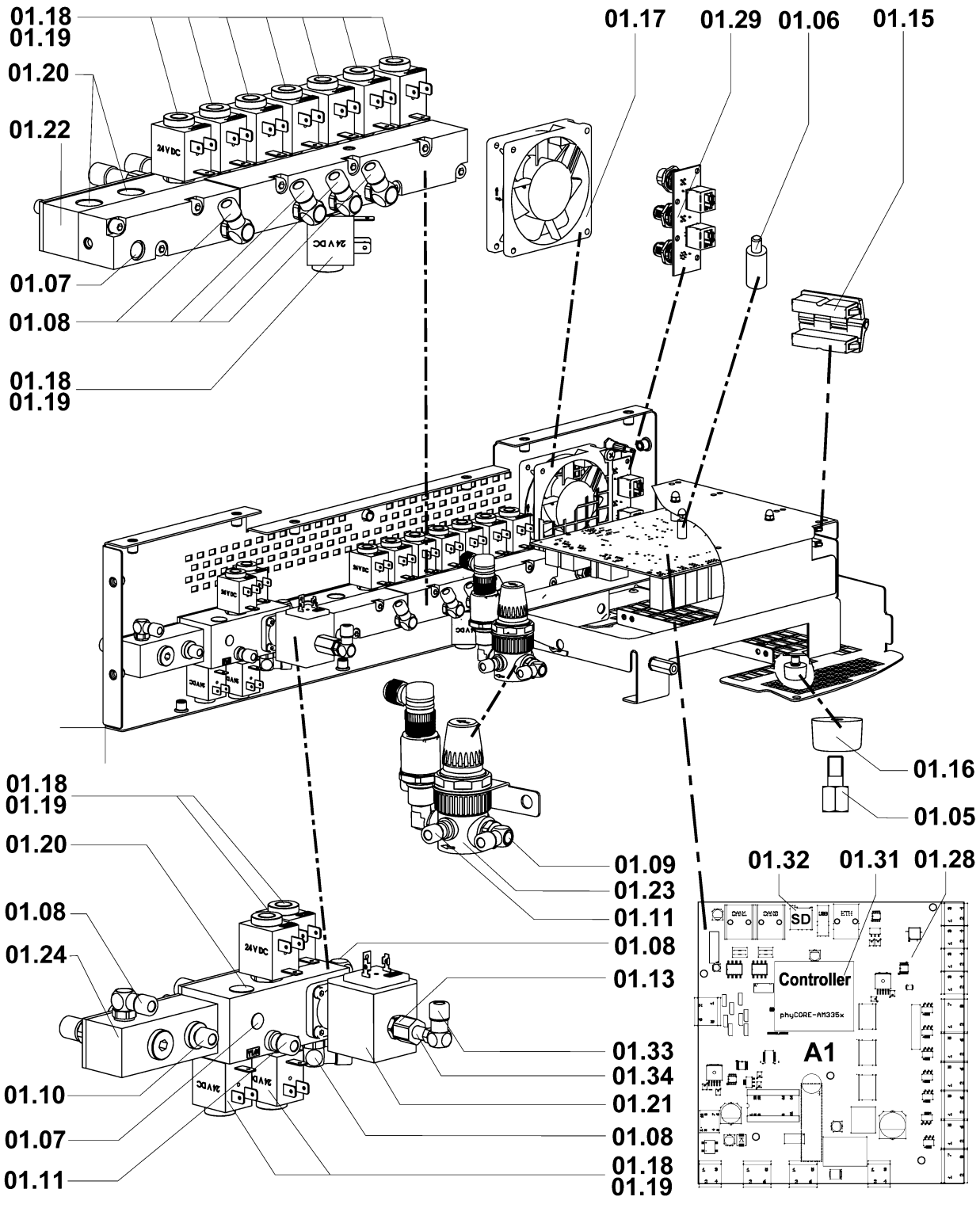


Fig. 46: Overview Q-Gas O_2 4500, part 1

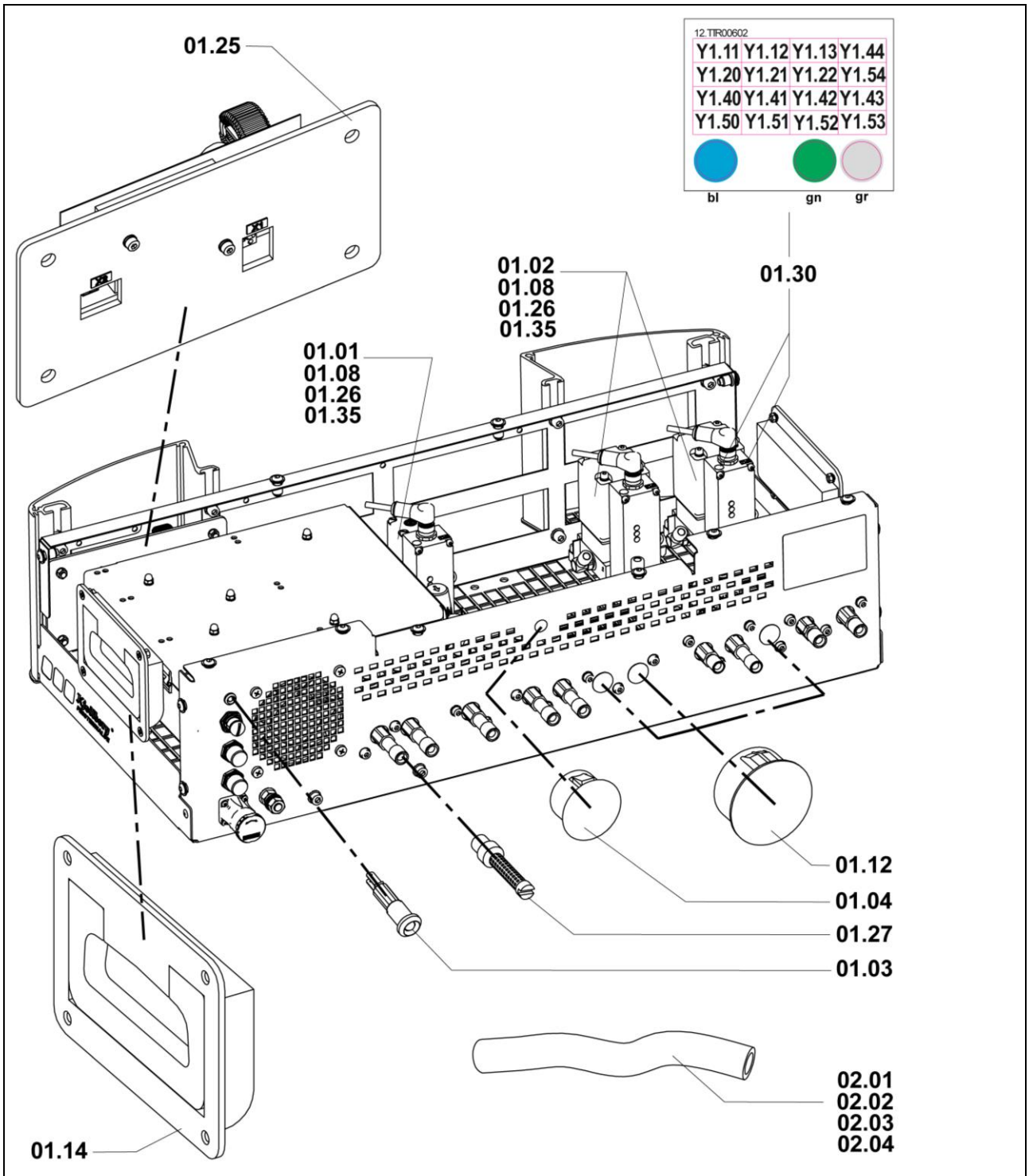


Fig. 47: Overview Q-Gas O_2 4500, part 2

11.4 Spare parts list Q-Torch 4510

.11.858.401.E0 28.08.2023

pos	article no.	designation	code	pcs.
00.01	.11.858.401.9010	Shaft - QT 4510 - 450A/C/1,0m		1
00.01	.11.858.401.9013	Shaft - QT 4510 - 450A/C/1,25m		1
00.01	.11.858.401.9015	Shaft - QT 4510 - 450A/C/1,5m		1
00.01	.11.858.401.9020	Shaft - QT 4510 - 450A/C/2,0m		1
00.01	.11.858.401.9025	Shaft - QT 4510 - 450A/C/2,5m		1
00.01	.11.858.401.9030	Shaft - QT 4510 - 450A/C/3,0m		1
00.31	.11.858.401.970	Bolt carrier- QT 4510		1
00.32	.11.848.401.972	Stop screw - PerCut 450M		1
00.33	.10.505.958	O-ring 42x2 VMQ ISO 1629 70 shore		1
00.35	.10.505.944	O-ring 35x1,5 VMQ ISO 1692 70 shore		1
00.36	.11.848.401.971	Threaded pin M6x8 - PerCut 450M		3
00.37	.10.257.543	Threaded pin M4x4 DIN913		4
00.41	.10.505.869	O-ring 10 X 1 VMQ ISO 1629 70 shore		1
00.42	.11.852.401.956	WV socket PerCut 451		1
00.43	.11.852.401.955	Current socket B10 - PerCut 451		1
00.44	.10.505.873	O-ring 12x1 VMQ ISO 1629 70 shore		1
00.45	.10.505.981	O-ring 5,0x1,5 VMQ 70 shore red		1
00.46	.11.852.401.9554	Valve tappet for socket - PerCut 451		1
00.47	.10.221.504	Compression spring d=0,5; De=5,5; Lo=14,0		1
00.48	.11.852.401.9553	Guide valve tappet - current socket		1
01.01	.11.858.401.100	Change head - QT 4510		1
01.08	.10.505.923	O-ring 28x2,0 VMQ ISO 1629 70 shore		1
01.09	.10.505.958	O-ring 42x2 VMQ ISO 1629 70 shore		1
01.12	.10.505.826	O-ring 6x1,5 VMQ ISO 1629 70 shore		1
01.13	.11.852.401.182	Current plug S10 - PerCut 451		1
01.14	.11.852.401.182	Current plug S10 - PerCut 451		1
01.15	.10.505.034	O-ring 9x1,5 VMQ ISO 1629 70 shore		1
01.16	.10.505.831	O-ring 7x1,5 VMQ ISO 1629 70 shore red		1
01.17	.10.505.826	O-ring 6x1,5 VMQ ISO 1629 70 shore		1
01.18	.10.505.913	O-ring 8x1 VMQ ISO 1629 70 shore, red		1
01.19	.11.852.401.174	PI- insulating socket - PerCut 451		1
01.20	.11.848.401.178	Pilot plug - PerCut 450M		1

.11.858.401.E0 28.08.2023

pos	article no.	designation	code	pcs.
01.21	.11.855.401.1781	ele. initial pos.-plug - PerCut 4000		1
01.22	.10.505.818	O-ring 4,5x1,5 VMQ ISO1629 70Shore red		1
01.23	.10.505.981	O-ring 5,0x1,5 VMQ 70 shore red		1
01.24	.11.852.401.181	Nipple PG/WG - PerCut 451		1
01.28	.11.858.401.079	Locking sleeve - QT 4510		1
01.29	.11.858.401.078	Locking ring - PerCut 4510		1
01.30	.11.848.401.080	Sealing ring - PerCut 450M		1
01.31	.11.858.401.071	Locking screw - QT 4510		3
01.40	.10.505.869	O-ring 10 X 1 VMQ ISO 1629 70 shore		1
60.00	.16.500.006	Torch tools		1
60.01	.12.38180	Socket wrench f. cooling tube		1
60.02	.11.848.401.810	Torch-Multitool		1
60.03	.11.848.401.815	Gas guide puller PerCut 440-450		1
60.10	.10.615.909	Torque screwdriver		1
60.11	.10.615.909.1	Connecting shaft E 6,3 / 1/4"		1
60.13	.10.615.909.6	Hexagon application, long 1/4" SW 8		1
60.14	.10.615.909.4	Hexagon application, long, 1/4" SW 6		1
60.20	.11.852.401.860	Socket wrench f. current- / WV-plug		1
60.30	.11.852.401.865	Socket wrench f. current- /WV-socket		1
70.00	.16.500.129	Accessories:		1
70.01	.10.616.104	Lubricant for O2 LC 40 Fluid 25 ml		1
70.10	.11.858.401.830	Parking station for change head - QT 4510		1

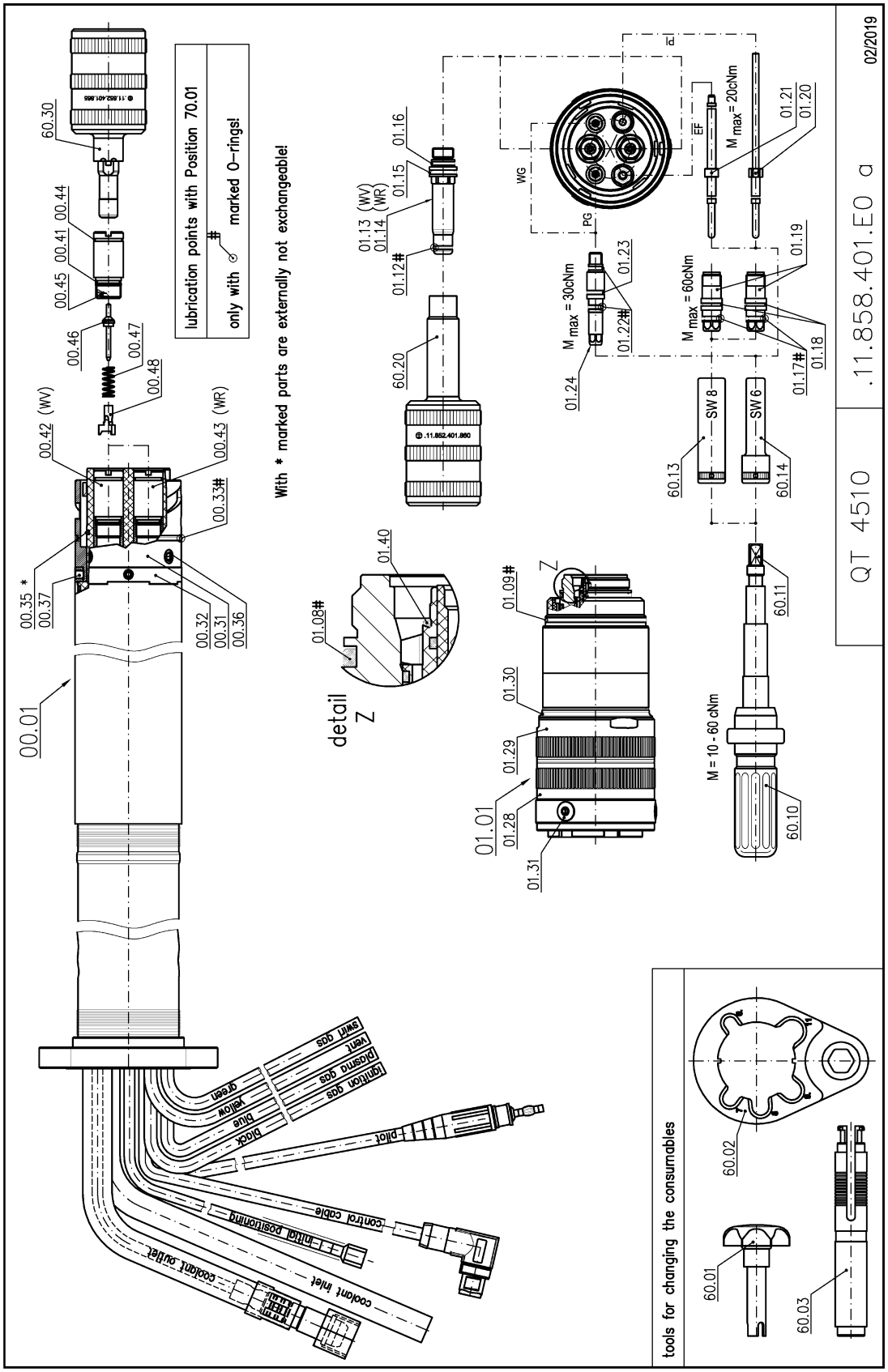


Fig. 48: Overview Q-Torch 4510

11.5 Spare parts list Q-Port 4500

.11.820.260A 20.04.2023

pos	article no.	designation	code	pcs.
01.01	.10.109.503	Micro switch with plunger	S1	1
01.02	.10.164.786	Device connector M17 plug straight 3+PE-pol	X314	1
01.03	.10.164.809	Dust protection cap device connector M17	X314	1
01.04	.10.164.810	Sealing cap device connector M12	X341 X343	2
01.05	.10.164.818	Dust protection cap device connector M17	X315	1
01.06	.10.164.856	Device connector M23 plug straight 5+PE-pol VW S	X315	1
01.07	.10.164.901	Patch cable, flat, U/FTP, 0.25 m, violet	X341	1
01.08	.10.164.903	Patch cable, Cat.6, 250 MHz, 0,30 m, blue	X343	1
01.09	.10.184.775	Cover plate Dm 11	X322	1
01.10	.10.184.799	Insulator		8
01.11	.10.184.827	Distance bolt		2
01.12	.10.189.371	G-Fuse 5x20 T2A/500VAC	F1	1
01.13	.10.500.153	Straight screw connection G3/8 SW20 NW9		1
01.14	.10.500.152	Straight screw connection G3/8 SW20 NW8		1
01.15	.10.500.140	Straight screw connection G3/8 SW20 NW11		1
01.16	.10.500.170	Coding sleeve 12/9 blau		1
01.17	.10.500.171	Coding sleeve 14/11 rot		1
01.18	.10.504.604	Flex fastener 9.5		1
01.19	.10.504.867	Rubber foot 4,5 x 20 x 12		4
01.20	.10.728.767	D-Snap Fastener 2-2.5 black case		2
01.21	.101.40.103	Resistor 220 OHM	R2	1
01.22	.11.035.002.070	HF-Transformer	01.22	1
01.23	.11.820.260.240.9	Single line X321 QP 4500	X321	1
01.24	.11.820.260.550	LP ignition, mounted	A2 + A2/T4	1
01.25	.11.820.260.715	Angle torch connection QP 4500, complete		1
01.26	.11.820.260.800	Solenoid valve assembly PBA-4500, mounted	Y2.11 - Y2.91	1
01.27	.11.820.260.931	Coolant-current connection, soldered		1
01.28	.12.LP080111	LP080111 Port Control	A1	1
01.29	.12.LP080120	LP080120 High Frequency / contact pcb	A2	1

.11.820.260A 20.04.2023

pos	article no.	designation	code	pcs.
01.30	.12.LP080153	LP080153-A M12 at PBA		1
01.31	.10.500.145	Straight screw connection G1/8, 6/4		3
01.32	.10.639.771	Pilot solenoid valve 24 V DC OLAB 10VA	Y2.31, Y2.32, Y2.41, Y2.91	4
01.33	.10.639.774	Proportionalventil 2/2 Wege 12bar Flansch	Y2.11	1
01.34	.10.639.776	Solenoid valve 3/2-way 24V DC Ø1,1	Y2.33, Y2.42	2
01.35	.12.102.005	Gas connection G1/8" StlMs		2
01.36	.12.102.005.1	Gas connection G1/8" StlM5Ms		1
01.37	.12.102.005.2	Gas connection G1/8" StlM5MsRV		1
01.38	.12.102.015.1	Gas connection G1/8"LH StlM5Ms		1
01.39	.12.29270	Filter M5x22		3
02.01	.10.189.373	G-Fuse 5x20 T2A/500VAC	F1	1
02.02	.10.189.374	G-Fuse 5x20 T2A/500VAC	F2	1
02.03	.12.LP080118	LP080118 Control electronic proportional valve	U4	1
02.04	.16.010.314.7	Controller phyCore-r2-AM335x-2	U8	1
02.05	.16.010.715	MicroSD Card, AF4GUD3A-WAAXX, 4GB	X6	1

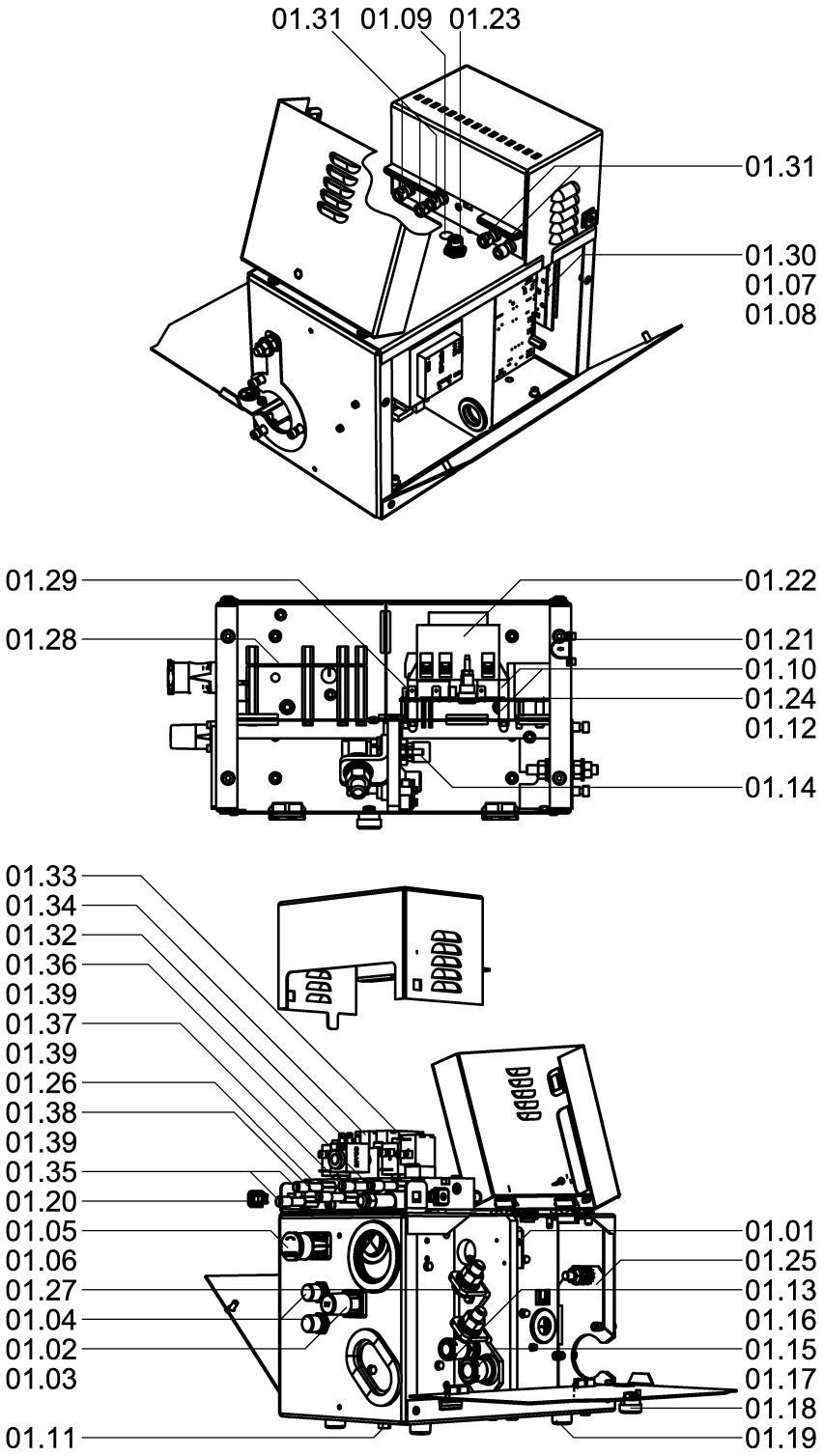


Fig. 49: Overview Q-Port 4500, part 1

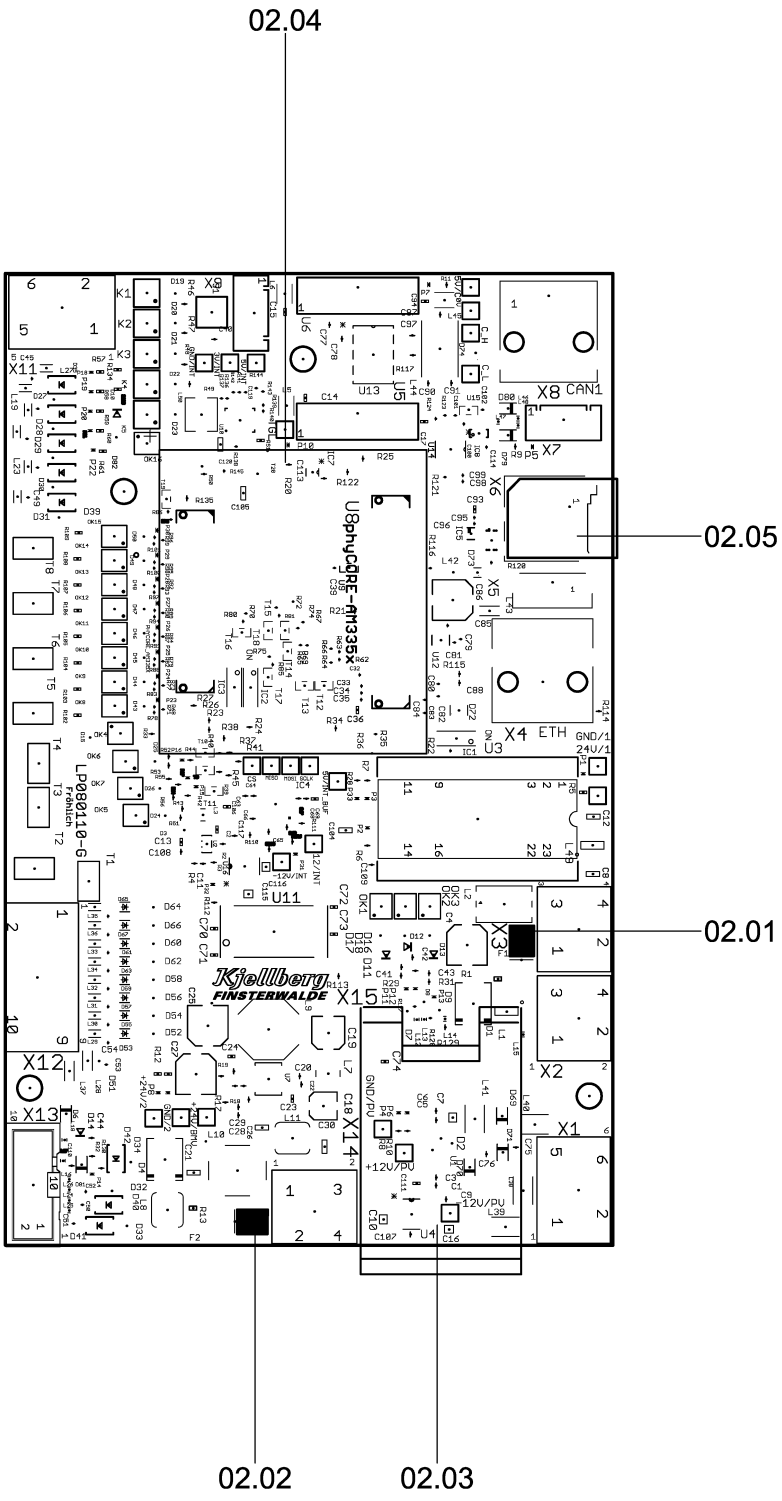


Fig. 50: Overview Q-Port 4500, part 2

12 List of Abbreviations

Abbreviation	German	English
Air	Luft	Air
BV	Brennermagnetventil	Torch solenoid valve
CAN	CAN-Bus	Controller Area Network
ccw	linksdrehend, entgegen Uhrzeigersinn	counterclockwise
cw	rechtsdrehend, im Uhrzeigersinn	clockwise
E	Entlüftung	Exhaust
eEF	elektrische Erstfindung	elect. initial positioning
EF	Erstfindung	initial positioning
EMV	Elektromagnetische Verträglichkeit	Electromagnetic compatibility (EMC)
ENTL	Entlüftung	Exhaust
EXH	Entlüftung	Exhaust
FB	Fernbediensatz	Remote control
GND	Masse, Bezugspotential, 0 V	Ground, reference potential, 0 V
HB	Hauptbogen	Main arc
HF	Hochfrequenz	High frequency
IG	Identgas	Identification gas
KCU	Kjellberg Verbindungseinheit	Kjellberg connection unit
KG	Kontrollgas	Control gas
KMR	Kühlmittelrücklauf	Coolant return
KMV	Kühlmittelvorlauf	Coolant supply
KWE	Kühleinheit	Cooling unit
LP	Leiterplatte	Printed Circuit Board (PCB)
MG	Markiergas	Marking gas
MGC	Gasdruckregler	Microgascontroller
MR	Mikrorechner	Microprocessor
MV	Magnetventil	Solenoid valve

Abbreviation	German	English
PA	Plasmaschneidanlage	Plasma cutting system
PBA	Plasmabrenneranschlusseinheit	Plasma torch connection unit
PFC	Plasmagasregeleinheit	Plasma flow control
PG	Plasmagas	Plasma gas
PGA	Plasmagasanschlusseinheit	Plasma gas connection unit
PGC	Plasmagassteuerung	Plasma gas controller
PGE	Plasmagaseinstelleinheit	Plasma gas control unit
PGV	Plasmagasventileinheit	Plasma gas valve unit
PI	Pilotleitung	Pilot cable
PM	POWER MODUL	POWER MODUL
PZE	Plasmazähleinheit	Plasma counter unit
PZL	Leitungssatz zur Plasmazündeinheit	Cable set for plasma ignition unit
QD	Q-Desk	Q-Desk
QG	Q-Gas	Q-Gas
Q-LED	Anzeigeelement an der Frontwand	Display element at front wall
QP	Q-Port	Q-Port
QT	Q-Torch	Q-Torch
RV	Rückschlagventil	Non-return valve
SG	Schneidgas	Cutting gas
SL	Steuerleitung	Control cable
SpG	Sperrgas	Sealing gas
StG	Startgas	Start gas
WG	Wirbelgas	Swirl gas
ZG	Zündgas	Ignition gas

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