

Kjellberg[®] **FINSTERWALDE**

Instruction Manual



- Power source
- Plasma gas control unit
- Plasma machine torch
- Plasma torch connection unit

- Q-Source
- Q-Gas
- Q-Torch
- Q-Port

Art.No.: .11.038.x021

Rev.-No.: 3.0 02.06.2022

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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



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



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



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



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.

General information

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

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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.

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General information

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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

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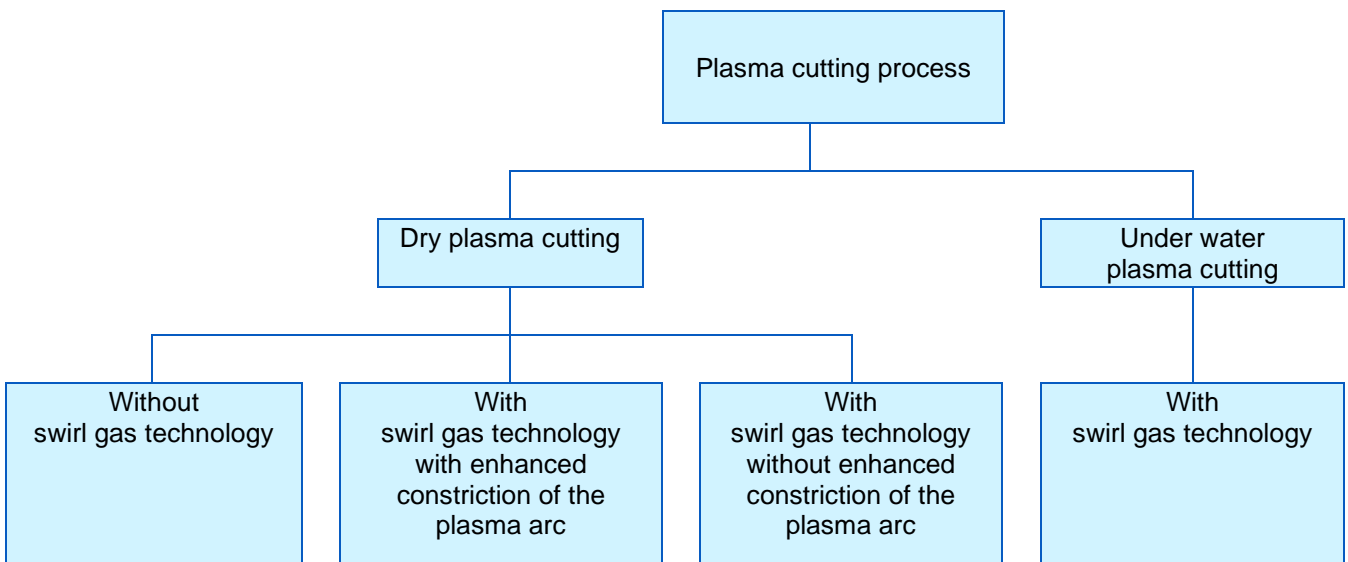
1.5 Plasma cutting as procedure

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

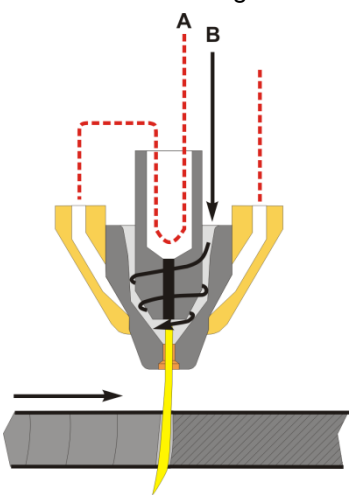
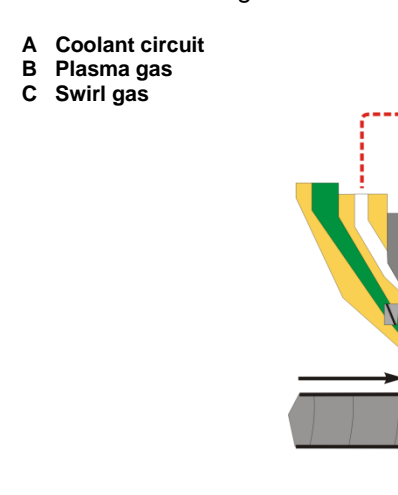
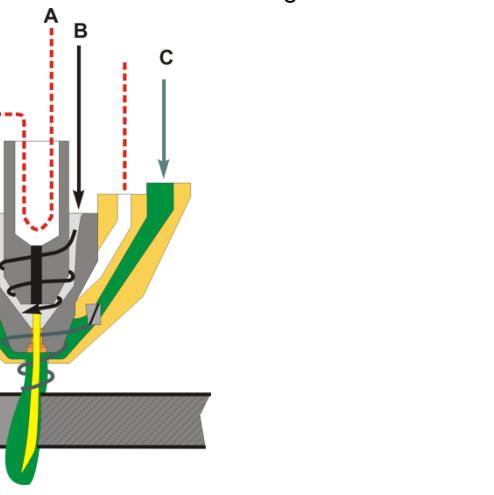
In the plasma torch this gas becomes heated up extremely and leaves it through the nozzle with a high speed. Due to the high heat concentration all electrically conductive materials will melt and due to the high speed and pressure of the plasma arc the molten material will be blown away forming a very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



General information

| Plasma cutting process | | |
|---|---|--|
| Dry-plasma cutting | | |
| without swirl gas | with swirl gas | Under water-plasma cutting |
| | | with swirl gas |
|  |  |  |
| <p>A Coolant circuit B Plasma gas C Swirl gas</p> | | |
| <p>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.</p> | <p>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 (vitaly 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.</p> | <p>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.</p> |

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

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 |

Safety instructions

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

Safety instructions

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 signalled hints or special useful information.

Safety instructions

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.

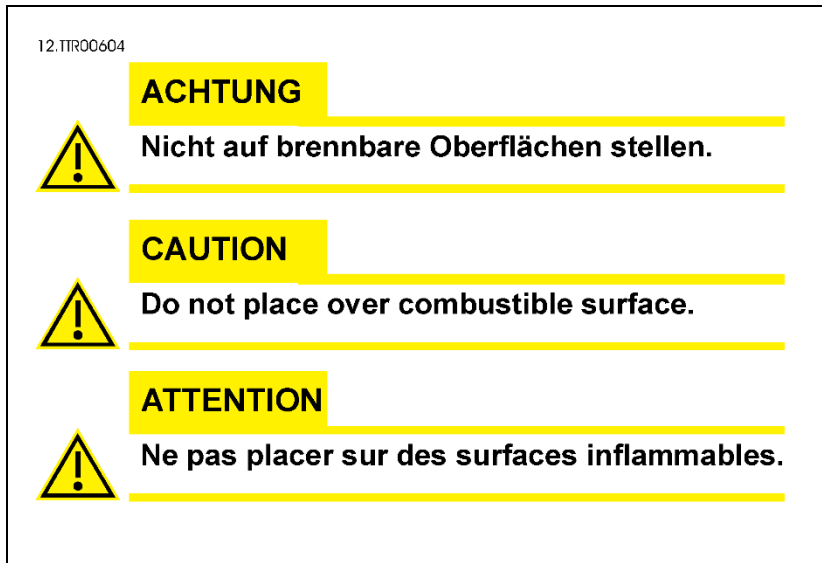


Abb. 1: Label under warning label

Further information and warning:

- to ensure stability 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 a 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 without 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

Be aware that during the plasma cutting a high noise level is produced.

Depending on the technological process and the cutting parameters the following sound level is reached:

| Process: Dry plasma cutting | | | | | |
|------------------------------------|--------------------|---|---------|---------|------------------|
| cutting current* | material thickness | max. sound level measured at a distance of: | | | cutting pressure |
| | | 1 m | 3 m | 6 m | |
| [A] | [mm] | [dB(A)] | [dB(A)] | [dB(A)] | [bar] |
| 20 | 1,5 | 89 | 76 | 75 | 5,2 |
| 35 | 6,0 | 91 | 83 | 80 | 6,0 |
| 60 | 6,0 | 94 | 86 | 84 | 9,9 |
| 90 | 6,0 | 96 | 86 | 83 | 9,9 |
| 130 | 6,0 | 100 | 91 | 86 | 9,9 |
| 160 | 25,0 | 105 | 93 | 91 | 9,9 |
| 200 | 15,0 | 112 | 96 | 90 | 9,9 |
| 280 | 20,0 | 104 | 98 | 93 | 5,5 |
| 360 | 25,0 | 104 | 95 | 91 | 7,0 |
| 400 | 40,0 | 112 | 99 | 96 | 7,0 |
| 440 | 70,0 | 112 | 102 | 100 | 7,0 |
| 600 | 150,0 | 122 | 112 | 107 | 7,0 |

* ... depending on the type of unit

Fig. 2: sound-level with dry plasma cutting process

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.

Safety instructions

 **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 (CO₂)
- 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> by application of Hydrogen or Oxygen: inspection of the gas supply (see chapter gas pressure test) | x | |
| all 4 to 6 month | <ul style="list-style-type: none"> Cleaning the power source and all components (control of the filter pads) | | x |
| | <ul style="list-style-type: none"> Cleaning small filters inside the gas connectors of the plasma gas control units | x | |
| all 6 month | <ul style="list-style-type: none"> electrical revision | | x |
| yearly | <ul style="list-style-type: none"> 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 intervals.

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 $< 0.1 \text{ Ohm}$ if line cross section is $> 6 \text{ mm}^2$ (otherwise pay attention to EN 60204-1) $< 0.1 \text{ Ohm}$
 - c) The insulating capacity of winding and line insulation has to be proofed:
 - insulation value between windings and housing (protective connector terminal) $> 2.5 \text{ MOhm}$ (dry and cold condition)
 - insulation value between primary and secondary coils of the transformer T1 $> 5 \text{ MOhm}$ (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 |
| | <ul style="list-style-type: none"> • 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 |
| | <ul style="list-style-type: none"> • 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 <i>Article No.</i> | 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) .10.161.751.24 | 04.04 | 1 | X | X | X | X | X | X |
| Suppressor element diode 11BGX78 225 (for Q0) .10.161.748 | 04.08 | 1 | X | X | X | X | X | X |
| 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 | | |

Maintenance

| component <i>Article No.</i> | 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 - pilot contactor (Q2) <i>.10.161.722.26</i> | 04.09 | 1 | X | X | X | X | X | X |
| auxiliary contact (Q2) <i>.10.161.703</i> | 04.10 | 1 | X | X | X | X | X | X |
| Air contactor – contactor "flying cutting" (Q3) <i>.10.161.722.26</i> | 04.09 | 1 | X | X | X | X | X | X |
| coolant pump, complete, mounted (M16) <i>.11.038.3002..320</i> | 01.20 | 1 | | | | | | X |
| torch hose package by manufacturer or authorised service | | | | | | X | | |

| component <i>Article No.</i> | 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 |
| Fan - cover for circuit boards (M17, Ø 125 mm) <i>.11.038.3002..905</i> | 01.11 | 1 | | | | | X | |
| Filter medium 125 x 125 x 8 mm F100S (for M17) <i>.10.140.724</i> | 01.12 | 1 | X | X | X | X | X | X |
| fan - heat exchanger (M13-M15, Ø 172 mm) <i>.11.038.3002..349</i> | 03.06 | 3 | | | | | X | |
| fan - inverter module (M1-M9, Ø 172 mm) <i>.11.038.3002..658</i> | 04.20 | per 3 | | | | | X | |
| fan – PCB A3 inverter module (Ø 119mm) <i>.11.412.3002..720</i> | 05.20 | per 1 | | | | | X | |
| fan – PCB A2 inverter module (Ø 119mm) <i>.11.412.3002..725</i> | 05.21 | per 1 | | | | | X | |
| capacitor 7600 µF µF – intermediate circuit (C1, C2) <i>671.100.028</i> | 05.22 | per 2 | | | | | | X |
| coolant and gas cable <i>condition depending</i> | | | | | | | | 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.



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 $\pm 10\%$, 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 mm ² |
| 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: | 5 - 150 A |
| marking current I_M: | 5 - 50 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 mm ² |
| cathode cable, cross section Cu: | 1 x 50 mm ² |
| 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: | 5 bar bei 5 l/min |
| *... more voltages, see chapter "mains connection" | |

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

Power source Q-Source

| | |
|---|---|
| Art.- no.: | Q 3000 / Q 3000 plus (.11.038.2021 / .11.038.4021) |
| primary side: | |
| mains voltage U_1^*: | 3~ +PE 400 V $\pm 10\%$, 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 mm ² |
| 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: | 5 - 300 A |
| marking current I_M: | 5 - 50 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 mm ² |
| cathode cable, cross section Cu: | 2 x 50 mm ² |
| 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: | 5 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 $\pm 10\%$, 50/60 Hz |
| connecting load (100 % DC): | max. 109 kVA (depending on cutting parameters) |
| fuse, slow: | T 200 A |
| mains cable, cross section Cu: | 4 x 50 mm ² |
| 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: | 5 - 450 A |
| marking current I_M: | 5 - 50 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 mm ² |
| cathode cable, cross section Cu: | 3 x 50 mm ² |
| 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: | 5 bar bei 5 l/min |
| * ... more voltages, see chapter "mains connection" | |

Fig. 6: Technical data Q 4500

Power source Q-Source

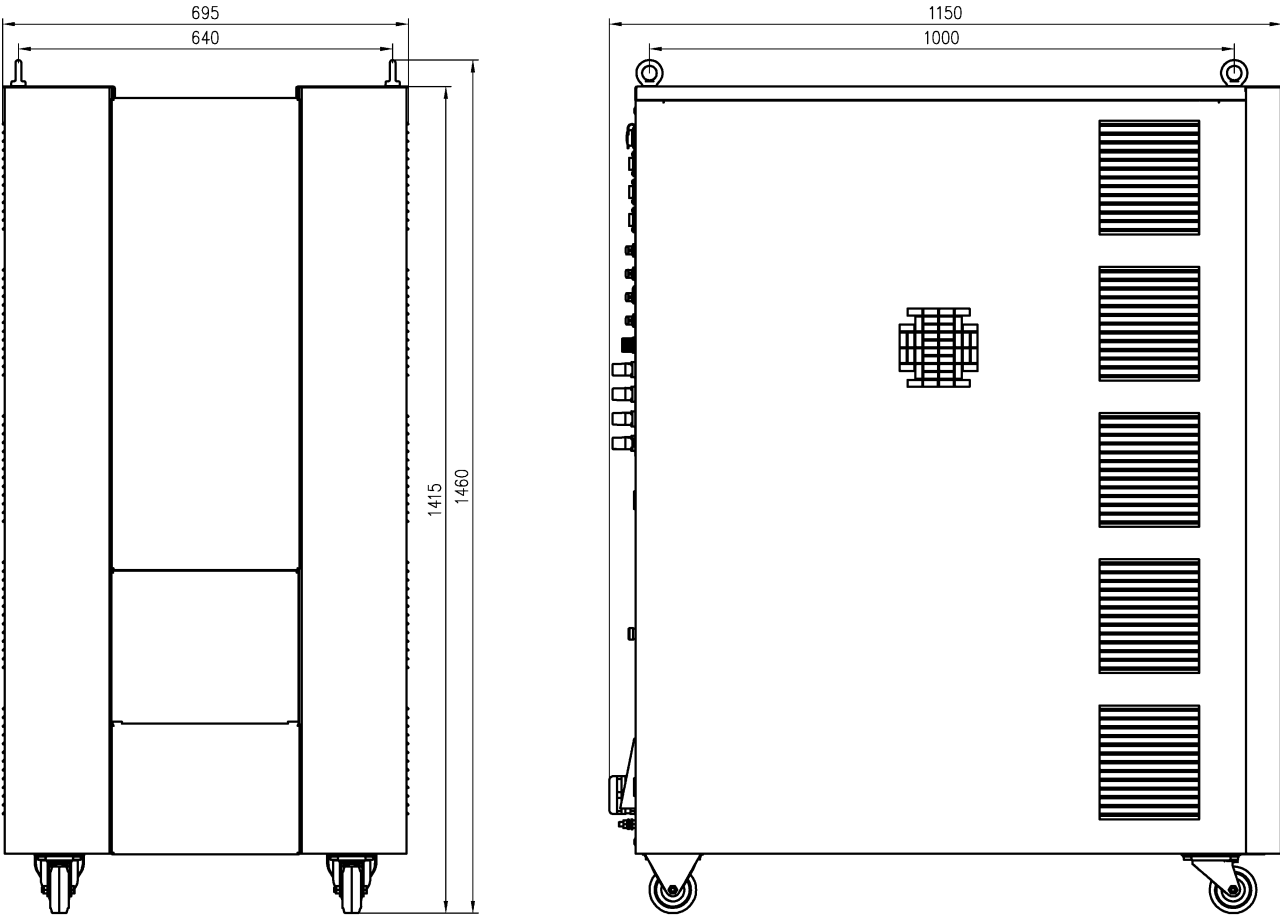


Fig. 7: Dimension diagram

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 HiFocus- technology

By the application of the Plasma Fine-Focus-Principle acc. to Professor Manfred von Ardenne with its extreme constriction of the plasma arc extraordinarily energy densities will be achieved, which will be additionally increased in the HiFocus range with HiFocus^{PLUS}-technology, resulting in various technological advantages.

- minimized consumption of gas and energy due to the highly constricted plasma arc
- precise cutting surfaces and less rework reduces costs considerably
 - small right-angled and inclination tolerance of the cuttings
 - high dimensional accuracy and repeat accuracy of the cutting parts
 - excellent contour at sharp corners and little radii
 - hole cutting with a low diameter
 - almost reworking free cuttings
 - low heat input, low distortion of the workpiece
- plasma cutting with laser-like quality over many material thickness ranges
- investment and operation costs are less than a tenth of the investment and operation costs of the laser cutting unit with the same cutting requirement
- high product life of consumables because of:
 - second gas ignition,
 - nozzle-saving hole piercing with swirl gas technology
 - extreme effective cooling
 - pilot arc adapted to the torch (nozzle-saving cutting)

6.2.3 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 of a display:
 - 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

6.2.4 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 O₂) and marking (with marking gas Ar) may reduce the lifetime of the O₂ cathode to 30%. In this case argon becomes alternatively recommended nitrogen or air instead of the marking gas.

INFORMATION



The use of an Ar/H₂ 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 life time 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.

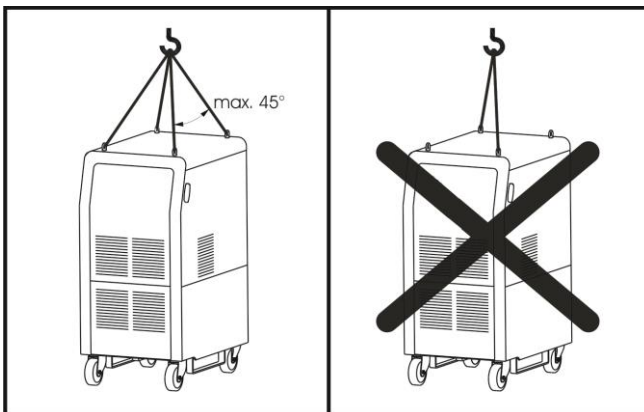
 **WARNING**



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 foot 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 mm ² | 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 mm ² | 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


Power source Q-Source

| 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 | 200 A | 4 x 50 mm ² | 1/0 | .11.038.5021 |
| 3~ 400 V, 50/60 Hz | 157 A | | | | .11.038.5022 |
| 3~ 415 V, 50/60 Hz | 151 A | | | | .11.038.5023 |
| 3~ 440 V, 50/60 Hz | 143 A | | | | |
| 3~ 460 V, 50/60 Hz | 136 A | | | | |
| 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)

Power source Q-Source

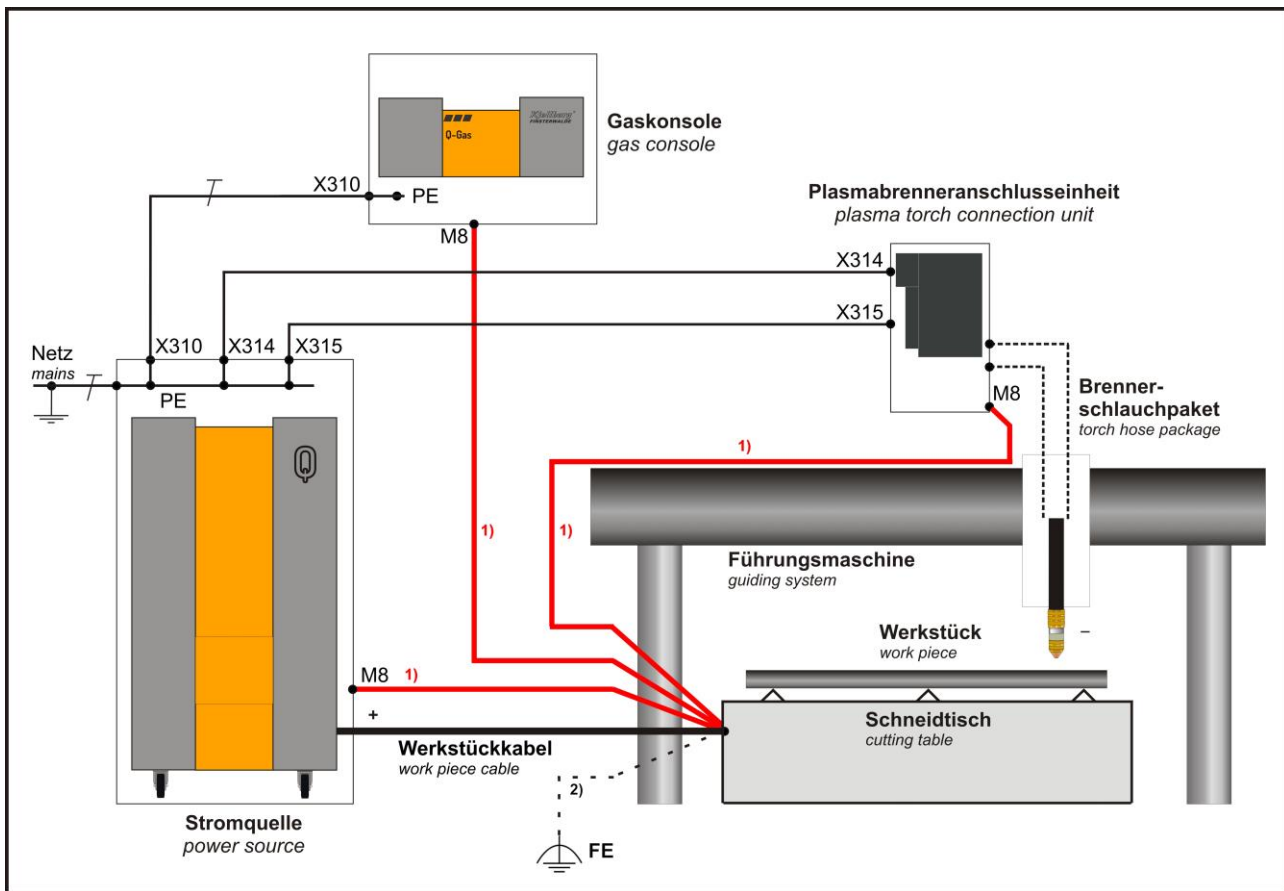




Fig. 11: Potential equalisation and protective conductor guidance, example

| 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

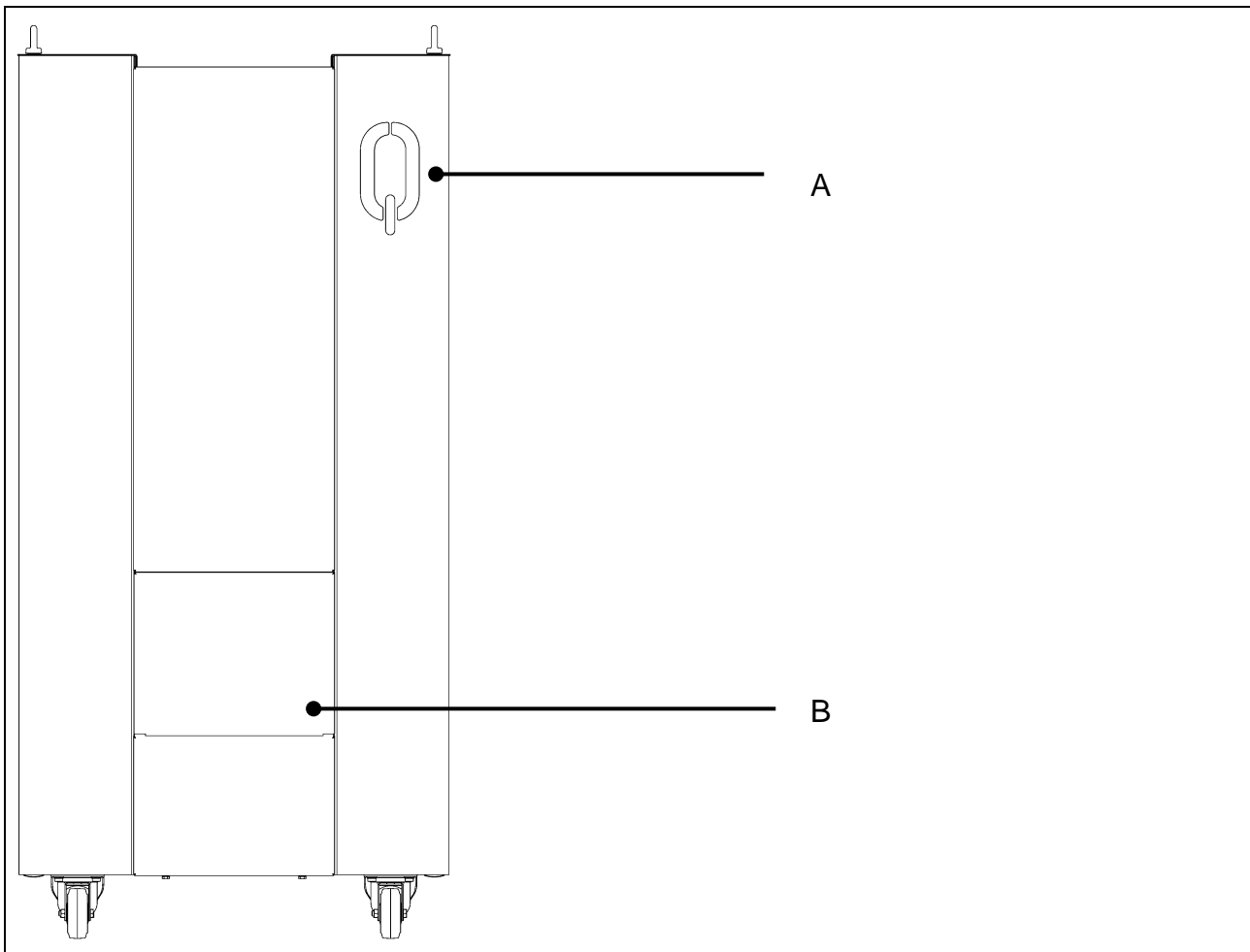


Fig. 12: Display element of power source

| 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 |

Power source Q-Source

| 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" | | | |

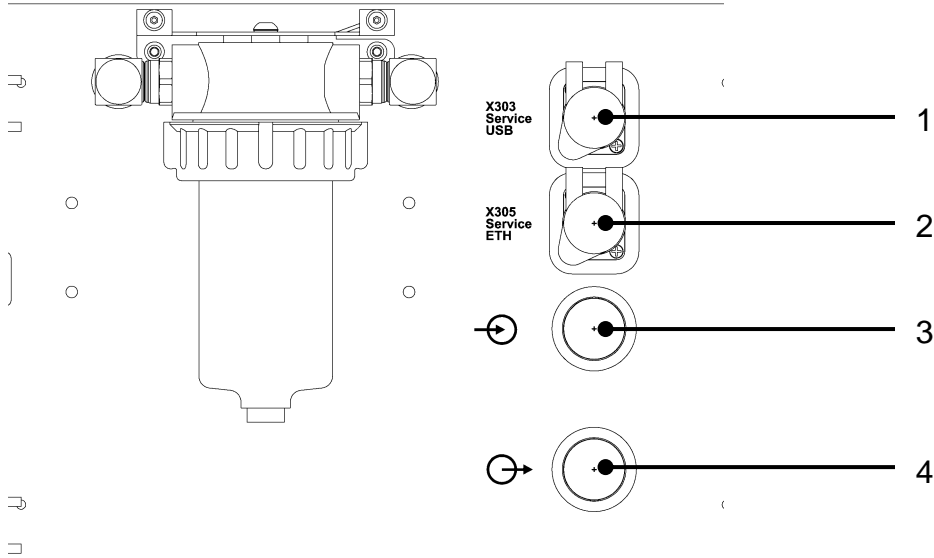


Fig. 13: B – Connections behind the flap

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. |

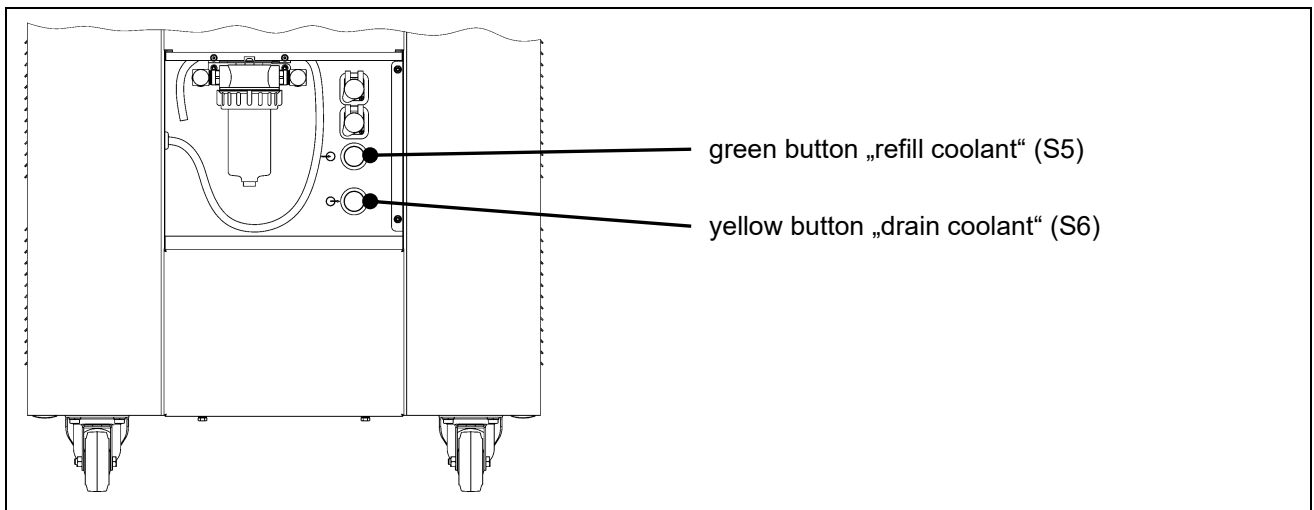


Fig. 14: Coolant flap

| | |
|----|---|
| 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. |

Power source Q-Source

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 <u>step 4 of refilling the coolant.</u> |
| 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.

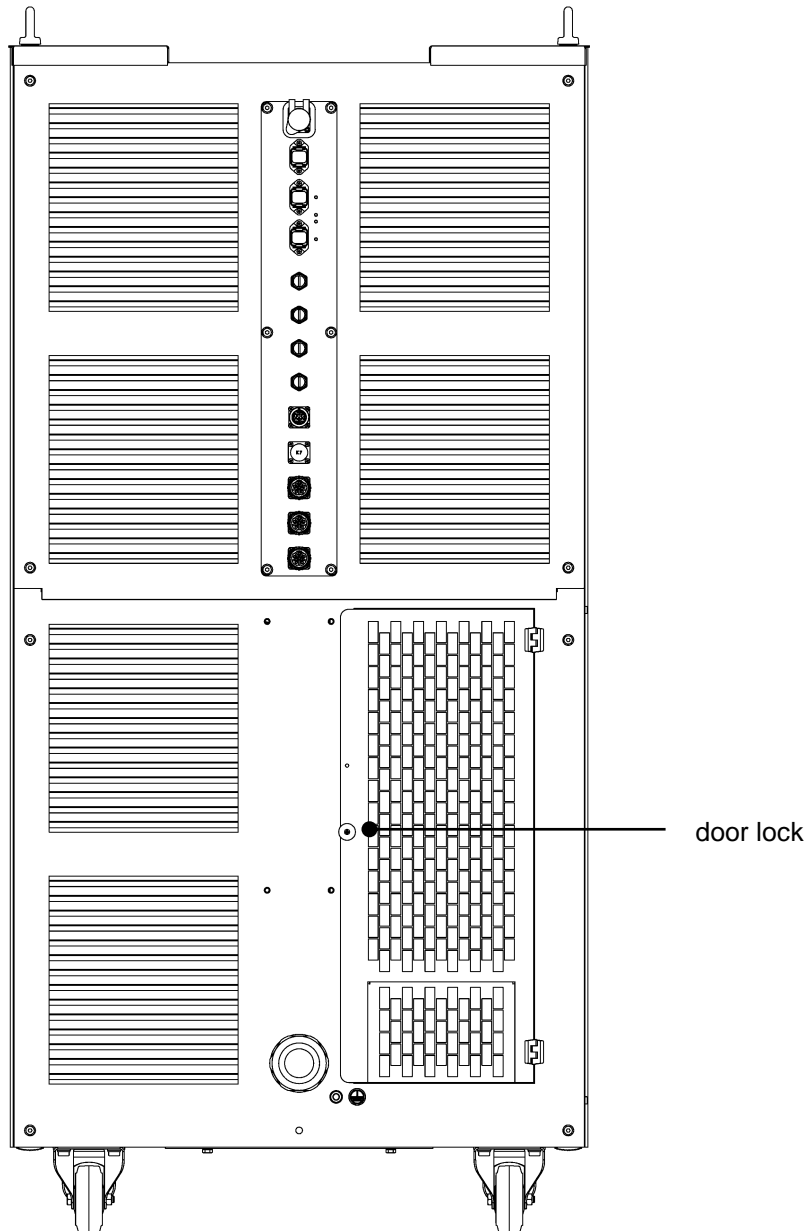


Fig. 15: rear panel

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.

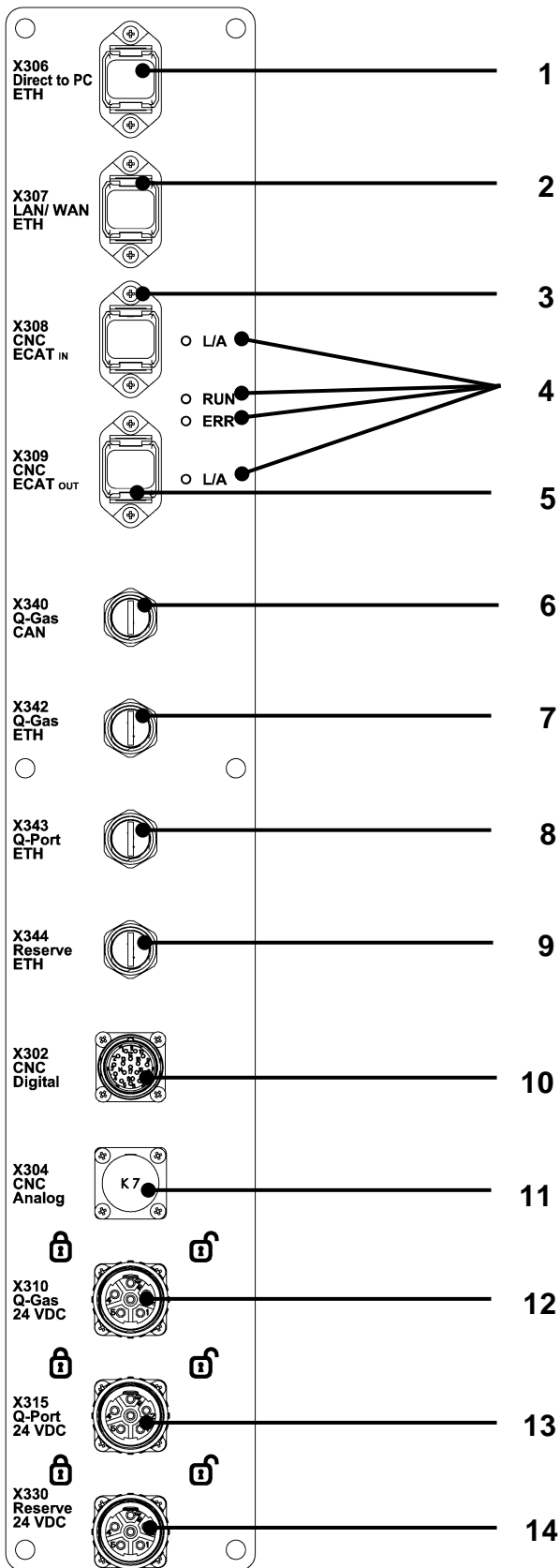


Fig. 17: upper connections (I)

Power source Q-Source

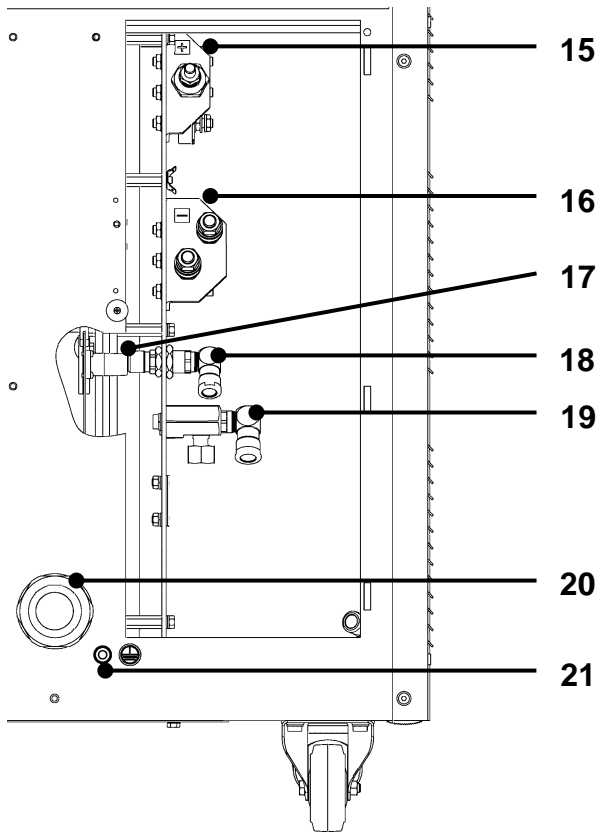


Fig. 18: lower connections (II)



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

Power source Q-Source

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 occurred (see error parameter) |
| | | single flash (200 ms ON, 1000 ms OFF) | Slave device application has changed the EtherCAT 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 occurred. Sync Manager Watchdog timeout or communication timeout occurred. |
| ON | | A critical communication or application controller error has occurred. 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 | |

(see chapter 0)

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 "SERVICE" (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 |

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

Power source Q-Source

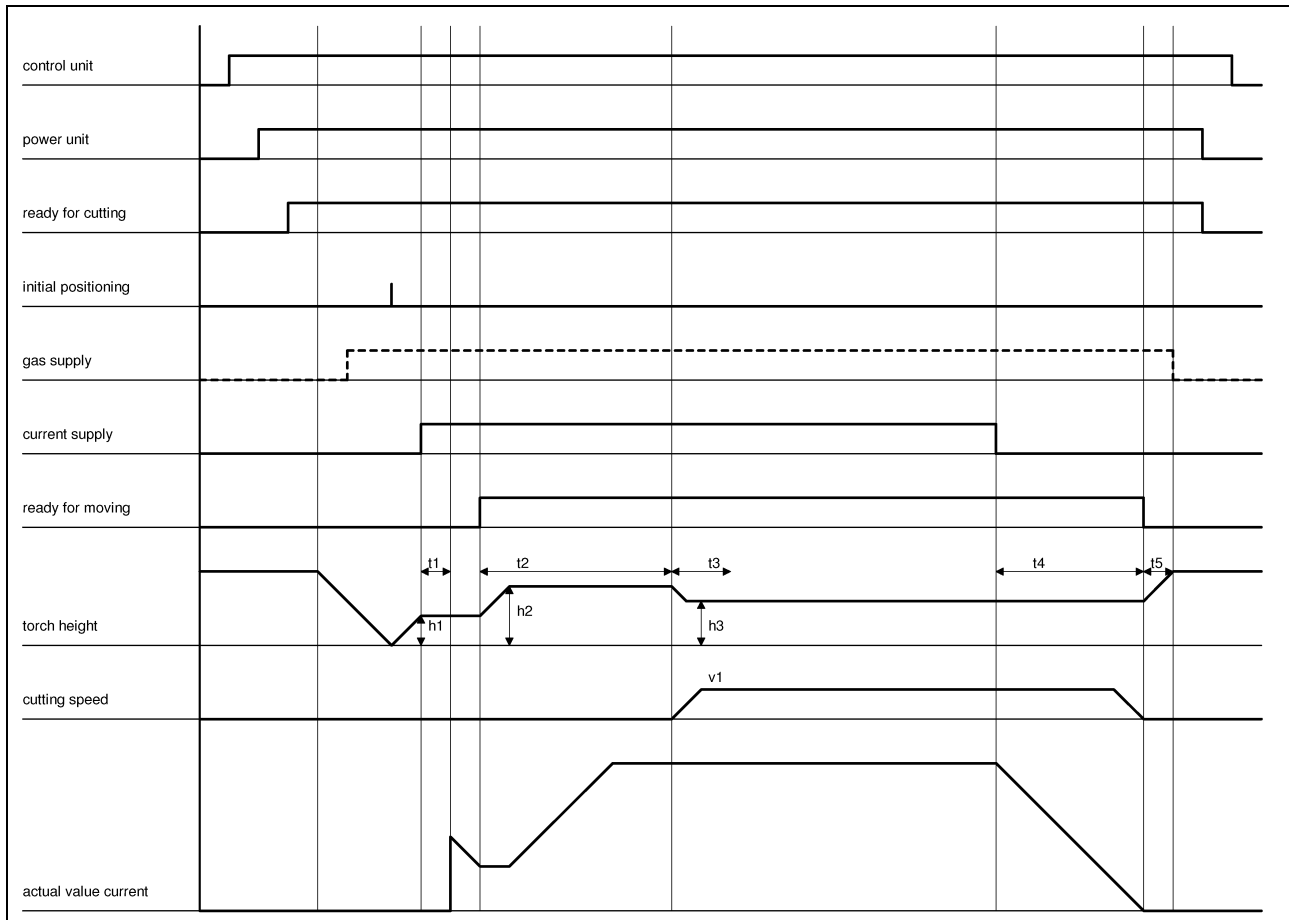


Fig. 20: schematic diagram of a cutting process with height control system

| 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

See wiring diagram "CNC interface ..." (... SP2)

The control cable for the combination of the power source with CNC-controls of guiding systems or robots has to be connected to the 17-pol. socket (X302) and 6-pol. socket (X304), placed in the back wall of the power source. A corresponding control cable must be provided by the operator. The necessary plug (system Phoenix Contact) can be supplied on request from Kjellberg Finsterwalde. The potential-free contacts are dimensioned for a current load of max. 500 mA DC at a control voltage of 24 V. Relay contacts have to be furnished with a protective diode.

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 error codes, if during service or operation errors are noticed.

In this case appear the corresponding 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 errors and the rectification is given in the following chart:

Power source Q-Source

| 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 |
| 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, check pilot cable X314 from/to Q-Source and Q-Port, check fuse F22 (Q-Source), check fuse F1 (Q-Port, PCB HF) |
| E115 | emergency stop 2 no emergency stop 1 | Check signal "e-stop 1" from CNC |
| 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 |

| Error code | Meaning | Elimination |
|-------------------|---|---|
| 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 |
| E149 | communication CAN - plasma control (PC) | Restart the Q-Source, check 24 V DC supply, check CAN connection from/to PCB PC |

Power source Q-Source

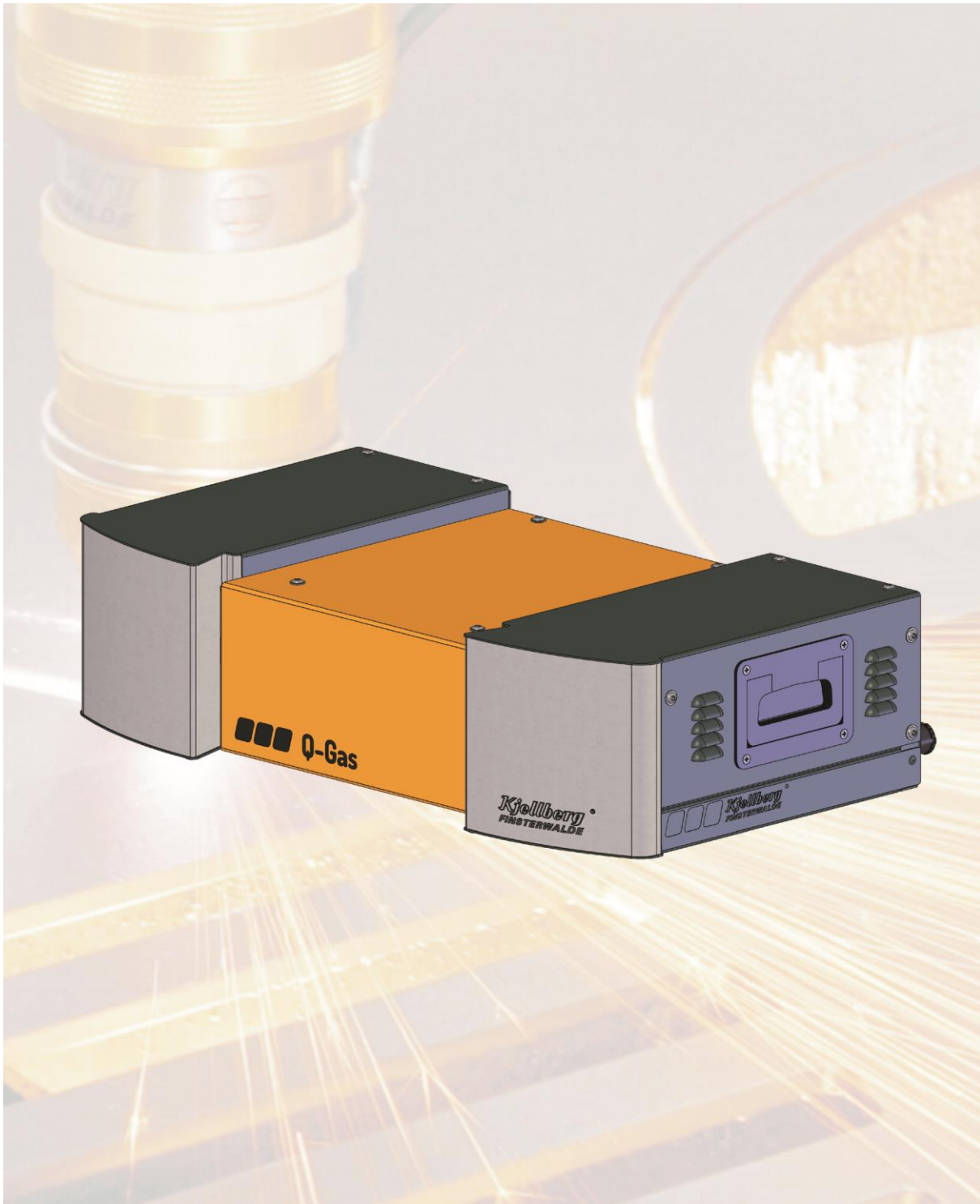
| Error code | Meaning | Elimination |
|-------------------|--|--|
| E151 | temperature too high - Module 1 | Leave to cool down the Q-Source |
| E152 | primary voltage too high - Module 1 | Check main voltage |
| E153 | primary voltage too low - Module 1 | Check main voltage |
| E154 | intermediate 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 | no torch identification | Contact the service |
| E171 | no dataset loaded | Transmit valid dataset number |
| E172 | leak in cutting break - ZG | Check ZG for leak |
| E173 | no configuration loaded | Restart the Q-Source |
| E176 | dataset with invalid gas code selected | Contact the service |
| 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 dataset 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 |
| E186 | intermediate circuit voltage too low - Module 2 | Contact the service |

| Error code | Meaning | Elimination |
|-------------------|--|--|
| 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 |
| E215 | communication CAN - GUIDE | Restart the Q-Source, check 24 V DC supply, check CAN connection from/to PCB GUIDE |
| 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 - Q-Source | Check coolant hoses, check correct seat of the torch head, check consumables |
| E224 | no database loaded | Transmit valid database version/-number. |

Power source Q-Source

| 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 "gas ON" at beginning of 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) | | | |
| Operating voltage | 24 V DC | | | |
| Solenoid valves: | 700 x 424 x 190 mm | | | |
| Dimensions (lxbxh): | approx. 23 kg | | | |
| Weight: | | | | |
| 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 NI/min | 50 NI/min | 65 NI/min | 150 NI/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 NI/min | 100 NI/min | 50 NI/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 |
| | | number of particles: | ≤ 20.000 | ≤ 400 |
| | | max. pressure dew point: | +3 °C | |
| | | max. rest oil content: | 0.01 mg/m ³ | |
| | 2) | Air: 5/0.01 µm, 17 bar | | |
| | 3) | O ₂ : 40/0.01 µm, 40 bar | | |

Fig. 21: Technical data

Plasma gas control unit Q-Gas (Gas console)

| | | | | | |
|------------------------------|--|---|--------------------------|------------|----------|
| Art.-No.: | Q-Gas O ₂ 4500 (.11.825.1301) | | | | |
| 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 NI/min | 50 NI/min | 65 NI/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 NI/min | 100 NI/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 |
| | | number of particles: | ≤ 20.000 | ≤ 400 | ≤ 10 |
| | | max. pressure dew point: | +3 °C | | |
| | | max. rest oil content: | 0.01 mg/m ³ | | |
| | 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!

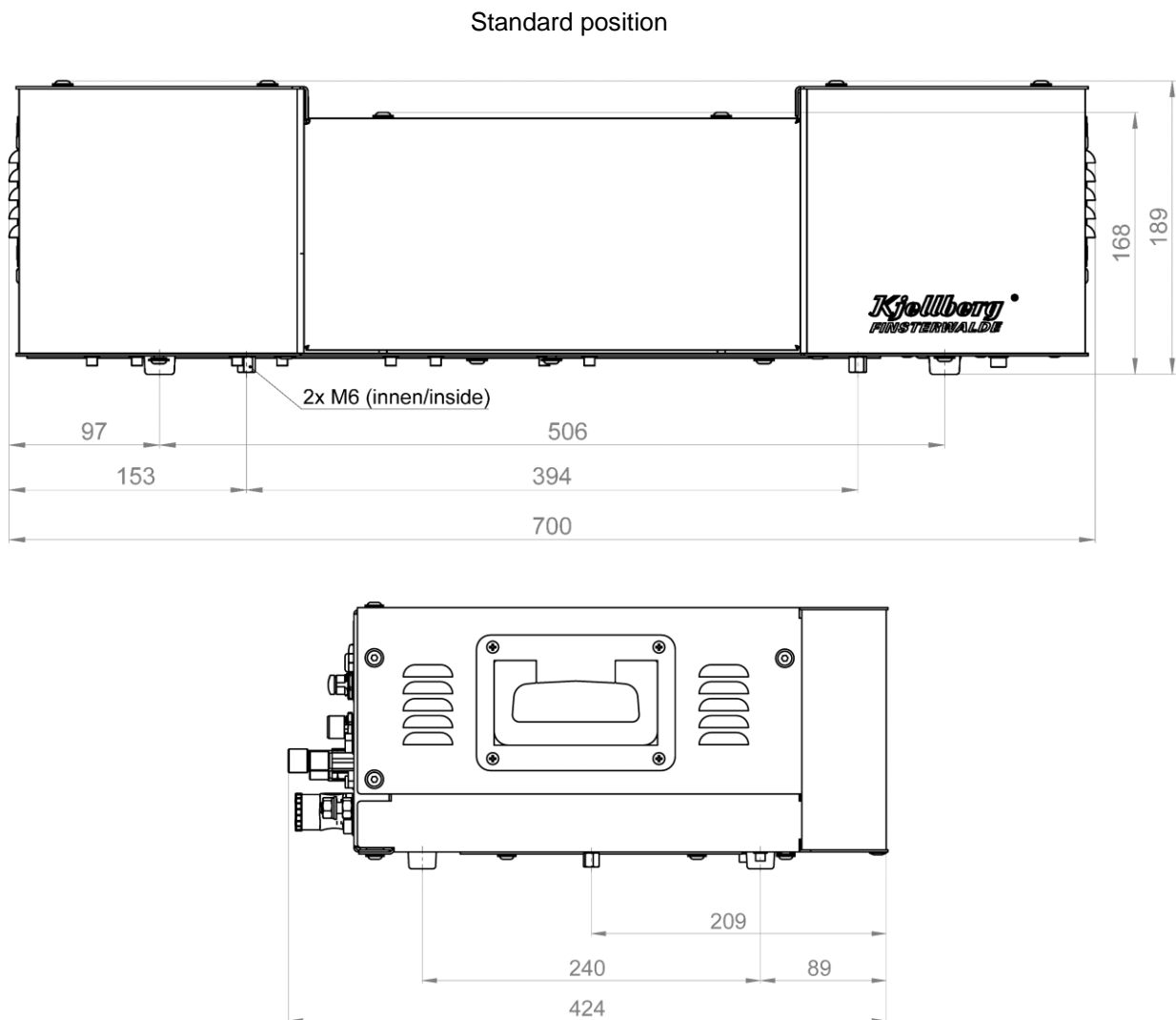


Fig. 23: Dimension diagram

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!

Plasma gas control unit Q-Gas (Gas console)

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.

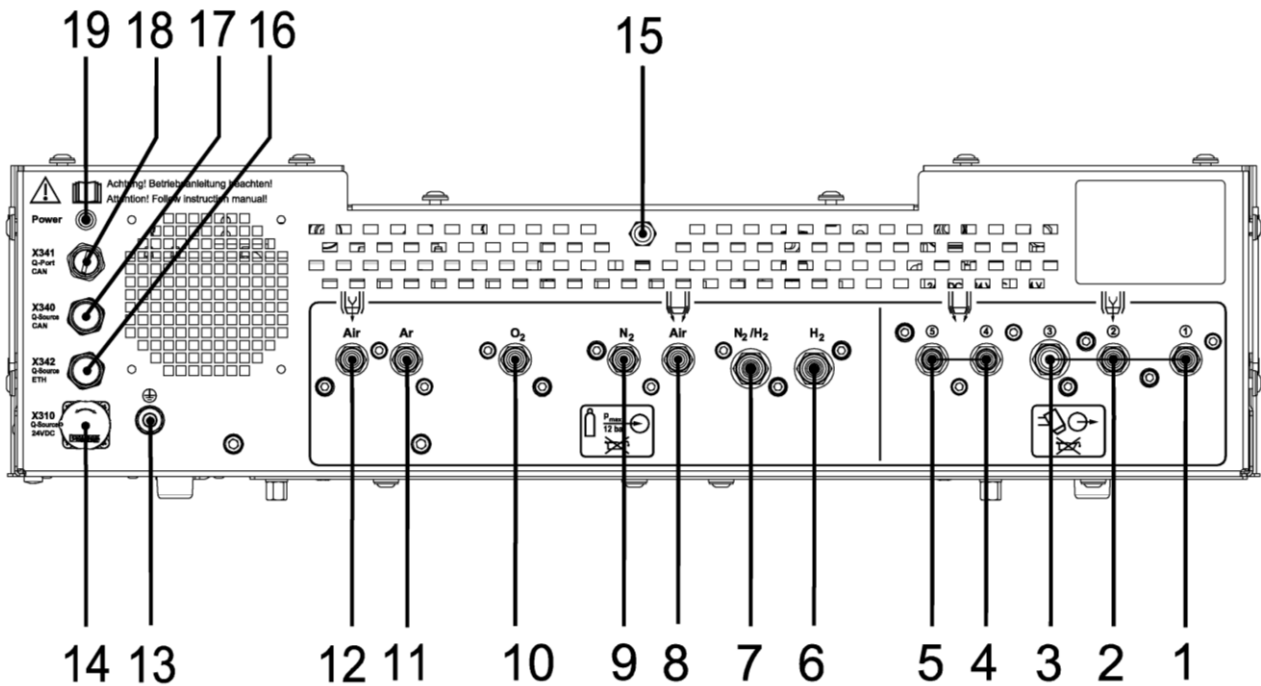


Fig. 24: rear connections of Q-Gas 4500

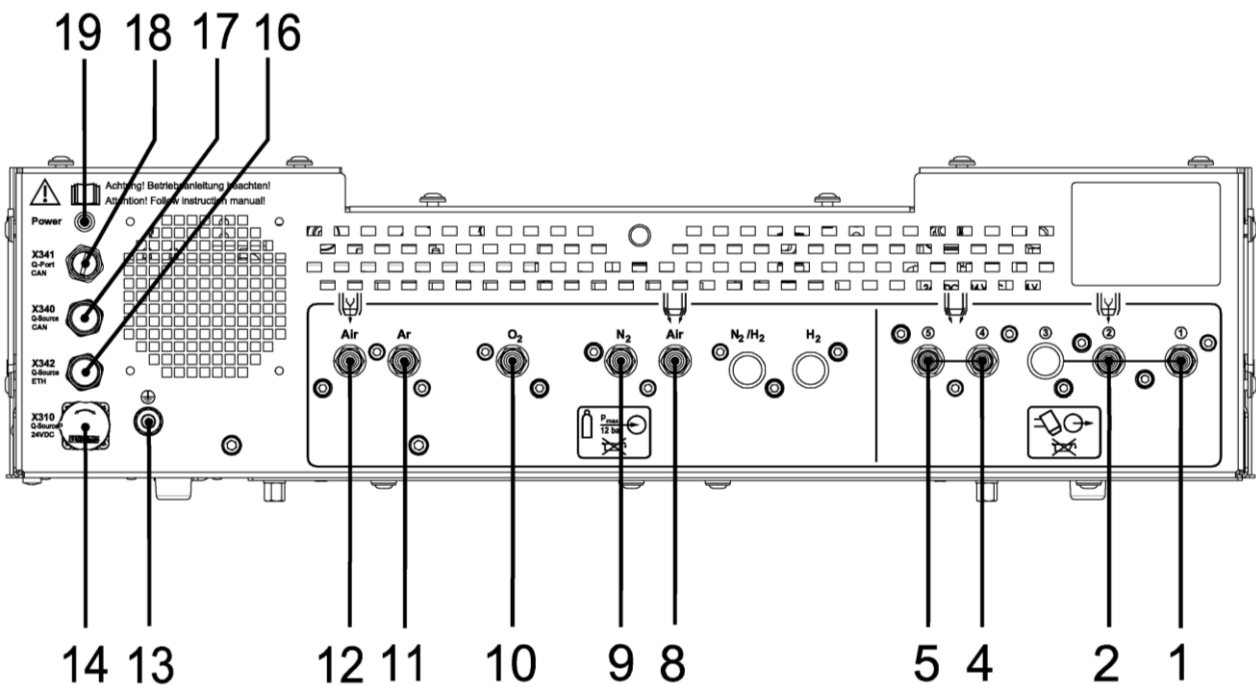


Fig. 25: rear connections of Q-Gas O₂ 4500

| | | | |
|----|--|-------|---------------|
| 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 be 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.).

Plasma gas control unit Q-Gas (Gas console)

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/m ³ | | | 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



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 "O₂" 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

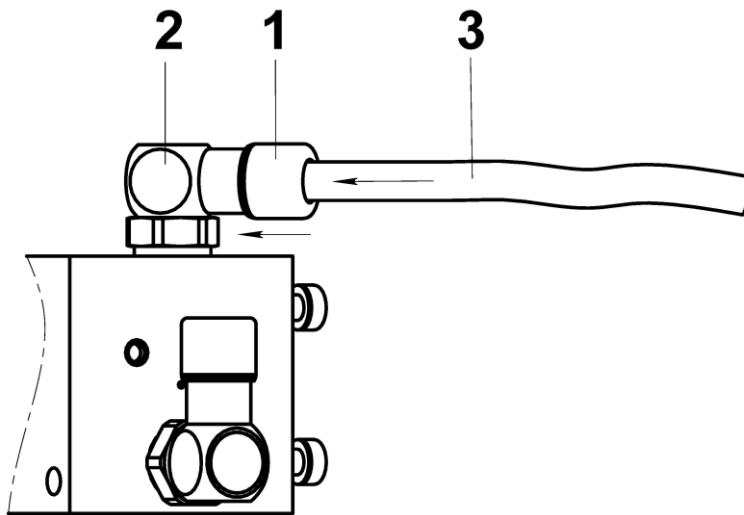
Argon, hydrogen, nitrogen, forming gas

- 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 "N₂" gas connector
- Using red gas hose G3/8"LH connect the hydrogen pressure-reducer to the plasma gas console "H₂" gas connector
- Using red / green coloured gas hose G1/4" connect the hydrogen pressure-reducer to the plasma gas console "N₂/H₂" 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

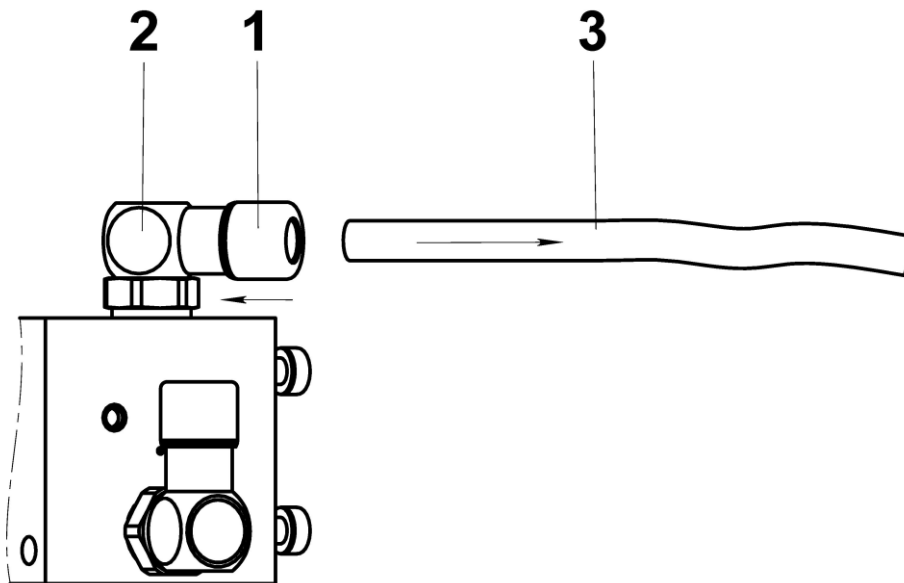
7.6.1 Mounting

- 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

Plasma machine torch Q-Torch

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 | |
| Flow rate coolant | <ul style="list-style-type: none"> • „Kjellfrost -15 °C“ (freezing protection up to -15 °C) or • „Kjellfrost -25 °C“ (up to -25 °C) with integrated corrosion protection min. 4,0 l/min | |
| 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

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 (O₂), argon (Ar), nitrogen (N₂), hydrogen (H₂) and their mixtures.

Swirl gases can be air (air), oxygen (O₂) and nitrogen (N₂) 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:

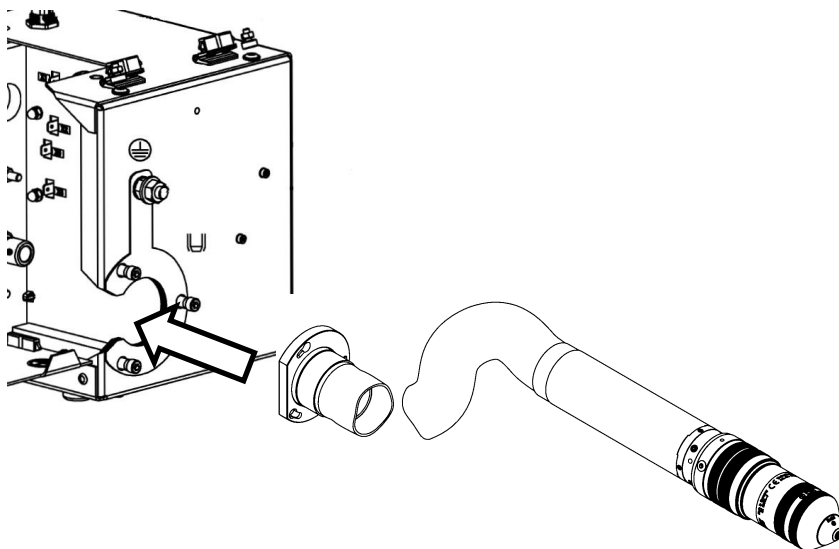
Q-Torch 4510

- 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) PU-hose AD6.0 x NW4 sw
 - ignition gas (ZG)
 - plasma gas 2 (PG2) PU-hose AD6.0 x NW4 bl
 - cutting gas (SG)
 - 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 power 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.

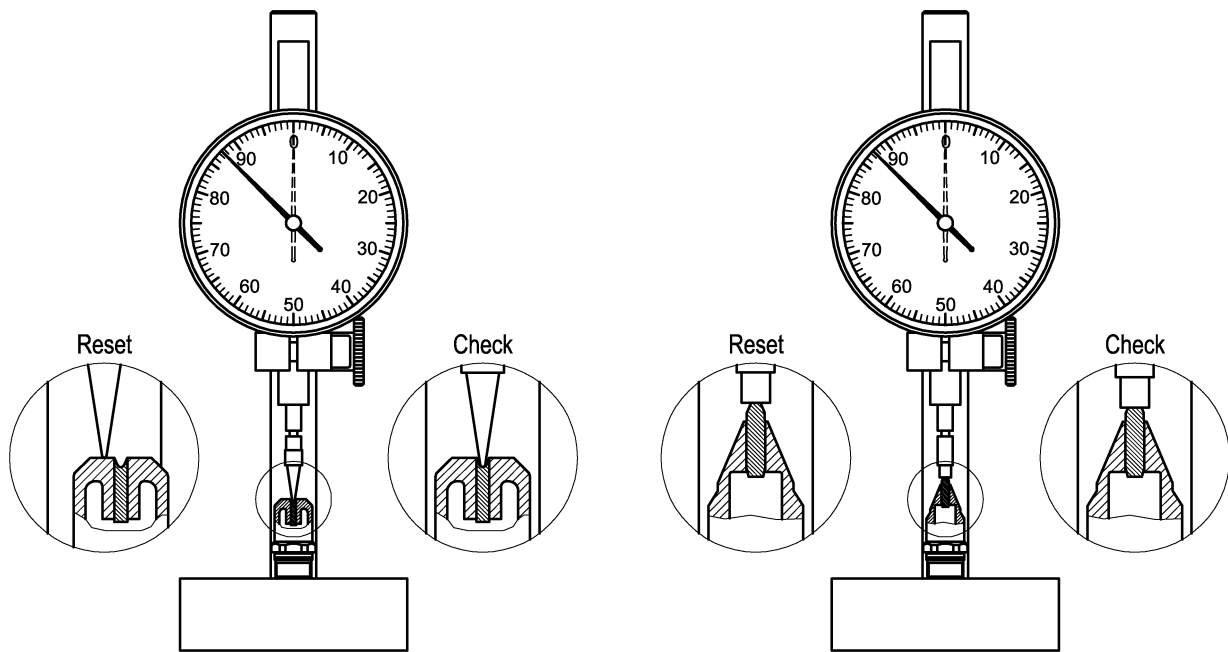
Dispose the absorbed material according to official regulations.



| 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 | ≤ 200 A | O ₂ | xx.02 | Q 1500 Q 3000 Q 4500 | 1,30 | 1,80 |
| E006 | .11.858.401.360 | | | | | 1,30 | 1,80 |
| E012 | .11.858.411.320 | | | | | 1,50 | 1,80 |
| E015 | .11.858.411.350 | | | | | 1,30 | 1,80 |
| E016 | .11.858.411.360 | | | | | 1,30 | 1,80 |
| E022 | .11.858.421.320 | | | | | 300 A | |
| E024 | .11.858.421.340 | 400 A | | | 1,30 | 1,80 | |
| E042 | .11.858.441.520 | ≤ 200 A | Ar/H ₂ | | | <0,50 | 0,50 |
| E052 | .11.858.451.520 | | | <0,50 | 0,50 | | |
| E065 | .11.858.461.550 | | | 450 A | <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.

Plasma machine torch Q-Torch

8.4.1 Plasma machine torch Q-Torch 4510

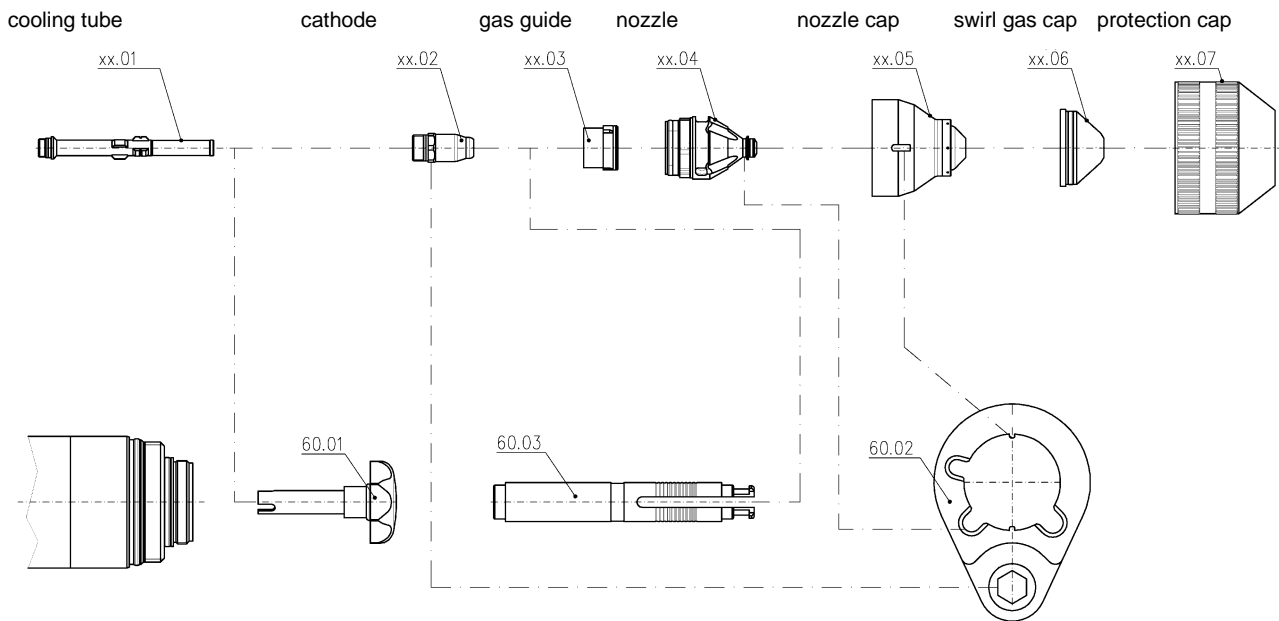


Fig. 32: Tools for changing consumables

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 \varnothing 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

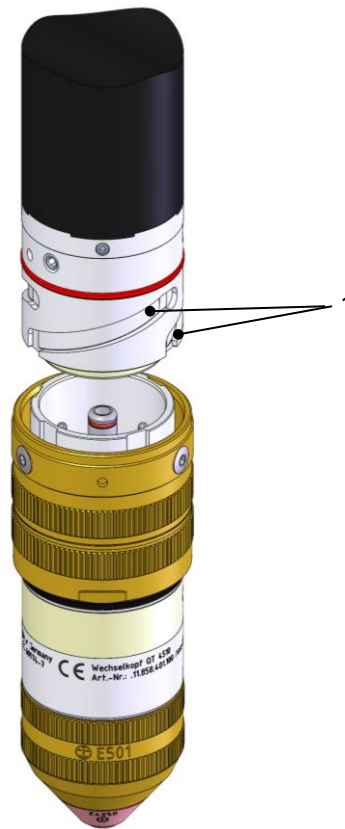
1. Screw in the cooling tube (xx.01) by aid of a socket wrench (60.01).
2. Screw in the cathode (xx.02), tighten the cathode with the multi-function torch tool (60.02).
3. Insert the gas guide (xx.03).
4. Insert the nozzle (**xx.04**) into the torch head (see picture on next page). Turn the nozzle such 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.

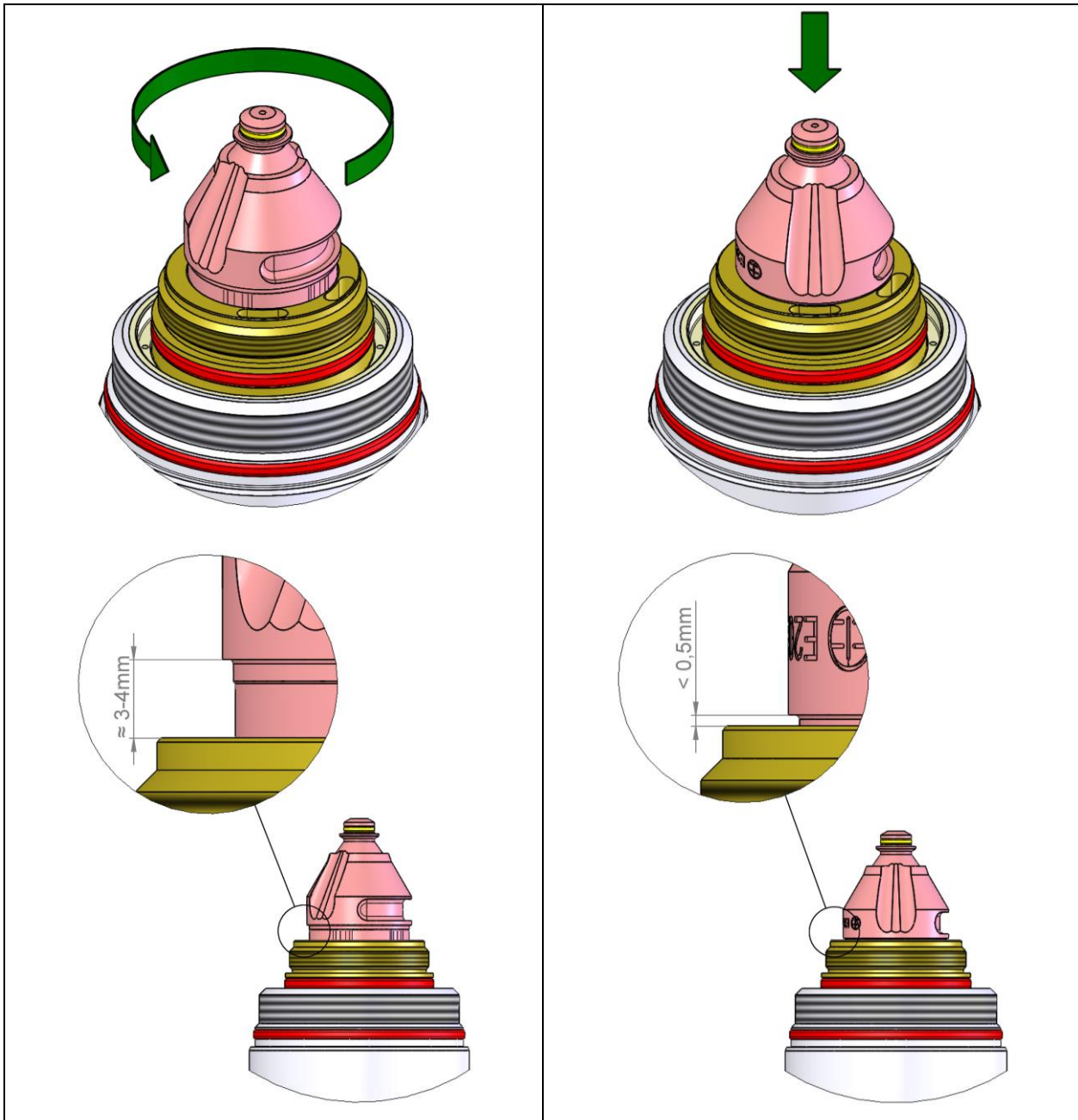


Fig. 33: Insert the nozzle into the torch head

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.

Plasma machine torch Q-Torch

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



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



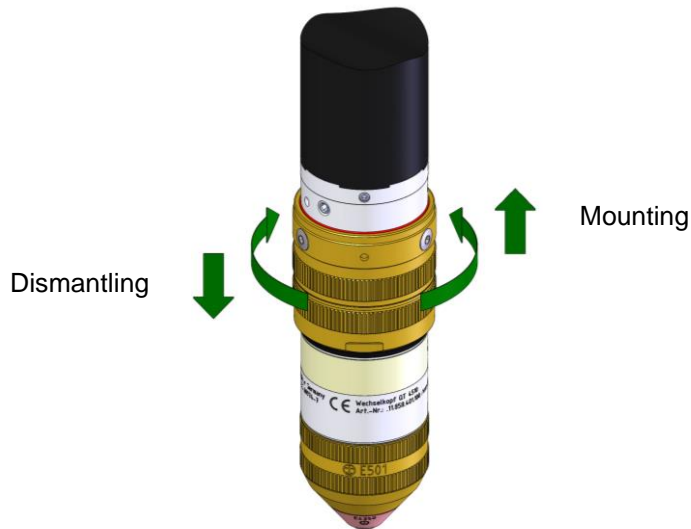
Do not drop the change head, it could be damaged!

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".

Plasma machine torch Q-Torch

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".

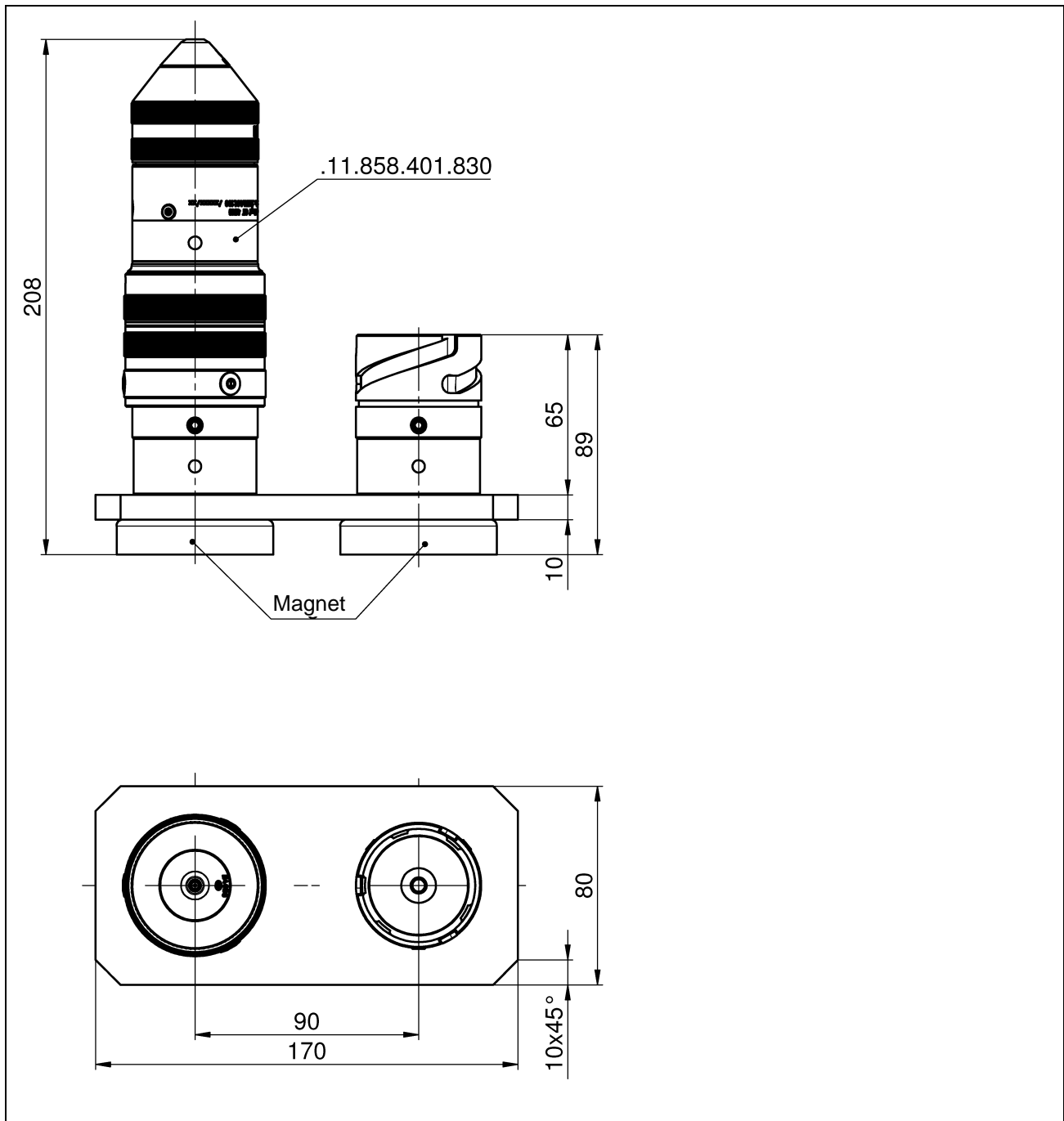


Fig. 34: Parking station .11.858.401.830 suitable for change head Q-Torch 4510

Plasma machine torch Q-Torch

8.5.2 Maintenance of the change head

| | |
|-----------------------------------|----------------|
| Plasma torch: | Q-Torch 4510 |
| Drawing of the spare parts lists: | .11.858.401.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 O₂ 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 / dismantling.
- 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.

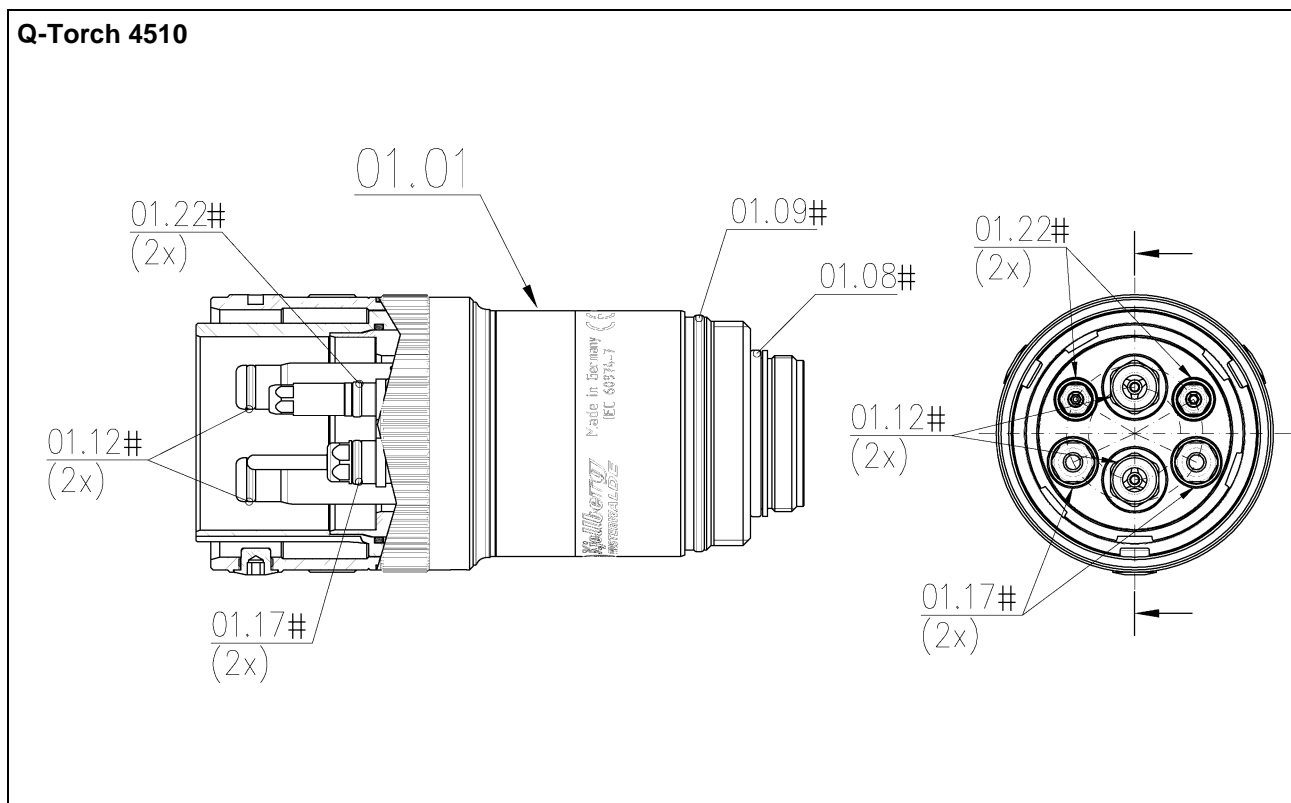


Fig. 35: Inner and outer o-rings of the change head

Plasma machine torch Q-Torch

8.5.3 Add on of the change heads

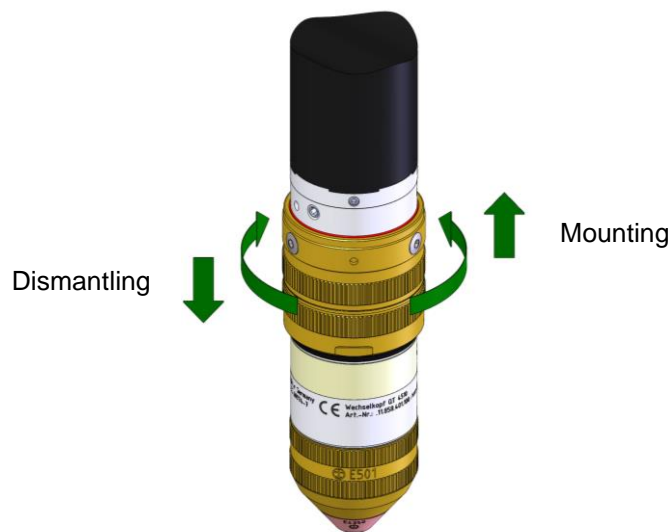
ATTENTION



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

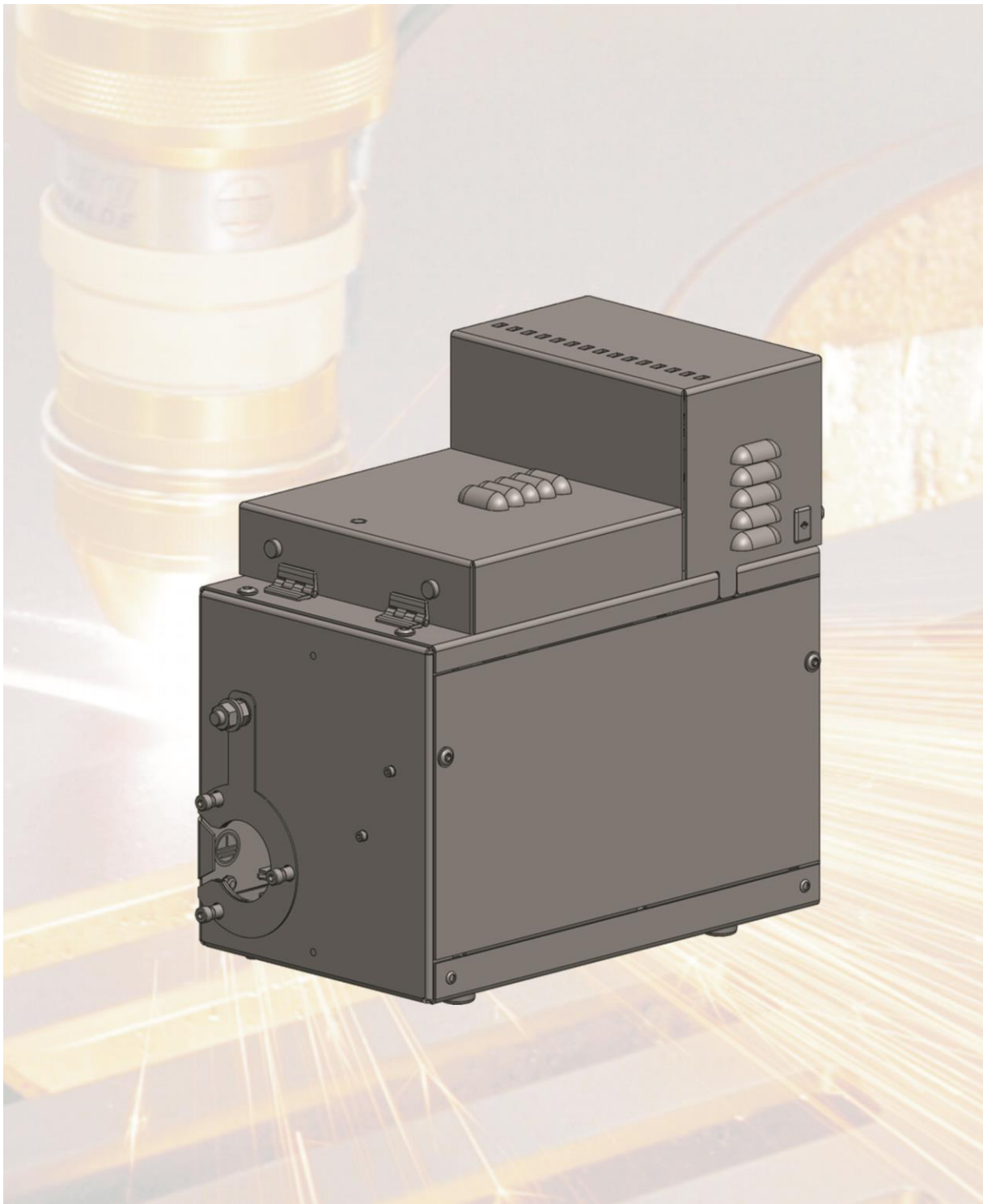
1. Turn the change head 120 ° (a half turn), according to the following figure, until the noticeable mechanical stop.



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

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

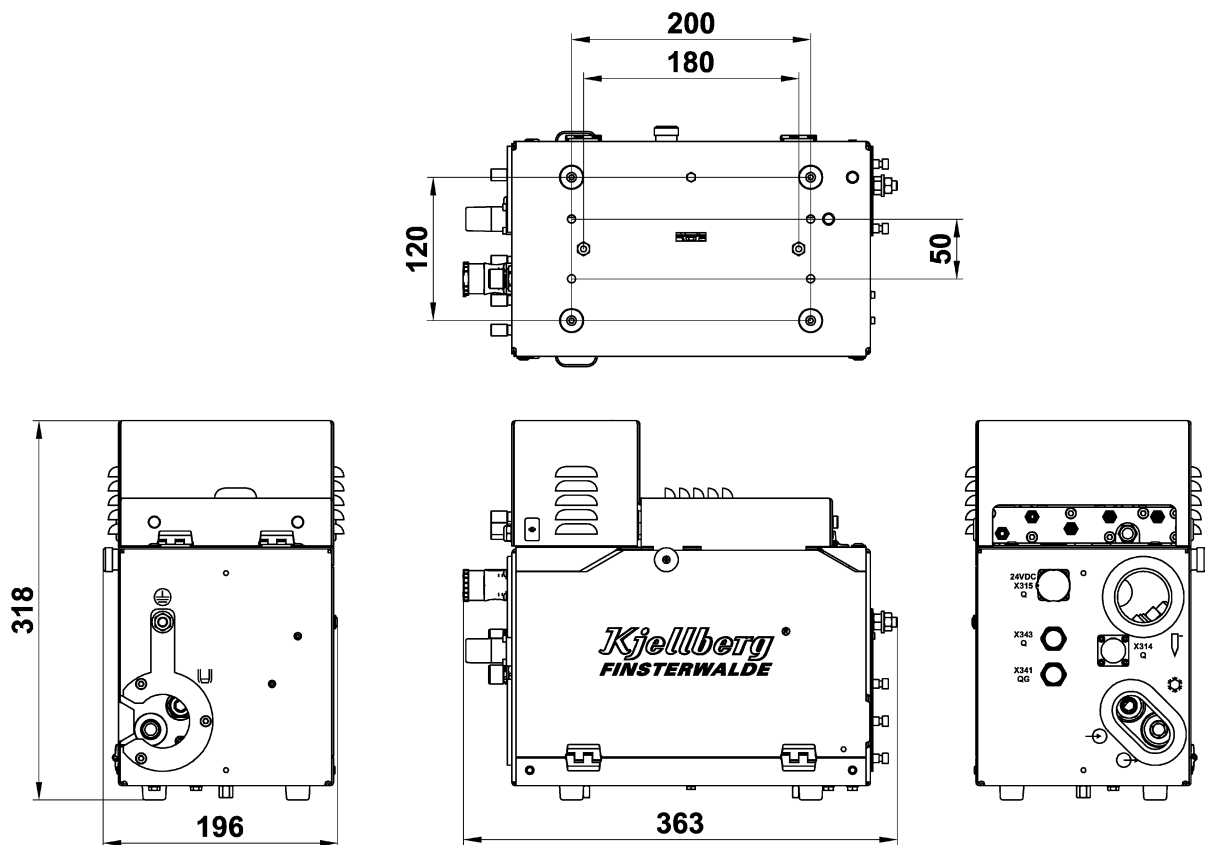


Fig. 37: Dimension diagram

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

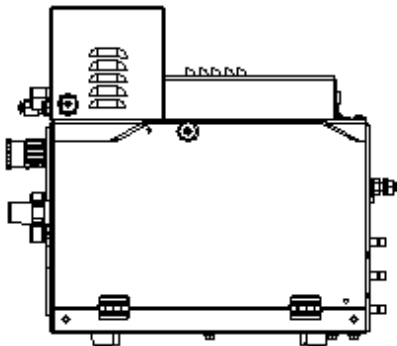
ATTENTION



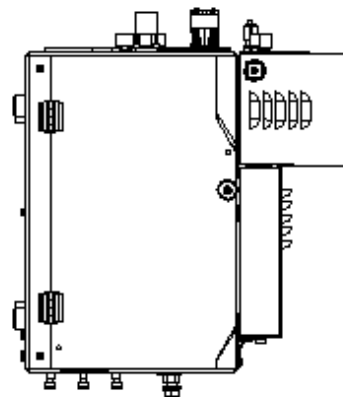
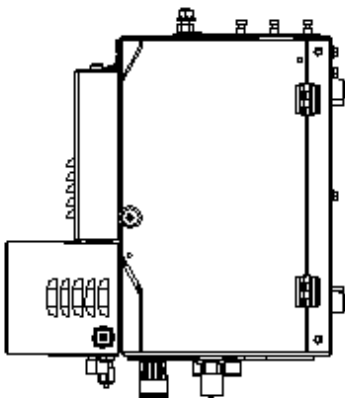
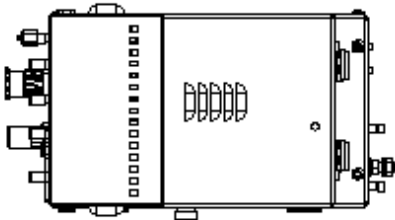
Make sure to use only one permissible installation position!

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!

Plasma torch connection unit Q-Port

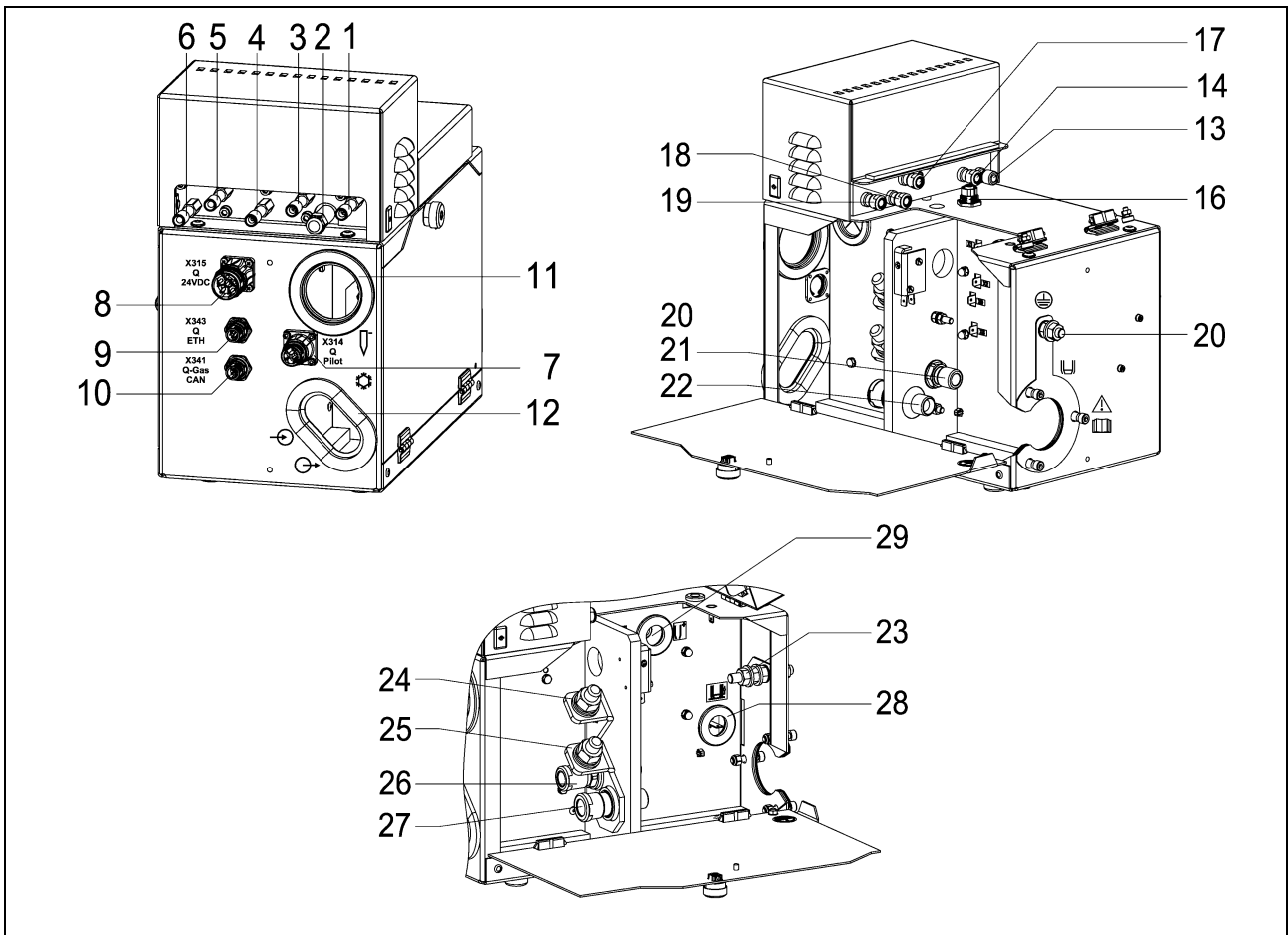


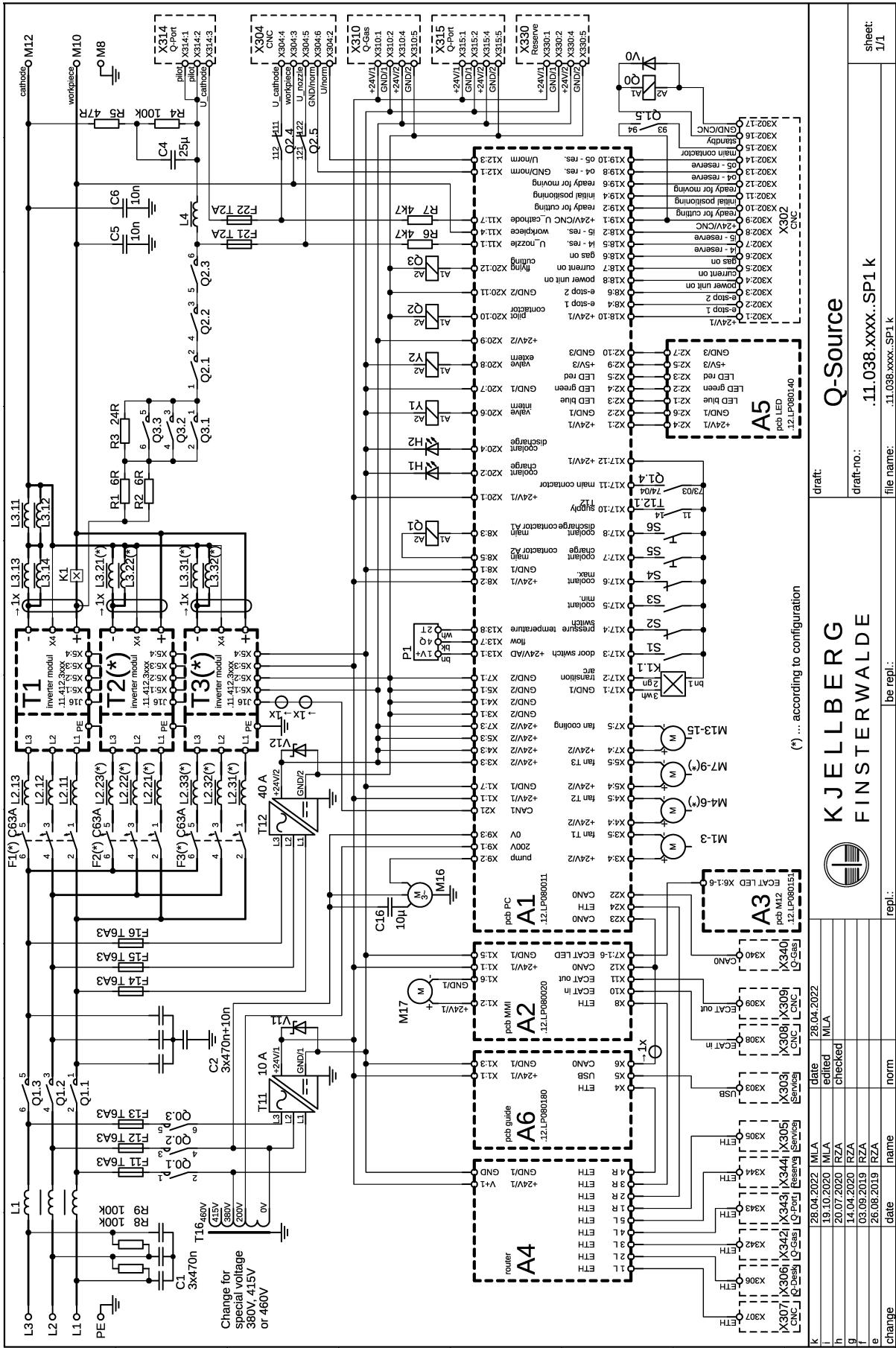
Fig. 38: Connections of Q-Port

| | | | | | |
|----|-------------------------|----------------------|-----------|---------------|---------|
| 1 | Connector 1 | ignition gas | | from Q-Gas | G1/8" |
| 2 | Exhaust with silencer | (exh) | | | |
| 3 | Connector 2 | cutting gas | | from Q-Gas | G1/8" |
| 4 | Connector 3 | cutting gas | | from Q-Gas | G1/8"LH |
| 5 | Connector 4 | swirl gas | | from Q-Gas | G1/8" |
| 6 | Connector 5 | swirl gas - not used | | from Q-Gas | |
| 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 + BDA | socket X321 (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 |

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 | .11.825.130x..SP1 |
| wiring diagram plasma torch connecting unit | .11.820.26x.SP1 |
| wiring diagram plasma torch | .11.858.x01.SP1 |
| wiring diagram inverter module | .11.412.3xxx..SP1 |



| | | | |
|------------|--|---------------------|--|
| draft: | | Q-Source | |
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| file name: | | .11.038.xxxx..SP1 k | |
| sheet: | | 1/1 | |

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| | | be repl.: | |
| date | 28.04.2022 | date | 28.04.2022 |
| edited | MLA | checked | MLA |
| h | 19.10.2020 | h | 20.07.2020 |
| g | 14.04.2020 | g | 03.09.2019 |
| e | 26.08.2019 | e | 26.08.2019 |

Wiring diagrams

.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 |

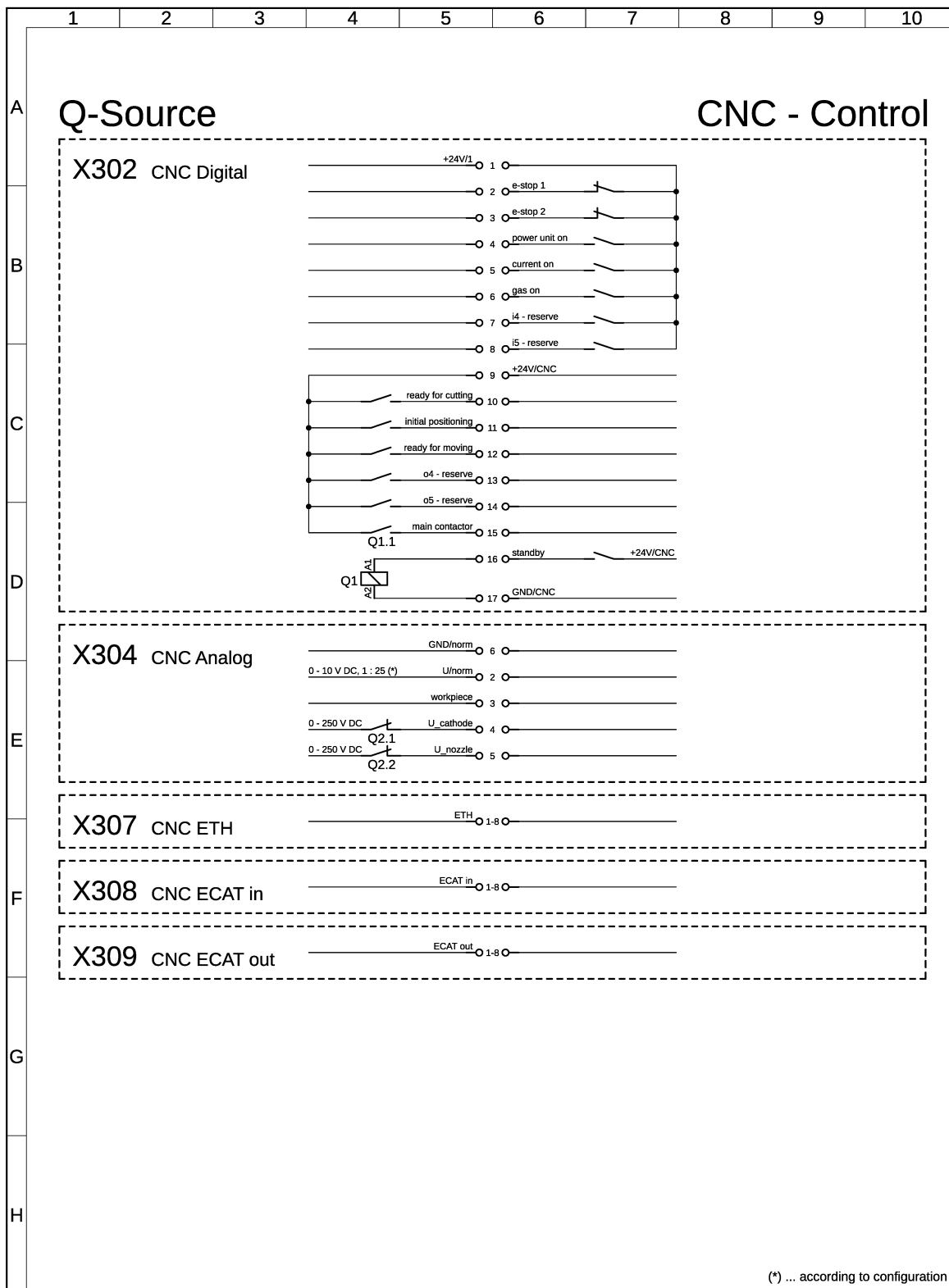
.11.038.xxxx..SP1

| 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 |
| M13-15 | 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 |
| 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 |

Wiring diagrams

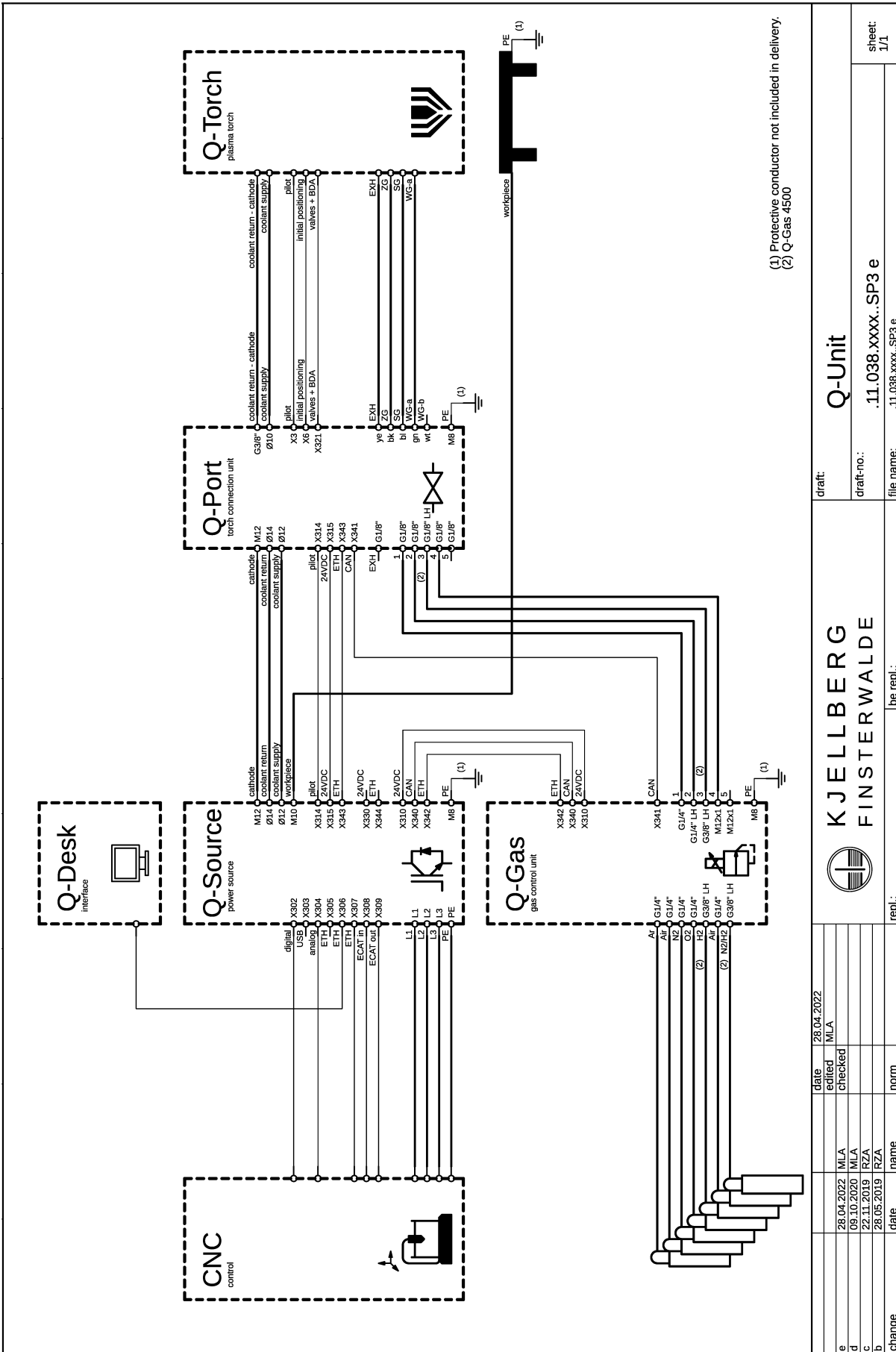
.11.038.xxxx..SP1

| 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 |
| 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 |



(*) ... according to configuration

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| | | | | date | name | draft: | |
| | | | created | 28.05.2018 | RZA | Q-Source - CNC-interface | |
| | | | edited | 23.02.2022 | MLA | | |
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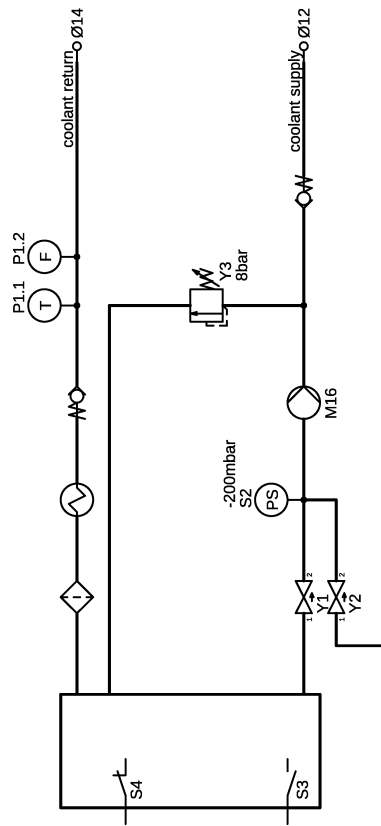



Q-Unit

KJELLBERG
FINSTERWALDE

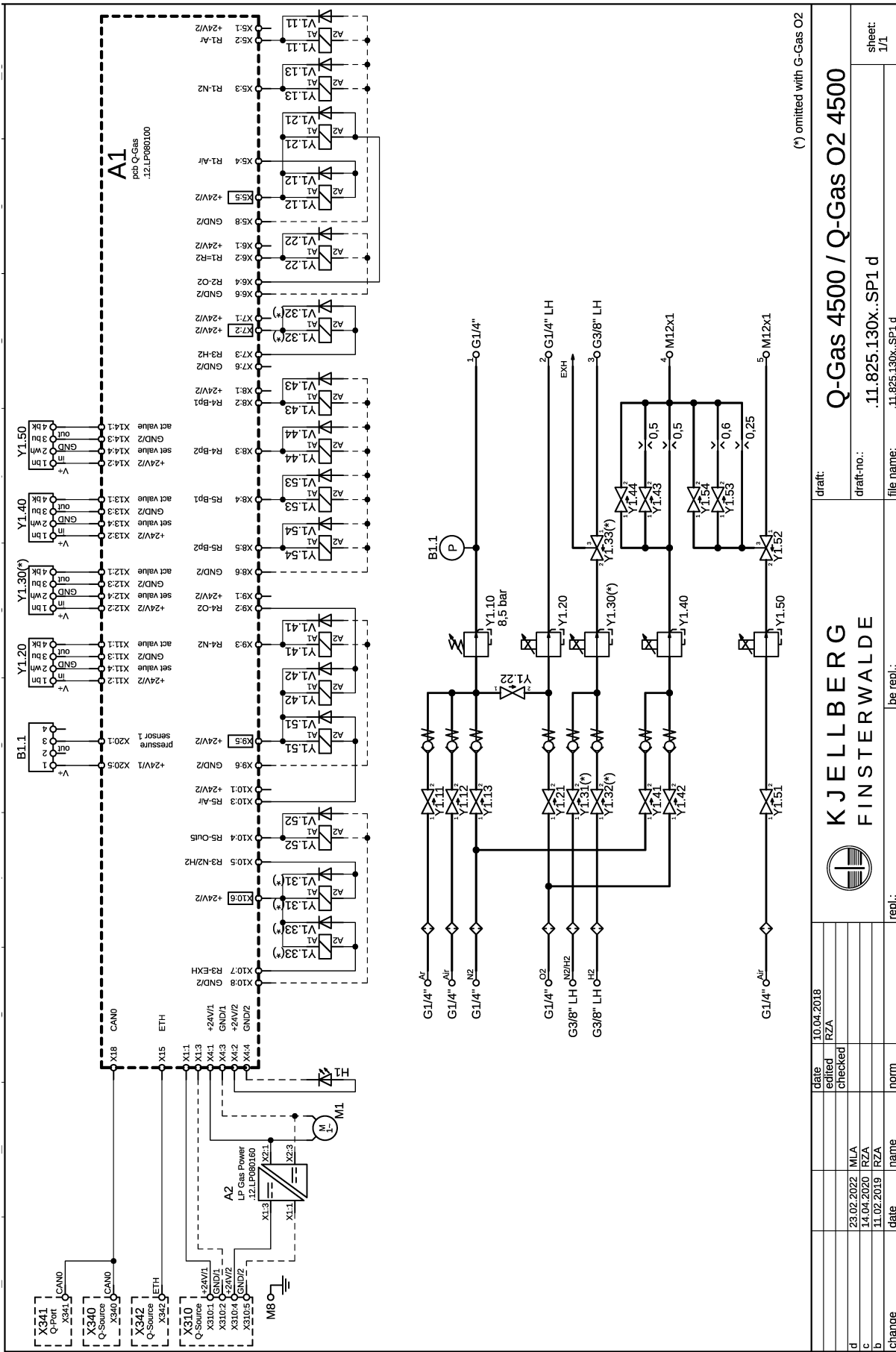


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Wiring diagrams



(*) omitted with G-Gas O2

| | | | |
|---|------------|------------------------------------|---------------------|
| KJELLBERG FINSTERWALDE | | Q-Gas 4500 / Q-Gas O2 4500 | |
|  | | draft: draft.no.: file name: | |
| date: 10.04.2018 edited: RZA checked: | | sheet: 1/1 | |
| d | 23.02.2022 | MLA | .11.825.130X..SP1 d |
| c | 14.04.2020 | RZA | .11.825.130X..SP1 d |
| b | 11.02.2019 | RZA | .11.825.130X..SP1 d |
| change | date | name | repl.: |

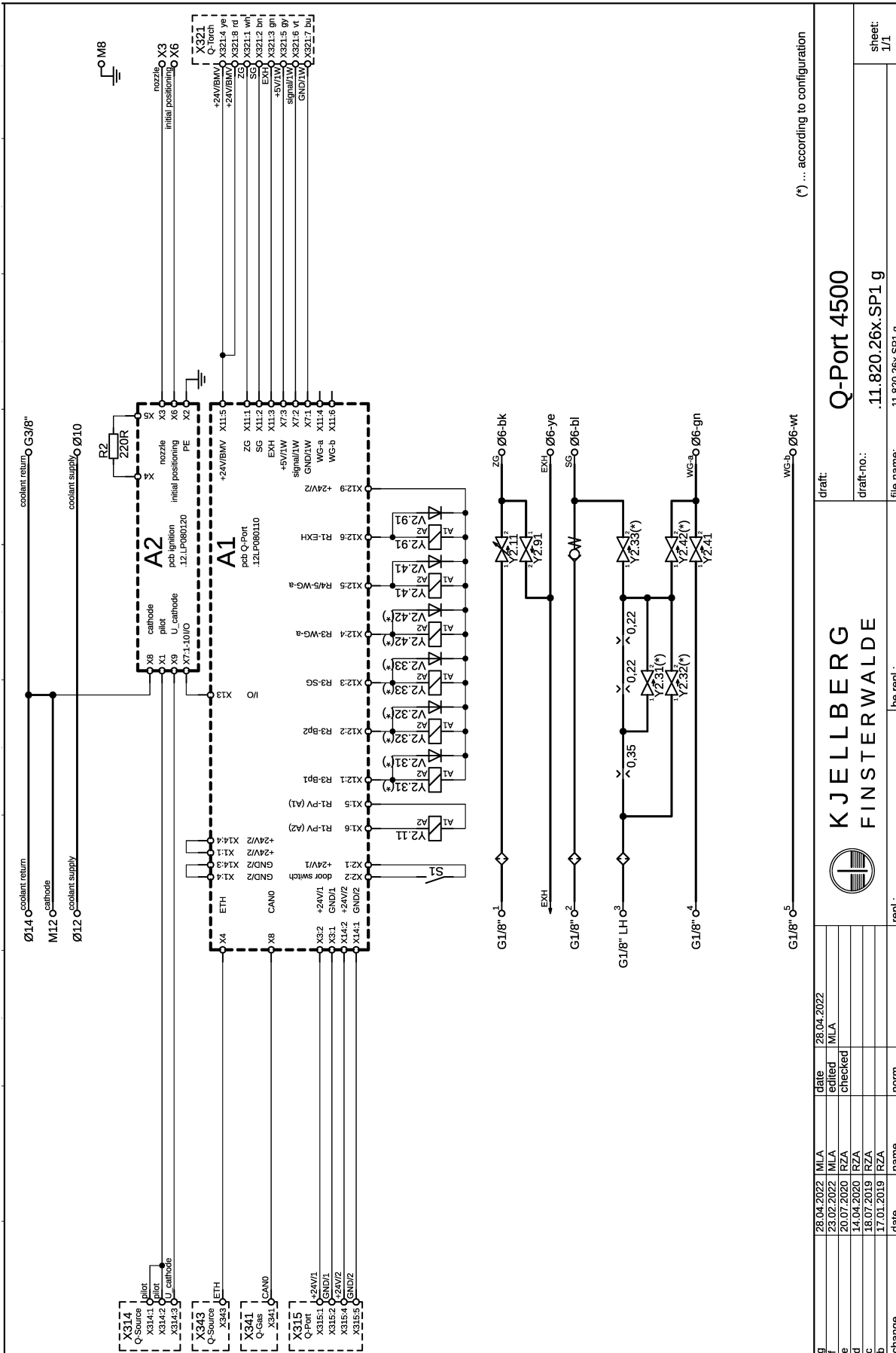
.11.825.130x..SP1

| 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 |
| S | Schalter | switch |
| S1 | Schalter, 1S, Druckschalter 1 | switch, 1no, pressure switch 1 |
| 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 |

Wiring diagrams

.11.825.130x..SP1

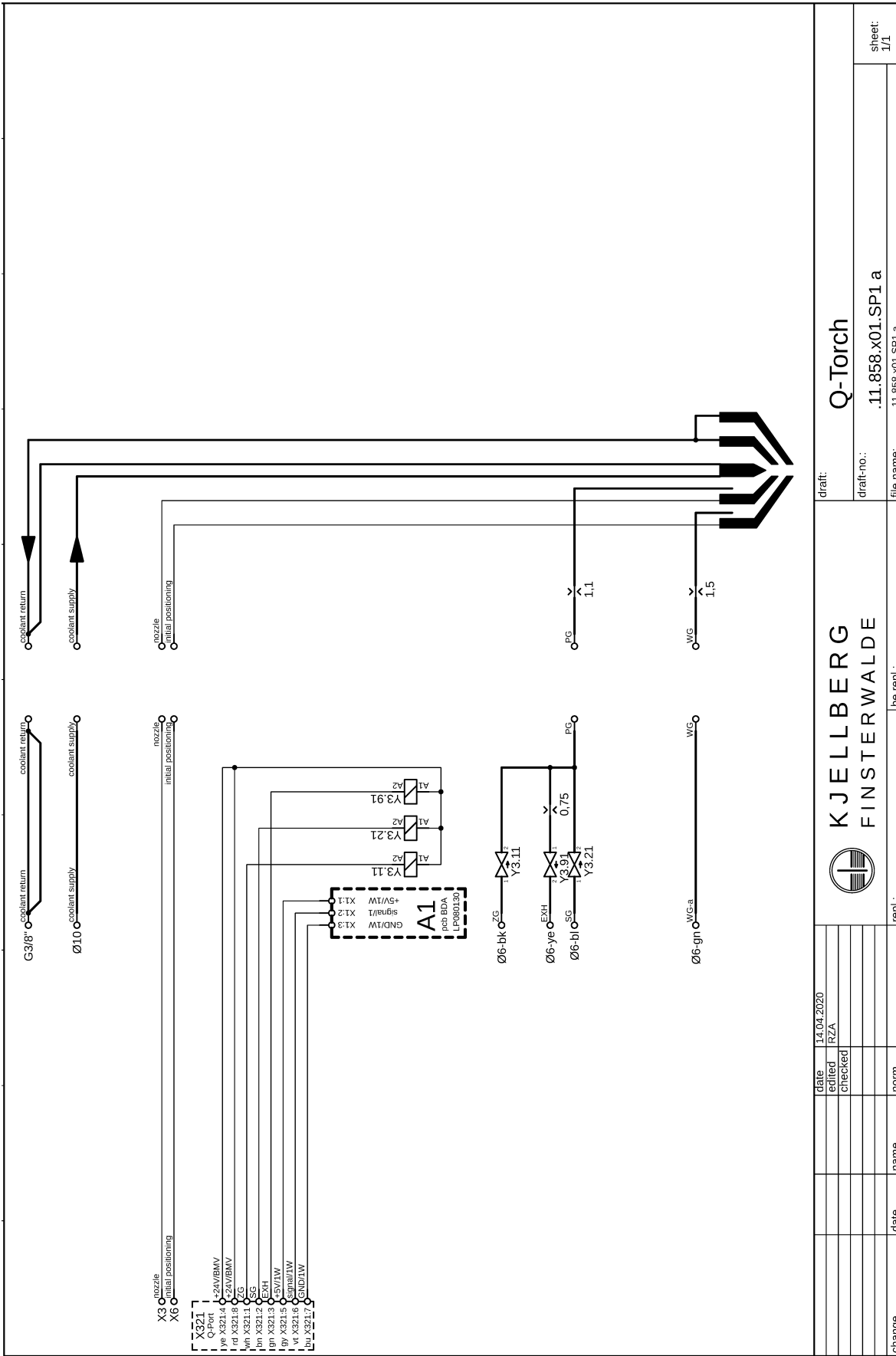
| Code | Beschreibung | description |
|-------------|-----------------------|-----------------------------|
| Y | Ventil | valve |
| Y1.10 | Regelventil, Regler 1 | control valve, controller 1 |
| Y1.11 | 2/2 Wege R1-Ar | 2/2 way R1-Ar |
| Y1.12 | 2/2 Wege R1-Luft | 2/2 way R1-Air |
| Y1.13 | 2/2 Wege 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 |



Wiring diagrams

.11.820.26x.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 |

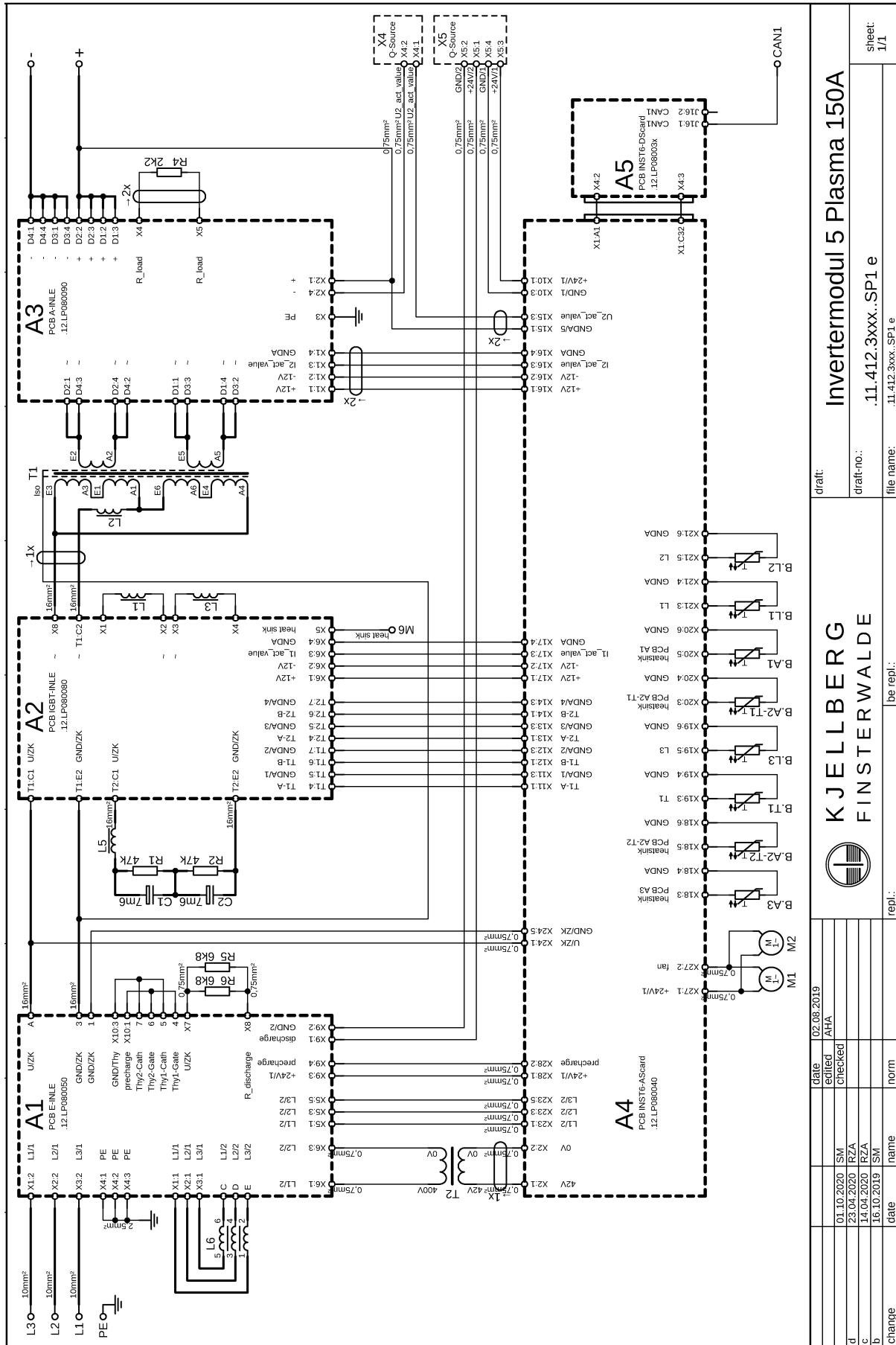


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| date | | 14.04.2020 | |
| edited | | RZA | |
| checked | | | |
| norm | | | |
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| draft: | | Q-Torch | |
| draft-no.: | | .11.858.X01.SP1 a | |
| file name: | | .11.858.X01.SP1 a | |
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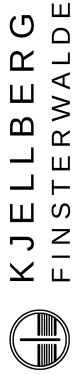
Wiring diagrams

.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 |



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| date | | 02.08.2019 | draft: | | Invertermodul 5 Plasma 150A |
| edited | | JAH | draft-no.: | | .11.412.3xxx..SP1 e |
| checked | | | file name: | | .11.412.3xxx.SP1 e |
| sheet: | | 1/1 | repl.: | | be repl.: |
| change | | | name | | |
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| SM | | 01.10.2020 | name | | |
| RZA | | 23.04.2020 | date | | |
| RZA | | 14.04.2020 | name | | |
| SM | | 16.10.2019 | date | | |



Wiring diagrams

.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-A-Scard (Invertersteuerung6-Analog Signal card) | INST6-A-Scard (inverter control6-analogue signal card) |
| A5 | INST6-D-Scard (Invertersteuerung6-Digital Signal card) | INST6-D-Scard (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)

28.02.2022

| 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 medium 125 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 | Contact 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 |

Spare parts lists

.11.038.1021 (Q 1500)

28.02.2022

| 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)

28.02.2022

| 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 | .10.148.921 | Flow meter SV4050 0,9-15l/min G1/2" | 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 connection G3/8 AD12, 1x sealing ring | | 1 |
| 03.12 | .10.500.157 | Angled screw-in connection G3/8 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 |

Spare parts lists

.11.038.1021 (Q 1500)

28.02.2022

| 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 | Contacto 3-pol. 11BG0601D024 | Q0 | 1 |
| 04.05 | .10.189.305 | G-Fuse T 2 A, 6.3x32 mm 500 V | F17,F18,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) | 1 |
| 04.09 | .10.161.722.26 | Contacto 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 | .10.164.190 | 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-M9 | 1 |
| 04.20 | .11.038.3002..658 | module-fan 172mm with plug connection | M1-M9 | 3 |

.11.038.1021 (Q 1500)

28.02.2022

| pos | article no. | designation | code | pcs. |
|------------|--------------------|---|-------------|-------------|
| 05.00 | .16.500.506 | Power module | | 1 |
| 05.01 | .12.LP080030 | PCB080030-B INST6 DS-Card | | 1 |
| 05.02 | .12.LP080040 | PCB080040-B INST6 AS-Card | | 1 |
| 05.03 | .12.LP080050 | PCB080050-B E-INLE | | 1 |
| 05.04 | .12.LP080080 | PCB080080-A IGBT-INLE | | 1 |
| 05.05 | .12.LP080090 | PCB080090-A A-INLE | | 1 |
| 05.06 | .10.190.021 | Mains transformer 400V/42V 0,8A, 50/60 Hz | | 1 |
| 05.07 | .10.190.036 | toroidal choke RK80 3x3mH/60A/10qmm | | 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 | | 1 |
| 05.12 | .11.412.3002..460 | Choke L5 | | 1 |
| 05.13 | .11.412.3002..470 | Choke L1 module | | 1 |
| 05.14 | .11.412.3002..480 | Choke L2 | | 1 |
| 05.15 | .11.412.3002..490 | Choke L3 module | | 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 | | 1 |
| 05.21 | .11.412.3002..725 | Fan mounted | | 1 |
| 05.22 | 671.100.028 | Capacitor 7600 µF 400 V 77x131,M12X16 | | 2 |
| 05.23 | 671.100.028.1 | Resistor 47k 11W 5% axial 10x50mm | | 2 |

Spare parts lists

.11.038.2021 (Q 3000)

28.02.2022

| 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 medium 125 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 | Contactoer G350 | (Q1) | 1 |
| 01.18 | .10.161.730.24 | Contactoer 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 |

.11.038.2021 (Q 3000)

28.02.2022

| 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 |

Spare parts lists

.11.038.2021 (Q 3000)

28.02.2022

| 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 | .10.148.921 | Flow meter SV4050 0,9-15l/min G1/2" | 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 connection G3/8 AD12, 1x sealing ring | | 1 |
| 03.12 | .10.500.157 | Angled screw-in connection G3/8 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 |

.11.038.2021 (Q 3000)

28.02.2022

| 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 | Contactora 3-pol. 11BG0601D024 | Q0 | 1 |
| 04.05 | .10.189.305 | G-Fuse T 2 A, 6.3x32 mm 500 V | F17,F18,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) | 1 |
| 04.09 | .10.161.722.26 | Contactora 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 |

Spare parts lists

.11.038.2021 (Q 3000)

28.02.2022

| pos | article no. | designation | code | pcs. |
|------------|--------------------|---|-------------|-------------|
| 05.00 | .16.500.506 | Power module | | 1 |
| 05.01 | .12.LP080030 | PCB080030-B INST6 DS-Card | | 1 |
| 05.02 | .12.LP080040 | PCB080040-B INST6 AS-Card | | 1 |
| 05.03 | .12.LP080050 | PCB080050-B E-INLE | | 1 |
| 05.04 | .12.LP080080 | PCB080080-A IGBT-INLE | | 1 |
| 05.05 | .12.LP080090 | PCB080090-A A-INLE | | 1 |
| 05.06 | .10.190.021 | Mains transformer 400V/42V 0,8A, 50/60 Hz | | 1 |
| 05.07 | .10.190.036 | toroidal choke RK80 3x3mH/60A/10qmm | | 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 | | 1 |
| 05.12 | .11.412.3002..460 | Choke L5 | | 1 |
| 05.13 | .11.412.3002..470 | Choke L1 module | | 1 |
| 05.14 | .11.412.3002..480 | Choke L2 | | 1 |
| 05.15 | .11.412.3002..490 | Choke L3 module | | 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 | | 1 |
| 05.21 | .11.412.3002..725 | Fan mounted | | 1 |
| 05.22 | 671.100.028 | Capacitor 7600 µF 400 V 77x131,M12X16 | | 2 |
| 05.23 | 671.100.028.1 | Resistor 47k 11W 5% axial 10x50mm | | 2 |

.11.038.3021 (Q 1500 plus, Q 3000 plus, Q 4500)

28.02.2022

| 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 medium 125 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 | Contactoer G350 | (Q1) | 1 |
| 01.18 | .10.161.731.24 | Contactoer 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 |

Spare parts lists

.11.038.3021 (Q 1500 plus, Q 3000 plus, Q 4500)

28.02.2022

| 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 |

.11.038.3021 (Q 1500 plus, Q 3000 plus, Q 4500)

28.02.2022

| 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 | .10.148.921 | Flow meter SV4050 0,9-15l/min G1/2" | 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 connection G3/8 AD12, 1x sealing ring | | 1 |
| 03.12 | .10.500.157 | Angled screw-in connection G3/8 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 |

Spare parts lists

.11.038.3021 (Q 1500 plus, Q 3000 plus, Q 4500)

28.02.2022

| 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 | Contactora 3-pol. 11BG0601D024 | Q0 | 1 |
| 04.05 | .10.189.305 | G-Fuse T 2 A, 6.3x32 mm 500 V | F17,F18,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) | 1 |
| 04.09 | .10.161.722.26 | Contactora 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 |

.11.038.3021 (Q 1500 plus, Q 3000 plus, Q 4500)

28.08.2020

| pos | article no. | designation | code | pcs. |
|------------|--------------------|---|-------------|-------------|
| 05.00 | .16.500.506 | Power module | | 1 |
| 05.01 | .12.LP080030 | PCB080030-B INST6 DS-Card | | 1 |
| 05.02 | .12.LP080040 | PCB080040-B INST6 AS-Card | | 1 |
| 05.03 | .12.LP080050 | PCB080050-B E-INLE | | 1 |
| 05.04 | .12.LP080080 | PCB080080-A IGBT-INLE | | 1 |
| 05.05 | .12.LP080090 | PCB080090-A A-INLE | | 1 |
| 05.06 | .10.190.021 | Mains transformer 400V/42V 0,8A, 50/60 Hz | | 1 |
| 05.07 | .10.190.036 | toroidal choke RK80 3x3mH/60A/10qmm | | 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 | | 1 |
| 05.12 | .11.412.3002..460 | Choke L5 | | 1 |
| 05.13 | .11.412.3002..470 | Choke L1 module | | 1 |
| 05.14 | .11.412.3002..480 | Choke L2 | | 1 |
| 05.15 | .11.412.3002..490 | Choke L3 module | | 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 | | 1 |
| 05.21 | .11.412.3002..725 | Fan mounted | | 1 |
| 05.22 | 671.100.028 | Capacitor 7600 µF 400 V 77x131,M12X16 | | 2 |
| 05.23 | 671.100.028.1 | Resistor 47k 11W 5% axial 10x50mm | | 2 |

Spare parts lists

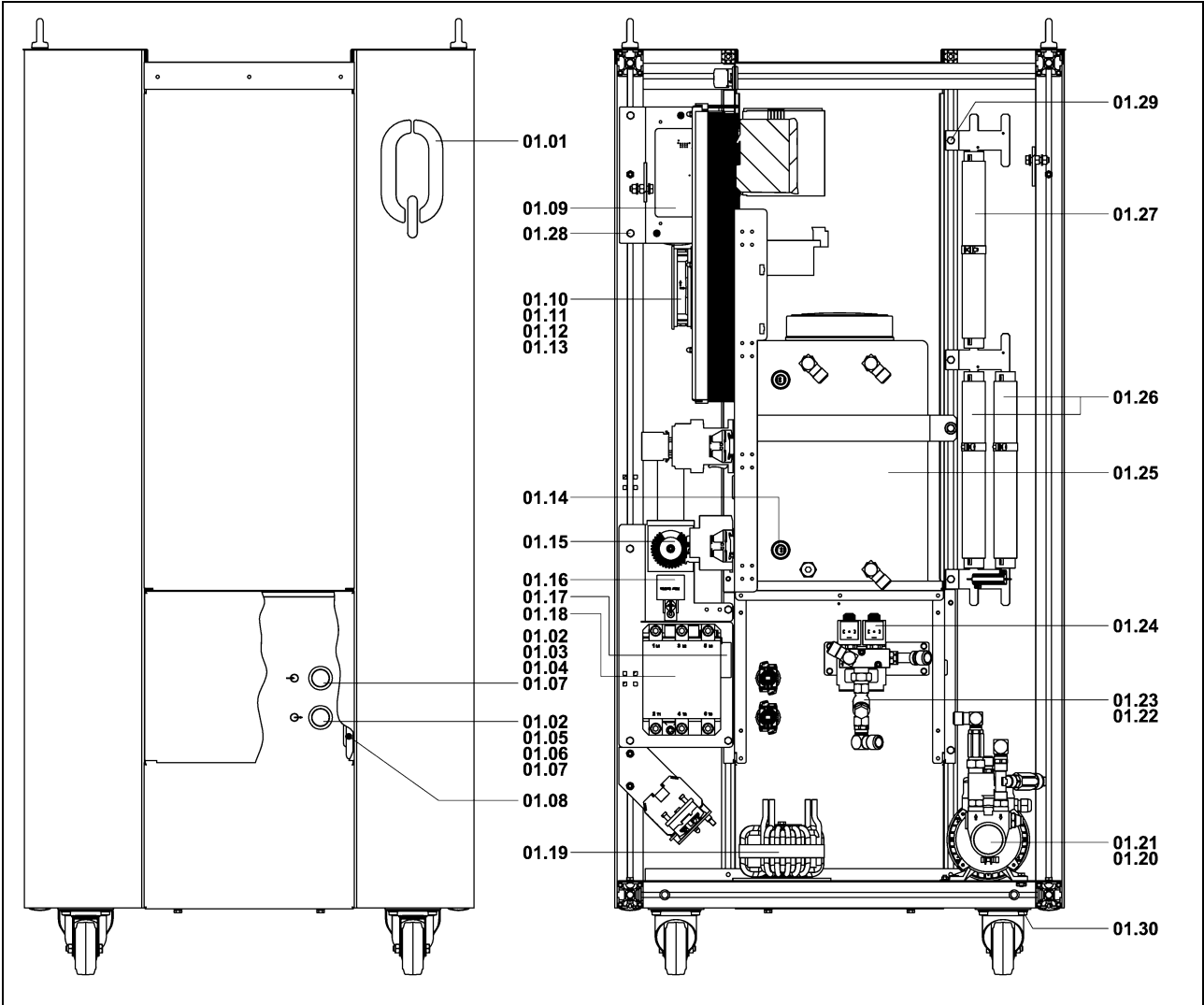
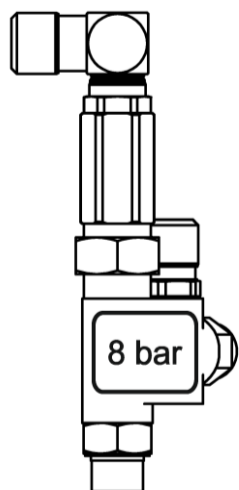


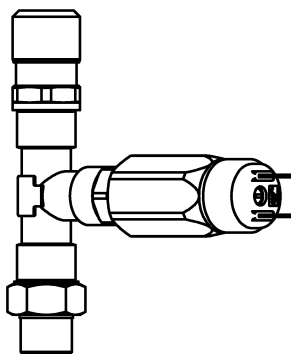
Fig. 39: front panel of Q



01.21

.11.038.3002..320.2

Overflow valve completely, mounted



01.21

.11.038.3002..320.3

Pressure switch completely, mounted

Spare parts lists

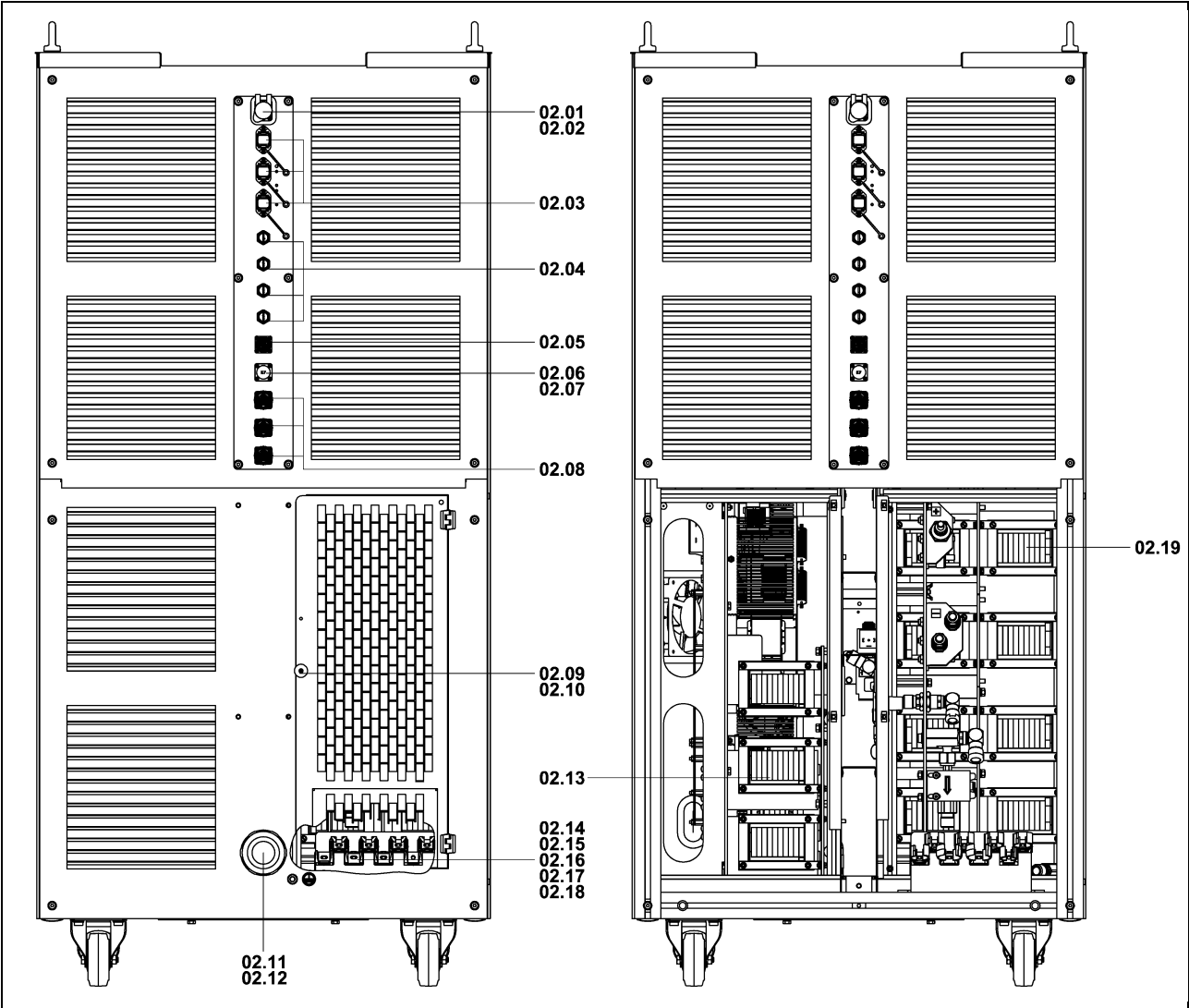


Fig. 40: rear panel of Q

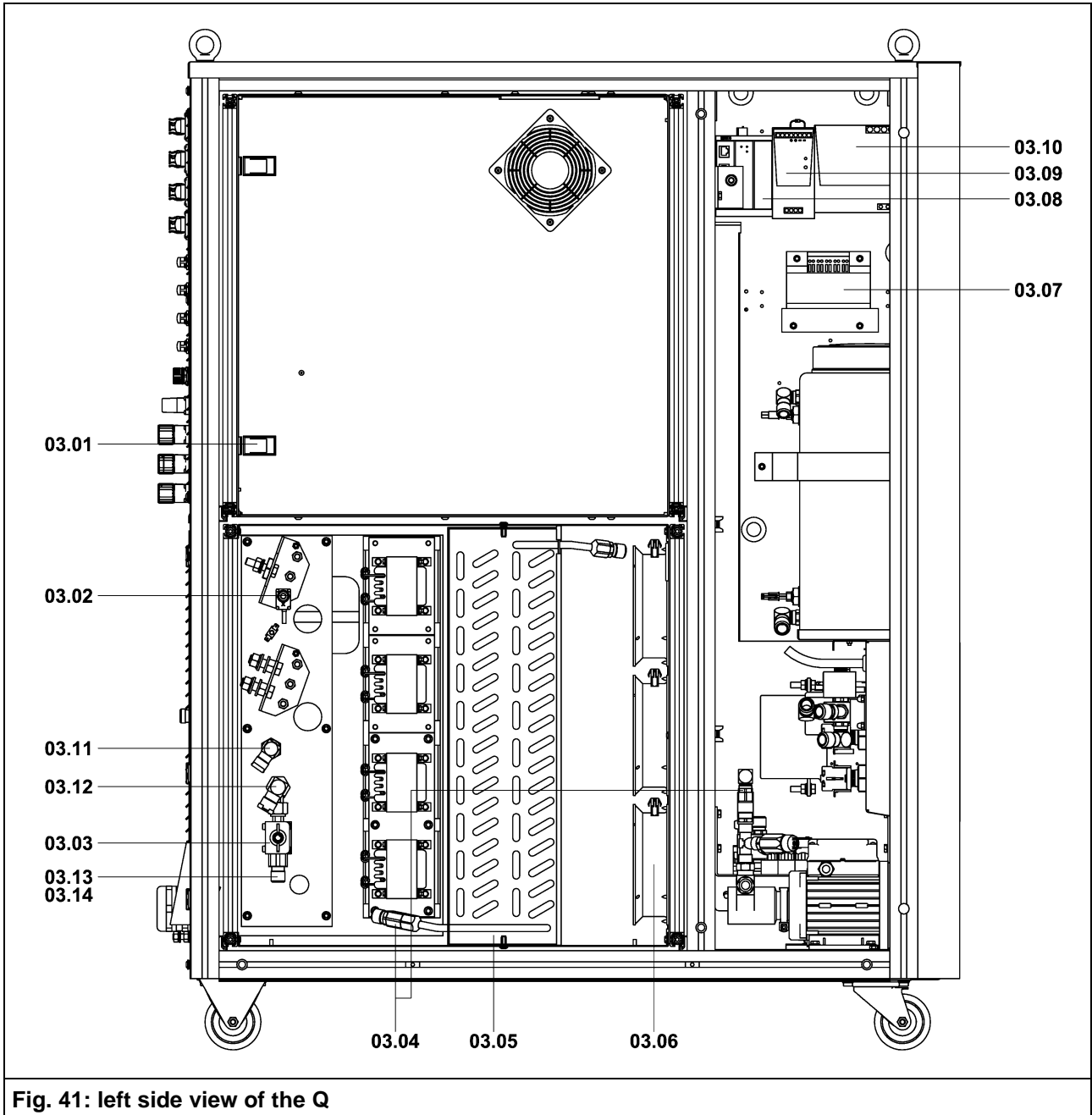


Fig. 41: left side view of the Q

Spare parts lists

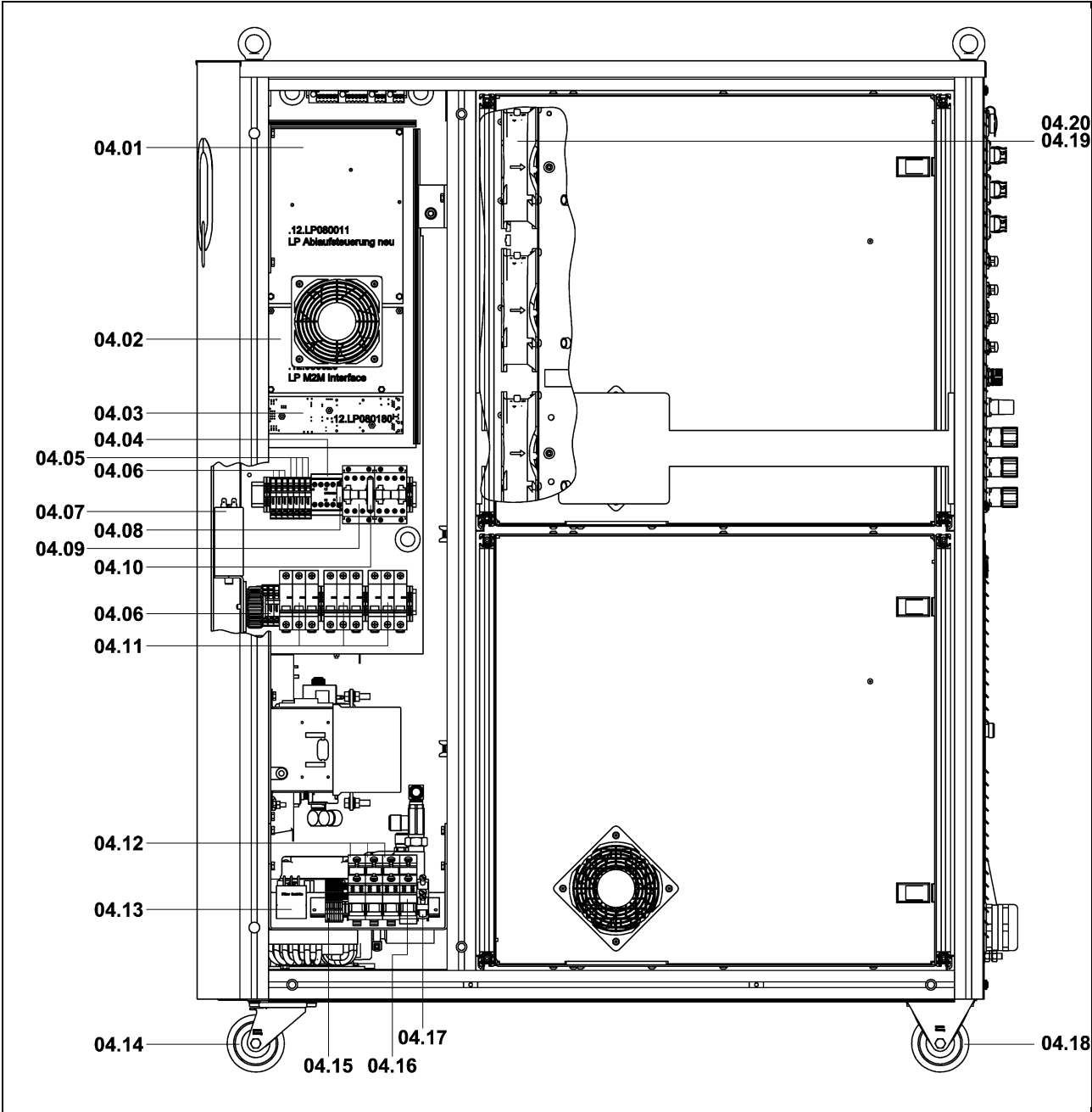


Fig. 42: right side view of the Q

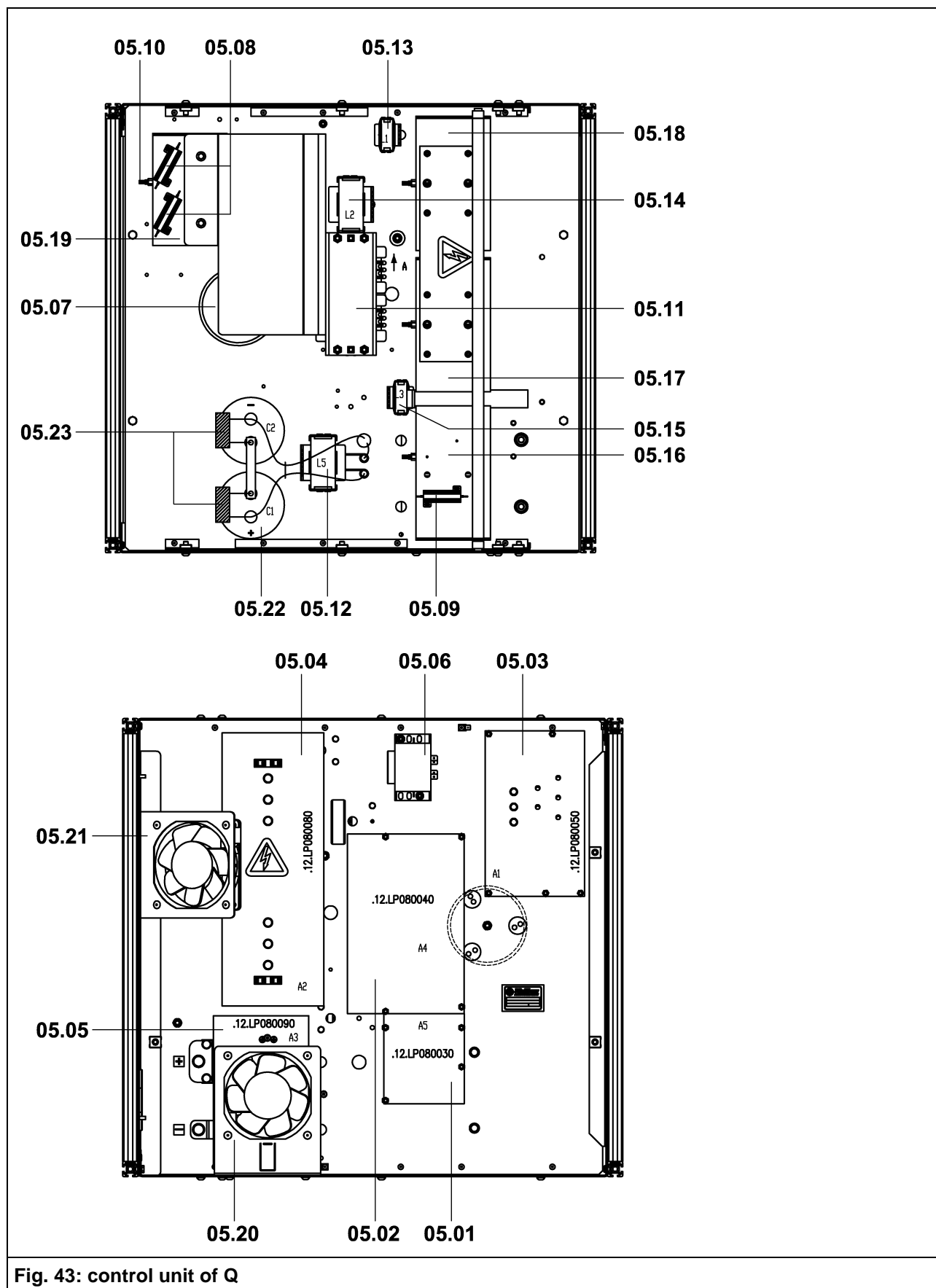


Fig. 43: control unit of Q

Spare parts lists

11.2 Spare parts list Q-Gas 4500

.11.825.1300

04.05.2022

| 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 | .10.503.338 | Sleeve G 1/8" I-I Ms | | 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 |

.11.825.1300

04.05.2022

| 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 | .11.825.1300..T840 | manual pressure regulator for ignition gas, mounted | S1, DR1 | 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 | A2 (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 |
| 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 |

Spare parts lists

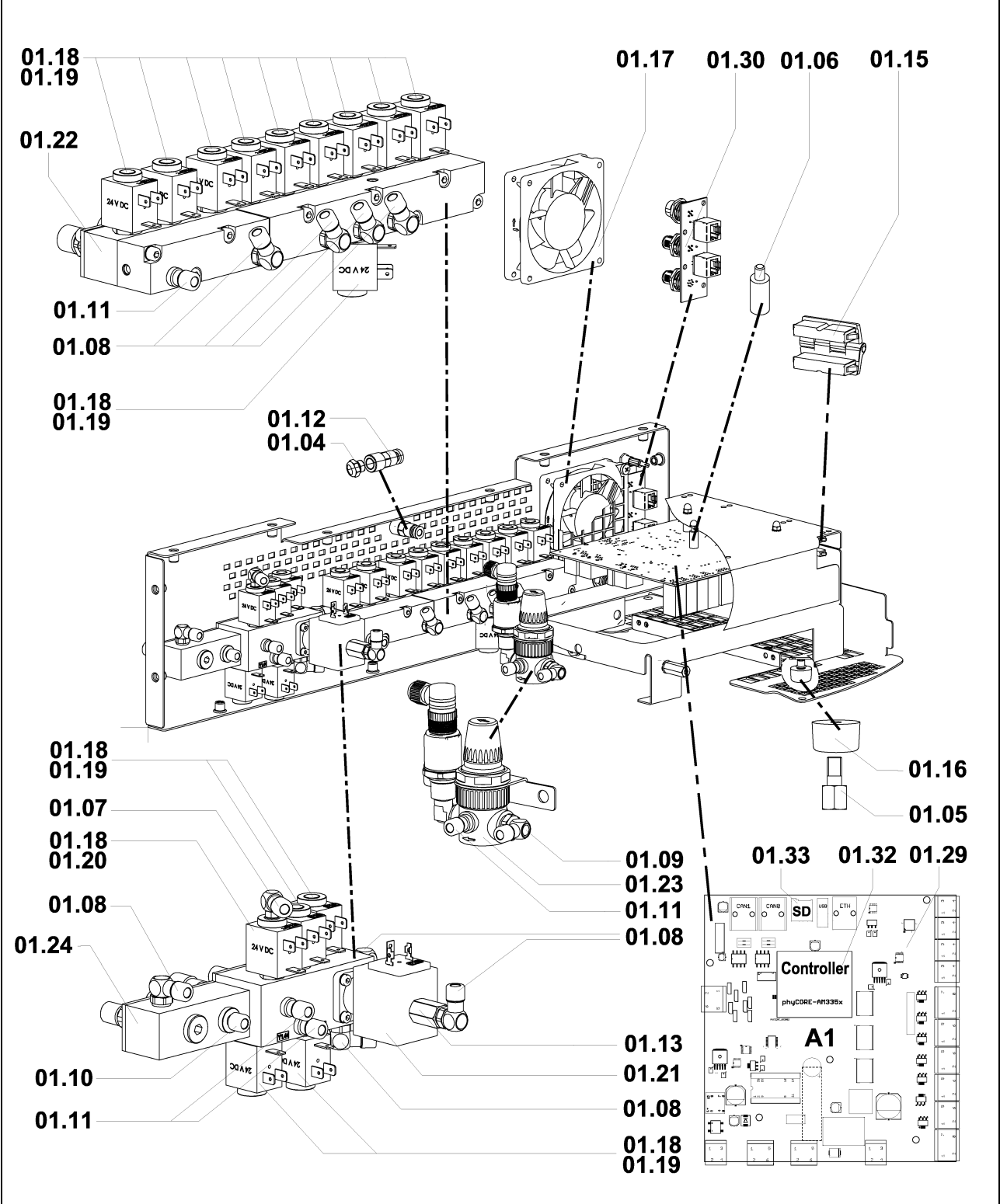


Fig. 44: Overview Q-Gas 4500, part 1

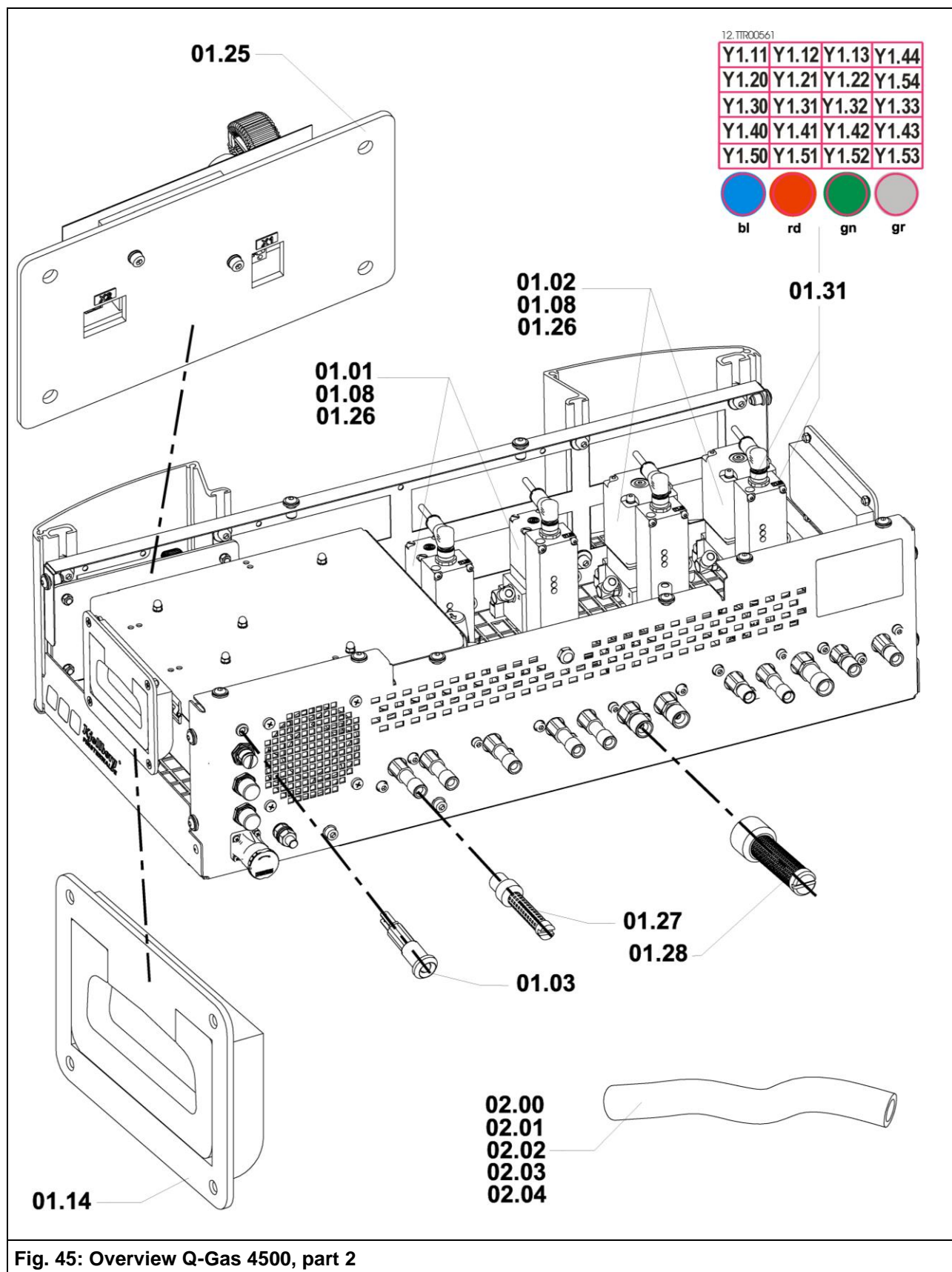


Fig. 45: Overview Q-Gas 4500, part 2

Spare parts lists

11.3 Spare parts list Q-Gas O₂ 4500

.11.825.1301

21.08.2020

| 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" | | 14 |
| 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 | .10.503.338 | Sleeve G 1/8" I-I Ms | | 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, Y1.53, Y1.54 | 12 |

.11.825.1301

21.08.2020

| 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 | .11.825.1300..T840 | manual pressure regulator for ignition gas, mounted | S1, DR1 | 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 |
| 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 |

Spare parts lists

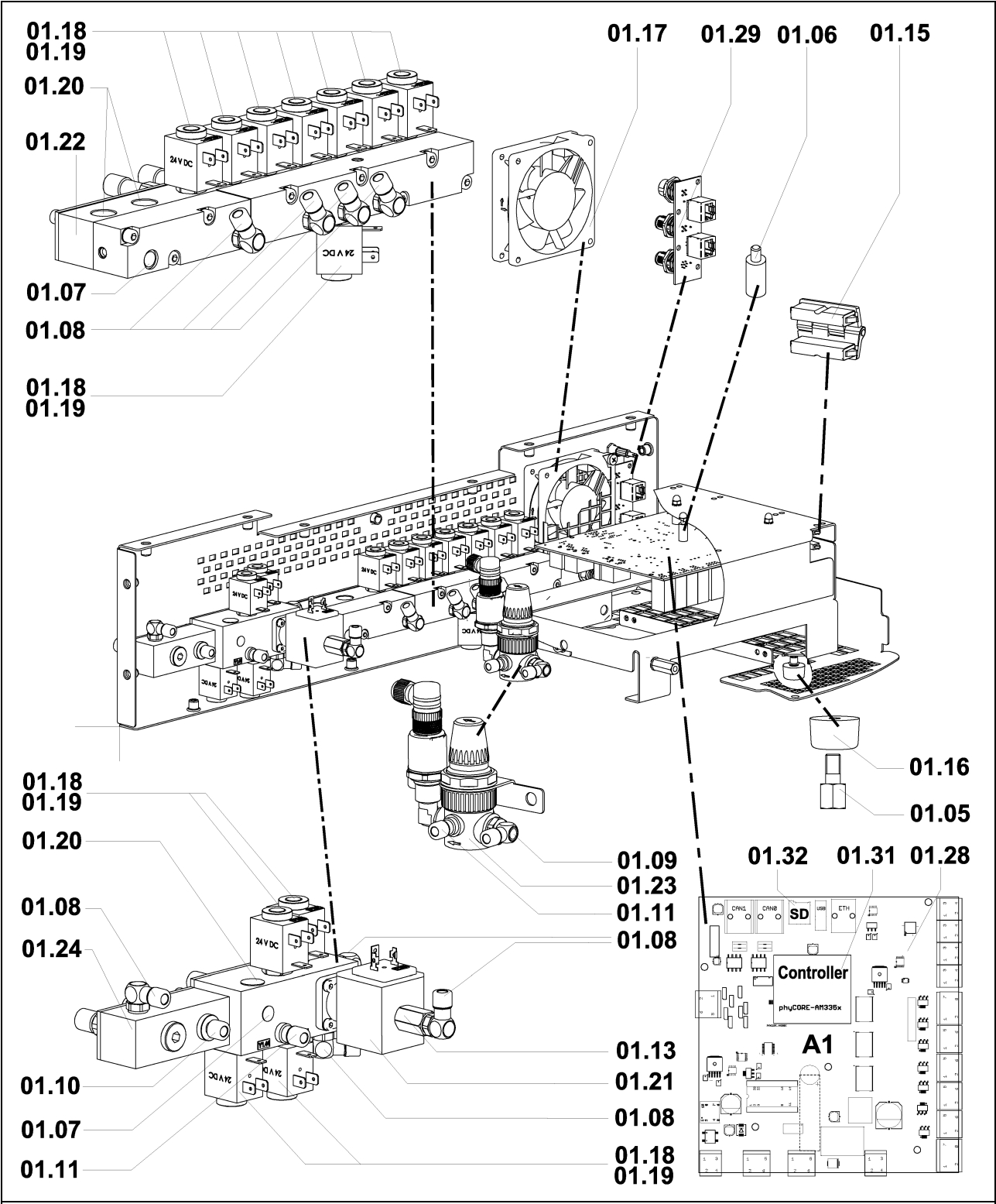


Fig. 46: Overview Q-Gas O₂ 4500, part 1

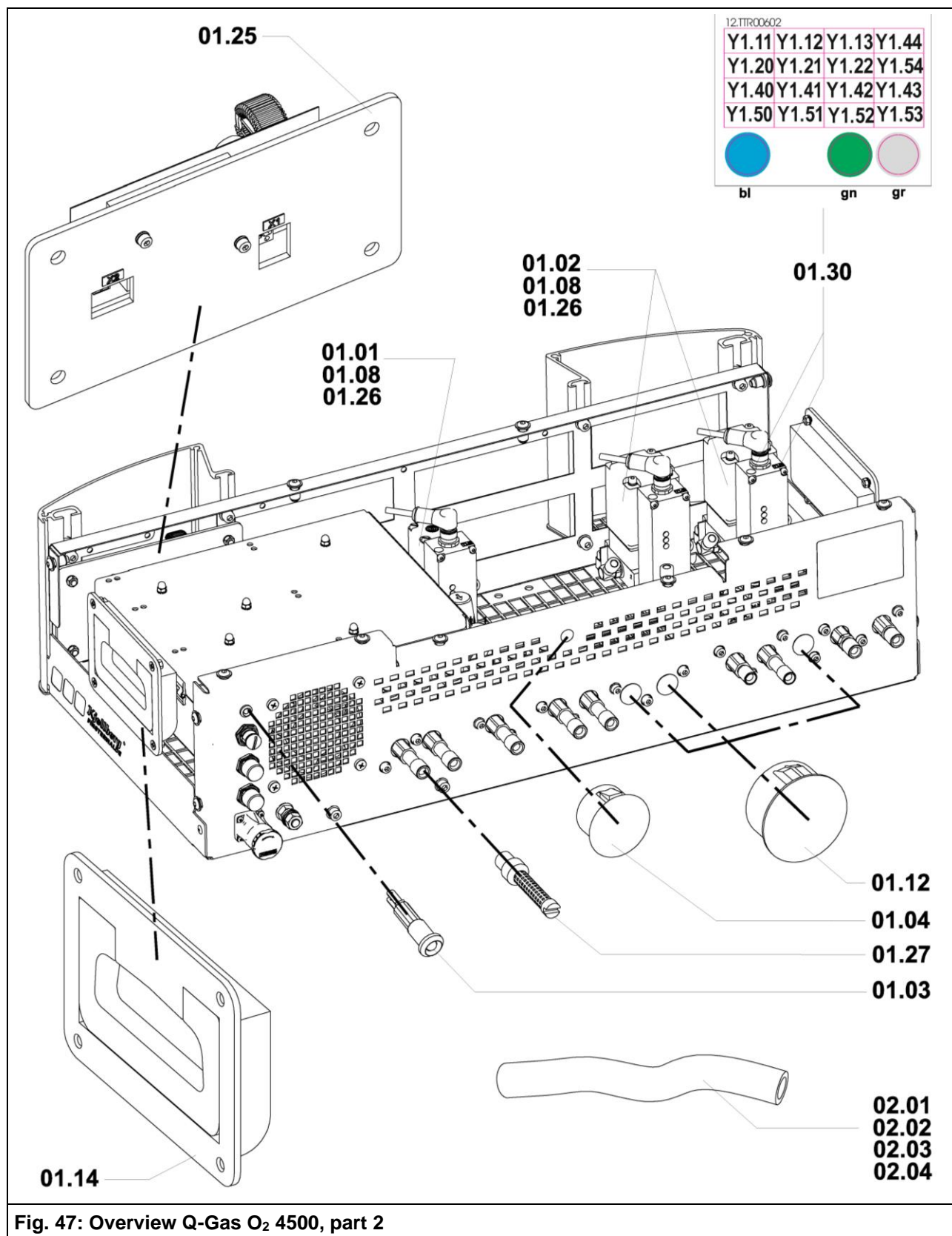


Fig. 47: Overview Q-Gas O₂ 4500, part 2

Spare parts lists

11.4 Spare parts list Q-Torch 4510

.11.858.401.E0

28.02.2019

| 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

28.02.2019

| 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 | .11.854.001.810 | Torch tool - PerCut 611 | | 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 |

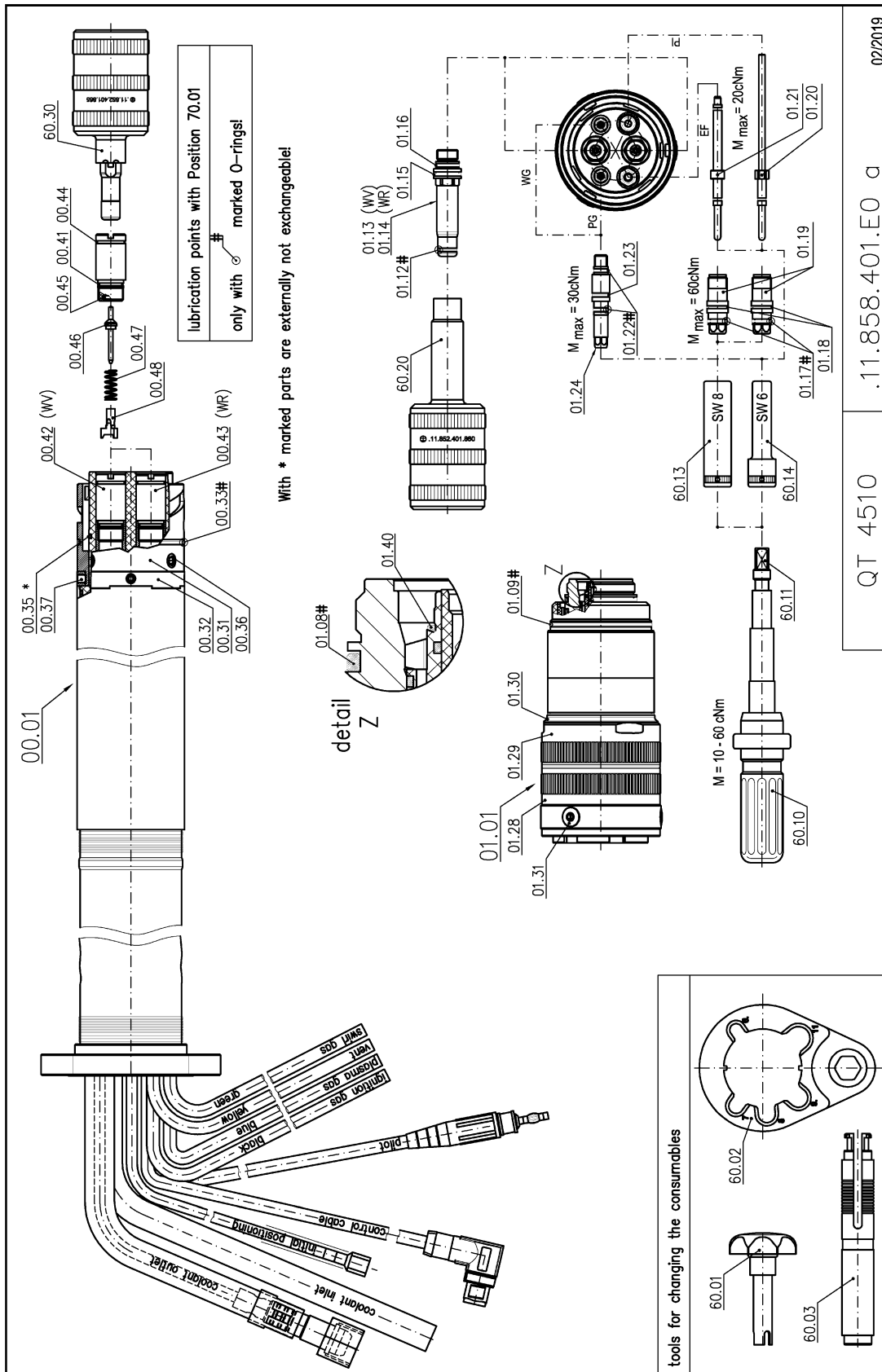


Fig. 48: Overview Q-Torch 4510

11.5 Spare parts list Q-Port 4500

.11.820.260

04.05.2022

| 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 | 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.LP080110 | LP080110-C PBA-control | A1 | 1 |
| 01.29 | .12.LP080120 | LP080120-C High Frequency / contact pcb | A2 | 1 |

Spare parts lists

.11.820.260

04.05.2022

| 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" StIMs | | 2 |
| 01.36 | .12.102.005.1 | Gas connection G1/8" StIM5Ms | | 1 |
| 01.37 | .12.102.005.2 | Gas connection G1/8" StIM5MsRV | | 1 |
| 01.38 | .12.102.015.1 | Gas connection G1/8"LH StIM5Ms | | 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-A 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 |

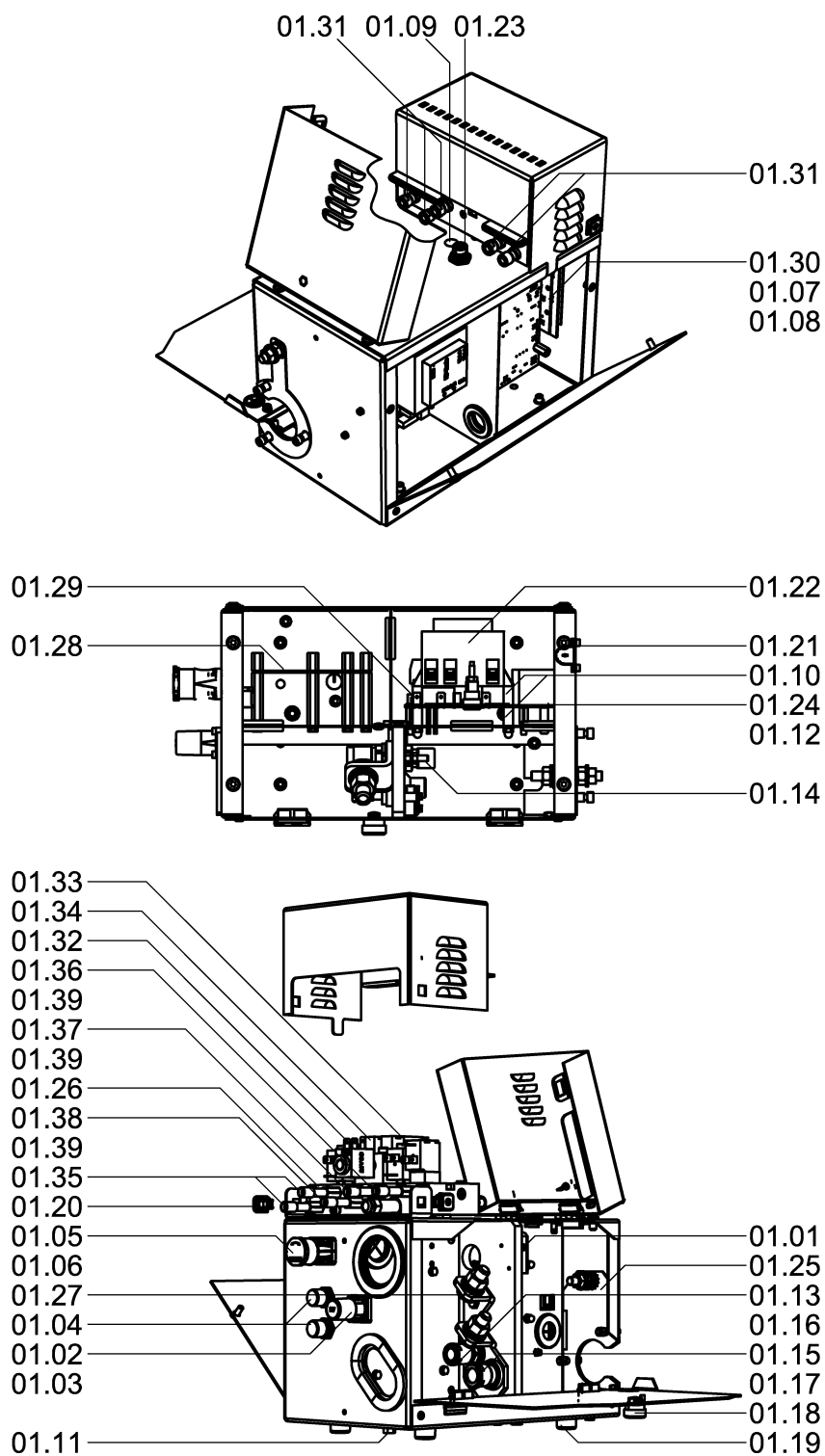


Fig. 49: Overview Q-Port 4500, part 1

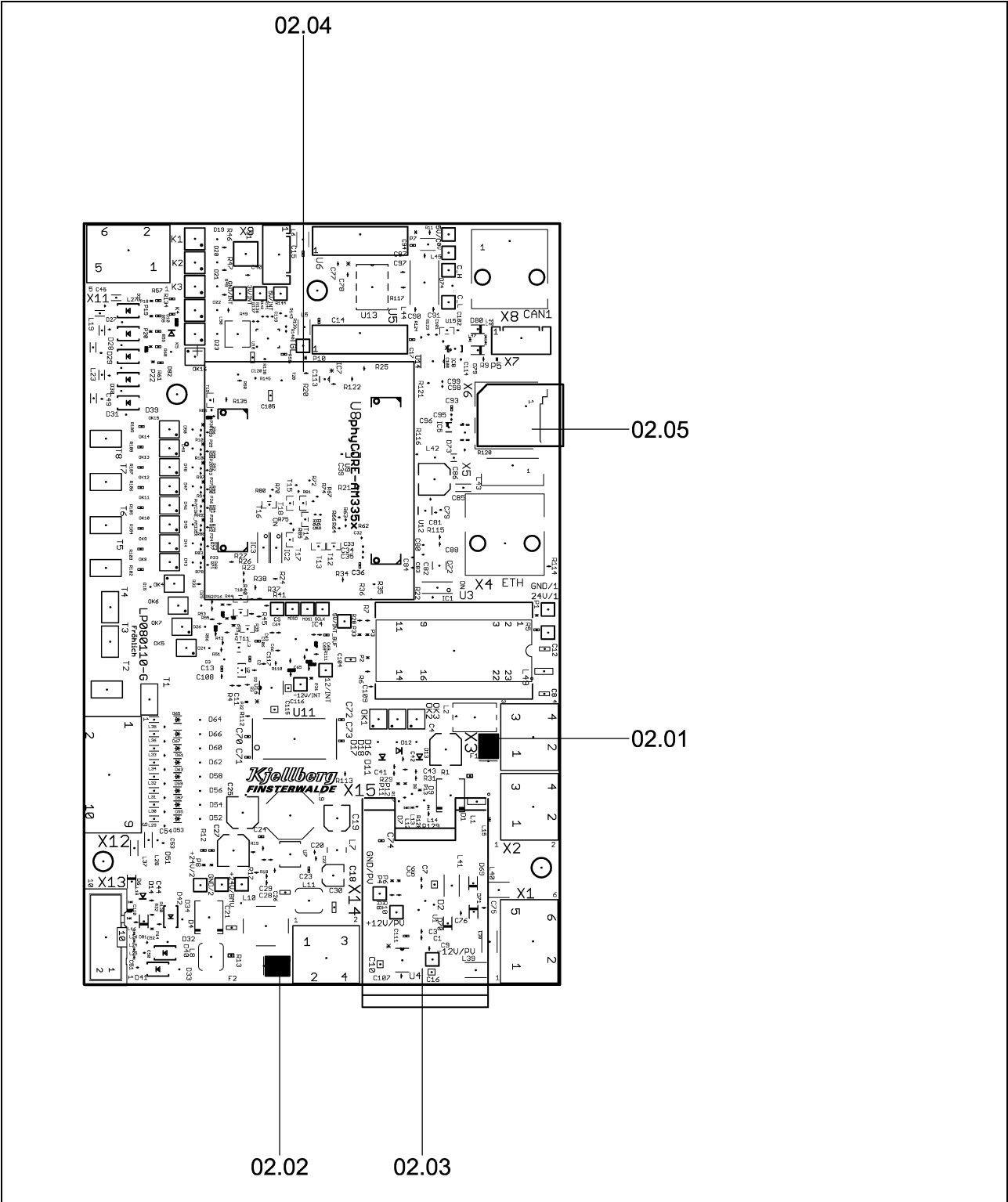


Fig. 50: Overview Q-Port 4500, part 2

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 |

List of Abbreviations

| 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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