

Operating instructions

AD 2060M P/PFC/MV

TIG/TIG AC/DC welding inverter



Issue 04/2025

COMPRESSED AIR TECHNOLOGY | WELDING TECHNOLOGY | METALWORKING | STONE CUTTING TECHNOLOGY | WORKSHOP TECHNOLOGY | POWER GENERATORS



Read and observe the operating instructions before use!

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1 Introduction

This chapter explains the safety regulations that must be observed when using this welding machine. It defines the responsibilities of the operator and the safety instructions that draw attention to the various hazard levels in the individual chapters.

WARNING



Improper use of the welding machine can lead to death or serious injury!

The "Safety" chapter must be read and understood by all persons carrying out operating, maintenance or repair work.

Inform dealer immediately in the event of transport damage

1.1 General provisions

The person responsible for the device must ensure that

- safety instructions and instructions for use are available and adhered to,
- The usage information and technical data in accordance with the order must be observed,
- protective devices are used,
- prescribed maintenance work is carried out and
- maintenance personnel are notified immediately or the electrical component is shut down immediately if abnormal voltages or noises, higher temperatures, vibrations, etc. occur in order to determine the causes.

The documentation contains the information required by qualified personnel when using the welding device in industrial plants. These instructions for use do not contain any information or instructions for unqualified persons who use this device outside of industrial operations.



We can only maintain a warranty if the documentation is observed and complied with.

1.2 Intended use Use

The device may only be used for the intended purpose listed in the "Product description" chapter. The specifications in the "Technical data" section of this documentation apply as binding application limits and characteristics. We will provide a remedy. Should an unexpected problem arise when using one of our appliance models, please contact our customer service team:

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Conversion to other types of processing is the sole responsibility of the operator. We accept no liability for any resulting damage. The user alone bears the risk.

1.3 Disregard of the safety regulations

We do not accept any liability for damage caused by disregarding the instructions and notes in this documentation.

This applies in particular to damage

- due to improper use or incorrect operation;
- by disregarding safety-relevant information in the operating instructions;
- due to defective or non-executed maintenance and repair work;
- due to incorrect choice of material for the workpieces or tools.

1.4 Basic Safety instructions

- Only authorised persons may work with the welding machine.
- The welding machine may only be operated when in perfect condition and in accordance with the instructions for use.
- If the mains cable is damaged during work, **unplug** the appliance immediately.
- Never use the appliance with a damaged cable.
- The appliance may only be connected to a properly earthed mains supply.
- Any working method that jeopardises the safety of persons or impairs the safety of the control system must be avoided.
- All maintenance and repair work must only be carried out when the appliance **is de-energised**.
- Repairs to the appliance may only be carried out by authorised and trained personnel. Always use original spare parts from **ELMAG** Entwicklungs und Handels GmbH. This ensures that the safety of the appliance is maintained.
- If in doubt, always contact the manufacturer.
- Do not expose the appliance to rain, do not hose it down and do not steam clean it. The appliance must not be damp and must also not be operated in humid ambient air.
- Ensure adequate extraction or ventilation of the room.
- Wear oil-free protective clothing, leather gloves and a leather apron.

1.5 Local laws, regulations and provisions

The generally applicable national and local safety and accident prevention laws and regulations for the operator can be requested from the national and local institutions and authorities.

1.6 Scope of application

The information, instructions and safety-related notes contained in this documentation apply exclusively to this welding machine.

1.7 Structure and meaning of Notes

Important instructions relating to technical safety and operational safety are emphasised in the technical documentation as follows:

DANGER



Indicates a dangerous situation that will result in death or serious injury.

WARNING



Indicates a dangerous situation that could lead to death or serious injury.

CAUTION



Indicates a potentially dangerous situation that could lead to minor or moderate bodily injury.

NOTE



Indicates a situation that can lead to material damage.


















Instructions for use and other useful information

1.8 Graphic Note symbols

These symbols can be found in various places in the operating manual, in the user information and on the components. These warning signs must be observed! The warnings themselves do not eliminate risks and cannot replace correct measures to prevent accidents.

The symbols (pictograms), warning and information signs (in accordance with ISO 1710) have the following meanings:

			
Hazard warning	Warning of explosive hazardous substances	Warning about gas cylinders	Warning of rotating rollers
			
Warning of hot surface	Warning of dangerous electrical voltage	Fire hazard	
Command sign			
			
Use protective clothing	Use foot protection	Use hand protection	Using a welding mask
			
Use eye protection	Secure gas cylinders	Use protective apron	Hint

1.9 DGUV V3 inspection (formerly BGV A3)

NOTE



The operator of commercially used welding systems is obliged to carry out regular safety inspections of the systems in accordance with DIN VDE 0701 and 0702. **ELMAG** recommends an inspection interval of 12 months.

A safety check must also be carried out after the system has been modified or repaired.

1.10 Electromagnetic compatibility (EMC)

This product complies with the currently applicable EMC standards.

Please note the following:

- The device is intended for welding under commercial and industrial operating conditions (CISPR 11 class A). When used in other environments (e.g. residential areas), other electrical devices may be disturbed.
- Electromagnetic problems during commissioning can occur in the following areas
 - Mains supply lines, control lines, signalling and telecommunication lines in the vicinity of the welding or cutting equipment
 - Television and radio transmitters and receivers

- Computers and other control devices
- Protective devices in commercial facilities (e.g. alarm systems)
- Pacemakers and hearing aids
- Equipment for calibration or measurement
- Devices with insufficient interference immunity

If other equipment in the vicinity is disturbed, additional shielding may be necessary.

- The surroundings to be taken into account can extend beyond the property boundary. This depends on the type of construction of the building and other activities taking place there.
- Operate the appliance in accordance with the manufacturer's specifications and instructions. The operator of the device is responsible for the installation and operation of the device. If electromagnetic interference occurs, the operator is responsible for eliminating it (possibly with technical assistance from the manufacturer).

2 Technical Data

Parameters	MODEL AD 2060M P/PFC/MV			
	~110V ±10 %, 50/60 Hz		~230V ±10 %, 50/60 Hz	
Rated input current (A)	36/40 (AC/DC MMA)	31/32 (AC/DC WIG)	28/32 (AC/DC MMA)	19/21 (AC/DC WIG)
Nominal input power (kW)	3.9/4.3 (AC/DC MMA)	3.4/3.5 (AC/DC WIG)	6.4/7.2 (AC/DC MMA)	4.3/4.8 (AC/DC WIG)
Duty cycle (40 °C, 10 minutes)	MMA	TIG	MMA	TIG
	30 % 130 A		35 % 200 A	
	60 % 110 A	60 % 160 A	60 % 140 A	60 % 200 A
	100 % 80 A	100 % 125 A	100 % 110 A	100 % 155 A
Adjustment range welding current (A)	5~ 130	5~ 160	5~ 200	
Power factor	0,99			
Open circuit voltage (V)	67			
Setting range Current reduction time (sec.)	0 - 10			
Gas pre-flow time (sec.)	0,1 - 2			
Setting range Gas post-flow time (sec.)	0 - 10			
Pulse frequency (Hz)	0,3 - 999			
Pulse width range (%)	5 - 95			
AC frequency (Hz)	50 - 250			
AC-Balance/Reini effect (%)	-5 / +5			
Spot welding time/Spt (S)	0,01 - 20			
Efficiency (%)	≥85 %			
Power consumption in idle mode (W)	43,9		42,6	
Protection class	IP23			
Insulation class	H			
Cooling	AF			
Dimensions / device (L×W×H) (mm)	610 x 190 x 375			
Net weight (kg)	18,90			
	Subject to change without notice			

2.1 Short introduction

The latest pulse width modulation technology (PWM) and bipolar transistors with insulated gate electrodes (IGBT) are used in these TIG/TIG welding units. Switching frequencies in the range of 20 kHz to 50 kHz are used to replace the mains transformer welders. The devices are therefore characterised by their ease of use, compact dimensions, low weight, low energy consumption and noise level, etc.

The parameters of the device can be continuously and continuously adjusted on the control panel, e.g. gas pre-flow time, starting current, current increase time (up-slope), welding current, base current, current decrease time (down-slope), decenter current, gas post-flow time, pulse frequency, pulse width range, AC frequency, AC balance, hot start, arc force and spot welding time. During welding, a high frequency and a high voltage are required to ignite the arc in order to ensure the reliability of the ignition.

2.2 Features

- PFC technology (Power Factor Correction): Very energy-efficient and environmentally friendly, as the power factor is over 0.99. Ensures a stable welding process even with fluctuating input voltage, operation with power generators or long supply cables and can be used for more flexible input voltages, works with 110 V or 220 V.
- TIG HF ignition for non-contact high-frequency ignition or LIFT TIG ignition for contact ignition without HF e.g. when used in the vicinity of sensitive electronic devices or controls.
- MMA/E-hand: adjustable arc force and hot start and automatic anti-stick function for better control and user-friendliness during E-hand welding.
- Pulse function for processing on ultra-thin surfaces without deformation.
- 2-stroke / RP(Repeat)=secondary value / 4-stroke control
- Digital display for precise setting and monitoring of the Welding parameters
- Equipped with temperature, voltage and current sensors for high protection
- Generator-compatible - generator output depends on the welding process
- TIG hosepack with UP/DOWN welding current control on the handle (max. +/- 20A), infinitely variable welding current control via potentiometer switching module (optional)
- Water cooling unit and transport trolley (optional).
- Hand/foot remote control wireless or wired (optional).



2.3 Connection Power supply

NOTE



These welding machines are designed for operation with a power supply of 110 V / 230 V AC.

If the supply voltage is above or below the safe operating voltage, the overvoltage or undervoltage protection integrated in the welding device is activated, the alarm light lights up and the power supply is interrupted at the same time.

If the supply voltage constantly exceeds the safe operating voltage range, this will shorten the service life of the welding device.

2.4 Product description



- **MCU control system, reacts immediately to changes.**
- **High frequency for arc ignition to ensure the reliability of the ignition.**
- **Prevents AC arc interruption by special means; even during arc interruptions, the HF function keeps the arc stable.**
- **Intelligent protection: In the event of overvoltage, overcurrent or overheating, the alarm light on the control panel lights up and the output current is interrupted. This serves to self-protect the appliance and extends its service life.**
- **Versatile applications: AC welding TIG/MMA and DC welding TIG/MMA, excellent for aluminium alloys, carbon steel, stainless steel, titanium,...**

Depending on the selection on the control panel, the following eight welding processes can be used:

DC TIG	AC TIG square wave	AC TIG sine wave
DC TIG pulse	AC TIG pulse square wave	AC TIG pulse sine wave
DC-MMA	AC-MMA	

1. For DC TIG and AC TIG, DCEN is used (welding torch connected to the negative pole, workpiece connected to the positive pole). This connection arrangement is characterised by a stable arc, low tungsten electrode loss, a higher welding current and a narrow and deep weld seam.
2. The AC TIG square wave ensures a higher welding speed, deeper penetration in thicker materials, higher heat input and a better cleaning effect than the sine wave. The AC TIG sine wave ensures less noise and smoother arc dynamics.
3. The DC TIG pulse welding process is characterised by the following features:
 - Pulsating heat input. Metal in the molten bath is briefly brought to a high temperature and solidifies quickly, which can reduce the possibility of hot cracks forming in thermally sensitive materials.
 - Moderate heating of the workpiece. Concentrated arc energy. Suitable for welding thin and ultra-thin sheet metal.
 - Precise control of heat input and melt pool size. Uniform penetration depth. Suitable for single-sided welding, double-sided moulding and pipe welding in all positions.
 - High-frequency pulsed arc ensures better metal microstructure, eliminates voids and improves the mechanical properties of the seam and is suitable for high welding speeds to increase productivity.
4. With the DC-MMA method, the polarity of the connection can be selected depending on the different electrodes.
5. With the AC-MMA method, the magnetic flux caused by the constant DC polarity can be prevented.



These TIG/TIG welding machines are suitable for welding various sheets of aluminium, carbon steel, alloy steel, stainless steel/chrome steel, titanium, copper, bronze, etc. in all positions. These devices are used in production/repair/maintenance/assembly operations as well as in pipeline/pipeline/metal/railing/swimming pool/machine/plant and container construction, mould repair/maintenance, all types of vehicles, as well as in the petrochemical industry, in trade and for general production work.

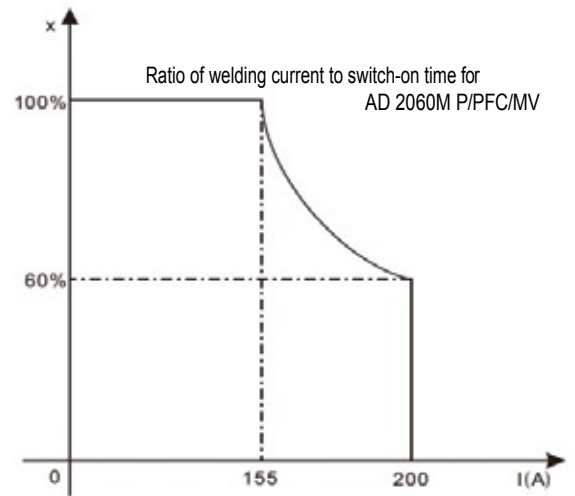
- MMA** Manual Metal Arc Welding= Manual arc welding;
- PWM** Pulse width modulation;
- IGBT** Bipolar transistors with insulated gate electrode;
- TIG/TIG** Tungsten inert gas welding/tungsten inert gas welding.

2.5 Duty cycle and Overheating

The letter " X " stands for the duty cycle, i.e. the proportion of time during which a welding machine can weld continuously at its rated output current within a specific time cycle (10 minutes).

The relationship between the duty cycle " X " and the output welding current " I " is shown in the figure on the right.

If the welding machine overheats, the IGBT overheating protection sends a signal to the control unit of the welding machine to switch off the output welding current and light up the overheating indicator light on the control panel.



NOTE



In this case, do not weld with the appliance for 10-15 minutes so that it can cool down with the help of the running fan. When the appliance is restarted, the welding output current or the duty cycle must be reduced.

3 Setup & Operation

3.1 Mains connection

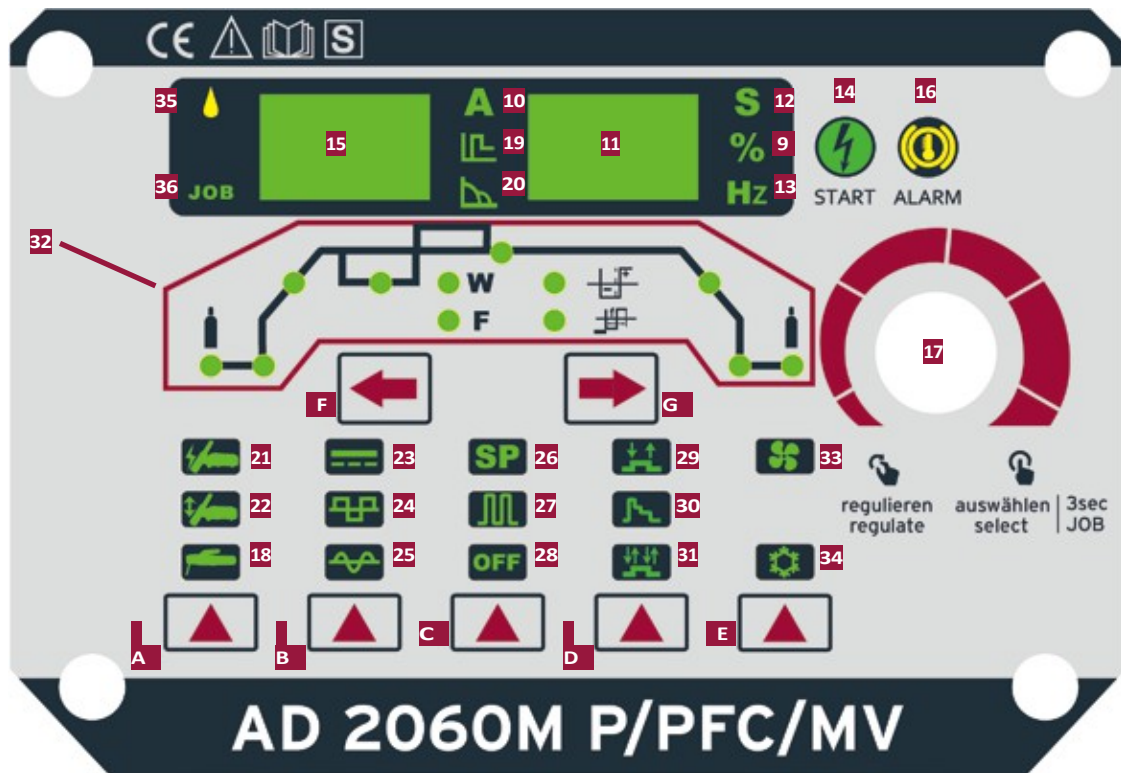
The appliances must be installed by qualified personnel. All connections must be made in accordance with the applicable regulations and in strict compliance with the accident prevention regulations of the country in which the appliance is operated.

3.2 Structure of the front and rear

1. "-" Output connection
2. Connection TIG hosepack control cable connector or remote control cable, e.g. for optional remote foot control
3. Gas connection for TIG torch
4. "+" Output connection
5. Mains cable
6. On/off switch
7. Gas inlet connection
8. Connection socket for the connection cable to the optionally available external water cooling unit



3.3 Control panel



9	Digital display with value display in per cent	24	AC TIG square waves or AC MMA mode *
10	Digital current display in amperes	25	AC TIG sine wave mode *
11	Right-hand digital multifunction display *	26	SP(Spot)= TIG spot welding *
12	Digital time display in seconds	27	DC or AC TIG pulse welding ON *
13	Digital frequency display in Hertz	28	DC or AC TIG pulse welding OFF *
14	Power indicator: Lights up when power is connected and the device is switched on	29	2T= TIG 2 cycle control *
15	Left-hand digital multifunction display *	30	RP(Repeat)= TIG second value control *
16	Alarm display *	31	4T= TIG 4-stroke control *
17	Rotary knob for parameter setting *	32	TIG parameter setting - see chapter 3.4
18	MMA/E-hand welding mode *	33	Water cooling OFF *
19	Settings display MMA Hot-Start *	34	Water cooling ON *
20	Settings display MMA Arc-Force *	35	Low water error display
21	TIG-HF ignition mode *	36	JOB / programme storage *
22	LIFT TIG ignition mode *		
23	DC-TIG or DC-MMA mode *	*	For detailed explanations of control elements, see below

Explanations of other control elements

(11) Right-hand digital multifunction display

Secondary functions and error codes are displayed here before welding. During welding, the Welding voltage is displayed.

(15) Left-hand digital multifunction display

Before welding, the settings selected/adjusted with the rotary knob (17) are displayed here. The welding current is displayed during welding. The displayed parameter setting is indicated by the LEDs on the side of the display: Current (A), Hot Start, Arc Force, Seconds (S), Percent (%), and Frequency (Hz). If no input is made on the control panel for several seconds, the display returns to the main setting for the welding current.

(16) Alarm display

Lights up when overvoltage, overcurrent or electrical overheating (due to excessive duty cycle) is detected and the protective function is activated. As soon as the protection is activated, the welding output is interrupted until the safety system has recognised a sufficient reduction in the overload and the indicator light goes out. This alarm indicator can also light up in the event of an internal circuit fault in the device.

(17) Rotary knob for parameter setting

The selected parameter setting is indicated by the respective LED on the control panel or next to the displays and the corresponding value is shown on the left-hand display (15). Set the parameter by turning the knob. If no input is made on the control panel for several seconds, the display returns to the main setting for the welding current.

This rotary knob is also used to access the JOB programme memory. To access the JOB programme memory function, press and hold the rotary knob for a few seconds (more detailed explanation 37 JOB / programme memory).

MMA parameter settings

(18) MMA/E-hand welding mode

Use the arrow button (A) to select the MMA/E manual welding mode (18). The left multifunction display shows the set welding current in amperes, which can be set using the rotary knob (17). Depending on the electrode type, select DC-MMA (25) or AC-MMA (26) using the arrow button.

(19) MMA Hot-Start setting

The hot-start function provides additional power at the start of welding to simplify arc ignition. To set the hot start, select the MMA/E manual welding mode (18) and press the rotary knob (17) once until the MMA hot start setting indicator (19) lights up. Then set the desired value (%) using the rotary knob (17) (setting range 0-100%).

(20) Setting MMA Arc-Force

This function increases the energy supplied to a shortened MMA arc, which accelerates the melting of the electrode to prevent sticking. This is useful for some electrode types and different electrode diameters, as well as for welding in some constrained positions to better control the arc. To set the arc force, select the MMA/E-hand welding mode (18) and press the rotary knob (17) twice until the MMA arc force setting indicator (20) lights up. Then set the desired value (%) using the rotary knob (17) (setting range 0-100%).

TIG arc ignition modes

In TIG welding, contact between the tungsten electrode and the workpiece leads to contamination of the tungsten and the workpiece, which has a negative effect on the welding quality, especially if the tungsten electrode is energised.

(21) TIG-HF ignition mode

Use the arrow button (A) to select the TIG-HF ignition mode (21). High-frequency ignition sends a high-energy current pulse through the torch system, which 'jumps' between the tungsten electrode and the workpiece, starting an arc between the tungsten electrode and the workpiece without contact. The disadvantage of HF ignition is that the high-energy current pulse causes considerable electrical and radio signal interference, which restricts the use of this ignition in the vicinity of sensitive electronic equipment such as computers and control systems.

(22) LIFT TIG ignition mode

Use the arrow button (A) to select the LIFT TIG ignition mode (22). LIFT TIG is a compromise solution that minimises tungsten contamination while eliminating the electrical interference caused by HF ignition systems. With LIFT TIG ignition, the tungsten electrode briefly touches the workpiece, the trigger of the torch is activated and the tungsten electrode is lifted. The control circuit recognises that the tungsten electrode has been removed from the workpiece and sends a weak current pulse through the tungsten electrode, which then ignites the TIG arc. As the tungsten electrode is not energised while in contact with the workpiece, contamination is reduced to a minimum.

TIG output current DC (direct current) / AC (alternating current)

Use the arrow button (A) to select the desired TIG arc ignition mode (21 or 22) and then select the desired TIG output current using the arrow button (B).

(23) DC TIG mode (direct current welding)

Suitable for TIG welding of carbon steel, alloy steel, stainless steel/chromium steel, titanium, copper and bronze.

(24+25) AC TIG square wave or sine wave mode (AC welding)

Suitable for TIG welding of reactive metals such as aluminium, magnesium and zinc. When reactive metals are exposed to air, they form an oxide layer that insulates the base metal, prevents the flow of the welding current and also contaminates the weld pool. The oxide layer on the aluminium surface, for example, has a higher melting point than the aluminium itself and cannot be broken through by simple melting.

The alternating current process generates a higher thermal energy, which contributes to the destruction of the oxide layer. Due to the alternating current, the polarity of the arc constantly changes between positive and negative. The positive electrode generates a higher thermal energy, which contributes to the destruction of the oxide layer, while the negative electrode melts the aluminium.

In addition, the alternating current process helps to reduce the influence of the filler material on the aluminium and produce a smoother weld seam.

(24) AC TIG square wave mode

Ensures a focussed "hard" arc, maximum penetration, deeper penetration, higher welding speed and better cleaning effect, e.g. for thicker materials.

(25) AC TIG sine wave mode

Ensures 'softer', quieter arc characteristics with less heat input, e.g. for thinner materials.

TIG operating modes SP(Spot)= TIG spot welding / DC or AC TIG pulse welding

(26) SP(Spot)= TIG spot welding

Used for tacking the workpiece and for setting welding points evenly. Select with the arrow button (C) and press the TIG parameter arrow button (F) until the abbreviations SPt appear on the right-hand multifunction display (11). Now set the desired spot welding time with the rotary knob (17) (setting range 0.01-20 sec.)

(27) DC or AC TIG pulse welding ON / (28) DC or AC TIG pulse welding OFF

In TIG pulse welding, the welding power alternates cyclically between a high and a low welding current. When used correctly, this function offers considerable advantages in TIG welding, such as lower heat input, better control over the weld pool, reduction of deformation and distortion, higher welding speed, improved appearance of the weld metal, possibility to weld thin material better.

Select with the arrow button (C) and use the TIG parameter arrow button (F or G) to call up and set the desired parameters.
(for further explanation see chapter 3.4)

The ratio between the base current and the peak current in TIG pulse welding influences the weld seam geometry and the welding speed. The base current is the lower welding current during the pulse, while the peak current is the higher welding current. The ratio between the base and peak current is referred to as the "duty cycle/pulse width" and indicates how long the welding current is maintained at the peak value during the pulse. If the pulse width is increased in the direction of the peak current, a higher welding speed can be achieved as it heats the weld pool faster and enables a deeper penetration. However, it can also lead to a wider weld seam. A lower peak current to base current ratio can result in a narrower weld and better weld quality as it controls the welding heat better. However, it can also lead to a lower welding speed. The optimum ratio of peak current to base current depends on the type of material, the thickness of the material and other welding parameters and should be adjusted accordingly.

A higher pulse frequency causes the arc to be more focussed, which is useful for fine stainless steel work and the like. Pulse welding can also be used to support the movement of the weld pool. This method is practical for welding work in constrained positions or with materials with higher weld pool viscosity. A lower pulse frequency causes greater heat input, while a higher pulse frequency has the opposite effect.

TIG 2T= 2 cycle / RP(Repeat)= second value / 4T= 4 cycle control**(29) 2T= 2-stroke control**

The button on the welding torch is pulled and held to activate the welding circuit; when the button is released, the welding circuit is interrupted.

(30) RP(Repeat)= Second value control or special 4 cycle

Each time the button on the welding torch is pressed, the system switches between peak (4) and base current setting (5) (see TIG parameter setting 3.4). Here is the sequence:

1. the button on the welding torch is pressed and held (gas pre-flow time and starting current are activated)
2. Release the button (the device switches to the current rise time (if set) up to the set peak current)
3. Briefly pressing and releasing the button switches to the set base current, briefly pressing and releasing the button again switches to the set base current. Pressing and releasing the button switches back to peak current, etc.
4. If you want to end the welding process, press and hold the button for longer to switch to current reduction and return to the welding mode. the final crater flow and the gas post-flow time.

(31) 4T= 4-stroke control

This operating mode is very common for TIG welding and is very useful for longer weld seams, as the button on the welding head can be used for longer welding seams.

torch does not have to be held down constantly. This ensures more relaxed welding and smoother hand guidance.

Here is the order:

1. The button is pressed and held once (gas pre-flow time and start current are activated)
2. Release the button (the device switches to the current rise time (if set) up to the set peak current)
3. If you want to end the welding process, press and hold the button for longer to switch to current reduction and return to the welding mode. the final crater flow and the gas post-flow time.

Water cooling OFF / ON**(34) Water cooling= OFF (for TIG welding with gas-cooled hosepack)**

Select using the arrow button (E). If the device is operated without optional water cooling, you should ensure that the Water cooling is switched off Use an air-cooled welding torch with a suitable load capacity for welding.

(35) Water cooling= ON (for TIG welding with water-cooled hosepack)

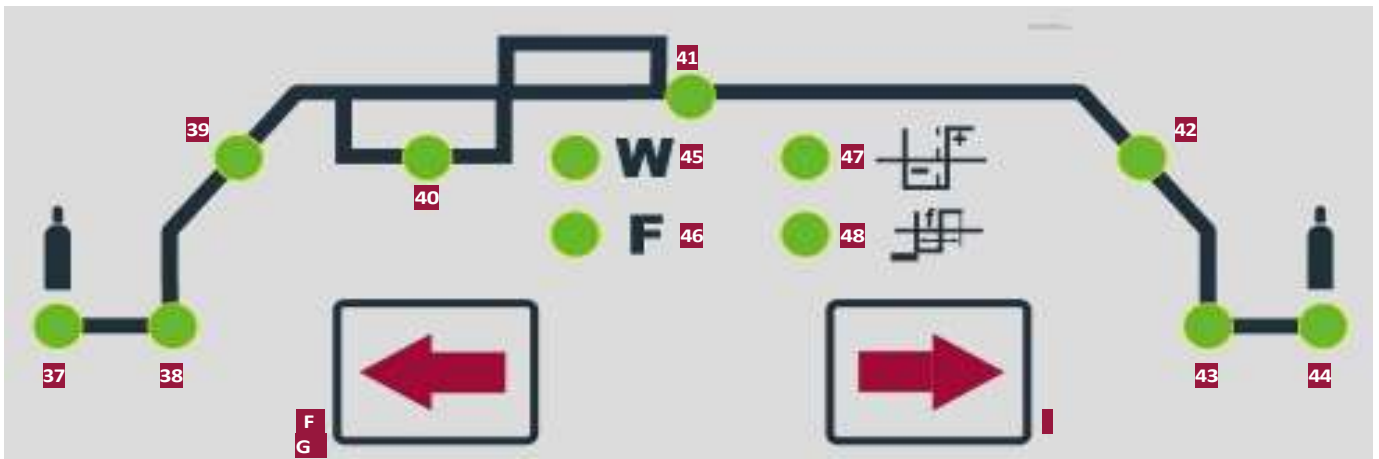
Select using the arrow button (E). If the device is operated with optional water cooling, make sure that the water cooling is switched on. Use a water-cooled welding torch with a suitable load capacity for welding.

(36) JOB / Programme storage

This welding machine has 9 memory / job locations to save and recall individual parameters. For example, if you often need these parameters for series work or simply want to save your personal favourite settings. To save (-S-) or load (-L-) the JOB, press and hold the rotary knob (17) for approx. 3 seconds until JOB appears on the display. After releasing the rotary knob, "- S-" for save or load appears on the right-hand multifunction display.

"-L-" for loading. Turn the rotary knob (17) to select whether you want to save or load a JOB. Briefly press the rotary knob (17) again and select the programme number 1-9 depending on where you want to save the JOB or which JOB you want to call up.

3.4 TIG- Parameter setting



(37) Gas pre-flow time setting display

The gas pre-flow time controls the period of time in which the shielding gas flows out as soon as the torch trigger is pressed and before the arc is ignited. This eliminates atmospheric gases in the working area that could contaminate the welding area before welding begins. Setting range (0.1 - 2.0 S) seconds.

(38) Start current setting display

Available in the 4T= 4 cycle control (31); start current setting option from 5 - 200 A, which is activated as soon as the torch trigger is pressed and held, before the current rise time (39 if set) up to the main welding current/peak current (41) is started by releasing the torch trigger.

(39) Setting display current rise time

In the 2T= 2 cycle control unit (29): If the torch trigger is pressed and held, the welding current increases gradually over the selected current rise time (39) up to the set main welding current (41).

In the RP(Repeat)= second value control (30) and 4T= 4 cycle control (31): When the torch trigger is pressed and released, the welding current increases gradually over the selected current rise time (39) up to the set main welding current/peak current (41). Setting range (0 - 10 S) seconds.

(40) Basic current setting display

Only active if DC or AC TIG pulse welding (27) has been selected: For setting the low basic pulse welding current. If RP(Repeat)= Second value control has been activated: For setting the basic welding current (second value). Setting range (5 - 200 A) Amperes.

(41) Main welding current/peak current setting display

For setting the main welding current or peak welding current. Setting range (5 - 200 A) amperes.

(42) Setting display power reduction time

In the 2T= 2 cycle control unit (29): When the torch trigger is released after being held down, the welding current is gradually reduced over the selected current reduction time (42 if set) towards 0 amps, followed by the gas post-flow time (44 if set).

In the RP(Repeat)= second value control (30) and 4T= 4 cycle control (31): If the torch trigger is pressed and released and then pressed again and held for a longer period of time, the welding current is gradually reduced over the selected current reduction time (42 if set) towards the final crater current (43). This enables the welder to complete the weld seam in a controlled manner without a 'crater' at the end of the weld pool. Setting range (0 - 10 S) seconds.

(43) End crater flow setting display

Only available with RP(Repeat)= two-step control (30) or 4T= 4-step control (31): If the torch trigger is pressed and released and then pressed again and held for a longer period of time, the welding current is gradually reduced over the selected current reduction time (42 if set) towards the final crater current (43). This enables the welder to complete the weld seam in a controlled manner without a 'crater' at the end of the weld pool. Setting range (5 - 200 A) Amperes. If the weld is to be completed after the end crater process, simply release the torch trigger and the gas post-flow time (44 if set) is then initiated.

(44) Gas post-flow time setting display

Controls the period of time during which the shielding gas continues to flow out after the arc is interrupted. This protects the welding point and the tungsten electrode from contamination while their temperature is still high enough to react with atmospheric gases after welding is complete. Setting range (0 - 10 S) seconds.

(45) Pulse width setting display

Only available if DC or AC TIG pulse welding (27) has been selected. Sets the time ratio in per cent between the peak current and the base current when using pulse mode. The neutral position is 50 %, the time span of the peak current and the base current pulse are identical. A higher pulse width causes a greater heat input, while a shorter pulse width has the opposite effect. The ratio between base current and peak current in TIG pulse welding influences the weld seam geometry and the welding speed. The base current is the lower welding current during the pulse, while the peak current is the higher welding current. The ratio between the base and peak current is referred to as the "duty cycle/pulse width" and indicates how long the welding current is maintained at the peak value during the pulse.

If the pulse width is increased in the direction of the peak current, a higher welding speed can be achieved as it heats the weld pool faster and enables a deeper penetration. However, it can also lead to a wider weld seam.

A lower ratio of peak current to base current can lead to a narrower weld seam and better weld quality, as it controls the welding heat better. However, it can also lead to a lower welding speed.

Setting range (5 - 95 %) per cent.

(46) Pulse frequency setting display

Only available if DC or AC TIG pulse welding (27) has been selected. For setting the frequency at which the welding output current switches between the peak and base current setting. A higher pulse frequency causes the arc to be more focussed, which is useful for fine stainless steel work and the like. Pulse welding can also be used to assist the movement of the weld pool. This method is useful for welding in constrained positions or for materials with higher weld pool viscosity. A lower pulse frequency causes greater heat input, while a higher pulse frequency has the opposite effect. Setting range (0.3 - 999 Hz) Hertz.

(47) AC balance/cleaning effect setting display

Only available in AC TIG square wave or AC TIG sine wave mode. For setting the balance/cleaning effect in per cent between forward and reverse current cycles during welding in AC output mode. The reverse current portion of the AC cycle has a cleaning effect on the welding material, while the forward cycle melts the welding material. The neutral setting is 0. Increased backward cyclicity causes a greater cleaning effect, less penetration and more heat in the tungsten electrode, which has the disadvantage that the output current that can be used for a given tungsten electrode size is reduced to avoid overheating the tungsten. An increased forward cyclicity has the opposite effect: less cleaning effect, deeper penetration and less heat in the tungsten electrode.

Setting range (- 5 / +5).

(48) AC frequency setting display

Only available in AC TIG square wave or AC TIG sine wave mode. An increased AC frequency focuses the shape of the arc into a narrower, more controlled arc with deeper penetration and a smaller area affected by the heat at the same current setting. A lower frequency results in a wider and softer arc shape.

Setting range (50 - 250 Hz) Hertz.

3.5 Setup & operation for MMA/E-hand welding

3.5.1 Connection configuration for MMA/E manual welding

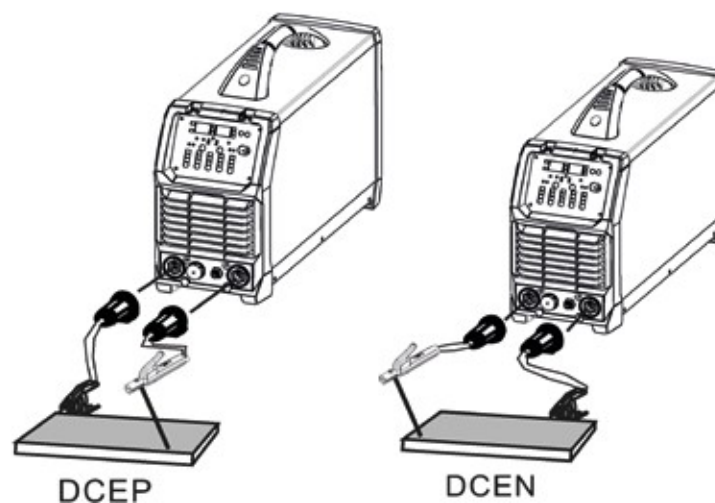
Connecting the output cables: There are two connection sockets on this welding machine. For manual MMA/E welding, connect the electrode holder to the positive terminal and connect the earth cable (workpiece) to the negative terminal. This configuration is referred to as DCEP. However, various electrodes require a different polarity in order to achieve optimum results. Ensure correct polarity. The correct polarity can be found in the electrode manufacturer's instructions.

DCEP: Electrode connected to output socket "+".

DCEN: Electrode connected to output socket "-".

DC-MMA mode: Depending on the electrode type, select the DCEN or DCEP configuration. Please follow the electrode instructions.

AC-MMA mode: No polarity requirements.



1. Set the ON/OFF switch (on the back of the appliance) to OFF.
2. Connect the earth cable to "-" and tighten to the right.
3. Attach the earth clamp to the workpiece. The contact with the workpiece must be stable. Attach the earth clamp to clean, bare metal without corrosion, paint or scale (at the contact point).
4. Connect the electrode cable to "+" and tighten to the right.
5. Use a multimeter to check whether the input voltage is within the fluctuation range and whether it is grounded.
6. Each appliance is equipped with a mains cable and power plug that correspond to the input voltage to prevent the use of an unsuitable voltage. Connect the power plug to the appropriate mains supply.
7. Ensure good contact with the corresponding power supply and avoid oxidation.

3.5.2 MMA/E manual welding operation

1. After correct set-up according to the above method, set the on/off switch to the "ON" position; the operating light will illuminate, the fan will switch on and the appliance will operate correctly.
2. Set to "MMA/E-hand welding mode" (18).
3. Use the parameter rotary knob to set the required welding parameters (according to the instructions in the previous section).
4. Insert the electrode into the electrode holder and clamp it in place.

5. Sweep the electrode across the workpiece to create an arc and then hold the electrode steady to maintain the arc.
6. Start welding. If necessary, correct the welding current by adjusting the rotary knob.
7. After welding is complete, leave the power source switched on for 5 to 10 minutes. This allows the fan to run and cool the internal components.
8. Set the ON/OFF switch (on the back of the appliance) to OFF to switch off the appliance.

NOTE

- Observe the polarity of the connections: MMA DC welding cable connections possible in two configurations. Observe the technical requirements of the welding electrode manufacturer with regard to the connection configuration. An incorrect selection leads to an unstable arc, spatter formation, strong sticking and other effects that have a direct negative impact on the weld seam quality.
- If there is a longer distance between the workpiece and the welding device (electrode holder and earth cable), select a correspondingly larger cable cross-section to reduce the voltage drop.

3.5.3 Troubleshooting manual electric welding

The table below addresses some common problems with manual metal arc welding. In the event of equipment malfunctions, the manufacturer's recommendations must be strictly followed and adhered to.

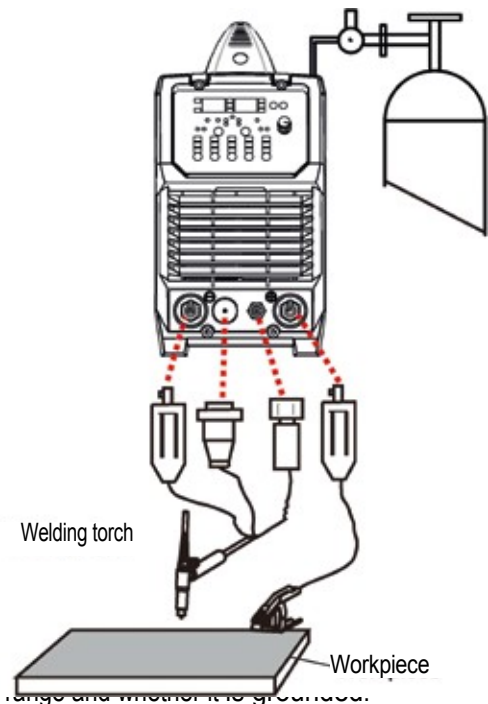
No.	Problem	Possible cause	Recommended remedial measures
1	No arc	Incomplete welding circuit	Check whether the earth cable is connected. Check all cable connections.
		No power supply	Check that the appliance is switched on and connected to the mains
		Wrong mode selected	Check whether MMA selection switch is selected
2	Porosity - small cavities or holes caused by gas inclusions in the welding material	Arc too long	Keep arc shorter
		Workpiece dirty, contaminated or damp	Remove moisture and substances such as paint, grease, oil and dirt, including mill scale, from the base metal
		Moist electrodes	Only use dry electrodes
3	Excessive splash formation	Current too high	Reduce current or select larger electrode
		Arc too long	Keep arc shorter
4	Weld seam is on top, binding defect	Insufficient heat supply	Increase the current and select a larger electrode if necessary
		Workpiece dirty, contaminated or damp	Remove moisture and substances such as paint, grease, oil and dirt, including mill scale, from the base metal
		Inadequate welding technology	Use the correct welding technique or obtain support for the correct technique
5	Lack of penetration	Insufficient heat supply	Increase the current and select a larger electrode if necessary
		Inadequate welding technology	Use the correct welding technique or obtain support for the correct technique
		Poor preparation of the connection	Check the joint design and fit; ensure that the material is not too thick. Obtain support for professional connection design and fit
6	Excessive penetration - burn-through	Excessive heat supply	Reduce the current and select a smaller electrode if necessary
		Incorrect welding speed	Try to increase the welding speed

7	Uneven weld seam pattern	Unsteady hand, trembling hand	Work with two hands if possible for stabilisation, refine technique
8	Distortion - deformation of the base metal during welding	Excessive heat supply	Reduce the current and select a smaller electrode if necessary
		Inadequate welding technology	Use the correct welding technique or obtain support for the correct technique
		Poor preparation of the connection and/or connection design	Check the joint design and accuracy of fit, ensure that the material is not too thick. Obtain support for professional connection design and fit
9	Electrode welds with different or unusual arc characteristics	Incorrect polarity	Change polarity, ask electrode manufacturer for correct polarity

3.6 Setup & operation for TIG/TIG welding

3.6.1 Connection configuration for TIG welding without water cooling

1. Set the ON/OFF switch (on the back of the appliance) to OFF.
2. Connect the earth cable to "+" and tighten to the right.
3. Attach the earth clamp to the workpiece. The contact with the workpiece must be stable. Attach the earth clamp to clean, bare metal without corrosion, paint or scale (at the contact point).
4. Connect the TIG hosepack to "-" and tighten to the right.
5. Connect the gas connection of the TIG torch to the TIG gas outlet and the control line plug for the TIG torch remote control to the socket for the remote control; ensure that all connections are firmly seated.
6. Fit the gas regulator to the gas cylinder and connect the gas hose to the gas regulator.
7. Connect the gas hose to the gas inlet connection on the back of the appliance using the quick-release connector. **Check for leaks!**
8. Open the gas cylinder valve and adjust the gas regulator; the Depending on the application, the flow rate should be between 5-12 l/min. the gas flow. Check the flow pressure of the regulator again with the burner valve the gas flows.
9. Use a multimeter to check whether the input voltage is within the fluctuation range and whether it is grounded.
10. Each appliance is equipped with a mains cable and power plug that correspond to the input voltage to prevent the use of an unsuitable voltage. Connect the power plug to the appropriate mains supply.
11. Ensure good contact with the corresponding power supply and avoid oxidation.



NOTE

Secure the gas cylinder in an upright position by chaining it to a fixed support or a suitable transport trolley to prevent it from falling or tipping over.

3.6.2 Connection configuration for TIG welding with optional water cooling

Follow the same steps as in the previous point "Connection configuration for TIG welding without water cooling", but carry out the following beforehand:

1. Assemble the transport trolley.
2. Mount the water cooling unit on the transport trolley.
3. Mount the welding unit on the water cooling system.
4. Connect the water cooling unit & the welding unit together using the enclosed control cable. (Connections can be found on the back of the devices)
5. Fill the water tank of the water cooling system with original coolant up to the maximum fill level indicator.
6. Connect the coolant hoses of the water-cooled hosepack to the water cooling system, red plug-in nozzle with red coupling (= water return) and blue plug-in nozzle with blue coupling (= water flow).
7. Carry out the same steps as in the previous point "Connection configuration for TIG welding without water cooling".
8. In addition, ensure that on the front panel of the welding machine Water cooling= ON (35) has been activated.



3.6.3 TIG welding operation

1. The tungsten electrode must be sharpened to achieve optimum welding results. The tungsten electrode must be sharpened in the direction of rotation of the grinding disc.
2. Insert the tungsten electrode so that it protrudes approx. 3 to 7 mm from the gas nozzle; ensure the correct clamping sleeve and clamping sleeve housing size.
3. Tighten the burner cap.
4. After correct set-up according to the above method, set the on/off switch to the "ON" position; the operation LED lights up, the fan switches on and the appliance works properly.
5. Select the desired ignition mode "TIG-HF ignition" (21) or "LIFT-TIG ignition" (22).
6. Use the parameter rotary knob to set the required welding parameters (according to the instructions in the previous section).
7. Start welding. If necessary, adjust the rotary knob or, if available, the UP/DOWN welding current control on the torch handle to correct the welding current.
8. After welding is complete, leave the power source switched on for 5 to 10 minutes. This allows the fan to run and cool the internal components.
9. Set the ON/OFF switch (on the back of the appliance) to OFF to switch off the appliance.

3.6.4 Troubleshooting TIG welding

The table below addresses some common problems with TIG welding. In the event of equipment malfunctions, the manufacturer's recommendations must be strictly followed and adhered to.

No.	Problem	Possible cause	Recommended measures
1	Tungsten burns off quickly	Wrong gas or no gas	Use pure argon, check that the gas cylinder contains gas, that the pressure regulator, the gas hose and the burner are properly connected and that the cylinder valve is open.
		Insufficient gas flow	Check whether the gas is connected; check the hoses, gas valve and Check burner for continuity.
		Burner cap not professional mounted	Make sure that the burner cap is mounted so that the O-ring is in the burner housing
		Burner connected to DC+	Connect the burner to the DC- output terminal
		Wrong tungsten electrode used	Check tungsten electrode type and replace if necessary
		Tungsten electrode oxidised after completion of the welding work	Shielding gas after interruption of the arc 10-15 seconds continue to flow. 1 second per 10 amps of welding current.
		Tungsten electrode melts back into the nozzle during AC welding	Check whether the correct type of tungsten electrode is being used. Check that the balance control is not set too high - Reduce setting value
2	Contaminated tungsten	Tungsten electrode touches weld pool	Prevent contact between the tungsten electrode and the weld pool. Raise the torch so that the tungsten electrode is 2-5 mm away from the workpiece
		Welding rod touches tungsten electrode	Avoid contact of the welding rod with the tungsten electrode during welding; insert the welding rod into the front edge zone of the weld pool in front of the tungsten electrode
		Tungsten melts in a weld pool	Check whether the correct type of tungsten electrode is being used. Current too high for tungsten electrode size; reduce current or use larger tungsten electrode
3	Porosity - appearance and colour of the weld seam insufficient	Incorrect gas / poor gas flow / gas leak	Use pure argon. Check that gas is connected; check hoses, gas valve and burner for continuity. Set gas flow to 5-12 l/min. Check hoses and fittings for holes, leaks, etc.
		Contaminated base metal	Remove moisture and substances such as paint, grease, oil and dirt from the base metal
		Contaminated welding rod	Clean welding rod completely of grease, oil or moisture
		Incorrect welding rod	Check welding rod and replace if necessary
4	Yellowish residues / smoke formation on ceramic nozzle / discoloured tungsten electrode	Wrong gas	Use pure argon gas
		Insufficient gas flow	Set the gas flow to 5-12 l/min
		Insufficient gas post-flow	Increase gas post-flow time
		Ceramic gas nozzle too small	Use a larger ceramic gas nozzle
5	Unstable arc during welding	Burner connected to DC+	Connect the burner to the DC- output terminal
		Contaminated base metal	Remove substances such as paint, grease, oil and dirt, including mill scale, from the base metal.
		Tungsten is contaminated	Remove 10 mm of the contaminated tungsten electrode and grind the electrode again
		Arc too long	Lower the torch so that the tungsten electrode is 2-5 mm away from the workpiece
6	HF present, but no welding current	Incomplete welding circuit	Check whether the earth cable is connected. Check all cable connections.
		No gas	Check whether gas is connected and cylinder valve is open, check hoses, gas valve and burner for continuity. Set gas flow to 5-12 l/min
		Tungsten melts in a weld pool	Check whether the correct type of tungsten electrode is being used. Current too high for tungsten electrode size; reduce current or use larger tungsten electrode

No.	Problem	Possible cause	Recommended measures
7	Arc travels during welding	Poor gas flow	Check gas flow and set to 5-12 l/min
		Incorrect arc length	Lower the torch so that the tungsten electrode is 2-5 mm away from the workpiece
		Tungsten electrode incorrect or in poor condition	Check whether the correct type of tungsten electrode is being used. Remove 10 mm of the contaminated tungsten electrode and grind the electrode again
		Poorly prepared tungsten electrodes	Grinding grooves must run in the longitudinal direction to the electrode tip, not in the circumferential direction. Use the correct grinding method and grinding disc.
		Base metal or welding rod contaminated	Remove contaminants such as paint, grease, oil and dirt, including mill scale, from the base metal. Clean all grease, oil or moisture from the welding rod
		Incorrect welding rod	Check welding rod and replace if necessary
8	Arc is difficult to ignite or does not weld	Device not set up correctly	Check that the device is set up correctly
		No gas, wrong gas flow	Check whether gas is connected and cylinder valve is open, check hoses, gas valve and burner for continuity. Set the gas flow to 5-12 l/min
		Incorrect tungsten electrode size or type	Check electrode size and/or type and change if necessary
		Tungsten is contaminated	Remove 10 mm of the contaminated tungsten electrode and grind the electrode again
		Loose connection	Check and tighten all connections
		Earthing terminal not connected to workpiece	If possible, connect the earthing clamp directly to the workpiece. connect
		Loss of high frequency	Check the burner and cable for cracks in the insulation or poor connections.

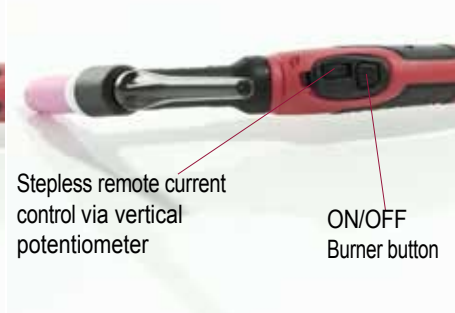
3.6.5 TIG/TIG hosepack Remote current control

With this welding machine, the current can be remotely controlled via UP/DOWN pushbuttons (=standard version) or continuously via a vertical or horizontal potentiometer (=optional) on the TIG/TIG hosepack. The UP/DOWN pushbuttons can be used to increase or decrease the current in 1 A increments or to change the current in one step up to 20 A by holding down the button. This is very useful for precision work. With a potentiometer remote current control, the current is changed from the minimum value of 5A to the maximum value set on the current control of the device (ATTENTION this potentiometer remote current control requires a different control line connector assignment than the UP/DOWN remote control via the push buttons, see circuit diagram below).

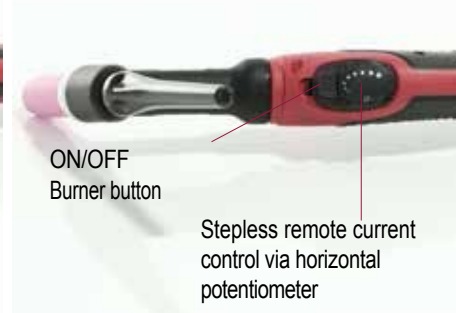
TIG hosepack with UP/DOWN pushbutton / switch module (3DT) (= standard)



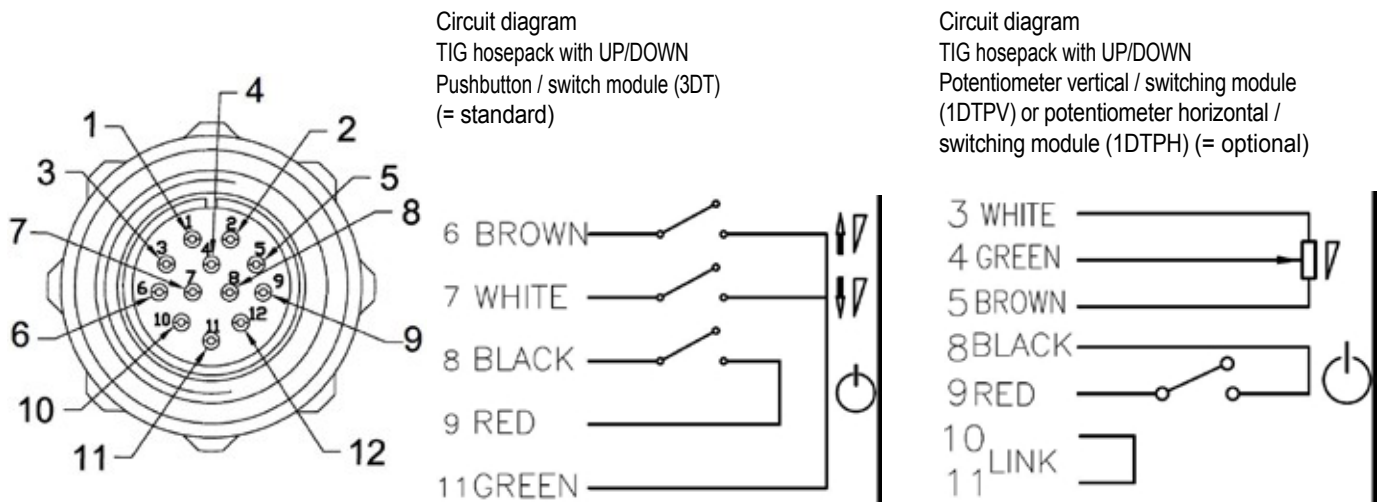
TIG hose package with UP/DOWN potentiometer vertical / switching module (1DTPV) (= optional)



TIG hose package with UP/DOWN potentiometer horizontal / switching module (1DTPH) (= optional)



3.6.6 TIG/TIG hosepack Circuit diagram / control cable connector assignment



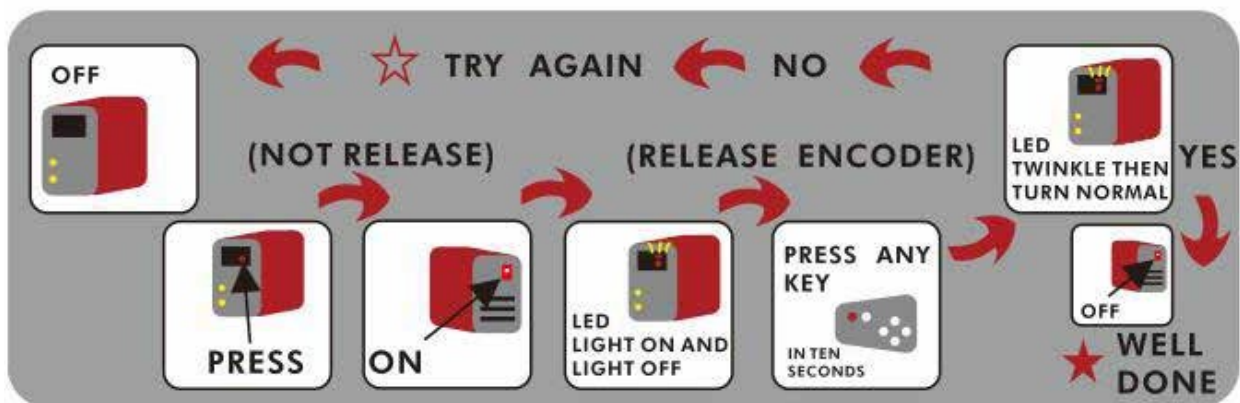
3.7 Configuration of the remote control

3.7.1 Configuration of the wireless radio hand or foot remote control



These welding machines can be configured to communicate exclusively with a wireless radio foot pedal or a wireless handheld remote control. This is achieved by simply synchronising the wireless remote control with the device frequencies. As each assigned interface frequency is unique several wireless remote control systems/devices can be used in the same area without any problems. The direct range of the remote control system is approx. 30 metres, depending on the location of the device and the remote control.

To synchronise a radio hand or foot remote control / remote control with a device, follow the instructions below:



1. Ensure that the power supply to the welding machine is switched off.
2. Hold down the rotary knob for parameter selection and setting (17) on the control panel (2-4 seconds) and simultaneously switch on the welding machine using the ON/OFF switch on the rear of the device until the indicator on the display flashes once briefly.
3. As soon as the display no longer shows anything, release the rotary knob (17). (ATTENTION: Subsequent synchronisation must be carried out within 10 s after the display goes out). Switch on the remote control or the foot pedal at the ON/OFF switch and press any button on the remote control panel or the foot pedal.

The digital display on the front of the welding machine flashes twice to indicate that synchronisation has been successfully completed. (Please also check that the corresponding batteries in the wireless foot or hand-held remote controls are correctly inserted and have sufficient supply voltage).

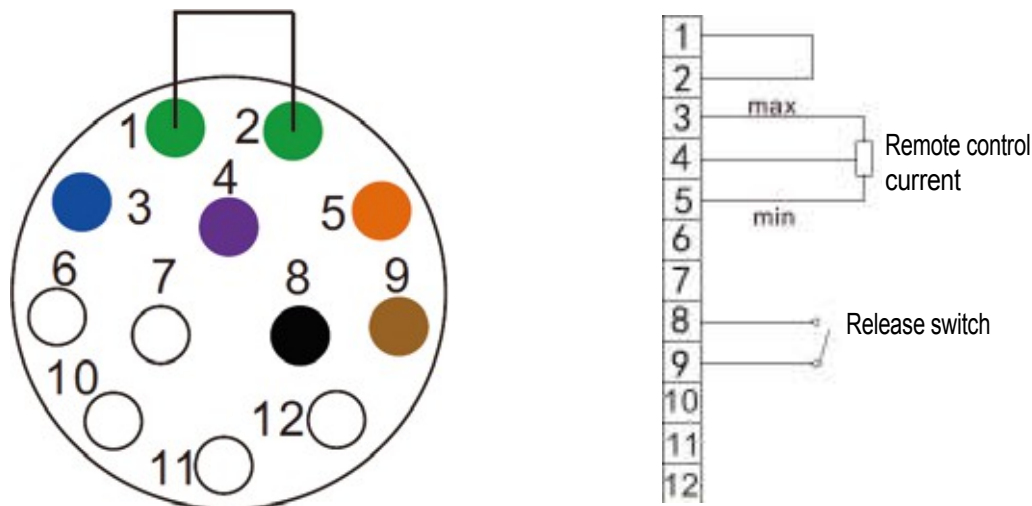
4. Switch the device off and on again to start the welding process.
5. If the synchronisation process is unsuccessful, repeat steps 1 to 4.
6. During operation, the control panel on the welding machine continues to function, but the remote control panel or foot pedal have higher priority.
7. If no input is made via the remote control panel or foot pedal within 10 seconds, it automatically switches to the sleep mode.
8. If the wireless remote control or the foot pedal are in sleep mode, only the front control panel is active. Any operation of the wireless remote control panel or foot pedal "wakes up" these accessories and they take over control of the appliance again.

Deactivate wireless remote control / remote control on the welding machine

1. Ensure that the power supply is switched off.
2. Press the rotary knob (17) on the control panel on the front of the appliance and switch on the appliance at the same time.
3. Press and hold the rotary knob for approx. 10-15 seconds until "rF" appears on the control panel display. The wireless remote control has been successfully deactivated.

3.7.2 Configuration of the wired foot pedal

- Connect the 5-pin plug of the foot pedal cable to the foot pedal and the 12-pin plug of this cable to the welding device. Set the welding machine to the desired TIG mode and to 2T= 2-stroke control and set the desired maximum welding current on the control panel.
- The welding process can now be started and stopped using the foot pedal and the welding current can be adjusted accordingly.



Connection for wired remote foot control / remote control

PIN	Function	PIN	Function
1	Short-circuited with 2	7	Not connected
2	Short-circuited with 1	8	Input release switch
3	20 kΩ connection (maximum) to 20 kΩ remote control potentiometer	9	Input release switch
4	Wiper arm connection to 20 kΩ remote control potentiometer	10	Not connected
5	Zero-ohm connection (minimum) to 20 kΩ remote control potentiometer	11	Not connected
6	Not connected	12	Not connected

3.8 Operating environment

NOTE



- Altitude above sea level: ≤ 1000 m
- Operating temperature range: -10~ +40 °C
- Relative humidity: below 90 % (20 °C)
- The angle of inclination of the appliance must not exceed 15° during operation.
- Protect the appliance from heavy rain and direct sunlight.
- The dust, acid and harmful gas levels in the ambient air must not exceed the standard values.
- Ensure adequate ventilation during welding.
- Maintain a distance of at least 30 cm between the wall and the appliance.

4 Maintenance & Troubleshooting

4.1 Maintenance

To ensure the safe and proper operation of welding equipment, it must be serviced regularly. be carried out. The maintenance points are listed in detail in the table below.

WARNING



For safety reasons, disconnect the power supply before starting maintenance work on the appliance and wait 5 minutes until the voltage of the capacitors has dropped to the safe value of 36 V!

Interval	Maintenance points
Daily check	<p>Ensure that the controls on the front and rear of the arc welder can be moved and are securely mounted. If a control element is not securely mounted, please correct it. If the control element cannot be corrected or repaired, replace it immediately.</p> <p>Inform the maintenance service if accessories are missing.</p> <p>After switching off the power supply, observe whether the arc welder trembles, makes whistling noises or smells strange. If any of these problems occur, determine the cause and rectify it. If the cause cannot be determined, please contact your dealer/representative.</p> <p>Check whether the LEDs on the display are intact. If this is not the case, please replace the damaged LEDs. replace it. If the display still does not work, service or replace the display circuit board.</p> <p>Check whether the min./max. display values of the LEDs match the set values. If there are deviations and these affect the normal welding results, please set again.</p> <p>Check whether the fan is damaged, whether it rotates normally and can be controlled. Please replace a defective fan immediately. If the fan does not start when the appliance overheats, check whether the impeller is blocked. If they are blocked, please rectify the problem. If the fan still does not work after rectifying the above problems, push the impeller in the direction of rotation of the fan. If the fan then runs normally, the starting capacitor must be replaced. If not, replace the fan.</p> <p>Check whether the quick connector is loose or overheated. If this is the case on the arc welder If this is the case, fasten or replace the connector.</p> <p>Check the power output cable for damage. Replace damaged power output cables.</p> <p>If water-cooled hosepacks are used, check the fluid level and top up if necessary. Check the cooling circuit and check for leaks. Defective hoses must be replaced.</p>

Interval	Maintenance points
Monthly audit	Clean the inside of the arc welder and the water cooling system with dry compressed air. In particular, the cooler, mains transformer, coils, IGBT modules, fast diodes, circuit boards, etc. must be dedusted. Check screws and bolts in the device. Tighten loose screws and bolts. Replace sheared screws and bolts. Remove rust from rusty screws and bolts and check for proper function. ensure.
Quarterly audit	Check whether the actual current corresponds to the displayed value. If not, the current can be regulated. The actual welding current value can be measured and set using a current clamp.
Half-yearly Examination	If a water cooling system is used, replace the coolant.
Annual audit	Measure the insulation resistance between the main circuit, the circuit board and the housing. If this is below 1 MΩ, the insulation is probably damaged and must be replaced or reinforced.

4.2 Troubleshooting

- The welding equipment leaves the factory in a tested and precisely calibrated condition. Modifications to the devices by persons not authorised by our company are prohibited!
- Maintenance work must be carried out carefully. Damaged or incorrectly routed cables or hosepacks pose a potential danger to the user!
- The appliance may only be overhauled by expert maintenance personnel authorised by our company!
- Before carrying out repair and maintenance work on the welding machine, ensure that the mains power supply is disconnected!
- If a problem occurs and no authorised expert maintenance technician is on site, please contact the local representative or dealer!
- In the event of minor problems with the welding machine, refer to the table below:

No.	Problem	Causes	Remedial measures
1	Power source switched on, operating light is on, but fan is not running	Foreign body in the blower	Remove foreign bodies
		Starting capacitor of the Blower defective	Replace capacitor
		Blower motor defective	Replace blower
		Intelligent blower	The fan switches itself off after a while, switch the device off again and then on again. run again
2	Value indication on display not intact	LED in display defective	Replace LED
3	The displayed max. and min. values do not correspond to the set value	The maximum value is not correct agree	potentiometer I _{max} with a calibrated ammeter to of the control board.
		Minimum value is not correct agree	potentiometer I _{min} with a calibrated ammeter to of the control board.
4	No idle voltage output	Device is defective	Check the main circuit and Pr4 on the main circuit board.

No.	Problem	Causes	Remedial measures	
5	TIG-HF ignition mode - arc cannot be ignited	HF board generates sparks.	Do not weld cables with the connected to two outputs on the welding device.	Connect the welding cable to the output of the welding unit.
			Welding cable defective.	Repair or replace.
			Earthing cable not safe connected.	Check earthing cable.
			Welding cable too long.	Suitable welding cable use.
			Oil or dust on workpiece.	Check and clean.
			Distance between tungsten electrode and workpiece too large.	Reduce the distance (approx. 3 mm).
		HF board does not generate a spark.	HF board does not work.	Repair or Pr8 on the Replace the main board.
			Distance between unloaders too short.	Set the distance (approx. 0.7 mm).
Fault in the trigger of the welding gun.	Trigger of the welding gun, Control cable and plug check.			
6	No gas flow (TIG)	Gas cylinder closed or Cylinder pressure too low	Open or replace gas cylinder	
		Foreign body in the valve	Remove foreign bodies	
		Electromagnetic valve Defective	Replace valve	
7	Constant gas flow	Foreign body in the valve	Remove foreign bodies	
		Electromagnetic valve Defective	Replace valve	
		Adjustment knob for gas pre-flow Time on control panel defective	Repair or replace	
8	Welding current not adjustable	Welding current potentiometer on Front of appliance in poor condition or defective	Repair or replace potentiometer	
9	Displayed welding current does not match the actual value.	Displayed minimum value does not match the actual value.	Set the potentiometer I _{min} on the mains board.	
		Displayed maximum value is correct does not match the actual value.	Set the I _{max} potentiometer on the mains board.	
10	Penetration of the molten bath is not sufficient.	Welding current set too low	Increase welding current	
11	Alarm light on the control panel lights up	Overheating protection	Welding current too high	Welding output current reduce
			Operating time too long	Reduce duty cycle (with work with interruptions)

4.3 List of general error codes

Error type	Error code	Description of the	Luminaire status
Thermal relay	E01	Overheating (1st thermal relay)	Yellow light (thermal protection) burns continuously
	E02	Overheating (2nd thermal relay)	Yellow light (thermal protection) burns continuously
	E03	Overheating (3rd thermal relay)	Yellow light (thermal protection) burns continuously
	E04	Overheating (4th thermal relay)	Yellow light (thermal protection) burns continuously
	E09	Overheating (programme delay)	Yellow light (thermal protection) burns continuously
Welding machine	E10	Phase loss	Yellow light (thermal protection) burns continuously
	E11	No water	Yellow light (low water) lights up continuously
	E12	No gas	Red light is permanently on
	E13	Undervoltage	Yellow light (thermal protection) burns continuously
	E14	Overvoltage	Yellow light (thermal protection) burns continuously
	E15	Overcurrent	Yellow light (thermal protection) burns continuously
	E16	Overload wire feeder	---
Switches	E20	Key error on the control panel when switching on the device	Yellow light (thermal protection) burns continuously
	E21	Other errors on the control panel when switching on the device	Yellow light (thermal protection) burns continuously
	E22	Burner error when switching on the appliance	Yellow light (thermal protection) burns continuously
	E23	Burner error during normal operation	Yellow light (thermal protection) burns continuously
Accessories	E30	Connection break-off Cutting torch	Red light flashes
	E31	Water cooler connection failure	Yellow light (low water) lights up continuously
Communication	E40	Connection problem between wire feed and power source	---
	E41	Communication error	---

4.4 Disposal of electrical and electronic devices



Electrical appliances must not be disposed of with normal household waste. Observe the local regulations when disposing of the appliance.

In accordance with European Directive 2012/19/EU on the disposal of waste electrical and electronic equipment and the corresponding transposition into national law, electrical equipment must be collected separately from other waste at the end of its service life and sent to a waste treatment plant for appropriate recycling.

Take the appliance to the nearest collection point. If necessary, enquire with our dealers.

When disposing of the appliance, the operator must remove the rating plate affixed to the back of the appliance to prevent it from being put back into service without protective devices, in which case THE MANUFACTURER WILL NO LONGER BE LIABLE. Compliance with the European Directive and local legislation will help to avoid possible negative effects on the environment and health and favour the reuse, recycling and/or recovery of the materials from which the appliance is made.

5 Spare parts

DANGER



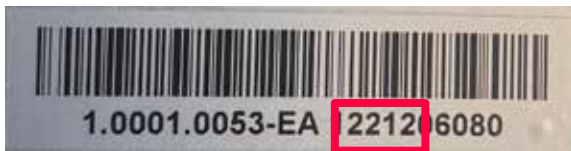
CAUTION There is a risk of injury if non-original spare parts or wearing parts are used. Only original spare parts from the manufacturer or spare parts authorised by the manufacturer should be used to avoid danger to the operator and damage or malfunction of the appliance.

5.1 Ordering spare parts

The spare or wear parts can be ordered via the authorised dealer or directly from the manufacturer.

Please always quote this serial number when making technical enquiries about your product or requesting spare parts.

These can also be used to identify the year and month of production
(e.g. 22 = year of construction 2022 / 12= month of December)



Contact details:

Fax: 0043 7752 80880

E-Mail: office@elmag.at

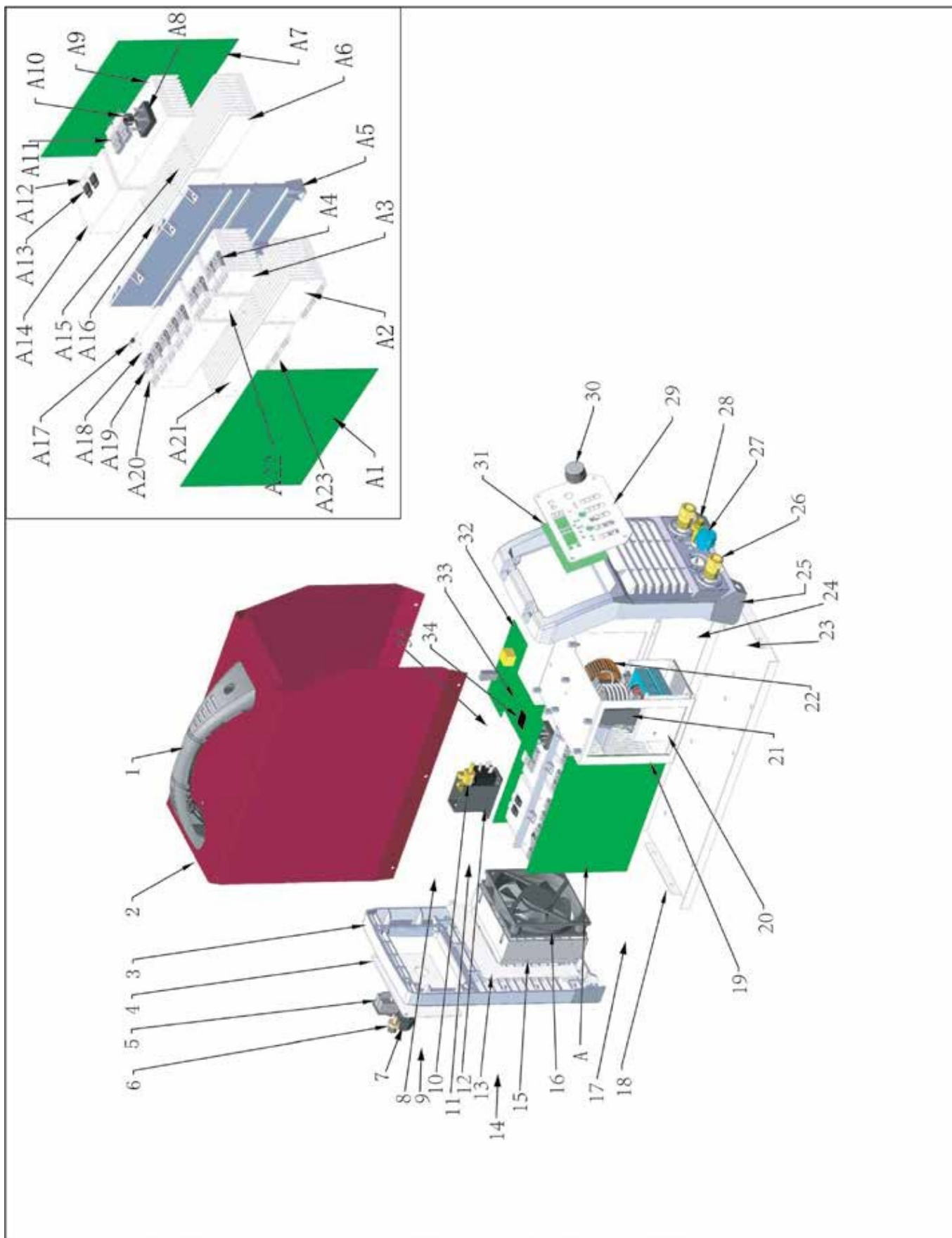
Specify the following key data when making enquiries or ordering spare parts:

- Model name / type designation
- if possible, photo of the type plate and serial number / year of manufacture
- Item number of the device
- Required spare part item number
- Required spare parts quantity
- Shipping & billing address

Information on the model name, type designation, Art. No. can be found on the rating plate attached to the appliance.

5.2 Spare parts drawing / Spare parts list

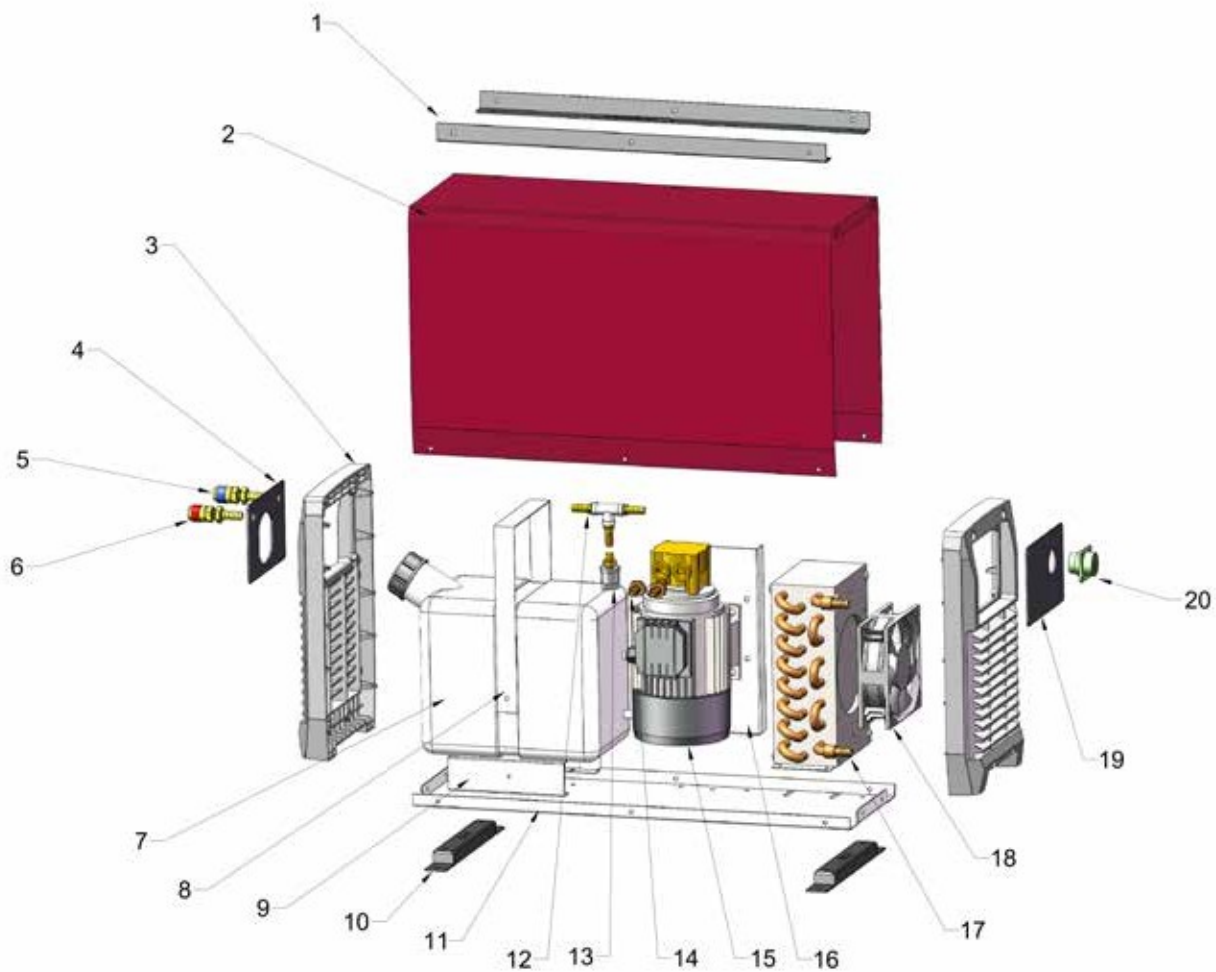
5.2.1 AD 2060M P/PFC/MV - TIG/TIG AC/DC welding inverter



Spare Part List AD 2060M P/PFC/MV

No. No.	Product Code	ELMAG Art. No.	Description	Description of the	UNIT Unit	QTY Quantity
1	7.2530.004	9105076	handle	Traquegriff	pcs/pc.	1
2	7.3010.0367-A-1	9105178	cover	Housing	pcs/pc.	1
3	7.0680.910	9105048	rear panel	PVC frame rear section	pcs/pc.	1
4	7.3070.0367		fixing plate in front of rear panel	Mounting plate for rear panel	pcs/pc.	1
5	6.2320.001	9105014	on/off switch	Main switch	pcs/pc.	1
6	7.4620.004	42672	gas fitting, DN5 (gas/inlet side) for devices from delivery before 07/2024/serial numbers <12404060001 thereafter only 9105207 mounted)	Quick Fit plug nipple DN5 (gas/input side) for appliances delivered before 07/2024/serial number <12404060001 thereafter only 9105207 installed)	pcs/pc.	
7	6.1550.003-B		fixing connector for external cable	Be+emiquqscclip for external cable	pcs/pc.	1
8	6.6260.210		horn sleeve clue sheath	Horn bushing Cable sheath (bli b	pcs/pc.	
9	6.1320.114-A	9105233	14 pin socket	14-pin socket for water cooling	pcs/pc.	1
10	6.2530.006	9105207	two position two way solenoid valve	Electric solenoid valve	pcs/pc.	1
11	3.0628.7168	9105182	single-phase surge protection PCB	Single-phase overvoltage protection board	pcs/pc.	
12	7.3040.007		Valve mounting box	Installation box for solenoid valve	pcs/pc.	1
13	7.1220.0366	9105183	fixing plate for fan	Fitting plate for fan	pcs/pc.	1
14	6.1540.004-D	9105016	power cable plug	Mains cable 3m, 3x2.5mm° (H07RN-F) "k' Plug	pcs/pc.	
15	7.3040.002	9105184	fan cover	Fan cover	pcs/pc.	1
16	6.7200.002	9105053	fan	Fan	pcs/pc.	1
17	7.7130.121-A		insulating paper	Insulating paper	pcs/pc.	2
18	7.0550.0367-C		bottom panel	Base plate	pcs/pc.	1
19	7.1230.221-B		supphrame	Support frame	pcs/pc.	1
20	5.2710.9004	9105187	HF inductance	HF-Drossel	pcs/pc.	1
21	5.1850.1365	9105188	main transformer	Transformer	pcs/pc.	1
22	5.2710.9005-B	9105191	PFC inductance	PFC throttle	pcs/pc.	1
23	3.0628.7008-A	9105201	HF absorption PCB	Absorption board HF	pcs/pc.	1
24	6.3210.001		Hall current sensor	Hall current sensor	pcs/pc.	1
25	7.0690.911	9105172	front panel PCB	PVC frame front section	pcs/pc.	1
26	6.1520.201	9105020	35-70MM euro socket	35-70MM installation book se	pcs/pc.	2
27	6.1320.012-G	9105132	12 pin plug socket	HF socket outlet, device side, 12-pin	pcs/pc.	1
28	7.4620.201	42671	Quick connector 0 8.9mm for front panel (gas outlet)	Mini built-in coupling with hose nozzle 6mm	pcs/pc.	
29	7.3060.0365-B		fixing plate *or front panel	Fixing plate for front panel	pcs/pc.	1
30	6.4580.014	9105021	knob	Rotary head+ to potentiometer 026 mm	pcs/pc.	1
31	3.P628.4027-B	9105194	digital display PCB	Front control board	pcs/pc.	1
32	3.0628.3010	9105195	power PCB	Power board	pcs/pc.	1
33	3.P628.1007-C	9105196	control PCB	Control board	pcs/pc.	1
54	3.0628.7000-A	9105197	wireless module e	Wireless module	pcs/pc.	1
35	3.0628.7079	9105200	Water Cooler Relay Control PCB	Control board for water cooling relay	pcs/pc.	1
A1	3.0628.6006-A		secondary inverter PCB		pcs/pc.	1
A2	7.4220.048		heat sink		pcs/pc.	1
A3	7.4220.046		heat sink		pcs/pc.	1
A4	6.4250.022		IGBT		pcs/pc.	4
A5	7.1230.905		middle plate		pcs/pc.	1
A6	7.4220.031		heat sink		pcs/pc.	1
A7	3.0628.2024-A		primary inverter PCB		pcs/pc.	1
A8	6.4110.008		rectifier bridge		pcs/pc.	1
A9	7.4220.028		heat sink		pcs/pc.	1
A10	6.6620.001		screw cover buckle		pcs/pc.	6
All	6.4250.033		IGBT		pcs/pc.	2
A12	7.7130.007	9105199 (2.2000.0366)	insulating block		pcs/pc.	2
A13	6.4010.001		last recovery diode		pcs/pc.	2
A14	7.4220.027		heat sink		pcs/pc.	1
A15	7.4220.030		heat sink		pcs/pc.	1
A16	7.4220.029		heat sink		pcs/pc.	1
A17	3.0628.7044		thermal PCB		pcs/pc.	2
A18	7.4220.044		heat sink		pcs/pc.	1
A19	6.4250.016		IGBT		pcs/pc.	8
A20	7.7130.001		insulating block		pcs/pc.	24
A21	7.4220.047		heat sink		pcs/pc.	1
A22	7.4220.045		heat sink		pcs/pc.	1
A23	6.4010.209		last recovery diode		pcs/pc.	8

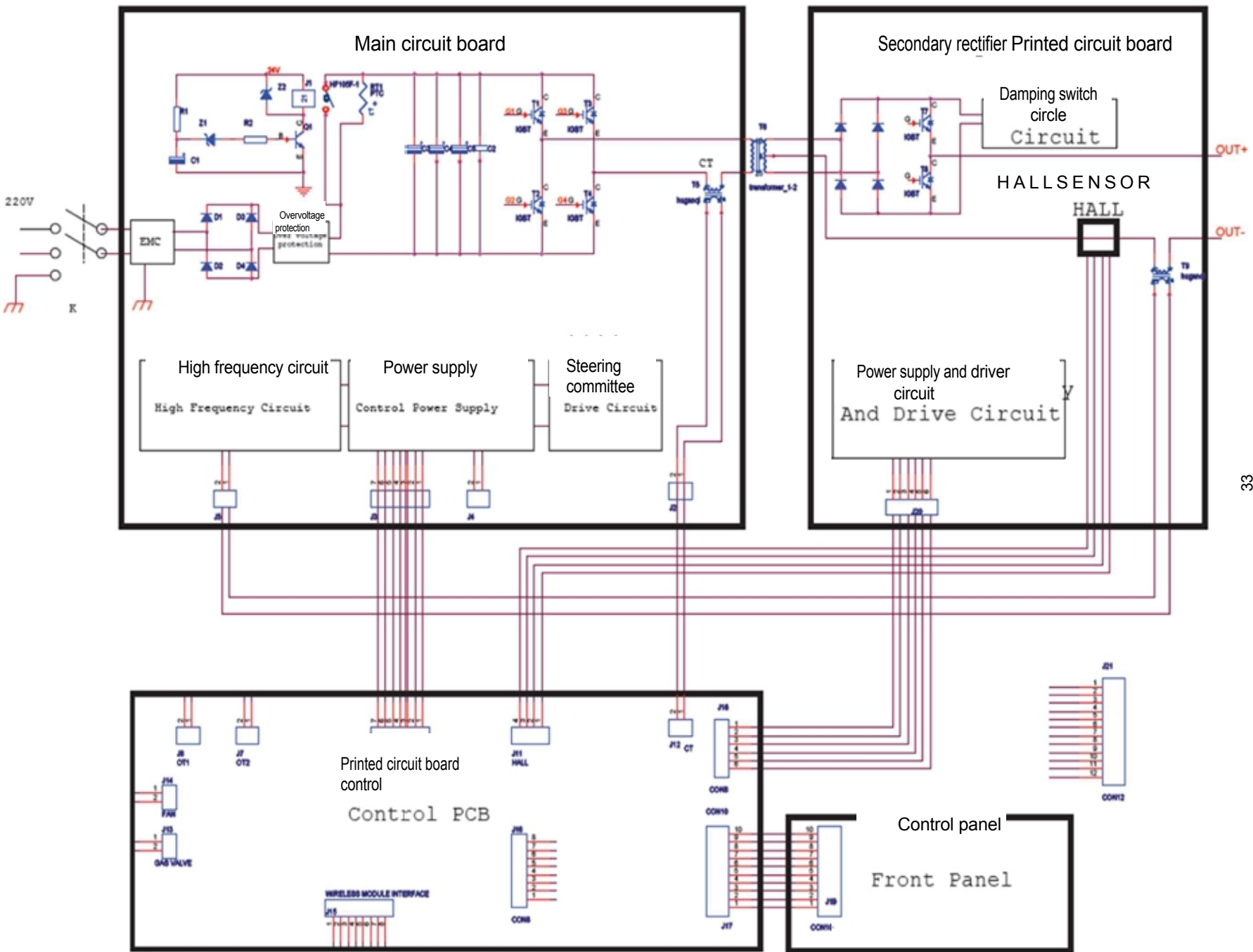
5.2.2 WK1-MINI - Water cooling unit



Spare Part List WK1-MINI

No. No.	Product Code	ELMAG Art. No.	Description	Description of the	UNIT Unit	QTY Quantity
1	7.1230.220-B		connecting plate for main machine	Mounting bracket for base unit	pcs/pc.	2
2	7.3010.0903	9105218	cover	Housing	pcs/pc.	1
3	7.0680.910	9105048	rear panel	PVC frame rear section	pcs/pc.	2
4	7.3060.0903		fixing plate for front panel	Mounting plate for front panel	pcs/pc.	1
5	7.4620.203	9105224	one-joint socket(blue)	Mini coupling, blue, DN 5, male M12x1	pcs/pc.	1
6	7.4620.202	9105223	one-joint socket(red)	Mini coupling, red, DN 5, male M12x1	pcs/pc.	1
7	6.7220.005	9105220	water tank	Water tank 5 lt.	pcs/pc.	1
8	7.1230.216-A		fixing clip for water tank	Fixing clamp for water tank	pcs/pc.	1
9	7.1230.218-A		fixing socket for water tank	Mounting base for water tank	pcs/pc.	1
10	7.1230.217-B		connecting plate	Mounting bracket for transport trolley	pcs/pc.	2
11	7.0550.0903		bottom panel	Base plate	pcs/pc.	1
12	6.6240.207	9105232	Y tee	Y-distributor	pcs/pc.	1
13	6.2320.401	9105235	on/off switch	Water pressure switch	pcs/pc.	1
14	7.4620.041		Hose fitting	Hose nozzle	pcs/pc.	2
15	6.7100.202	9105229	pump	Water pump 230V, 120W, 2700 rpm	pcs/pc.	1
16	7.1230.219		fixing plate for pump	Mounting plate for water pump	pcs/pc.	1
17	5.0810.002-A	9105230	heat sink	Cooler	pcs/pc.	1
18	6.7200.014	9105231	fan	Fan	pcs/pc.	1
19	7.3070.0903		fixing plate for rear panel	Mounting plate for rear panel	pcs/pc.	1
20	6.1320.114-A	9105233	14 pin socket	Socket, device side, 14-pin	pcs/pc.	1

6 Electrical circuit diagram AD 2060M P/PFC/MV



7 Declaration of Conformity



Declaration of conformity in accordance with the Low Voltage Directive 2014/35/EU.

We hereby declare under our sole responsibility that the machines described below comply with all provisions of the EC Directives due to their design and construction as well as in the version placed on the market by us:

- 2014/35/EU (Low Voltage Directive),
- 2014/30/EU (EMC Directive).

This declaration loses its validity if the machine is modified without our agreement.

Distributor:

Company name: ELMAG Entwicklungs und Handels GmbH
Address: Hannesgrub North 19
A-4911 Ried/Tumeltsham Austria

The technical documentation of the machine is managed by:

Company name: ELMAG Entwicklungs und Handels GmbH
Address: Technical Documentation Department
Hannesgrub Nord 19
A-4911 Ried/Tumeltsham Austria

Product: TIG/TIG AC/DC welding inverter
Feature: TIG welding unit for carrying out arc welding processes Model: AD
2060M P/PFC/MV
Serial number: See type plate on the device

Indication of the relevant harmonised standards and specifications applicable to this machine: EN 60974-1:2012

Arc welding equipment - Part 1: Welding power sources

EN 60974-10:2014+A1:2015

Arc welding equipment - Part 10: Requirements for the
Electromagnetic compatibility (EMC) (IEC 60974-10:2014+A1:2015)

Ried im Innkreis, 17 March 2025

Markus Einfinger (Managing Director)

ELMAG Entwicklungs und Handels GmbH

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