

Wire feed unit

tigSpeed oscillation drive 45 hotwire

099-000180-EW501

Observe additional system documents!

15.10.2015

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General instructions

CAUTION



Read the operating instructions!

The operating instructions provide an introduction to the safe use of the products.

- Read the operating instructions for all system components!
- Observe accident prevention regulations!
- Observe all local regulations!
- Confirm with a signature where appropriate.



In the event of queries on installation, commissioning, operation or special conditions at the installation site, or on usage, please contact your sales partner or our customer service department on +49 2680 181-0.

A list of authorised sales partners can be found at www.ewm-group.com.

Liability relating to the operation of this equipment is restricted solely to the function of the equipment. No other form of liability, regardless of type, shall be accepted. This exclusion of liability shall be deemed accepted by the user on commissioning the equipment.

The manufacturer is unable to monitor whether or not these instructions or the conditions and methods are observed during installation, operation, usage and maintenance of the equipment. An incorrectly performed installation can result in material damage and injure persons as a result. For this reason, we do not accept any responsibility or liability for losses, damages or costs arising from incorrect installation, improper operation or incorrect usage and maintenance or any actions connected to this in any way.

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2 Safety instructions

2.1 Notes on the use of these operating instructions

DANGER

Working or operating procedures which must be closely observed to prevent imminent serious and even fatal injuries.

- Safety notes include the "DANGER" keyword in the heading with a general warning symbol.
- The hazard is also highlighted using a symbol on the edge of the page.

WARNING

Working or operating procedures which must be closely observed to prevent serious and even fatal injuries.

- Safety notes include the "WARNING" keyword in the heading with a general warning symbol.
- The hazard is also highlighted using a symbol in the page margin.

CAUTION

Working or operating procedures which must be closely observed to prevent possible minor personal injury.

- The safety information includes the "CAUTION" keyword in its heading with a general warning symbol.
- The risk is explained using a symbol on the edge of the page.

CAUTION

Working and operating procedures which must be followed precisely to avoid damaging or destroying the product.















- The safety information includes the "CAUTION" keyword in its heading without a general warning symbol.
- The hazard is explained using a symbol at the edge of the page.

Special technical points which users must observe.

Instructions and lists detailing step-by-step actions for given situations can be recognised via bullet points, e.g.:

- Insert the welding current lead socket into the relevant socket and lock.

2.2 Explanation of icons

Symbol	Description
	Special technical points which users must observe.
	Correct
	Wrong
	Press
	Do not press
	Press and keep pressed
	Turn
	Switch
	Switch off machine
	Switch on machine
ENTER	enter the menu
NAVIGATION	Navigating in the menu
EXIT	Exit the menu
4 s 	Time display (example: wait 4s/press)
	Interruption in the menu display (other setting options possible)
	Tool not required/do not use
	Tool required/use

2.3 General

DANGER



Electromagnetic fields!

The power source may cause electrical or electromagnetic fields to be produced which could affect the correct functioning of electronic equipment such as IT or CNC devices, telecommunication lines, power cables, signal lines and pacemakers.

- Observe the maintenance instructions - See 6 Maintenance, care and disposal chapter!
- Unwind welding leads completely!
- Shield devices or equipment sensitive to radiation accordingly!
- The correct functioning of pacemakers may be affected (obtain advice from a doctor if necessary).



Do not carry out any unauthorised repairs or modifications!

To avoid injury and equipment damage, the unit must only be repaired or modified by specialist, skilled persons!

The warranty becomes null and void in the event of unauthorised interference.

- Appoint only skilled persons for repair work (trained service personnel)!



Electric shock!

Welding machines use high voltages which can result in potentially fatal electric shocks and burns on contact. Even low voltages can cause you to get a shock and lead to accidents.

- Do not touch any live parts in or on the machine!
- Connection cables and leads must be free of faults!
- Switching off alone is not sufficient!
- Place welding torch and stick electrode holder on an insulated surface!
- The unit should only be opened by specialist staff after the mains plug has been unplugged!
- Only wear dry protective clothing!
- Wait for 4 minutes until the capacitors have discharged!

WARNING



Risk of injury due to radiation or heat!

Arc radiation results in injury to skin and eyes.

Contact with hot workpieces and sparks results in burns.

- Use welding shield or welding helmet with the appropriate safety level (depending on the application)!
- Wear dry protective clothing (e.g. welding shield, gloves, etc.) according to the relevant regulations in the country in question!
- Protect persons not involved in the work against arc beams and the risk of glare using safety curtains!



Explosion risk!

Apparently harmless substances in closed containers may generate excessive pressure when heated.

- Move containers with inflammable or explosive liquids away from the working area!
- Never heat explosive liquids, dusts or gases by welding or cutting!

WARNING



Smoke and gases!

Smoke and gases can lead to breathing difficulties and poisoning. In addition, solvent vapour (chlorinated hydrocarbon) may be converted into poisonous phosgene due to the ultraviolet radiation of the arc!

- Ensure that there is sufficient fresh air!
- Keep solvent vapour away from the arc beam field!
- Wear suitable breathing apparatus if appropriate!



Fire hazard!

Flames may arise as a result of the high temperatures, stray sparks, glowing-hot parts and hot slag produced during the welding process.

Stray welding currents can also result in flames forming!

- Check for fire hazards in the working area!
- Do not carry any easily flammable objects such as matches or lighters.
- Keep appropriate fire extinguishing equipment to hand in the working area!
- Thoroughly remove any residue of flammable substances from the workpiece before starting welding.
- Only continue work on welded workpieces once they have cooled down.
Do not allow to come into contact with flammable material!
- Connect welding leads correctly!



Risk of accidents due to non-compliance with the safety instructions!

Non-compliance with the safety instructions can be fatal!

- Carefully read the safety instructions in this manual!
- Observe the accident prevention regulations and any regional regulations!
- Inform persons in the working area that they must comply with the regulations!



Danger when coupling multiple power sources!

Coupling multiple power sources in parallel or in series has to be carried out by qualified personnel and in accordance with the manufacturer's guidelines. Before bringing the power sources into service for arc welding operations, a test has to verify that they cannot exceed the maximum allowed open circuit voltage.

- Connection of the machine may be carried out by qualified personnel only!
- When decommissioning individual power sources, all mains and welding current leads have to be safely disconnected from the welding system as a whole. (Danger due to inverse voltages!)
- Do not couple welding machines with pole reversing switch (PWS series) or machines for AC welding, as a minor error in operation can cause the welding voltages to be combined.

CAUTION



Noise exposure!

Noise exceeding 70 dBA can cause permanent hearing damage!

- Wear suitable ear protection!
- Persons located within the working area must wear suitable ear protection!

CAUTION**Obligations of the operator!****The respective national directives and laws must be observed for operation of the machine!**

- National implementation of the framework directive (89/391/EWG), as well as the associated individual directives.
- In particular, directive (89/655/EWG), on the minimum regulations for safety and health protection when staff members use equipment during work.
- The regulations regarding work safety and accident prevention for the respective country.
- Setting up and operating the machine according to IEC 60974-9.
- Check at regular intervals that users are working in a safety-conscious way.
- Regular checks of the machine according to IEC 60974-4.

**Damage due to the use of non-genuine parts!****The manufacturer's warranty becomes void if non-genuine parts are used!**

- Only use system components and options (power sources, welding torches, electrode holders, remote controls, spare parts and replacement parts, etc.) from our range of products!
- Only insert and lock accessory components into the relevant connection socket when the machine is switched off.

**Damage to the machine due to stray welding currents!****Stray welding currents can destroy protective earth conductors, damage equipment and electronic devices and cause overheating of components leading to fire.**

- Make sure all welding leads are securely connected and check regularly.
- Always ensure a proper and secure electrical connection to the workpiece!
- Set up, attach or suspend all conductive power source components like casing, transport vehicle and crane frames so they are insulated!
- Do not place any other electronic devices such as drillers or angle grinders, etc., on the power source, transport vehicle or crane frames unless they are insulated!
- Always put welding torches and electrode holders on an insulated surface when they are not in use!

**Mains connection****Requirements for connection to the public mains network**

High-performance machines can influence the mains quality by taking current from the mains network. For some types of machines, connection restrictions or requirements relating to the maximum possible line impedance or the necessary minimum supply capacity at the interface with the public network (Point of Common Coupling, PCC) can therefore apply. In this respect, attention is also drawn to the machines' technical data. In this case, it is the responsibility of the operator, where necessary in consultation with the mains network operator, to ensure that the machine can be connected.

CAUTION



EMC Machine Classification

In accordance with IEC 60974-10, welding machines are grouped in two electromagnetic compatibility classes - See 8 Technical data chapter:

Class A machines are not intended for use in residential areas where the power supply comes from the low-voltage public mains network. When ensuring the electromagnetic compatibility of class A machines, difficulties can arise in these areas due to interference not only in the supply lines but also in the form of radiated interference.

Class B machines fulfil the EMC requirements in industrial as well as residential areas, including residential areas connected to the low-voltage public mains network.

Setting up and operating

When operating arc welding systems, in some cases, electro-magnetic interference can occur although all of the welding machines comply with the emission limits specified in the standard. The user is responsible for any interference caused by welding.

In order to **evaluate** any possible problems with electromagnetic compatibility in the surrounding area, the user must consider the following: (see also EN 60974-10 Appendix A)

- Mains, control, signal and telecommunication lines
- Radios and televisions
- Computers and other control systems
- Safety equipment
- The health of neighbouring persons, especially if they have a pacemaker or wear a hearing aid
- Calibration and measuring equipment
- The immunity to interference of other equipment in the surrounding area
- The time of day at which the welding work must be carried out

Recommendations for **reducing interference emission**

- Mains connection, e.g. additional mains filter or shielding with a metal tube
- Maintenance of the arc welding equipment
- Welding leads should be as short as possible and run closely together along the ground
- Potential equalization
- Earthing of the workpiece. In cases where it is not possible to earth the workpiece directly, it should be connected by means of suitable capacitors.
- Shielding from other equipment in the surrounding area or the entire welding system

2.4 Transport and installation

WARNING



Incorrect handling of shielding gas cylinders!

Incorrect handling of shielding gas cylinders can result in serious and even fatal injury.

- Observe the instructions from the gas manufacturer and in any relevant regulations concerning the use of compressed air!
- Place shielding gas cylinders in the holders provided for them and secure with fixing devices.
- Avoid heating the shielding gas cylinder!



Risk of accident due to improper transport of machines that may not be lifted!

Do not lift or suspend the machine! The machine can fall down and cause injuries! The handles and brackets are suitable for transport by hand only!

- The machine may not be lifted by crane or suspended!

CAUTION



Risk of tipping!

There is a risk of the machine tipping over and injuring persons or being damaged itself during movement and set up. Tilt resistance is guaranteed up to an angle of 10° (according to IEC 60974-1).

- Set up and transport the machine on level, solid ground.
- Secure add-on parts using suitable equipment.



Damage due to supply lines not being disconnected!

During transport, supply lines which have not been disconnected (mains supply leads, control leads, etc.) may cause hazards such as connected equipment tipping over and injuring persons!

- Disconnect supply lines!

CAUTION



Equipment damage when not operated in an upright position!

The units are designed for operation in an upright position!

Operation in non-permissible positions can cause equipment damage.

- Only transport and operate in an upright position!

2.4.1 Ambient conditions

CAUTION



Installation site!

The machine must not be operated in the open air and must only be set up and operated on a suitable, stable and level base!

- The operator must ensure that the ground is non-slip and level, and provide sufficient lighting for the place of work.
- Safe operation of the machine must be guaranteed at all times.

CAUTION



Equipment damage due to dirt accumulation!

Unusually high quantities of dust, acid, corrosive gases or substances may damage the equipment.

- Avoid high volumes of smoke, vapour, oil vapour and grinding dust!
- Avoid ambient air containing salt (sea air)!



Non-permissible ambient conditions!

Insufficient ventilation results in a reduction in performance and equipment damage.

- Observe the ambient conditions!
- Keep the cooling air inlet and outlet clear!
- Observe the minimum distance of 0.5 m from obstacles!

2.4.1.1 In operation

Temperature range of the ambient air:

- -25 °C to +40 °C

Relative air humidity:

- Up to 50% at 40 °C
- Up to 90% at 20 °C

2.4.1.2 Transport and storage

Storage in an enclosed space, temperature range of the ambient air:

- -30 °C to +70 °C

Relative air humidity

- Up to 90% at 20 °C

3 Intended use

WARNING



Hazards due to improper usage!

Hazards may arise for persons, animals and material objects if the equipment is not used correctly. No liability is accepted for any damages arising from improper usage!

- The equipment must only be used in line with proper usage and by trained or expert staff!
- Do not modify or convert the equipment improperly!

3.1 Applications

3.1.1 tigSpeed welding

By moving the wire forward and backward, the continual wire feeding has a superimposed effect. This leads to a particularly stable welding process with a high deposition rate, which is especially suitable for positional welding.

3.1.2 TIG hot wire welding

The TIG hot wire welding system technology is based on the TIG cold wire welding system technology. A wire feed system transports the wire-like welding consumable, which is heated at the stick-out between contact tip and weld pool contact point by means of resistance heating. A second power source is required for this resistance heating. Its secondary power circuit is closed by the wire's permanent contact with the weld pool. The process of pre-heating the wire can be controlled in a wide range by the selected hot wire power.

By pre-heating the wire, the energy taken from the weld pool for melting the wire can be reduced. This allows a significantly larger amount of welding consumables to be used at a higher welding speed, thus reducing the energy per unit length.

3.1.3 TIG cold wire welding

Cold wire welding is a variant of TIG welding featuring mechanically fed filler material. With this process, cold welding wire is melted, without power, in the arc of a tungsten electrode.

3.2 Use and operation solely with the following machines




A suitable power source (system component) is required in order to operate the wire feed unit!

A cold/hot wire Tetrix power source (AW) is required for operation.

3.3 Documents which also apply

3.3.1 Warranty

 For more information refer to the "Warranty registration" brochure supplied and our information regarding warranty, maintenance and testing at www.ewm-group.com!

3.3.2 Declaration of Conformity


 The designated machine conforms to EC Directives and standards in terms of its design and construction:

- EC Low Voltage Directive (2006/95/EC),
- EC EMC Directive (2004/108/EC),

This declaration shall become null and void in the event of unauthorised modifications, improperly conducted repairs, non-observance of the deadlines for the repetition test and / or non-permitted conversion work not specifically authorised by the manufacturer.

The original copy of the declaration of conformity is enclosed with the unit.

3.3.3 Welding in environments with increased electrical hazards

 In compliance with IEC / DIN EN 60974, VDE 0544 the machines can be used in environments with an increased electrical hazard.

3.3.4 Service documents (spare parts and circuit diagrams)



DANGER



Do not carry out any unauthorised repairs or modifications!

To avoid injury and equipment damage, the unit must only be repaired or modified by specialist, skilled persons!

The warranty becomes null and void in the event of unauthorised interference.

- Appoint only skilled persons for repair work (trained service personnel)!

Original copies of the circuit diagrams are enclosed with the unit.

Spare parts can be obtained from the relevant authorised dealer.

3.3.5 Calibration/Validation

We hereby confirm that this machine has been tested using calibrated measuring equipment, as stipulated in IEC/EN 60974, ISO/EN 17662, EN 50504, and complies with the admissible tolerances.

Recommended calibration interval: 12 months

4 Machine description – quick overview

4.1 System overview



The machine described in this manual is integrated into the welding system as shown in the diagram.

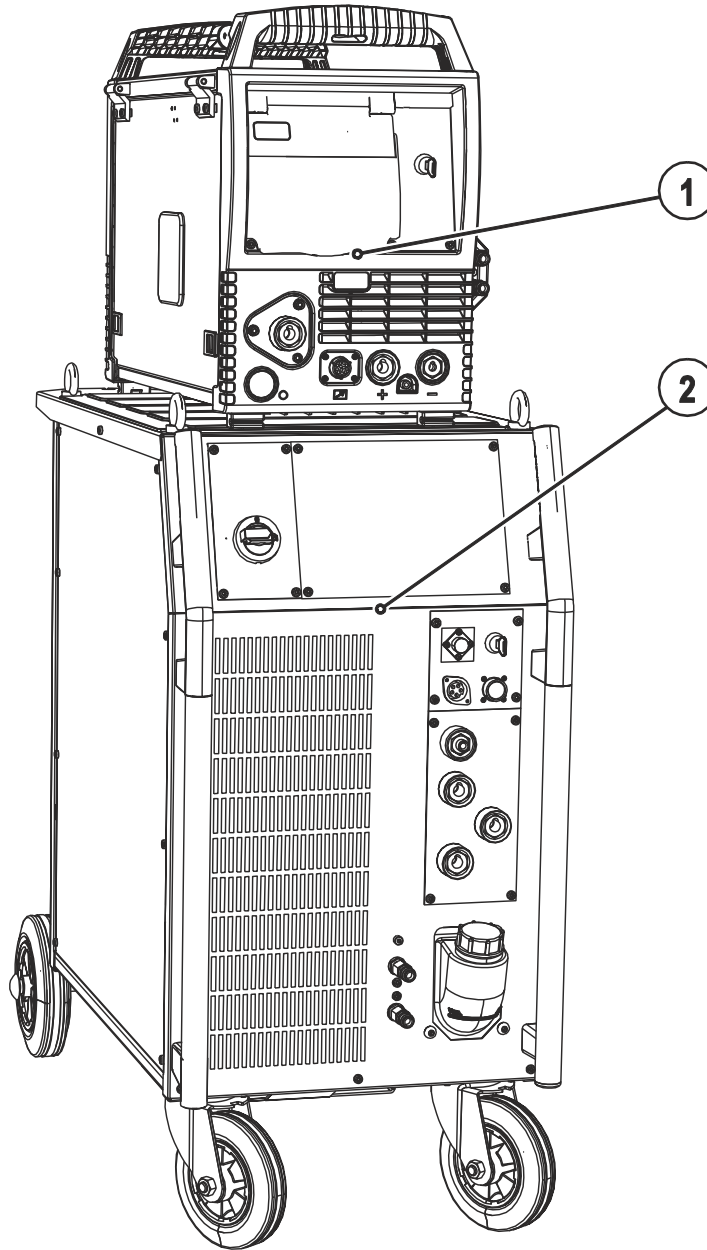


Figure 4-1

Item	Symbol	Description
1		Wire feeder with power source (TIG hot wire)
2		Power source (TIG) Observe additional system documents!

4.2 Front view

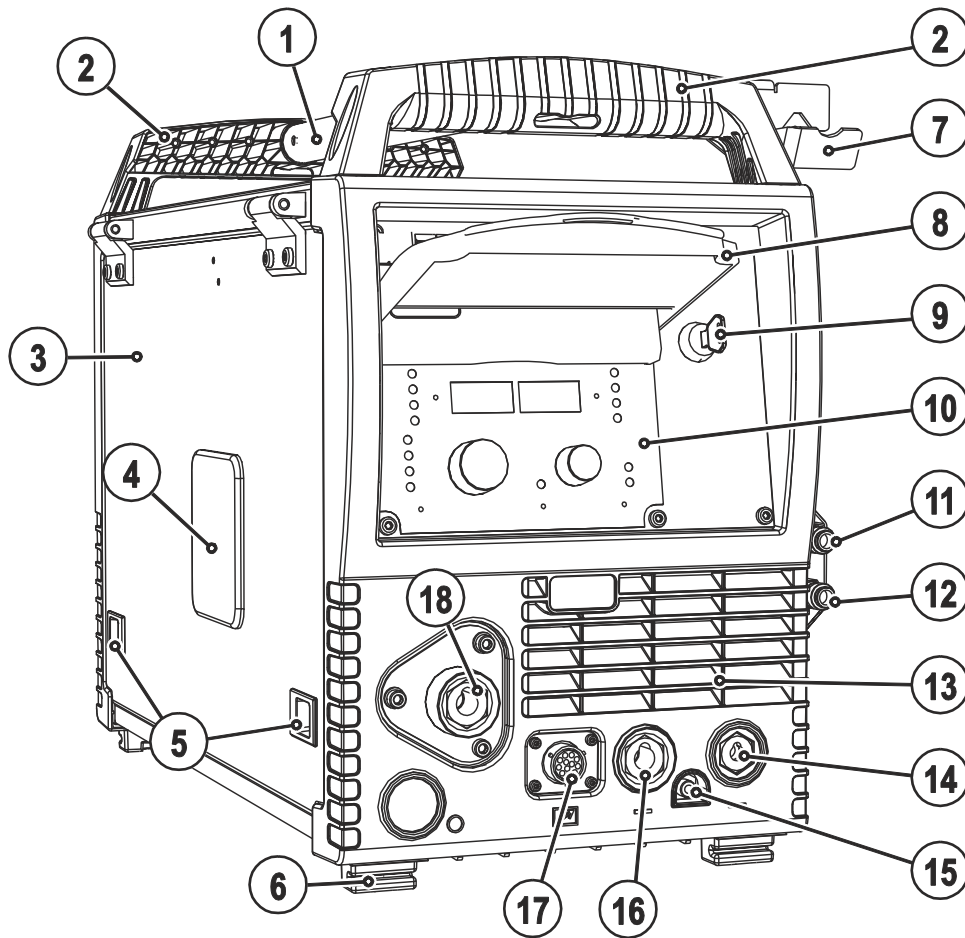
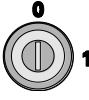








Figure 4-2

Item	Symbol	Description
1		Transport bar
2		Carrying handle
3		Protective cap Cover for the wire feed mechanism and other operating elements. Depending on the machine series, additional stickers with information on the replacement parts and JOB lists will be located on the inside.
4		Wire spool inspection window Check wire supply
5		Slide latch, lock for the protective cap
6		Machine feet
7		Torch holder
8		Protective cap - See 5.5.1 Protective flap, welding machine control chapter
9		Key switch for protection against unauthorised use Position "1" > changes possible, Position "0" > changes not possible. - See 5.15 Protecting welding parameters from unauthorised access chapter
10		Machine control- See 4.4 Machine control – Operating elements chapter
11		Quick connect coupling (red) coolant return
12		Quick connect coupling (blue) coolant supply
13		Cooling air outlet
14		Connection socket (TIG hot wire) Hot wire power, minus potential
15		Quick connect coupling Shielding gas
16		Connection socket (TIG) Welding current, minus potential
17		Connection socket (12-pole) Welding torch control lead
18		Wire electrode connection Welding torch wire feed

4.3 Rear view

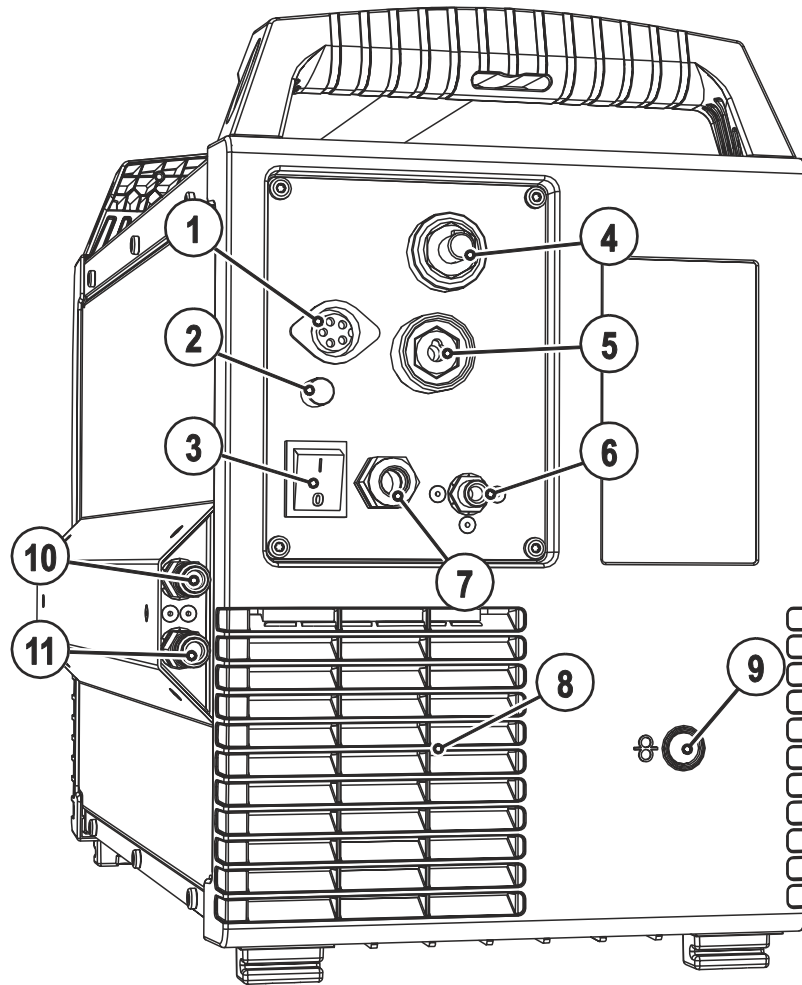










Figure 4-3

Item	Symbol	Description
1		Connector plug, 5-pole Control lead
2	Fuse 6.3A	Machine fuse (6,3 A)
3		Main switch, machine on/off
4		Connector plug (TIG) Welding current, minus potential
5		Connection socket (TIG hot wire) Hot wire power, plus potential, workpiece connection
6		Connecting nipple G¹/₄, shielding gas connection
7		Mains connection cable - See 5.6 Mains connection chapter
8		Cooling air inlet
9		External wire feed inlet Pre-cut casing inlet for external wire feed.
10		Quick connect coupling (red) coolant return
11		Quick connect coupling (blue) coolant supply

4.4 Machine control – Operating elements

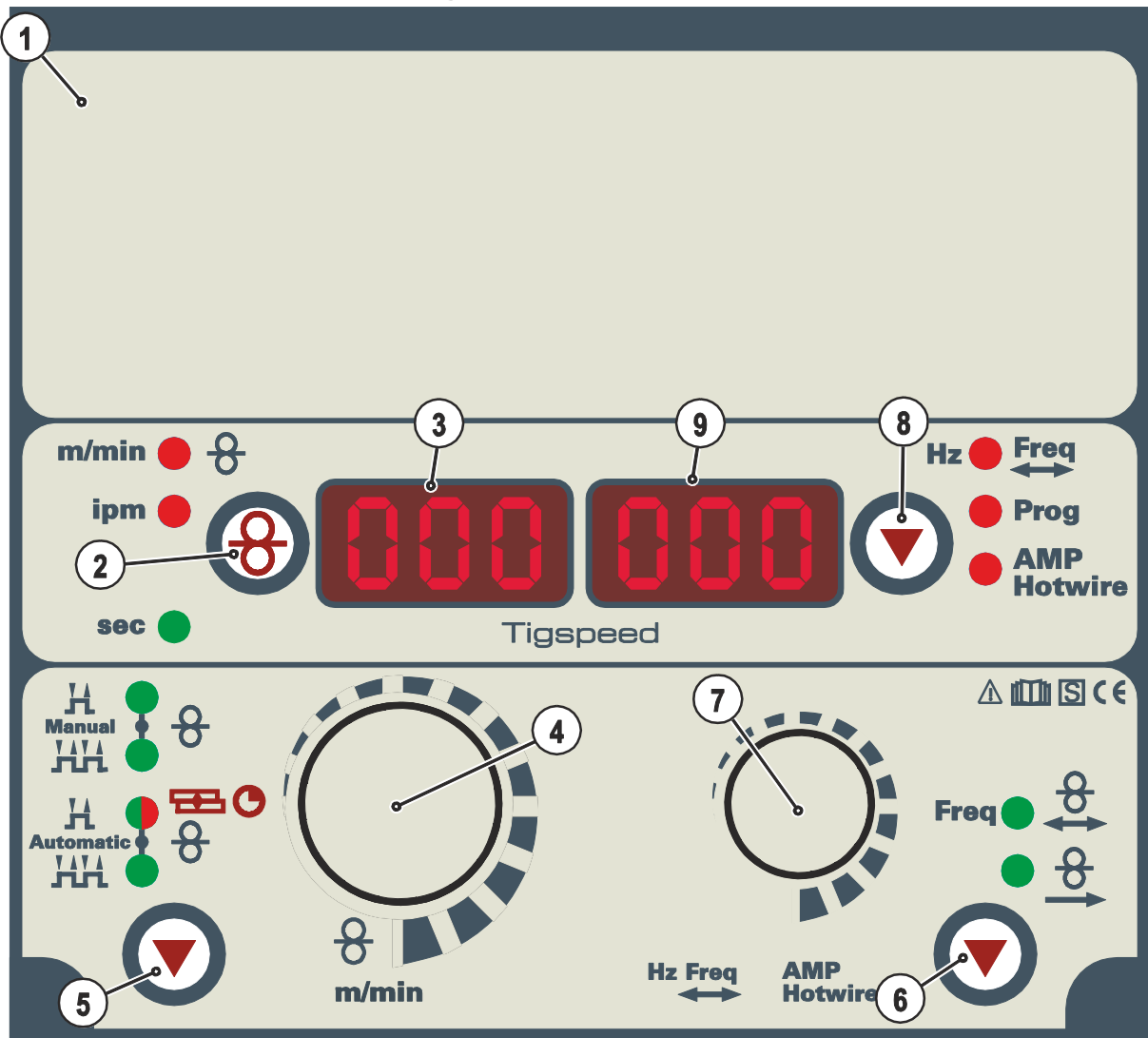


Figure 4-4

Item	Symbol	Description
1		Lid - See 4.4.1 Machine control – Concealed operating elements chapter
2		Push-button for switching the wire feed speed display m/min Wire feed speed in meters per minute. ipm Wire feed speed in inch per minute.
3		Display, left Wire feed speed
4		Rotary dial, welding parameter setting To set the wire feed speed and other welding parameters.
5		Operating mode selection push-button H Non-latched, manual HH Latched, manual H Non-latched, automatic HH Latched, automatic Signal light lights up in red: TIG tack welding
6		Selection push-button for superimposed forward/backward motion of the wire Feed with forward/backward motion Feed without forward/backward motion
7		Rotary knob to set the parameters for forward/backward motion/hot wire current/program number • Selection of forward/backward motion 1Hz–16Hz • Selection of the hot wire current 40 A–180 A • Selection of the program number
8		Display switching push-button Freq Forward/backward motion display in hertz Prog Program number display AMP Hotwire Hot wire current display
9		Display, right Forward/backward motion, hot wire current, program number

4.4.1 Machine control – Concealed operating elements

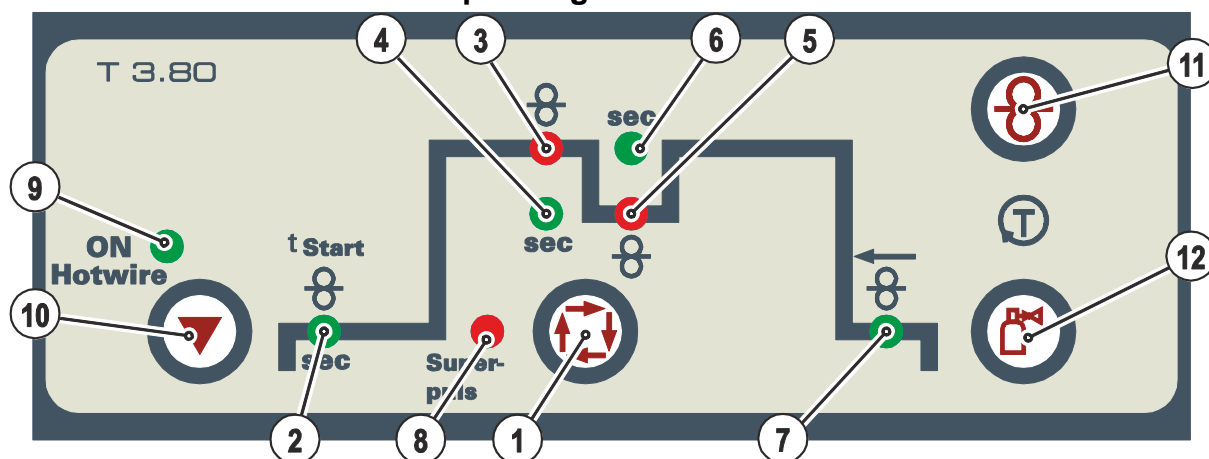


Figure 4-5

Item	Symbol	Description
1		Select welding parameters button This button is used to select the welding parameters depending on the welding process and operating mode used.
2		Signal light, wire feeder start delay Setting range 0.0 s to 20.0 s
3		Signal light, wire feed speed of main program (P_A)
4		Signal light, duration of main program P_A Setting range 0.1 s to 20.0 s (0.1 s increments). Used e.g. in connection with the super pulse function
5		Signal light, wire feed speed of reduced main program (P_B)
6		Signal light, duration of reduced main program P_B Setting range: 0.1 s to 20.0 s (0.1 s increments). Use in combination with superPuls or tacking function.
7		Signal light, wire return Setting range from 0.0 mm to 50.0 mm
8		Signal lamp, super pulse function Lights up when the super pulse function is active.
9		Signal light, ON Hotwire Lights up when the Hotwire function is active.
10		Push-button, ON Hotwire Switch Hotwire function on/off.
11		Push-button, wire inching/motor current (wire feed mechanism) - See 5.11.4 Inching the wire electrode chapter
12		Gas test Gas test: For setting the shielding gas quantity - See 5.12.2 Gas test chapter

4.4.2 Operating elements in the machine

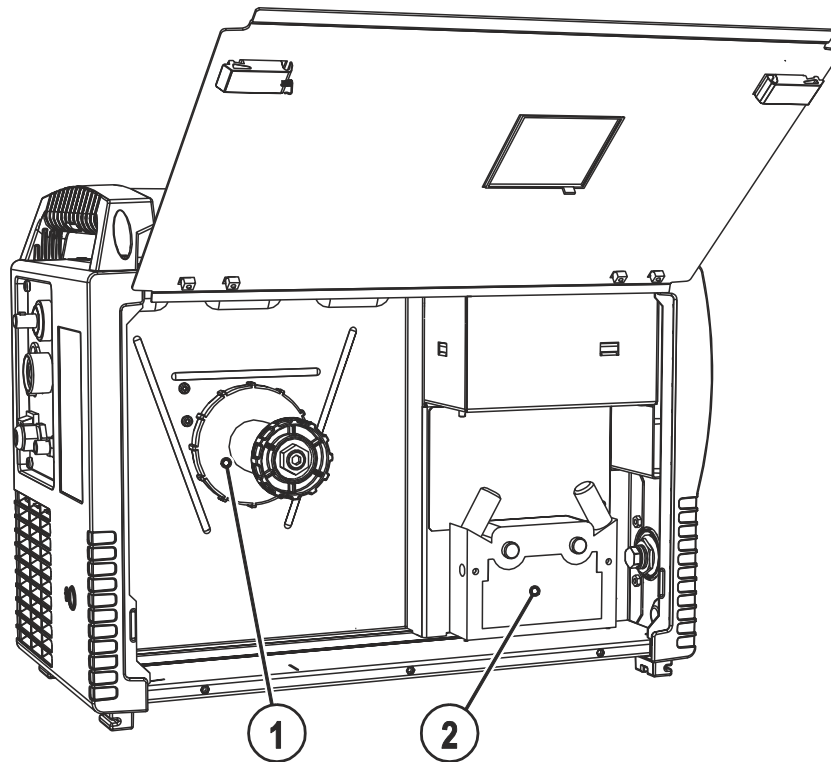


Figure 4-6

Item	Symbol	Description
1		Wire spool holder
2		Wire feed unit

5 Design and function

5.1 General

WARNING



Risk of injury from electric shock!

Contact with live parts, e.g. welding current sockets, is potentially fatal!

- Follow safety instructions on the opening pages of the operating instructions.
- Commissioning may only be carried out by persons who have the relevant expertise of working with arc welding machines!
- Connection and welding leads (e.g. electrode holder, welding torch, workpiece lead, interfaces) may only be connected when the machine is switched off!

CAUTION



Insulate the arc welder from welding voltage!

Not all active parts of the welding current circuit can be shielded from direct contact. To avoid any associated risks it is vital for the welder to adhere to the relevant safety regulations. Even low voltages can cause a shock and lead to accidents.

- Wear dry and undamaged protective clothing (shoes with rubber soles/welder's gloves made from leather without any studs or braces)!
- Avoid direct contact with non-insulated connection sockets or connectors!
- Always place torches and electrode holders on an insulated surface!



Risk of burns on the welding current connection!

If the welding current connections are not locked, connections and leads heat up and can cause burns, if touched!

- Check the welding current connections every day and lock by turning in clockwise direction, if necessary.



Risk of injury due to moving parts!

The wire feeders are equipped with moving parts, which can trap hands, hair, clothing or tools and thus injure persons!

- Do not reach into rotating or moving parts or drive components!
- Keep casing covers or protective caps closed during operation!



Risk of injury due to welding wire escaping in an unpredictable manner!

Welding wire can be conveyed at very high speeds and, if conveyed incorrectly, may escape in an uncontrolled manner and injure persons!

- Before mains connection, set up the complete wire guide system from the wire spool to the welding torch!
- Remove the pressure rollers from the wire feeder if no welding torch is fitted!
- Check wire guide at regular intervals!
- Keep all casing covers or protective caps closed during operation!



Risk from electrical current!

If welding is carried out alternately using different methods and if a welding torch and an electrode holder remain connected to the machine, the open-circuit/welding voltage is applied simultaneously on all cables.

- The torch and the electrode holder should therefore always be placed on an insulated surface before starting work and during breaks.

CAUTION**Damage due to incorrect connection!**

Accessory components and the power source itself can be damaged by incorrect connection!

- Only insert and lock accessory components into the relevant connection socket when the machine is switched off.
- Comprehensive descriptions can be found in the operating instructions for the relevant accessory components.
- Accessory components are detected automatically after the power source is switched on.

**Using protective dust caps!**

Protective dust caps protect the connection sockets and therefore the machine against dirt and damage.

- The protective dust cap must be fitted if there is no accessory component being operated on that connection.
- The cap must be replaced if faulty or if lost!



Observe documentation of other system components when connecting!

5.2 Machine cooling

To obtain an optimal duty cycle from the power components, the following precautions should be observed:

- Ensure that the working area is adequately ventilated.
- Do not obstruct the air inlets and outlets of the machine.
- Do not allow metal parts, dust or other objects to get into the machine.

5.3 Workpiece lead, general






CAUTION**Risk of burns due to incorrect connection of the workpiece lead!**

Paint, rust and dirt on the connection restrict the power flow and may lead to stray welding currents.

Stray welding currents may cause fires and injuries!

- Clean the connections!
- Fix the workpiece lead securely!
- Do not use structural parts of the workpiece as a return lead for the welding current!
- Take care to ensure faultless power connections!

5.4 Notes on the installation of welding current leads

-  **Incorrectly installed welding current leads can cause faults in the arc (flickering).**
-  **Lay the workpiece lead and hose package of power sources without HF igniter (MIG/MAG) for as long and as close as possible in parallel.**
-  **Lay the workpiece lead and hose package of power sources with HF igniter (TIG) for as long as possible in parallel with a distance of 20 cm to avoid HF sparkover.**
-  **Always keep a distance of at least 20 cm to leads of other power sources to avoid interferences**
-  **Always keep leads as short as possible! For optimum welding results max. 30 m (welding lead + intermediate hose package + torch lead).**

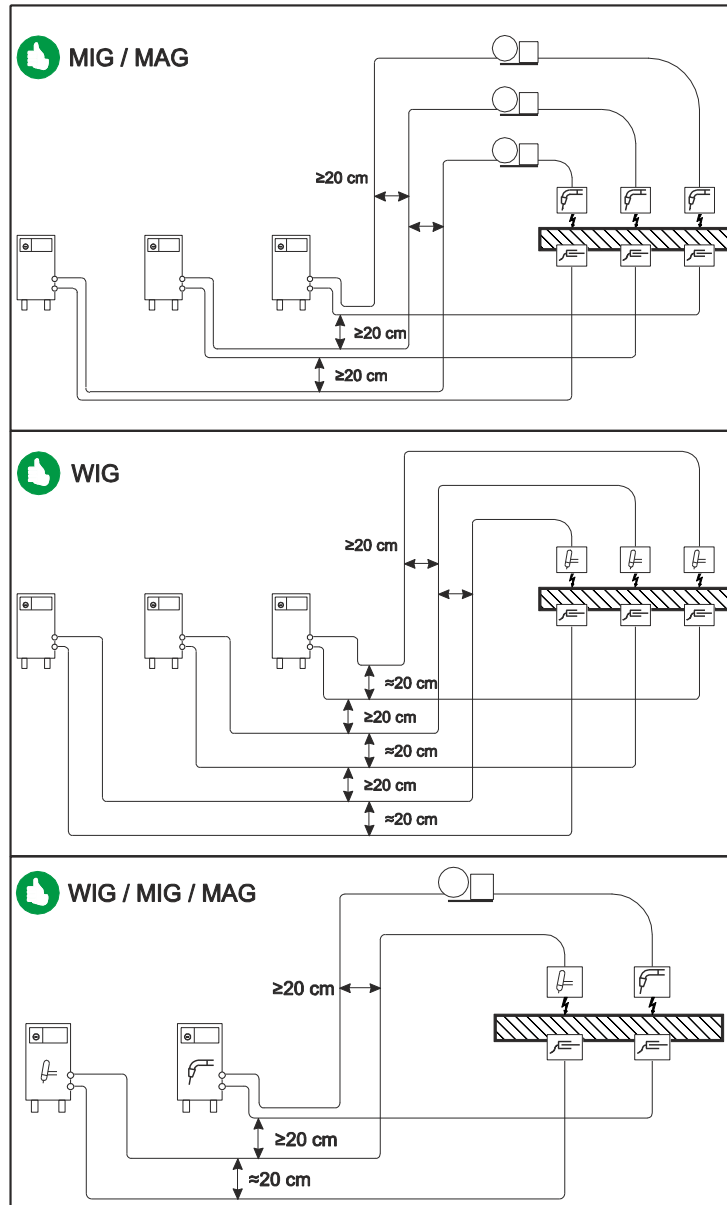


Figure 5-1

Use an individual welding lead to the workpiece for each welding machine!

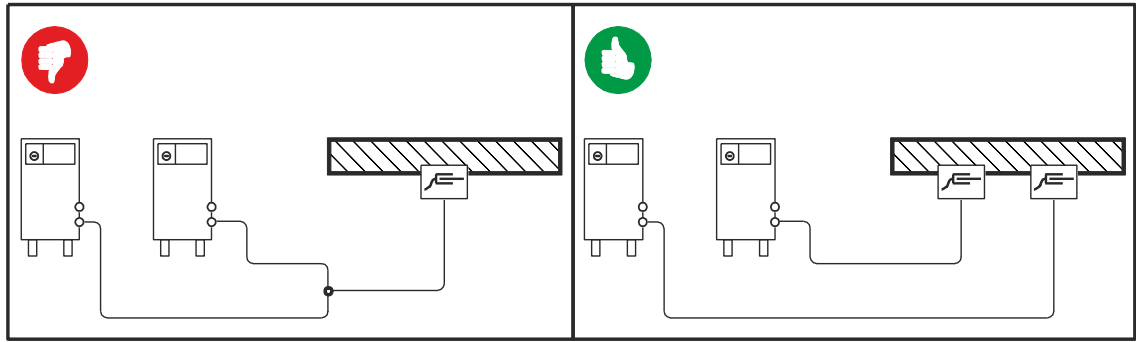


Figure 5-2

Fully unroll welding current leads, torch hose packages and intermediate hose packages. Avoid loops!

Always keep leads as short as possible!

Lay any excess cable lengths in meanders.

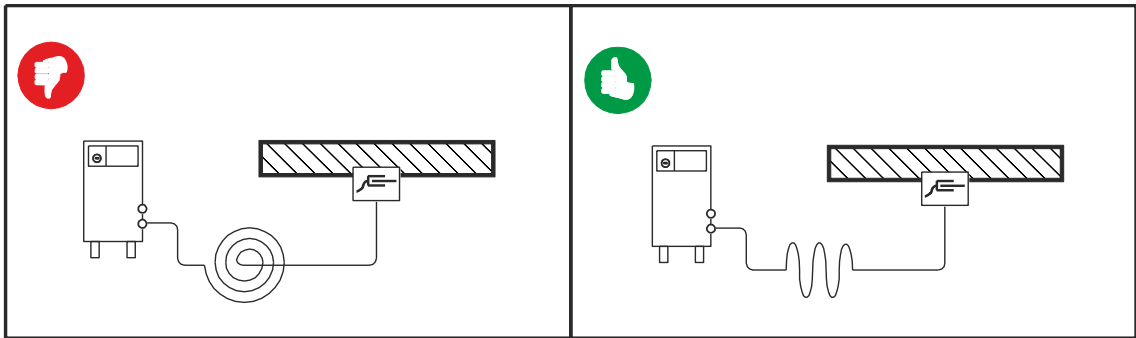


Figure 5-3

5.5 Installation

WARNING



Risk of accident due to improper transport of machines that may not be lifted!
Do not lift or suspend the machine! The machine can fall down and cause injuries! The handles and brackets are suitable for transport by hand only!

- The machine may not be lifted by crane or suspended!
- Depending on machine type, equipment for lifting by crane or use while suspended is available as a retrofitting option - See 9 Accessories chapter.

CAUTION



Installation site!
The machine must not be operated in the open air and must only be set up and operated on a suitable, stable and level base!

- The operator must ensure that the ground is non-slip and level, and provide sufficient lighting for the place of work.
- Safe operation of the machine must be guaranteed at all times.

5.5.1 Protective flap, welding machine control

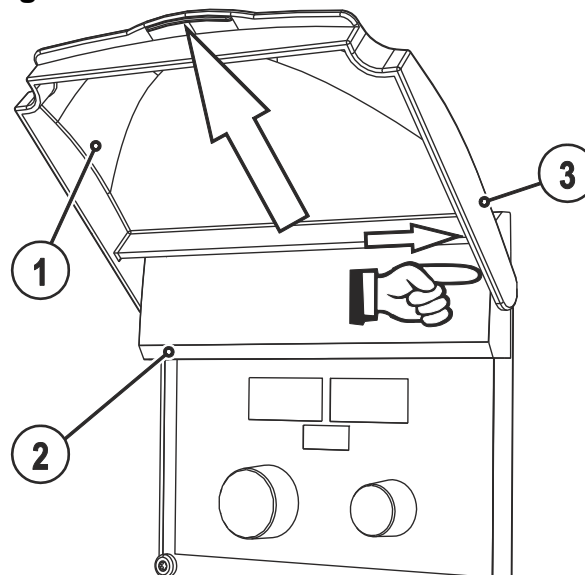


Figure 5-4

Item	Symbol	Description
1		Protective cap
2		Lid
3		Bracket, protective cap

- Push the right-hand bracket of the protective cap to the right and remove the protective cap.

5.5.2 TIG hot wire welding

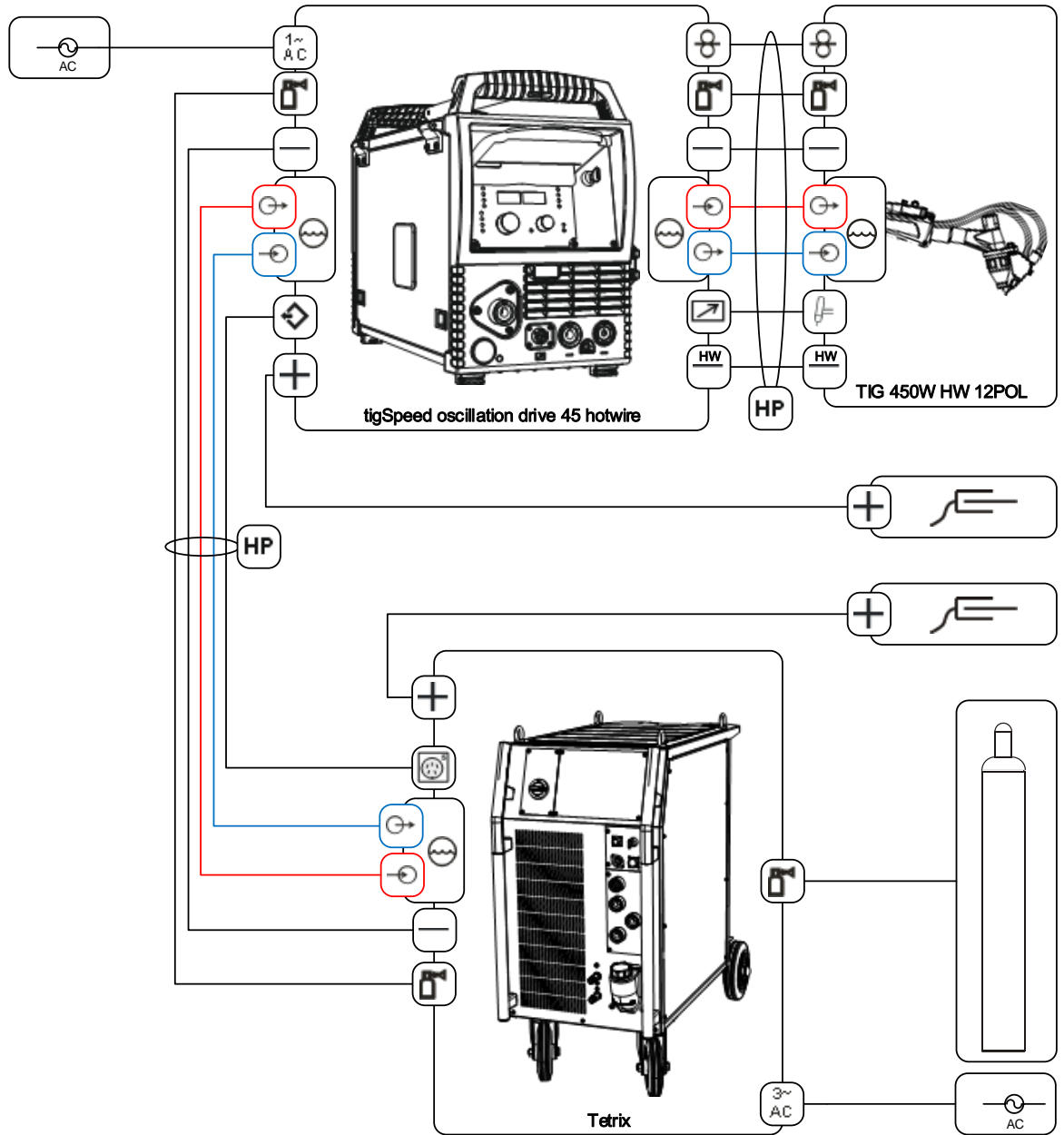
















Figure 5-5

5.5.2.1 Legend

	Shielding gas
	Welding current (minus potential)
	Coolant inlet (colour-coded)
	Coolant outlet (colour-coded)
	Hose package (HP = hose package)
	Welding current (plus potential, workpiece)
	Control cable, hot wire (signal input, 5-pole)
	Control cable, hot wire (signal output, 5-pole)
	Supply voltage connection (1-phase)
	Supply voltage connection (3-phase)
	Welding torch control cable connection (12-pole)
	Hot wire current, (minus potential, TIG hot wire)
	Welding torch control cable (12-pole)
	Wire feeding

5.6 Mains connection

DANGER



Hazard caused by improper mains connection!

An improper mains connection can cause injuries or damage property!

- Only use machine with a plug socket that has a correctly fitted protective conductor.
- If a mains plug must be fitted, this may only be carried out by an electrician in accordance with the relevant national provisions or regulations!
- Mains plug, socket and lead must be checked regularly by an electrician!
- When operating the generator always ensure it is earthed as stated in the operating instructions. The resulting network has to be suitable for operating devices according to protection class 1.

5.6.1 Mains configuration



The machine may only be connected to a one-phase system with two conductors and an earthed neutral conductor.

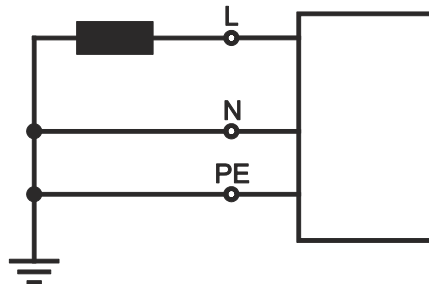


Figure 5-6

Legend

Item	Designation	Colour code
L	Outer conductor	brown
N	Neutral conductor	blue
PE	Protective conductor	green-yellow

CAUTION



Operating voltage - mains voltage!

The operating voltage shown on the rating plate must be consistent with the mains voltage, in order to avoid damage to the machine!

- - See 8 Technical data chapter!

- Insert mains plug of the switched-off machine into the appropriate socket.

5.7 Welding torch cooling system

CAUTION



Coolant mixtures!

Mixtures with other liquids or the use of unsuitable coolants result in material damage and renders the manufacturer's warranty void!

- Only use the coolant described in this manual (overview of coolants).
- Do not mix different coolants.
- When changing the coolant, the entire volume of liquid must be changed.



Insufficient frost protection in the welding torch coolant!

Depending on the ambient conditions, different liquids are used for cooling the welding torch - See 5.7.1 List of coolants chapter.

Coolants with frost protection (KF 37E or KF 23E) must be checked regularly to ensure that the frost protection is adequate to prevent damage to the machine or the accessory components.

- The coolant must be checked for adequate frost protection with the TYP 1 frost protection tester .
- Replace coolant as necessary if frost protection is inadequate!



The disposal of coolant must be carried out according to official regulations and observing the relevant safety data sheets (German waste code number: 70104)!

Coolant must not be disposed of together with household waste.

Coolant must not be discharged into the sewerage system.

Recommended cleaning agent: water, if necessary with cleaning agent added.

5.7.1 List of coolants

The following coolants may be used - See 9 Accessories chapter:

Coolant	Temperature range
KF 23E (Standard)	-10 °C to +40 °C
KF 37E	-20 °C to +10 °C

5.7.2 Maximal hose package length

	Pump 3.5 bar	Pump 4.5 bar
Machines with or without separate wire feeder	30 m	60 m
Compact machines with additional intermediate drive (example. miniDrive)	20 m	30 m
Machines with separate wire feeder and additional intermediate drive (example: miniDrive)	20 m	60 m

Data as a rule refer to the entire hose package length

including welding torch. The pump output is shown on the type plate (parameter: Pmax).

Pump 3.5 bar: Pmax = 0.35 MPa (3.5 bar)

Pump 4.5 bar: Pmax = 0.45 MPa (4.5 bar)

5.8 Intermediate hose package connection

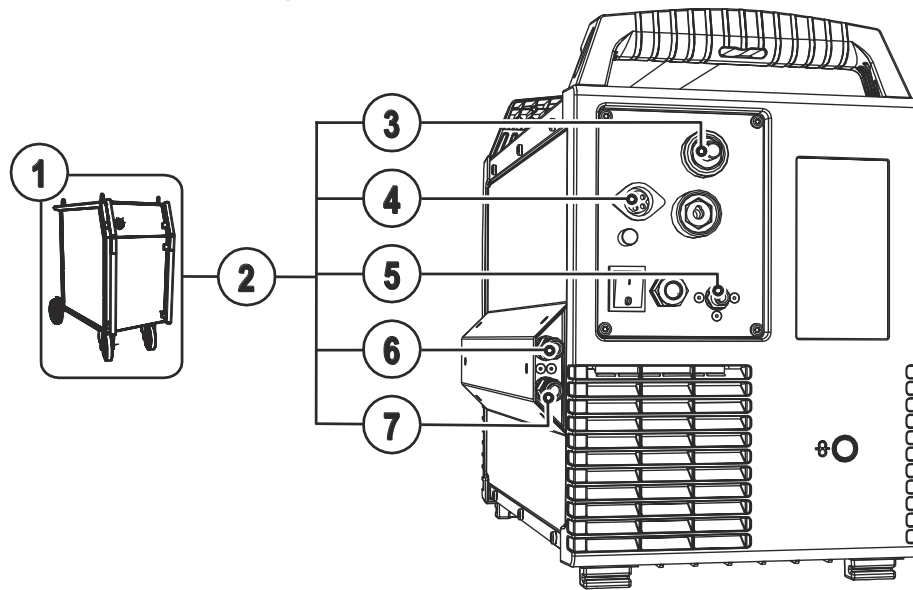
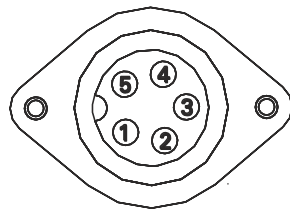


Figure 5-7

Item	Symbol	Description
1		Power source
2		Intermediate hose package
3		Connector plug (TIG) Welding current, minus potential
4		Connector plug, 5-pole Control lead
5		Connecting nipple G$\frac{1}{4}$, shielding gas connection
6		Quick connect coupling (red) coolant return
7		Quick connect coupling (blue) coolant supply

- Push the cable socket for the welding current (TIG) onto the connector plug (TIG) and lock by turning to the right.
- Lock connecting nipples of the cooling water tubes into the corresponding quick connect couplings: Return line red to quick connect coupling, red (coolant return) and supply line blue to quick connect coupling, blue (coolant supply).
- Insert the control cable plug into the connection socket (5-pole) and secure (the plug can only be inserted into the connection socket in one position).
- Screw the crown nut on the shielding gas lead gastight to the connecting thread (G $\frac{1}{4}$ ").

5.8.1 Control cable pin configuration




1	BRT Ausgang
2	BRT Ausgang
3	NC
4	NC
5	NC

Figure 5-8

Output (make contact) for torch trigger input of the power source (floating contact)

5.9 Connection for workpiece lead

 The item described in the following is part of the machine's scope of delivery.

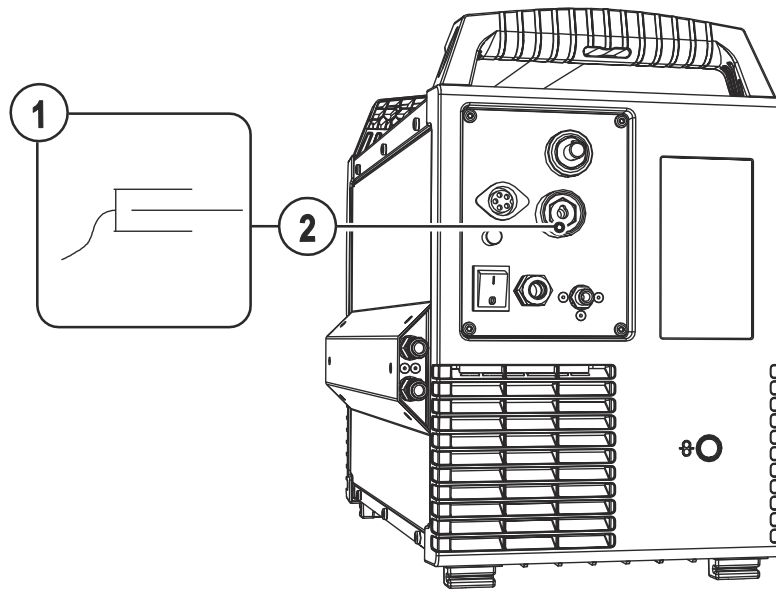




Figure 5-9

Item	Symbol	Description
1		Workpiece
2		Connection socket (TIG hot wire) Hot wire power, plus potential, workpiece connection

- Push the cable plug for the hot wire current onto the connection socket (TIG hot wire) and lock by turning to the right.

5.10 Welding torch connection

CAUTION



Equipment damage due to improperly connected coolant pipes!

If the coolant pipes are not properly connected or a gas-cooled welding torch is used, the coolant circuit is interrupted and equipment damage can occur.

- Connect all coolant pipes correctly!
- Completely unroll the hose package and the torch hose package!
- Observe maximal hose package length - See 5.7 Welding torch cooling system chapter.
- When using a gas-cooled welding torch, use a hose bridge to establish the coolant circuit - See 9 Accessories chapter.



Prepare welding torch according to the welding task in hand (see operating instructions for the torch).

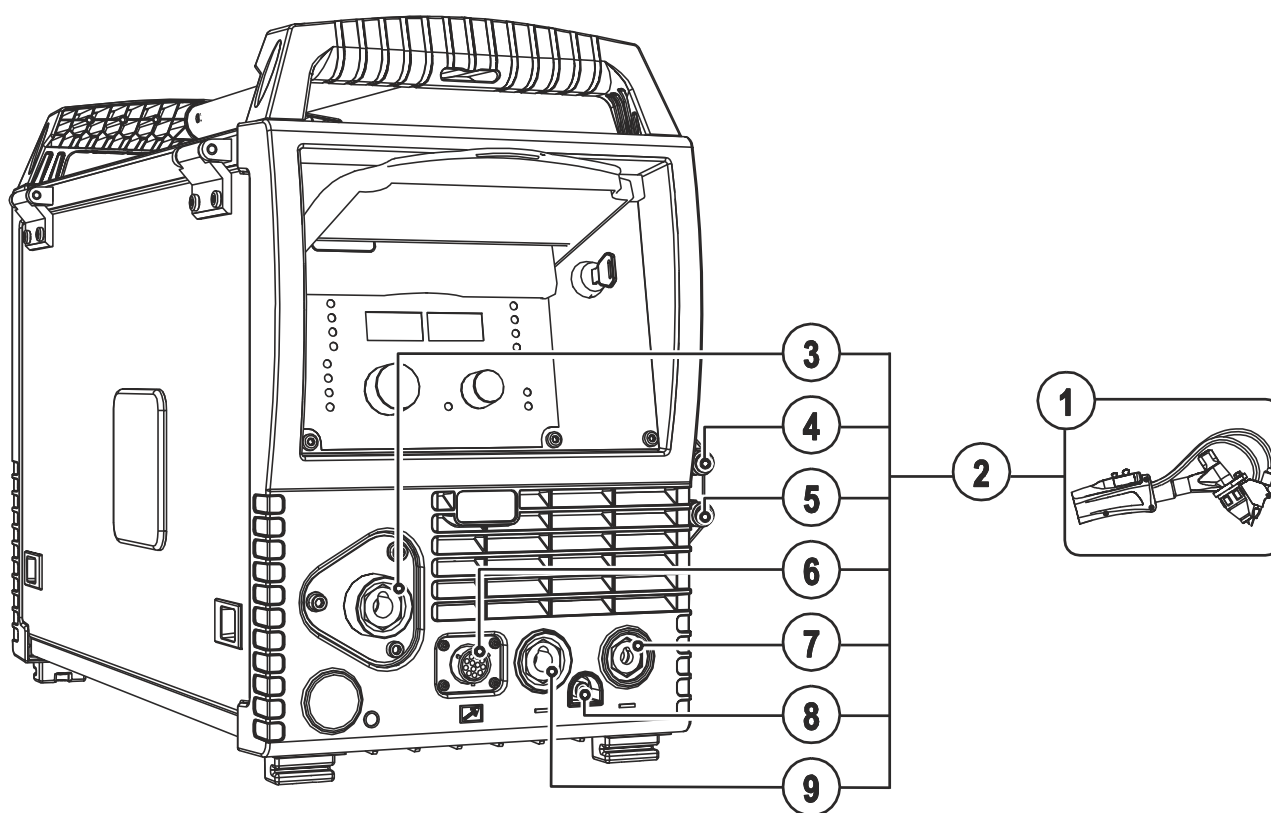


Figure 5-10

Item	Symbol	Description
1		Welding torch Observe additional system documents!
2		Welding torch hose package
3		Wire electrode connection Welding torch wire feed
4		Quick connect coupling (red) coolant return
5		Quick connect coupling (blue) coolant supply
6		Connection socket (12-pole) Welding torch control lead

Item	Symbol	Description
7		Connection socket (TIG hot wire) Hot wire power, minus potential
8		Quick connect coupling Shielding gas
9		Connection socket (TIG) Welding current, minus potential

- Extend and lay out the torch hose package.
- Insert the wire feed plug of the welding torch into the wire electrode connector and lock by turning to the right.
- Push the cable plug for the welding current (TIG) onto the connection socket (TIG) and lock by turning to the right.
- Insert shielding gas rapid-action closure nipple in the quick connect coupling and engage.
- Insert welding torch control lead into the 12-pole connection socket and secure with the crown nut.

If fitted:

- Lock connecting nipples of the cooling water tubes into the corresponding quick connect couplings: Return line red to quick connect coupling, red (coolant return) and supply line blue to quick connect coupling, blue (coolant supply).
- Push the cable plug for the hot wire current onto the connection socket (TIG hot wire) and lock by turning to the right.

5.10.1 Control cable pin configuration

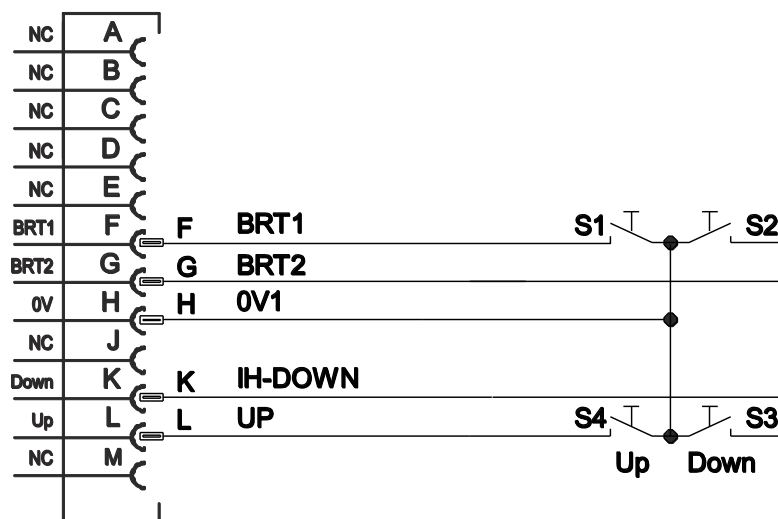


Figure 5-11

5.11 Wire feed

5.11.1 Open the protective flap of the wire feeder

CAUTION



To perform the following steps, the protective flap of the wire feeder needs to be opened. Make sure to close the protective flap again before starting to work.

- Unlock and open protective flap.

5.11.2 Inserting the wire spool

CAUTION



Risk of injury due to incorrectly secured wire spool.

If the wire spool is not secured properly, it may come loose from the wire spool holder and fall to the ground, causing damage to the machine and injuries.

- Securely fasten the wire spool to the wire spool holder using the knurled nut.
- Before you start working, always check the wire spool is securely fastened.



Standard D300 wire spool holder can be used. Adapters - See 9 Accessories chapter are required when using standardised basket coils (DIN 8559).

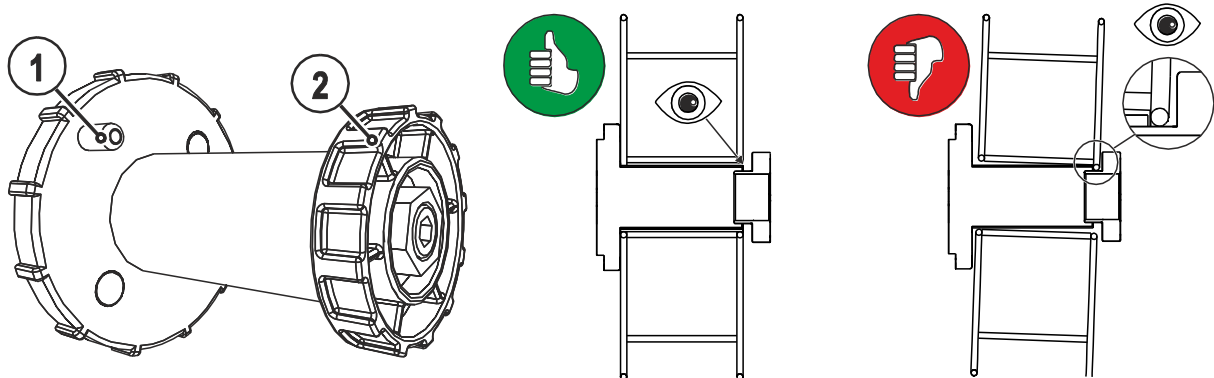



Figure 5-12

Item	Symbol	Description
1		Carrier pin For fixing the wire spool
2		Knurled nut For fixing the wire spool

- Loosen knurled nut from spool holder.
- Fix welding wire reel onto the spool holder so that the carrier pin locks into the spool bore.
- Fasten wire spool using knurled nut.

5.11.3 Changing the wire feed rollers

 **Unsatisfactory welding results due to faulty wire feeding! Wire feed rollers must be suitable for the diameter of the wire and the material.**

- **Check the roller label to verify that the rollers are suitable for the wire diameter. Turn or change if necessary!**
- **use V-groove rollers with for steel wires and other hard wires,**
- **use U-groove rollers for aluminium wires and other soft, alloyed wires.**
- Slide new drive rollers into place so that the diameter of the wire used is visible on the drive roller.
- Screw the drive rollers in place with knurled screws.

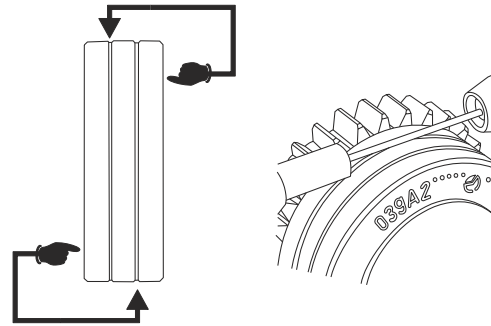


Figure 5-13

5.11.4 Inching the wire electrode

CAUTION



Risk of injury due to moving parts!

The wire feeders are equipped with moving parts, which can trap hands, hair, clothing or tools and thus injure persons!

- Do not reach into rotating or moving parts or drive components!
- Keep casing covers or protective caps closed during operation!



Risk of injury due to welding wire escaping in an unpredictable manner!

Welding wire can be conveyed at very high speeds and, if conveyed incorrectly, may escape in an uncontrolled manner and injure persons!

- Before mains connection, set up the complete wire guide system from the wire spool to the welding torch!
- Remove the pressure rollers from the wire feeder if no welding torch is fitted!
- Check wire guide at regular intervals!
- Keep all casing covers or protective caps closed during operation!



Risk of injury due to welding wire escaping from the welding torch!

The welding wire can escape from the welding torch at high speed and cause bodily injury including injuries to the face and eyes!

- Never direct the welding torch towards your own body or towards other persons!

CAUTION



Extensive wear due to incorrect contact pressure!

Incorrect contact pressure will cause extensive wear of the wire feed rollers!

- With the adjusting nuts of the pressure units set the contact pressure so that the wire electrode is conveyed but will still slip through if the wire spool jams.
- Set the contact pressure of the front rollers (in wire feed direction) to a higher value!



The inching speed is infinitely adjustable by simultaneously pressing the wire inching push-button and turning the wire speed rotary knob. The left display shows the wire feed speed selected, the right display shows the current motor current of the wire feed mechanism.



The push-button of the welding torch can be used as well to inch and reverse inch the wire. - See 5.13 Configuring the welding machine for mechanical arc fusion welding chapter

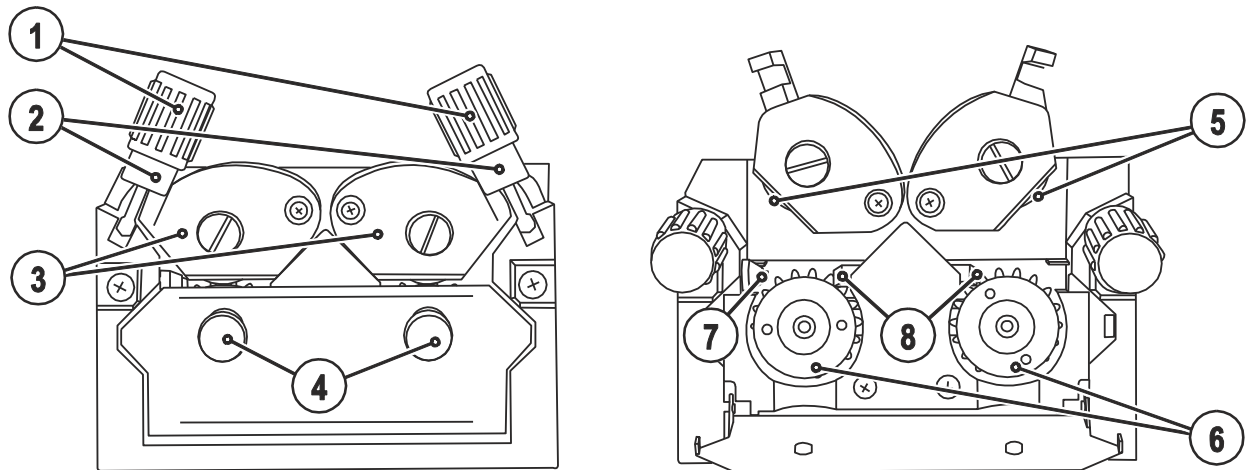


Figure 5-14

Item	Symbol	Description
1		Adjusting nut
2		Feed roll tensioner Fixing the clamping unit and setting the pressure.
3		Clamping unit
4		Knurled screw
5		Pressure roller
6		Drive roller
7		Wire feed nipple
8		Guide tube

- Extend and lay out the torch hose package.
- Unfasten pressure units and fold out (clamping units and pressure rollers will automatically flip upwards).
- Unwind welding wire carefully from the wire spool and insert through the wire inlet nipple over the drive roller grooves and the guide pipe into the capillary tube and Teflon core using guide pipe.
- Press the clamping element with the pressure roller back downwards and fold the wire units back up again (wire electrode should be in the groove on the drive roller).
- Set the contact pressure with the adjusting nuts of the pressure unit.
- Press the wire inching button until the wire electrode projects out of the welding torch.

5.11.5 Spool brake setting

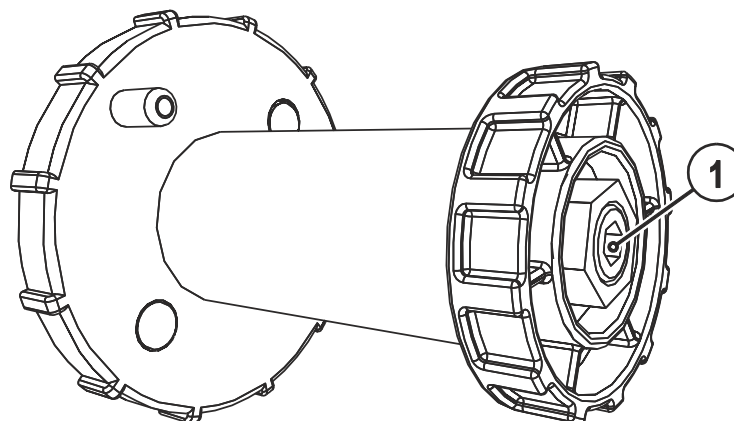


Figure 5-15

Item	Symbol	Description
1		Allen screw Securing the wire spool retainer and adjustment of the spool brake

- Tighten the Allen screw (8 mm) in the clockwise direction to increase the braking effect.



Tighten the spool brake until the wire spool no longer turns when the wire feed motor stops but without it jamming during operation!

5.12 Shielding gas supply (shielding gas cylinder for welding machine)

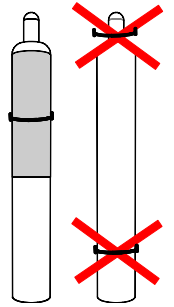
5.12.1 Connecting the shielding gas supply

WARNING



**Risk of injury due to improper handling of shielding gas cylinders!
Improper handling and insufficient securing of shielding gas cylinders can cause serious injuries!**

- Secure shielding gas cylinders using the standard fastening elements on the unit (chain/belt)!
- The fastening elements must tightly enclose the shielding gas cylinder!
- Attach the fastening elements within the upper half of the shielding gas cylinder!
- Do not attach any element to the shielding gas cylinder valve!
- Observe the instructions from the gas manufacturer and any relevant regulations concerning the use of compressed air!
- Avoid heating the shielding gas cylinder!



CAUTION



Faults in the shielding gas supply.

An unhindered shielding gas supply from the shielding gas cylinder to the welding torch is a fundamental requirement for optimum welding results. In addition, a blocked shielding gas supply may result in the welding torch being destroyed.

- Always re-fit the yellow protective cap when not using the shielding gas connection.
- All shielding gas connections must be gas tight.



Before connecting the pressure regulator to the gas cylinder, open the cylinder valve briefly to expel any dirt.

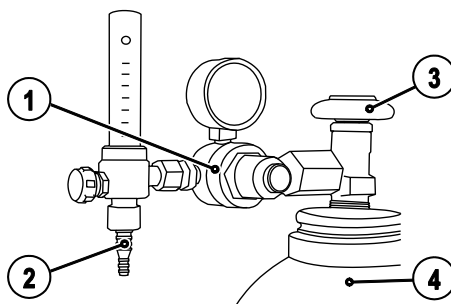



Figure 5-16

Item	Symbol	Description
1		Pressure regulator
2		Shielding gas cylinder
3		Output side of the pressure regulator
4		Cylinder valve

- Place the shielding gas cylinder into the relevant cylinder bracket.
- Secure the shielding gas cylinder using a securing chain.
- Tighten the pressure regulator screw connection on the gas bottle valve to be gas-tight.
- Tighten gas hose on pressure regulator to be gas tight.
- Fasten the gas hose to the shielding gas connecting nipple at the back of the machine using the crown nut.

5.12.2 Gas test

- Slowly open the gas cylinder valve.
- Open the pressure regulator.
- Switch on the power source at the main switch.
- Initiate gas test function on the machine control.
- Set the relevant gas quantity for the application on the pressure regulator.
- The gas test is triggered on the machine control by pressing the  button briefly.

Shielding gas flows for around 25 seconds or until the button is pressed again.

5.13 Configuring the welding machine for mechanical arc fusion welding

The welding machine must be configured before commissioning for the first time for mechanical arc fusion welding (cold or hot wire welding). The basic settings are configured directly at the welding machine control.

1. Cold or hot wire welding process (Hotwire = on/off)
2. Forward/backward motion selection (Freq = on/off)

In addition, the wire return can be adjusted if necessary.

5.13.1 Function sequences/operating modes



Torch trigger 1 (BRT 1) switches the welding current on or off.

Torch trigger 2 (BRT 2) switches the wire feeding on or off.

In addition, you can inch the wire by pressing torch trigger 2 (BRT 2) or reverse inch the wire by tapping it.

You can choose between four operating modes (see the following functional sequences). Wire feeding is infinitely adjustable by means of torch triggers 3 and 4 (BRT 3 and BRT 4).

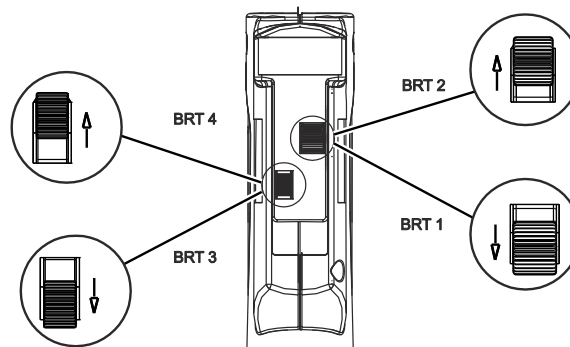


Figure 5-17

5.13.1.1 Explanation of symbols

Symbol	Meaning
	Press torch trigger
	Release torch trigger
	Tap torch trigger (quick pressing and releasing)
	Shielding gas flowing
I	Welding performance
	Non-latched, manual
	Latched, manual
	Non-latched automatic
	Latched automatic
t	Time
P _{START}	Start program
P _A	Main program
P _B	Reduced main program
P _{END}	End program
	Wire feeding

5.13.1.2 Non-latched Manual

The welding machine has to be set to a latched operating mode.

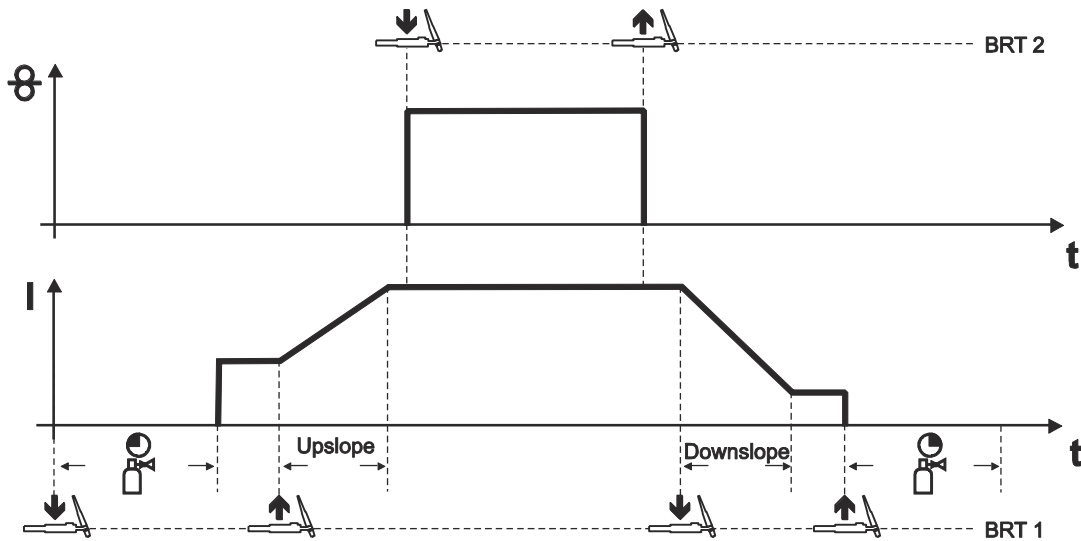


Figure 5-18

First cycle (current)

- Press torch trigger 1 (BRT 1), the gas pre-flow time elapses.
- HF ignition pulses jump from the tungsten electrode to the workpiece. The arc ignites.
- Welding current flows.

Second cycle (current)

- BRT 1 Release .
- The welding current ramps up to the main current AMP in the selected up-slope time.

First cycle (wire)

- Press torch trigger 2 (BRT 2).
Wire electrode is fed.

Second cycle (wire)

- BRT 2 Release .
Wire electrode feeding is stopped, wire electrode is returned by the set wire return value.

Third cycle (current)

- BRT 1 Press .
- The main current is reduced in the selected down-slope time.

Fourth cycle (current)

- BRT 1 Release , the arc extinguishes.
- Shielding gas continues to flow in the selected gas post-flow time.

5.13.1.3 Latched manual

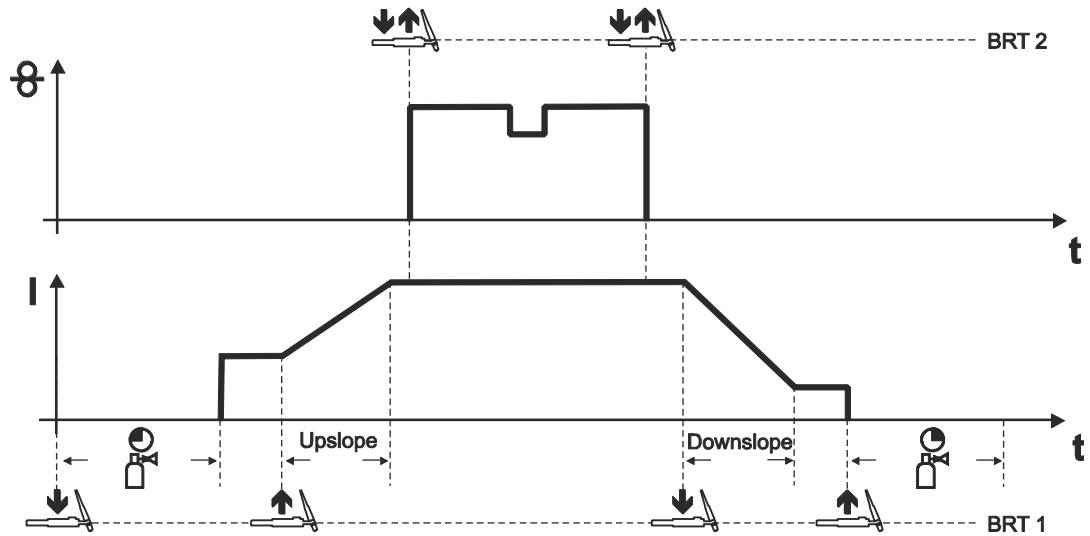


Figure 5-19

This operating mode differs from non-latched operation in the following ways:

- Wire feeding is started by pressing and releasing (tapping) BRT 2.
- By tapping you can switch to the reduced wire feeding.
- By pressing and releasing (tapping) BRT 2 again, wire feeding will stop. (It is not necessary to keep the torch trigger pressed. This is especially helpful with long welding seams.)

Stopping the welding process:

- Keep BRT 1 pressed for a period longer than the set tapping time.



Wire feeding can already be stopped by pressing the BRT2 torch trigger.

For this to work, the "3rd cycle" parameter has to be activated, - See 5.14 Menus and sub-menus on the machine control chapter.

5.13.1.4 Non-latched automatic

The welding machine has to be set to a non latched operating mode.

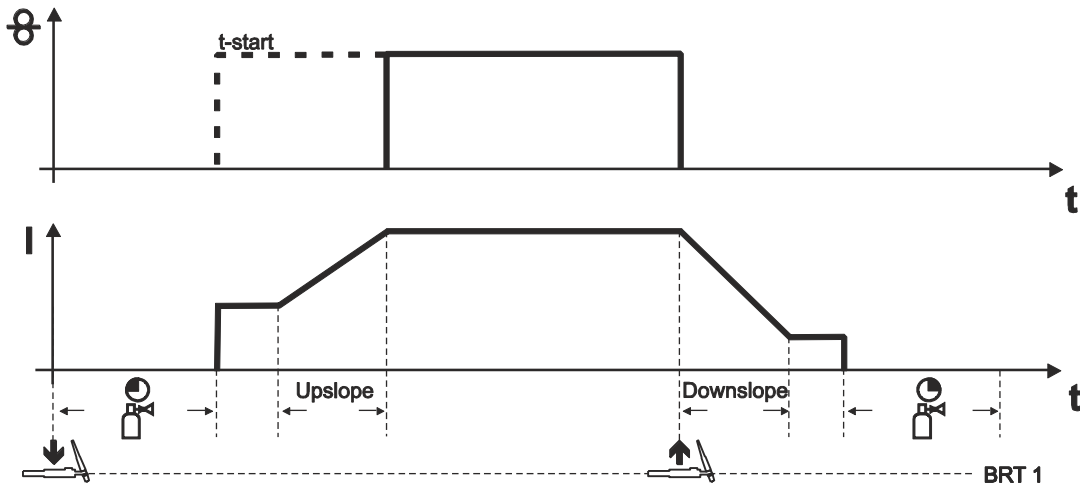


Figure 5-20

First cycle (current)

- Press torch trigger 1 (BRT 1) and keep pressed.
- The gas pre-flow time elapses.
- HF ignition pulses jump from the electrode to the workpiece. The arc ignites.
- The welding current flows and immediately assumes the value of the starting current I_{start} .
- HF switches off.
- The welding current increases in the set up-slope time to the main current AMP.
- The wire electrode is fed once the delay time (t-start) has elapsed.

Second cycle (current)

- Release BRT 1.
- Wire electrode feeding is stopped, wire electrode is returned by the set wire return value.
- The main current is reduced in the selected down-slope time, the arc is extinguished.
- Shielding gas continues to flow in the selected gas post-flow time.

5.13.1.5 Latched automatic

 The welding machine has to be set to a latched operating mode.

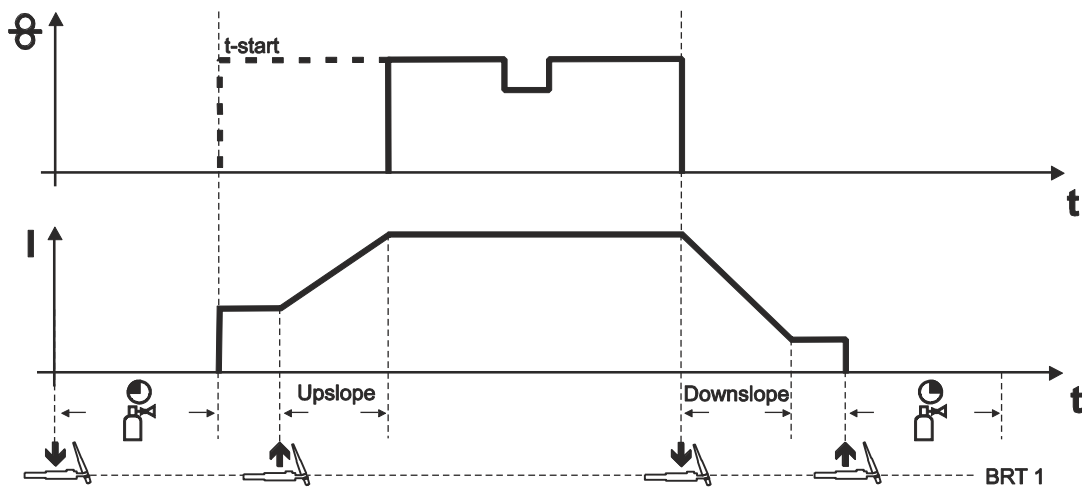


Figure 5-21

1. cycle (current)

- Press torch trigger 1 (BRT 1), the gas pre-flow time elapses.
- HF ignition pulses jump from the tungsten electrode to the workpiece. The arc ignites.
- Welding current flows.

2. cycle (current)

Release BRT 1.

- The welding current ramps up to the main current AMP in the selected up-slope time.

1. cycle (wire)

- The wire electrode is fed once the delay time (t-start) has elapsed.

3. cycle (current)

- Press BRT 1.
- The main current is reduced in the selected down-slope time.

2. cycle (wire)

- Wire electrode feeding is stopped, wire electrode is returned by the set wire return value.

4. cycle (current)

- Release BRT 1, the arc extinguishes.
- Shielding gas continues to flow in the selected gas post-flow time.
- By tapping you can switch to the reduced wire feeding.
- By pressing and releasing (tapping) BRT 1 again, wire feeding will stop. (It is not necessary to keep the torch trigger pressed. This is especially helpful with long welding seams.)

Stopping the welding process:

- Keep BRT 1 pressed for a period longer than the set tapping time.

5.13.1.6 TIG tacking

The welding machine has to be set to a non latched operating mode.

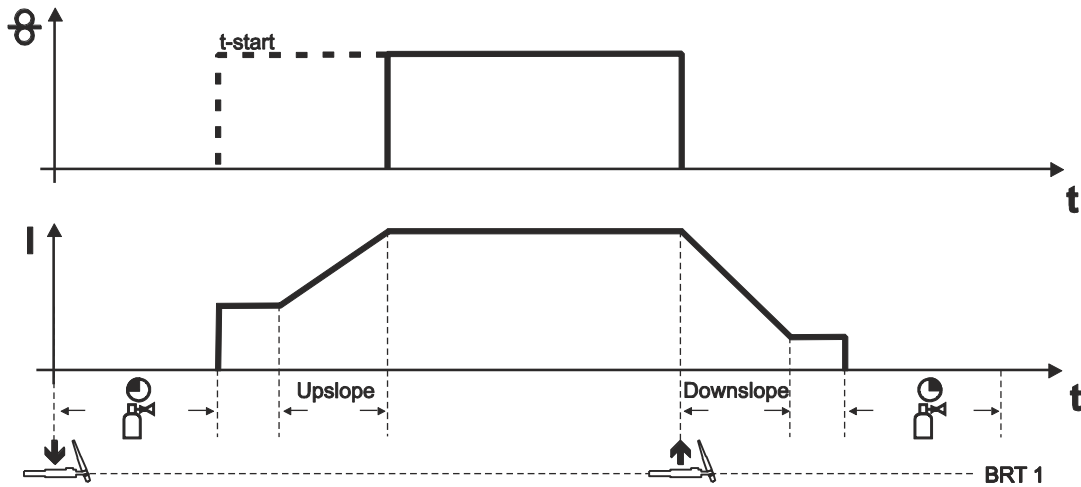


Figure 5-22

Sequence:

- Press torch trigger 1 (BRT 1) and keep pressed.
- The gas pre-flow time elapses.
- HF ignition pulses jump from the electrode to the workpiece. The arc ignites.
- The welding current flows and immediately assumes the value of the starting current I_{start} .
- HF switches off.
- The welding current increases in the set up-slope time to the main current AMP.
- The wire electrode is fed once the delay time (t-start) has elapsed.
- Release BRT 1.
- Wire electrode feeding is stopped, wire electrode is returned by the set wire return value.
- The main current is reduced in the selected down-slope time, the arc is extinguished.
- Shielding gas continues to flow in the selected gas post-flow time.

5.13.1.7 superPuls



The two functions **superPuls** and **superimposed forward/backward motion of the wire** can not be used simultaneously.

The EWM superPuls function enables automatic switching between two operating points in a process.

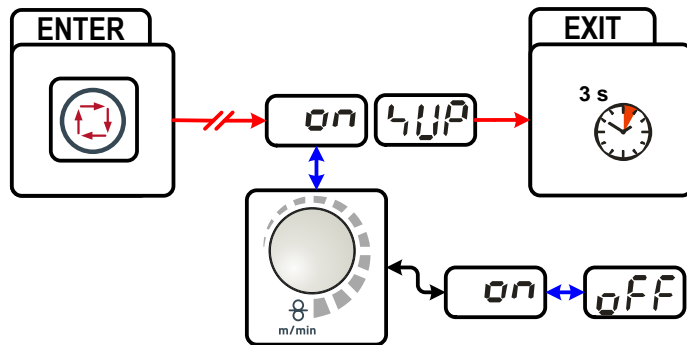


Figure 5-23

Display	Setting/selection
	Selects superPuls Switches function on or off.
	Switch on Switching on machine function
	Switch off Switching off machine function

5.13.2 Selection and adjustment

Setting the welding programs with the welding machine control

Operating element	Action	Result	Display
		Press the push-button until signal light Prog flashes.	 Wire feed speed (left)/program number (right)
		Select/get program number, e.g. No. 1	
		Set operating mode (can be defined separately for each program)	No change
		Select "main program (P _A)" program sequence parameter. (signal light on)	
		Set wire feed speed. (absolute value)	
		Switch on Hotwire function.	
		Press the push-button until signal light AMP Hotwire flashes.	 Wire feed speed (left)/hot wire current (right)
		Set hot wire current for the individual program (e.g. 75 A for program 1).	
		Set superimposed forward/backward motion.	
		Press the push-button until signal light Hz Freq flashes.	 Wire feed speed (left)/forward/backward motion frequency (right)
		Set forward/backward motion frequency for the individual program (e.g. 5 Hz for program 1).	

5.14 Menus and sub-menus on the machine control

5.14.1 Direct menus (direct access to parameters)

Functions, parameters and their values can be accessed directly, e.g. can be selected by pressing a button once.

5.14.2 Expert menu

ENTER (enter the menu)

- Keep the "welding parameters" button pressed for 4 s.

NAVIGATION (Navigating in the menu)

- Parameters are selected by pressing the "welding parameters" button.
- Set or change the parameters by turning the "welding parameter setting" rotary dial.

EXIT (leave the menu)

- After 4 s, the machine will return automatically to the ready-to-operate status.

The expert menu includes functions and parameters which are either not set on the machine control, or which do not require regular setting.

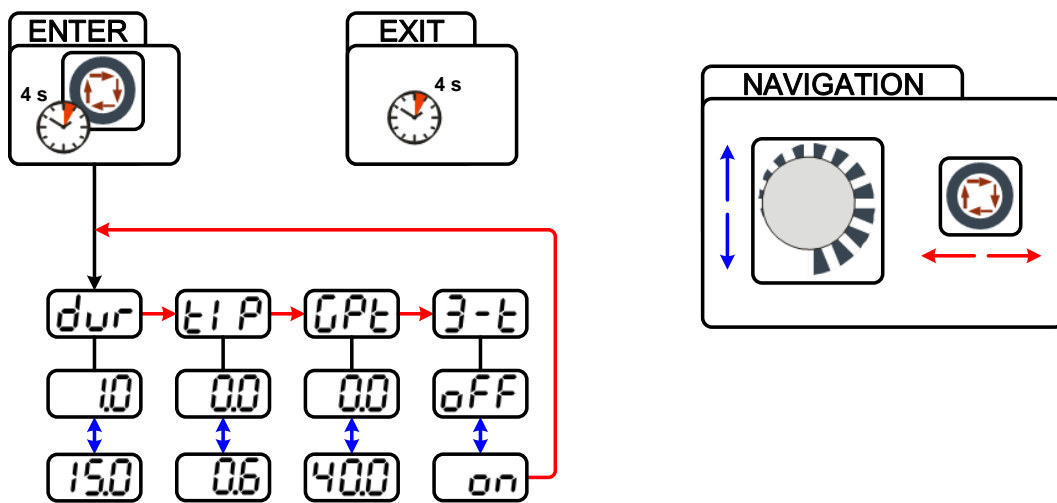


Figure 5-24

Display	Setting/selection
	WIRE RETURN speed Setting range 1 m/min to 15 m/min
	Tapping time Setting range: 0.0 s to 0.6 s (0.1 s increments).
	Gas post-flow time Setting range: 0.0 s to 40.0 s (0.1 s increments).
	Wire stop with manual latched operation <ul style="list-style-type: none"> • on = wire stops in the 3rd cycle • off = wire stops in the 4th cycle (ex works)

5.15 Protecting welding parameters from unauthorised access

To prevent people from unauthorised or inadvertent changing of the welding parameters at the machine, entering values on the control can be blocked by using the key switch.

Key position 1 = All parameters can be set

Key position 0 = The following controls/functions cannot be changed:

- Push-button for switching the wire feed speed display
- Parameter value " hot wire current " can be displayed but not changed
- Parameter value "forward/backward motion" can be displayed but not changed
- Parameter values in the functional sequence can be displayed but not changed

5.16 Welding torch holder

The item described in the following is part of the machine's scope of delivery.

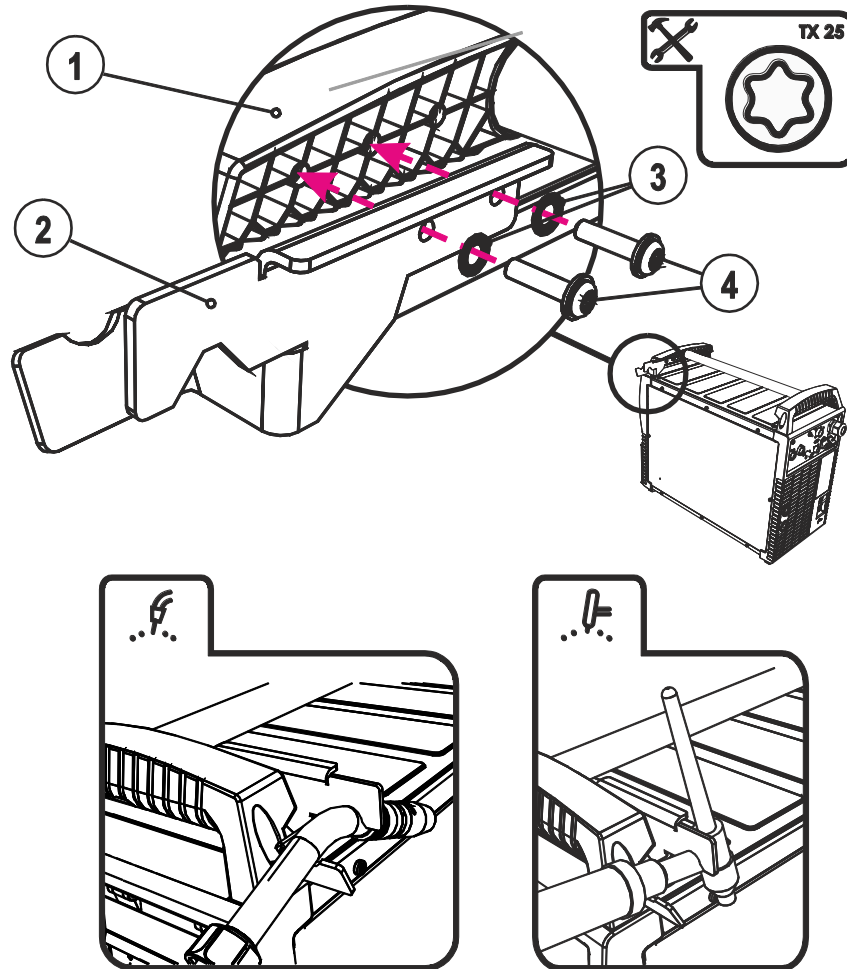


Figure 5-25

Item	Symbol	Description
1		Crossmember of the transport handle
2		Torch holder
3		Fan-type lock washers
4		Fixing screws (x 4)

- Use the mounting screws to screw the torch holder onto the crossmember of the transport handle.
- Insert the welding torch into the welding torch holder as shown.

6 Maintenance, care and disposal



DANGER



Improper maintenance and testing

The equipment may only be cleaned, repaired or tested by specialist, skilled persons! A skilled person is one who, due to training, knowledge and experience, is able to recognise the dangers that can occur during testing of this equipment as well as possible subsequent damage and who is able to implement the required safety procedures.

- Complete all tests given in the chapter below!
- Only put the equipment back into operation following a successful test.



Risk of injury from electric shock!

Cleaning machines that are not disconnected from the mains can lead to serious injuries!

- Disconnect the machine completely from the mains.
- Remove the mains plug!
- Wait for 4 minutes until the capacitors have discharged!

Repair and maintenance work may only be performed by qualified authorised personnel; otherwise the right to claim under warranty is void. In all service matters, always consult the dealer who supplied the machine. Return deliveries of defective equipment subject to warranty may only be made through your dealer. When replacing parts, use only original spare parts. When ordering spare parts, please quote the machine type, serial number and item number of the machine, as well as the type designation and item number of the spare part.

6.1 General

When used in the specified environmental conditions and under normal operating conditions, this machine is largely maintenance-free and requires a minimum of care.

There are some points, which should be observed, to guarantee fault-free operation of your welding machine. Among these are regular cleaning and checking as described below, depending on the pollution level of the environment and the length of time the unit is in use.

6.2 Maintenance work, intervals

6.2.1 Daily maintenance tasks

- Check that all connections and wearing parts are hand-tight and tighten if necessary.
- Check that all screw and plug connections and replaceable parts are secured correctly, tighten if necessary.
- Remove any spatter.
- Clean the wire feed rollers on a regular basis (depending on the degree of soiling).

6.2.1.1 Visual inspection

- Check hose package and power connections for exterior damage and replace or have repaired by specialist staff as necessary!
- Mains supply lead and its strain relief
- Gas tubes and their switching equipment (solenoid valve)
- Other, general condition

6.2.1.2 Functional test

- Check correct mounting of the wire spool.
- Welding current cables (check that they are fitted correctly and secured)
- Gas cylinder securing elements
- Operating, message, safety and adjustment devices (Functional test)

6.2.2 Monthly maintenance tasks

6.2.2.1 Visual inspection

- Casing damage (front, rear and side walls)
- Wheels and their securing elements
- Transport elements (strap, lifting lugs, handle)
- Check coolant tubes and their connections for impurities

6.2.2.2 Functional test

- Selector switches, command devices, emergency stop devices, voltage reducing devices, message and control lamps
- Check that the wire guide elements (inlet nipple, wire guide tube) are fitted securely.

6.2.3 Annual test (inspection and testing during operation)



The welding machine may only be tested by competent, capable persons! A capable person is one who, because of his training, knowledge and experience, is able to recognise the dangers that can occur while testing welding power sources as well as possible subsequent damage and who is able to implement the required safety procedures.



For more information refer to the "Warranty registration" brochure supplied and our information regarding warranty, maintenance and testing at www.ewm-group.com!

A periodic test according to IEC 60974-4 "Periodic inspection and test" has to be carried out. In addition to the regulations on testing given here, the relevant local laws and regulations must also be observed.

6.3 Disposing of equipment



Proper disposal!

The machine contains valuable raw materials, which should be recycled, and electronic components, which must be disposed of.

- **Do not dispose of in household waste!**
- **Observe the local regulations regarding disposal!**



6.3.1 Manufacturer's declaration to the end user

- According to European provisions (guideline 2002/96/EG of the European Parliament and the Council of January, 27th 2003), used electric and electronic equipment may no longer be placed in unsorted municipal waste. It must be collected separately. The symbol depicting a waste container on wheels indicates that the equipment must be collected separately. This machine is to be placed for disposal or recycling in the waste separation systems provided for this purpose.
- According to German law (law governing the distribution, taking back and environmentally correct disposal of electric and electronic equipment (ElektroG) from 16.03.2005), used machines are to be placed in a collection system separate from unsorted municipal waste. The public waste management utilities (communities) have created collection points at which used equipment from private households can be disposed of free of charge.
- Information about giving back used equipment or about collections can be obtained from the respective municipal administration office.
- EWM participates in an approved waste disposal and recycling system and is registered in the Used Electrical Equipment Register (EAR) under number WEEE DE 57686922.
- In addition to this, returns are also possible throughout Europe via EWM sales partners.

6.4 Meeting the requirements of RoHS

We, EWM AG Mündersbach, hereby confirm that all products supplied by us which are affected by the RoHS Directive, meet the requirements of the RoHS (Directive 2011/65/EU).

7 Rectifying faults

All products are subject to rigorous production checks and final checks. If, despite this, something fails to work at any time, please check the product using the following flowchart. If none of the fault rectification procedures described leads to the correct functioning of the product, please inform your authorised dealer.

7.1 Checklist for rectifying faults



The correct machine equipment for the material and process gas in use is a fundamental requirement for perfect operation!

Legend	Symbol	Description
	↘	Fault/Cause
	✘	Remedy

Coolant error/no coolant flowing

- ↘ Insufficient coolant flow
 - ✘ Check coolant level and refill if necessary
 - ✘ Eliminate kinks in conduit system (hose packages)
 - ✘ Reset automatic cutout of the coolant pump by activating
- ↘ Air in the coolant circuit
 - ✘ Vent coolant circuit - See 7.4 Vent coolant circuit chapter

Functional errors

- ↘ Machine control without displaying the signal lights after switching on
 - ✘ Phase failure > check mains connection (fuses)
- ↘ No welding performance
 - ✘ Phase failure > check mains connection (fuses)
- ↘ Various parameters cannot be set
 - ✘ Entry level is blocked, disable access lock - See 5.15 Protecting welding parameters from unauthorised access chapter
- ↘ Connection problems
 - ✘ Make control lead connections and check that they are fitted correctly.

Welding torch overheated

- ↘ Loose welding current connections
 - ✘ Tighten power connections on the torch and/or on the workpiece
 - ✘ Tighten contact tip correctly
- ↘ Overload
 - ✘ Check and correct welding current setting
 - ✘ Use a more powerful welding torch

Unstable arc

- ↘ Unsuitable or worn welding torch equipment
 - ✘ Adjust contact tip to wire diameter and -material and replace if necessary
 - ✘ Adjust wire guide to material in use, blow through and replace if necessary
- ↘ Material inclusions in the tungsten electrode due to contact with filler material or workpiece
 - ✘ Regrind or replace the tungsten electrode
- ↘ Incompatible parameter settings
 - ✘ Check settings and correct if necessary

Wire feed problems

- ✓ Unsuitable or worn welding torch equipment
 - ✗ Adjust contact tip (cold wire/hot wire) to wire diameter, blow through and replace if necessary
 - ✗ Adjust wire guide to material in use, blow through and replace if necessary
- ✓ Contact tip blocked
 - ✗ Clean, spray with anti-spatter spray and replace if necessary
- ✓ Setting the spool brake - See 5.11.5 Spool brake setting chapter
 - ✗ Check settings and correct if necessary
- ✓ Setting pressure units - See 5.11.4 Inching the wire electrode chapter
 - ✗ Check settings and correct if necessary
- ✓ Worn wire rolls
 - ✗ Check and replace if necessary
- ✓ Wire feed motor without supply voltage (automatic cutout triggered by overloading)
 - ✗ Reset triggered fuse (rear of the power source) by pressing the key button
- ✓ Kinked hose packages
 - ✗ Extend and lay out the torch hose package
- ✓ Incompatible parameter settings
 - ✗ Check settings and correct if necessary
- ✓ Arc between gas nozzle and workpiece (metal vapour on the gas nozzle)
 - ✗ Replace gas nozzle

Pore formation

- ✓ Inadequate or missing gas shielding
 - ✗ Check shielding gas setting and replace shielding gas cylinder if necessary
 - ✗ Shield welding site with protective screens (draughts affect the welding result)
 - ✗ Use gas lens for aluminium applications and high-alloy steels
- ✓ Unsuitable or worn welding torch equipment
 - ✗ Check size of gas nozzle and replace if necessary
- ✓ Condensation (hydrogen) in the gas tube
 - ✗ Replace hose package

7.2 Error messages

A welding machine error is indicated by the collective fault signal lamp (A1) lighting up and an error code (see table) being displayed in the machine control display. In the event of a machine error, the power unit shuts down.

The display of possible error numbers depends on the machine version (interfaces/functions).

- Document machine errors and inform service staff as necessary.

Error message	Possible cause	Remedy
Err 3	Speedometer error	Check wire guide/hose package
Err 10	PE error	Switch the machine off and on again. If the error persists, notify the service department.
Err 34	Hot wire inverter	Switch the machine off and on again. If the error persists, notify the service department.

7.3 Resetting welding parameters to the factory settings

All customised welding parameters that are stored will be replaced by the factory settings.

Operating element	Action	Result	Display	
			left	right
		Switch off the welding machine		
 Hz ● Freq ● Prog ● AMP ● Hotwire		Keep the push-button pressed		
		Switch on the welding machine		
 Hz ● Freq ● Prog ● AMP ● Hotwire		Release the push-button Wait about 3 seconds		
		Switch off the welding machine and restart in order to put the changes into effect.		

7.4 Vent coolant circuit

To vent the cooling system always use the blue coolant connection, which is located as deep as possible inside the system (close to the coolant tank)!

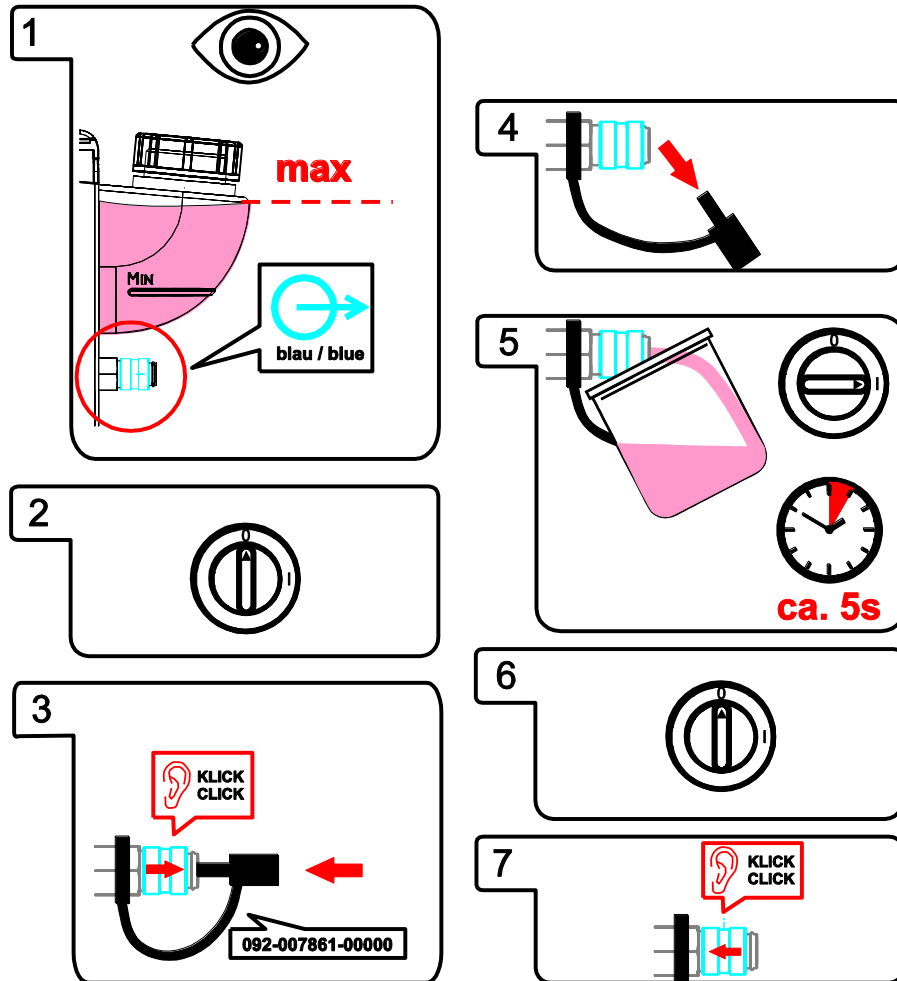


Figure 7-1

8 Technical data

8.1 tigSpeed oscillation drive 45 hotwire




Performance specifications and guarantee only in connection with original spare and replacement parts!

Hot wire current setting range	40 A to 180 A
Max. hot wire voltage	10 V
Duty cycle at 40 °C ambient temperature	
35% DC	180 A
60% DC	150 A
100% DC	130 A
Load alternation	10 min. (60% DC \triangleq 6 min. welding, 4 min. pause)
Open circuit voltage	98 V
Reduced open circuit voltage	10 V
Mains voltage (tolerances)	1 x 230 V (-40% to +15%)
Frequency	50/60 Hz
Mains fuse	1 x 10 A
Mains connection lead	H07RN-F4G2,5
Max. connected load	2.8 kVA
Recommended generator rating	3.8 kVA
cos ϕ /efficiency	0.99 / 86%
Insulation class/protection classification	H/IP 23
Ambient temperature*	-25 °C to +40 °C
Machine cooling	Fan
Hot wire current welding lead	25 mm ²
Welding current welding lead	95 mm ²
Wire feed speed	0.3 m/min. to 15 m/min. 11 ipm to 590 ipm
Standard WF roller equipment	1.0 + 1.2 mm (for steel wire)
Drive	4-roller (37 mm)
Welding torch connection	Decentral
Forward/backward motion frequency	1 Hz–16 Hz
Dimensions L/W/H	625 x 340 x 480 mm 24.61 x 13.46 x 18.9"
Weight	34,6 kg 76,3 lb
EMC class	A
Constructed to standards	IEC 60974-1, -5, -10 ☐ / C €



**Ambient temperature depends on coolant! Observe the coolant temperature range for the welding torch cooling!*

9 Accessories

 *Performance-dependent accessories like torches, workpiece leads, electrode holders or intermediate hose packages are available from your authorised dealer.*

9.1 Options

Type	Designation	Item no.
ON WAK tigSpeed	Wheel assembly kit with strain relief	092-007927-00000
ON MF XX5	Dirt filter	092-002662-00000

9.2 General accessories

Type	Designation	Item no.
ADAP ZSP 5POLIG/500MM	Adapter for tigSpeed intermediate hose package for connection to equipment from other manufacturers	094-019463-00000
tigSpeed 95QMM W AW 5POL 2m	Intermediate hose package, water-cooled, filler wire, incl. strain relief	094-019139-00000
tigSpeed 95QMM W AW 5POL 5m	Intermediate hose package, water-cooled, filler wire, incl. strain relief	094-019139-00005
tigSpeed 95QMM W AW 5POL 10m	Intermediate hose package, water-cooled, filler wire, incl. strain relief	094-019139-00010
DMDIN TN 200B AR/MIX 35L	Manometer pressure regulator	094-000009-00000
GH 2X1/4" 2M	Gas hose	094-000010-00001
AK300	Wire spool adapter K300	094-001803-00001
ADAP CEE16/SCHUKO	Earth contact coupling/CEE16A plug	092-000812-00000

10 Replaceable parts

CAUTION



Damage due to the use of non-genuine parts!

The manufacturer's warranty becomes void if non-genuine parts are used!

- Only use system components and options (power sources, welding torches, electrode holders, remote controls, spare parts and replacement parts, etc.) from our range of products!
- Only insert and lock accessory components into the relevant connection socket when the machine is switched off.

10.1 Wire feed rollers

10.1.1 Wire feed rollers for steel wire

Type	Designation	Item no.
FE 2DR4R 0,6+0,8	Drive rollers, 37 mm, steel	092-000839-00000
FE 2DR4R 0,8+1,0	Drive rollers, 37 mm, steel	092-000840-00000
FE 2DR4R 0,9+1,2	Drive rollers, 37 mm, steel	092-000841-00000
FE 2DR4R 1,0+1,2	Drive rollers, 37 mm, steel	092-000842-00000
FE 2DR4R 1,2+1,6	Drive rollers, 37 mm, steel	092-000843-00000
FE/AL 2GR4R SF	Pressure rollers, smooth, 37 mm	092-000414-00000

10.1.2 Wire feed rollers for aluminium wire

Type	Designation	Item no.
AL 4ZR4R 0,8+1,0	Twin rollers, 37 mm, for aluminium	092-000869-00000
AL 4ZR4R 1,0+1,2	Twin rollers, 37 mm, for aluminium	092-000848-00000
AL 4ZR4R 1,2+1,6	Twin rollers, 37 mm, for aluminium	092-000849-00000

10.1.3 Conversion sets

Type	Designation	Item no.
URUE VERZ>UNVERZ FE/AL 4R SF	Conversion kit, 37mm, 4-roller drive on non-toothed rollers (steel/aluminium)	092-000415-00000
URUE AL 4ZR4R 0,8+1,0 SF	Conversion kit, 37 mm, 4-roller drive for aluminium	092-002268-00000
URUE AL 4ZR4R 1,0+1,2 SF	Conversion kit, 37 mm, 4-roller drive for aluminium	092-002266-00000
URUE AL 4ZR4R 1,2+1,6 SF	Conversion kit, 37 mm, 4-roller drive for aluminium	092-002269-00000

Verschleißteile 4 Rollen-Antrieb $\varnothing = 37\text{mm}$		St= Stahl Al= Aluminium CrNi= Edelstahl Cu= Kupfer		St= Steel Al= Aluminium CrNi= Stainless steel Cu= Copper	Wear parts 4-Roller drive system $\varnothing = 37\text{mm}$	
V-Nut: St-, CrNi-, Cu-Draht „Standard V-Nut“, oben unverzahnt und glatt, Rollenbezeichnung: „1,0“			V-groove: St-, CrNi-, Cu wire "Standard V-groove", on the top ungeared and plane, rolls description: "1,0"			
Antriebsrollen- \varnothing (b): Drive rolls- \varnothing (b): 0,6 + 0,8 0,8 + 1,0 0,9 + 1,2 1,0 + 1,2 1,2 + 1,6		Ersatzset: Spare set: 092-000839-00000 092-000840-00000 092-000841-00000 092-000842-00000 092-000843-00000				
Gegendruckrollenset (a) <i>Set of counter pressure rolls (a)</i>			092-000414-00000			
Umrüstung verzahnt \rightarrow unverzahnt: <i>conversion geared \rightarrow ungeared:</i>			092-000415-00000			
U-Nut: Al-, Cu-Draht „Option U-Nut“, oben verzahnt, Rollenbezeichnung: „1,0 A2“			U-groove: Al-, Cu wire "Option U-groove", on the top geared-twin rolls, rolls description: "1,0 A2"			
Antriebsrollen- \varnothing (a+b): Drive rolls- \varnothing (a+b): 0,8 + 1,0 1,0 + 1,2 1,2 + 1,6 2,4 + 3,2		Ersatzset: Spare set: 092-000869-00000 092-000848-00000 092-000849-00000 092-000870-00000		Umrüstset: Conversion set: 092-002268-00000 092-002266-00000 092-002269-00000 092-002270-00000		
U-Nut gerändelt: Füll-/Röhrchendraht „Option U-Nut gerändelt“, oben verzahnt, ohne Nut gerändelt, Rollenbezeichnung: „1,0-1,2 R“			knurled U-groove: Cored wire "Option knurled U-groove", on the top geared, without knurled groove, rolls description: "1,0-1,2 R"			
Antriebsrollen- \varnothing (b): Drive rolls- \varnothing (b): 0,8 / 0,9 + 0,8 / 0,9 1,0 / 1,2 + 1,4 / 1,6 1,4 / 1,6 + 2,0 / 2,4 2,8 + 3,2		Ersatzset: Spare set: 092-000834-00000 092-000835-00000 092-000836-00000 092-000837-00000		Umrüstset: Conversion set: 092-000410-00000 092-000411-00000 092-000412-00000 092-000413-00000		
Gegendruckrollenset (a): <i>Set of counterpressure rolls (a):</i>			092-000838-00000			
<small>094-014500-00502</small>						

Figure 10-1

11 Appendix A

11.1 Setting instructions



*The parameter lists below serve as an aid to determine the parameters.
The actual parameters to be set depend on the joint and welding position.
The welding speed as well depends on the welding task and the parameters set.*

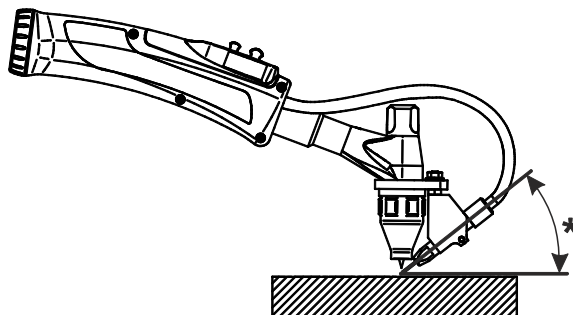


Figure 11-1

Item	Description
t	Material thickness in mm
Is	Welding current (TIG, power source)
Dv	Wire feed speed (tigSpeed)
Hz	Weave frequency (tigSpeed)
IH	Hot wire current (tigSpeed)
Vs	Welding speed
Welding torch°	Torch angle
Wire angle°	Wire feed angle

11.1.1 Continuous TIG hot wire welding
Fillet weld PB position
Parent metal: Unalloyed/low-alloy
Welding consumable: Unalloyed/low-alloy, Ø 1.0 mm

t [mm]	Is [A]	WF (m/min)	Hz [1/s]	IH [A]	Vs [cm/min]	Welding torch [°]	Wire angle [°]
1.5	90	0.8				Forehand 10–20	41-42
2	135	1.0				Forehand 10–20	41-42
4	180	1.8				Forehand 10–20	41-42
6	220	2.5				Forehand 10–20	41-42
8	260	3.5				Forehand 10–20	41-42
10	280	4.5				Forehand 10–20	41-42

Fillet weld PF position
Parent metal: Unalloyed/low-alloy
Welding consumable: Unalloyed/low-alloy, Ø 1.0 mm

t [mm]	Is [A]	WF (m/min)	Hz [1/s]	IH [A]	Vs [cm/min]	Welding torch [°]	Wire angle [°]
1.5	90	0.8				Forehand 10–20	41-42
2	135	1.0				Forehand 10–20	41-42
4	180	1.8				Forehand 10–20	41-42
6	220	2.5				Forehand 10–20	41-42
8	260	3.5				Forehand 10–20	41-42
10	280	4.5				Forehand 10–20	41-42

11.1.2 Continuous TIG hot wire welding

Fillet weld PB position

Parent metal: Unalloyed/low-alloy							
Welding consumable: Unalloyed/low-alloy, Ø 1.0 mm							
t [mm]	Is [A]	WF (m/min)	Hz [1/s]	IH [A]	Vs [cm/min]	Welding torch [°]	Wire angle [°]
1.5	90	0.9		80		Forehand 10–20	41-42
2	135	1.2		80		Forehand 10–20	41-42
4	180	2.0		80		Forehand 10–20	41-42
6	220	2.7		80		Forehand 10–20	41-42
8	260	4.0		80		Forehand 10–20	41-42
10	280	5.0		80		Forehand 10–20	41-42

Fillet weld PF position

Parent metal: Unalloyed/low-alloy							
Welding consumable: Unalloyed/low-alloy, Ø 1.0 mm							
t [mm]	Is [A]	WF (m/min)	Hz [1/s]	IH [A]	Vs [cm/min]	Welding torch [°]	Wire angle [°]
1.5	90	0.9		80		Forehand 10–20	41-42
2	135	1.2		80		Forehand 10–20	41-42
4	180	2.0		80		Forehand 10–20	41-42
6	220	2.7		80		Forehand 10–20	41-42
8	260	4.0		80		Forehand 10–20	41-42
10	280	5.0		80		Forehand 10–20	41-42

11.1.3 TIG cold wire welding with superPuls
Fillet weld PB position
Parent metal: Unalloyed/low-alloy
Welding consumable: Unalloyed/low-alloy, Ø 1.0 mm

t	Is	Wf1/tWF1		Wf2/tWF2		IH	Vs	Welding torch	Wire angle
		[m/min]	[sec]	[m/min]	[sec]				
[mm]	[A]	[m/min]	[sec]	[m/min]	[sec]	[A]	[cm/min]	[°]	[°]
1.5	100	1.9	0.15	0.0/off	0.35			Forehand 15	45
2	140	3.5	0.15	0.0/off	0.35			Forehand 15	45
4	190	4.0	0.15	0.0/off	0.35			Forehand 15	45
6	240	5.0	0.15	0.0/off	0.35			Forehand 15	45
8	280	6.5	0.15	0.0/off	0.35			Forehand 15	45
10	300	7.5	0.15	0.0/off	0.35			Forehand 15	45

Fillet weld PF position
Parent metal: Unalloyed/low-alloy
Welding consumable: Unalloyed/low-alloy, Ø 1.0 mm

t	Is	Wf1/tWF1		Wf2/tWF2		IH	Vs	Welding torch	Wire angle
		[m/min]	[sec]	[m/min]	[sec]				
[mm]	[A]	[m/min]	[sec]	[m/min]	[sec]	[A]	[cm/min]	[°]	[°]
1.5	100	1.9	0.15	0.0/off	0.35			Forehand 15	45
2	140	3.5	0.15	0.0/off	0.35			Forehand 15	45
4	190	4.0	0.15	0.0/off	0.35			Forehand 15	45
6	240	5.0	0.15	0.0/off	0.35			Forehand 15	45
8	280	6.5	0.15	0.0/off	0.35			Forehand 15	45
10	300	7.5	0.15	0.0/off	0.35			Forehand 15	45

11.1.4 TIG hot wire welding with superPuls

Fillet weld PB position

Parent metal: Unalloyed/low-alloy									
Welding consumable: Unalloyed/low-alloy, Ø 1.0 mm									
t	Is	Wf1/tWF1		Wf2/tWF2		IH	Vs	Welding torch	Wire angle
[mm]	[A]	[m/min]	[sec]	[m/min]	[sec]	[A]	[cm/min]	[°]	[°]
1.5	100	2.0	0.15	0.0/off	0.35	80		Forehand 15	45
2	140	3.5	0.15	0.0/off	0.35	80		Forehand 15	45
4	190	4.5	0.15	0.0/off	0.35	80		Forehand 15	45
6	240	5.5	0.15	0.0/off	0.35	80		Forehand 15	45
8	280	7.0	0.15	0.0/off	0.35	80		Forehand 15	45
10	300	8.0	0.15	0.0/off	0.35	80		Forehand 15	45

Fillet weld PF position

Parent metal: Unalloyed/low-alloy									
Welding consumable: Unalloyed/low-alloy, Ø 1.0 mm									
t	Is	Wf1/tWF1		Wf2/tWF2		IH	Vs	Welding torch	Wire angle
[mm]	[A]	[m/min]	[sec]	[m/min]	[sec]	[A]	[cm/min]	[°]	[°]
1.5	100	2.0	0.15	0.0/off	0.35	80		Forehand 15	45
2	140	3.5	0.15	0.0/off	0.35	80		Forehand 15	45
4	190	4.5	0.15	0.0/off	0.35	80		Forehand 15	45
6	240	5.5	0.15	0.0/off	0.35	80		Forehand 15	45
8	280	7.0	0.15	0.0/off	0.35	80		Forehand 15	45
10	300	8.0	0.15	0.0/off	0.35	80		Forehand 15	45

11.1.5 Oscillation TIG hot wire welding
Fillet weld PB position

Parent metal: Unalloyed/low-alloy						
Welding consumable: Unalloyed/low-alloy, Ø 1.0 mm						
t [mm]	Is [A]	WF (m/min)	Hz [1/s]	Vs [cm/min]	Welding torch [°]	Wire angle [°]*
2	110	0.7	10	17	Forehand 10–20	41–42
3	146	1.0	10	17	Forehand 10–20	41–42
4	189	1.2	10	21	Forehand 10–20	41–42
6	220	1.5	10	21	Forehand 10–20	41–42
8	260	1.7	10	21	Forehand 10–20	41–42
10	285	2.0	10	25	Forehand 10–20	41–42

Fillet weld PF position

Parent metal: Unalloyed/low-alloy						
Welding consumable: Unalloyed/low-alloy, Ø 1.0 mm						
t [mm]	Is [A]	WF (m/min)	Hz [1/s]	Vs [cm/min]	Welding torch [°]	Wire angle [°]*
2	130	1.3	10	13	Forehand 10–20	41–42
3	149	1.4	10	13	Forehand 10–20	41–42
4	190	1.6	10	13	Forehand 10–20	41–42
6	250	1.8	10	13	Forehand 10–20	41–42
8	280	2.0	10	18	Forehand 10–20	41–42
10	280	2.2	10	18	Forehand 10–20	41–42

11.1.6 OscillationTIG hot wire welding

Fillet weld PB position

Parent metal: Unalloyed/low-alloy							
Welding consumable: Unalloyed/low-alloy, Ø 1.0 mm							
t [mm]	Is [A]	WF (m/min)	Hz [1/s]	IH [A]	Vs [cm/min]	Welding torch [°]	Wire angle [°]
2	190	2.1	16	100	22	Forehand 15	41-42
3	250	3.0	16	100	40	Forehand 15	41-42
4	280	3.5	16	100	37	Forehand 15	41-42
6	320	4.0	16	100	36	Forehand 15	41-42
8	350	4.2	16	100	33	Forehand 15	41-42
10	390	4.0	16	100	33	Forehand 15	41-42

Fillet weld PF position

Parent metal: Unalloyed/low-alloy							
Welding consumable: Unalloyed/low-alloy, Ø 1.0 mm							
t [mm]	Is [A]	WF (m/min)	Hz [1/s]	IH [A]	Vs [cm/min]	Welding torch [°]	Wire angle [°]
2	140	1.4	16	80	19	Forehand 15	41-42
3	190	1.8	16	100	18	Forehand 15	41-42
4	220	2.2	16	100	20	Forehand 15	41-42
6	260	2.6	16	100	22	Forehand 15	41-42
8	280	3.2	16	100	25	Forehand 15	41-42
10	330	3.8	16	100	21	Forehand 15	41-42

11.1.7 Continuous TIG hot wire welding
Fillet weld PB position
Parent metal: High-alloy
Welding consumable: High-alloy. Ø 1.0 mm

t [mm]	Is [A]	WF (m/min)	Hz [1/s]	IH [A]	Vs [cm/min]	Welding torch [°]	Wire angle [°]
1.5	90	0.8				Forehand 10–20	41-42
2	135	1.0				Forehand 10–20	41-42
4	180	1.8				Forehand 10–20	41-42
6	220	2.5				Forehand 10–20	41-42
8	260	3.5				Forehand 10–20	41-42
10	280	4.5				Forehand 10–20	41-42

Fillet weld PF position
Parent metal: High-alloy
Welding consumable: High-alloy. Ø 1.0 mm

t [mm]	Is [A]	WF (m/min)	Hz [1/s]	IH [A]	Vs [cm/min]	Welding torch [°]	Wire angle [°]
1.5	90	0.8				Forehand 10–20	41-42
2	135	1.0				Forehand 10–20	41-42
4	180	1.8				Forehand 10–20	41-42
6	220	2.5				Forehand 10–20	41-42
8	260	3.5				Forehand 10–20	41-42
10	280	4.5				Forehand 10–20	41-42

11.1.8 Continuous TIG hot wire welding

Fillet weld PB position

Parent metal: High-alloy

Welding consumable: High-alloy. Ø 1.0 mm

t [mm]	Is [A]	WF (m/min)	Hz [1/s]	IH [A]	Vs [cm/min]	Welding torch [°]	Wire angle [°]
1.5	90	0.9		80		Forehand 10–20	41-42
2	135	1.2		80		Forehand 10–20	41-42
4	180	2.0		80		Forehand 10–20	41-42
6	220	2.7		80		Forehand 10–20	41-42
8	260	4.0		80		Forehand 10–20	41-42
10	280	5.0		80		Forehand 10–20	41-42

Fillet weld PF position

Parent metal: High-alloy

Welding consumable: High-alloy. Ø 1.0 mm

t [mm]	Is [A]	WF (m/min)	Hz [1/s]	IH [A]	Vs [cm/min]	Welding torch [°]	Wire angle [°]
1.5	90	0.9		80		Forehand 10–20	41-42
2	135	1.2		80		Forehand 10–20	41-42
4	180	2.0		80		Forehand 10–20	41-42
6	220	2.7		80		Forehand 10–20	41-42
8	260	4.0		80		Forehand 10–20	41-42
10	280	5.0		80		Forehand 10–20	41-42

11.1.9 TIG cold wire welding with superPuls

Fillet weld PB position

Parent metal: High-alloy

Welding consumable: High-alloy. Ø 1.0 mm

t	Is	Wf1/tWF1		Wf2/tWF2		IH	Vs	Welding torch	Wire angle
[mm]	[A]	[m/min]	[sec]	[m/min]	[sec]	[A]	[cm/min]	[°]	[°]
1.5	90	1.9	0.15	0.0/off	0.35		32	Forehand 15	45
2	135	3.5	0.15	0.0/off	0.35		38	Forehand 15	45
4	180	4.0	0.15	0.0/off	0.35		41	Forehand 15	45
6	220	5.0	0.15	0.0/off	0.35		43	Forehand 15	45
8	260	6.5	0.15	0.0/off	0.35		43	Forehand 15	45
10	280	7.5	0.15	0.0/off	0.35		48	Forehand 15	45

Fillet weld PF position

Parent metal: High-alloy

Welding consumable: High-alloy. Ø 1.0 mm

t	Is	Wf1/tWF1		Wf2/tWF2		IH	Vs	Welding torch	Wire angle
[mm]	[A]	[m/min]	[sec]	[m/min]	[sec]	[A]	[cm/min]	[°]	[°]
1.5	90	1.9	0.15	0.0/off	0.35			Forehand 15	45
2	135	3.5	0.15	0.0/off	0.35			Forehand 15	45
4	180	4.0	0.15	0.0/off	0.35			Forehand 15	45
6	220	5.0	0.15	0.0/off	0.35			Forehand 15	45
8	260	6.5	0.15	0.0/off	0.35			Forehand 15	45
10	280	7.5	0.15	0.0/off	0.35			Forehand 15	45

11.1.10 TIG hot wire welding with superPuls

Fillet weld PB position

Parent metal: High-alloy

Welding consumable: High-alloy. Ø 1.0 mm

t	Is	Wf1/tWF1		Wf2/tWF2		IH	Vs	Welding torch	Wire angle
		[m/min]	[sec]	[m/min]	[sec]				
[mm]	[A]	[m/min]	[sec]	[m/min]	[sec]	[A]	[cm/min]	[°]	[°]
1.5	90	2.2	0.15	0.0/off	0.35	80	32	Forehand 15	45
2	135	3.5	0.15	0.0/off	0.35	80	38	Forehand 15	45
4	180	4.5	0.15	0.0/off	0.35	80	41	Forehand 15	45
6	220	5.5	0.15	0.0/off	0.35	80	43	Forehand 15	45
8	260	7.0	0.15	0.0/off	0.35	80	43	Forehand 15	45
10	280	8.0	0.15	0.0/off	0.35	80	48	Forehand 15	45

Fillet weld PF position

Parent metal: High-alloy

Welding consumable: High-alloy. Ø 1.0 mm

t	Is	Wf1/tWF1		Wf2/tWF2		IH	Vs	Welding torch	Wire angle
		[m/min]	[sec]	[m/min]	[sec]				
[mm]	[A]	[m/min]	[sec]	[m/min]	[sec]	[A]	[cm/min]	[°]	[°]
1.5	90	2.2	0.15	0.0/off	0.35	80		Forehand 15	45
2	135	3.5	0.15	0.0/off	0.35	80		Forehand 15	45
4	180	4.5	0.15	0.0/off	0.35	80		Forehand 15	45
6	220	5.5	0.15	0.0/off	0.35	80		Forehand 15	45
8	260	7.0	0.15	0.0/off	0.35	80		Forehand 15	45
10	280	8.0	0.15	0.0/off	0.35	80		Forehand 15	45

11.1.11 Oscillation TIG hot wire welding
Fillet weld PB position
Parent metal: High-alloy
Welding consumable: High-alloy. Ø 1.0 mm

t [mm]	Is [A]	WF (m/min)	Hz [1/s]	Vs [cm/min]	Welding torch [°]	Wire angle [°]*
2	150	1.5	13.5	31	Forehand 10–20	41–42
3	190	1.8	13.5	31	Forehand 10–20	41–42
4	210	2.1	13.5	31	Forehand 10–20	41–42
6	240	2.5	13.5	31	Forehand 10–20	41–42
8	260	2.8	13.5	31	Forehand 10–20	41–42
10	290	3.0	13.5	30	Forehand 10–20	41–42

Fillet weld PF position
Parent metal: High-alloy
Welding consumable: High-alloy. Ø 1.0 mm

t [mm]	Is [A]	WF (m/min)	Hz [1/s]	Vs [cm/min]	Welding torch [°]	Wire angle [°]*
2	150	1.5	13.5	31	Forehand 10–20	41–42
3	190	1.8	13.5	31	Forehand 10–20	41–42
4	210	2.1	13.5	31	Forehand 10–20	41–42
6	240	2.5	13.5	31	Forehand 10–20	41–42
8	260	2.8	13.5	31	Forehand 10–20	41–42
10	290	3.0	13.5	30	Forehand 10–20	41–42

11.1.12 OscillationTIG hot wire welding

Fillet weld PB position

Parent metal: High-alloy

Welding consumable: High-alloy. Ø 1.0 mm

t [mm]	Is [A]	WF (m/min)	Hz [1/s]	IH [A]	Vs [cm/min]	Welding torch [°]	Wire angle [°]
2	199	2.9	16	70	47	Forehand 15	41-42
3	241	3.4	16	80	44	Forehand 15	41-42
4	260	3.6	16	80	43	Forehand 15	41-42
6	281	4.0	16	80	42	Forehand 15	41-42
8	300	4.2	16	80	41	Forehand 15	41-42
10	341	4.7	16	80	40	Forehand 15	41-42

Fillet weld PF position

Parent metal: High-alloy

Welding consumable: High-alloy. Ø 1.0 mm

t [mm]	Is [A]	WF (m/min)	Hz [1/s]	IH [A]	Vs [cm/min]	Welding torch [°]	Wire angle [°]
2	110	1.3	16	70	21	Forehand 15	41-42
3	190	3.0	16	70	38	Forehand 15	41-42
4	210	3.2	16	70	33	Forehand 15	41-42
6	250	3.8	16	70	31	Forehand 15	41-42
8	279	3.8	16	70	30	Forehand 15	41-42
10	279	3.8	16	70	30	Forehand 15	41-42

12 Appendix B

12.1 Overview of EWM branches

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