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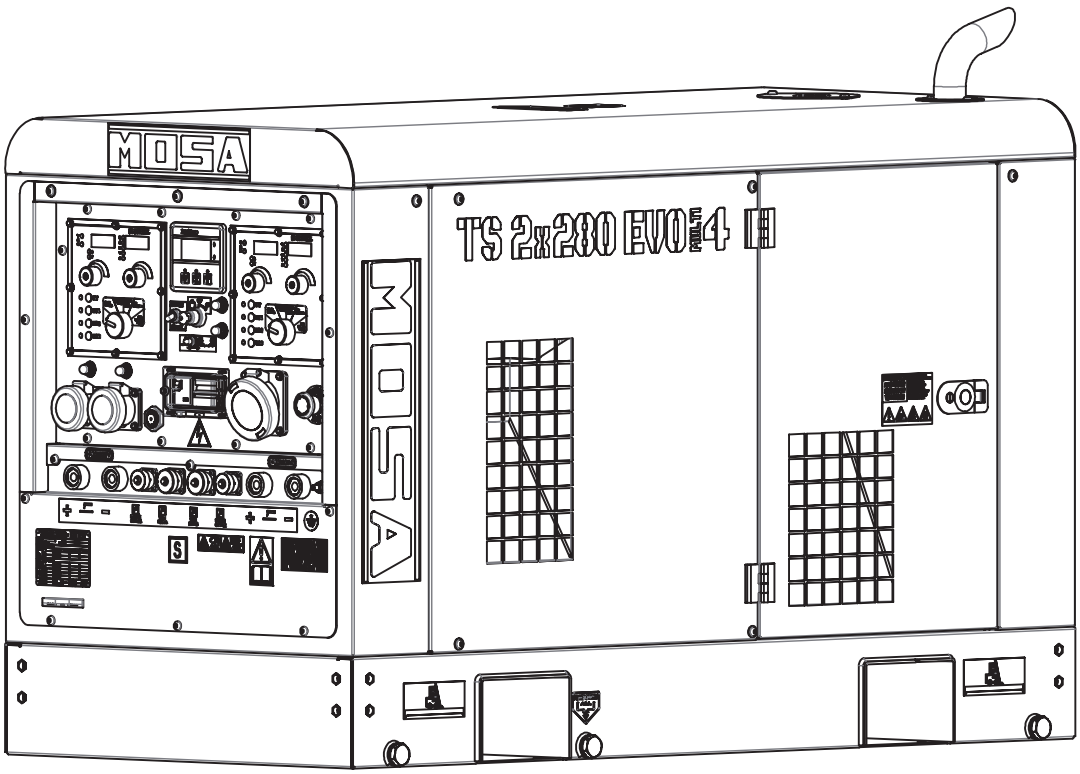
Use and Maintenance Manual



D5264800

Engine driven welder
TS 2x280 EVO MULTI4

CE UK CA

Original instructions

Contents

1. Introduction 1
1.1 Foreword 1
1.2 Supplied documentation 1
1.3 Customer service 2
1.4 Spare parts 2
1.5 Declaration of conformity 2
1.6 Unauthorized changes 2
1.7 Allowed and non-allowed use 2
1.8 Identification data 3

2. Safety 5
2.1 Safety information 5
2.2 Positioning of safety decal and information 6
2.2.1 Decal explanation 7
2.3 General precautions 10
2.3.1 Personal protective equipment 10
2.3.2 Check the work area 10
2.4 Fire prevention 11
2.4.1 Fire due to fuel, oil, coolant 11
2.4.2 Fires caused by flammable material build-up 11
2.4.3 Fire caused by electrical wiring 11
2.4.4 Fire caused by piping 11
2.5 Handling precautions 12
2.5.1 Lifting by chains or ropes 12
2.5.2 Lifting by forklift 12
2.5.3 Transport with towing carriages 13
2.6 Precautions for positioning the machine 14
2.6.1 Positioning site precautions 14
2.6.2 Precautions for electric connections 14
2.7 Precautions during operation 15
2.8 Precautions during fuel and engine oil filling 15
2.9 Precautions against noise 15
2.10 Electromagnetic Compatibility (EMC) 16
2.10.1 Installation and use 16
2.10.2 Assessment of the area 16
2.10.3 Emission-reducing methods 17
2.11 Precautions during welding 18
2.11.1 Precautions in the workplace 18
2.11.2 Welding precautions 18
2.12 Checks and precautions when using gas cylinders 20
2.13 Maintenance precautions 21
2.14 Precautions for disposal of waste material 22
2.15 Disposal of the machine 22

3. Technical data 23
3.1 Machine dimensions 23

3.2 Technical data....24
3.3 Remote Control connector wiring diagram (10-pin)....26
3.4 Wire Fender connector wiring diagram (14-pin)....26

4. Description....27
4.1 Main components....27
4.1.1 External components....27
4.1.2 Internal components....28
4.1.3 Control panel and electrical panel components....30

5. Installation....33
5.1 Fixed installation....34
5.2 Installation on a vehicle....34
5.3 Grounding....35
5.3.1 Grounding with residual current circuit breaker....35
5.3.2 Grounding with isolation monitor....35

6. Operation....37
6.1 Checks before start-up....37
6.2 Starting the engine....37
6.3 Stopping the engine....39
6.4 Emergency stop....39
6.5 Auto Idle....40
6.6 Welding....41
6.6.1 Electrical safety....41
6.6.2 Welding cables connection....41
6.6.3 Welding cables....42
6.6.4 VRD (Voltage Reduction Device) function....42
6.6.5 Single/Dual Workstation Selector....43
6.6.6 Remote control....43
6.7 Duty cycle....44
6.7.1 DC-Constant Current Welding - SMAW/STICK coated electrode....44
6.7.2 CV Constant Direct Current Voltage Processes....50
6.8 EVO CONTROL MULTI4....53
6.8.1 Stick and Stick Contact....53
6.8.2 Mig/Flux Cored - Mig/Flux Cored Contact....54
6.8.3 TIG Scratch Arc....54
6.8.4 TIG Lift Arc Pulse....55
6.8.5 LEDs and buttons....57
6.8.6 Changing parameters and saving to memory....58
6.8.7 Error Table....59
6.8.8 Firmware Update....60
6.9 Simultaneous use of welding and auxiliary current generation functions....61
6.10 Generating set operation....61
6.10.1 Auxiliary current generation in AC 400V/50Hz - 230V/50Hz - 110V/50H....61
6.10.2 Operating conditions....62
6.10.3 Connectable electrical devices....64
6.11 Electrical protection....65
6.11.1 Machine's main switch....65
6.11.2 Residual current circuit breaker....65

6.11.3 Insulation monitor 65
6.11.4 Circuit breaker 66
6.11.5 Thermal Protection 66
6.12 Troubleshooting 67
6.12.1 Engine 67
6.12.2 Welding circuit 69
6.12.3 AC auxiliary current circuit 71

7. Maintenance 73
7.1 Refuelling 73
7.1.1 Fuel 73
7.1.2 Engine oil 74
7.1.3 Coolant 75
7.1.4 Checking and cleaning the engine air filter 76
7.2 Routine maintenance 77
7.3 Storage 77
7.4 Disposal 78

1. Introduction

1.1 Foreword

This manual supplies the Operator and qualified and authorised Technicians with technical information on the TS 2x280 EVO MULTI4 engine driven welder (hereinafter also referred to as the "machine") produced by MOSA Div. of BCS S.p.A. (hereinafter also referred to as the "manufacturer").

In this manual, the Operator in charge and the qualified Technicians will find the indications for:

- Getting familiar with the safety measures and basic standards to be adopted, to prevent hazards and damage to people, to the engine driven welder and to the environment.
- Getting to know the main components of the engine driven welder and its operation.
- Performing the programmed routine maintenance.
- Getting to know any extraordinary maintenance operation.

This manual is an integral part of the engine driven welder and must follow it in any changes of ownership, until the final dismantling.

The manual and all the publications attached to it must be kept with care, in an easily accessible place, known to the operator and to the qualified technicians authorized for maintenance. Read the descriptions carefully before starting to work or carrying out the required adjustments or maintenance.

If the manual is lost, damaged or becomes illegible, request a copy to MOSA, indicating the model of the engine driven welder, the serial number and the year of construction.

If the engine driven welder is transferred, the transferor must deliver this manual to the new owner.

The engine driven welder is subject to updates to improve its performance; this manual summarises the information regarding the current state of technology at the moment of the supply.

MOSA reserves the right to make improvements and modifications to parts and accessories, without promptly updating this manual, except in exceptional cases of fundamental integrations concerning safe operation.

CAUTION

- **Improper use or maintenance can cause serious damage to people and shorten the "useful life" of the engine driven welder.**
- **The Operator and the qualified Technicians must be familiar with all the indications given in this manual before using the engine driven welder or carrying out maintenance operations on it.**
- **The procedures contained in this manual are intended to be applicable to engine driven welders only for permitted uses, and with all safety devices in function.**
  If the engine driven welder is used for purposes other than those indicated or in safety conditions other than those indicated, the Customer becomes directly responsible for any person possibly involved in accidents or injuries and for abnormal wear and tear of the machine.

1.2 Supplied documentation

The documentation supplied with the engine driven welder includes this Use and Maintenance Manual and the main component manuals (e.g. engine).

1.3 Customer service

The Technical Assistance and Spare Parts Service are available to the Customers.
MOSA recommends that you contact the nearest authorised service centre for specialised intervention for all control and overhaul operations.
In order to obtain quick and effective responses, indicate the Model and Serial Number shown on the identification plate (see “1.8 Identification data”).

1.4 Spare parts

Only original spare parts that guarantee functionality and durability must be used.
The use of non-original spare parts will void all warranty and Technical Support obligations.

1.5 Declaration of conformity

The manufacturer:
MOSA Div. of BCS S.p.A.
Viale Europa, 59 20047 Cusago (Milano) Italy

Declares that the machine:
TS 2x280 EVO MULTI4

Complies with the requirements of the following EC/EU Directives:

- Machine Directive 2006/42/EC
- Low Voltage Directive 2014/35/EU
- Electromagnetic Compatibility Directive 2014/30/EU

and with the requirements of the following UK regulations:

- The Supply of Machinery (Safety) Regulations 2008/1597
- The Electrical Equipment (Safety) - Regulations 2016/1101
- Electromagnetic Compatibility - Regulations 2016/1091

1.6 Unauthorized changes

No changes can be made to the machine without MOSA'S authorization.
Unauthorized changes void any form of warranty on the machine and any civil and/or criminal liability in case of accidents or injuries

1.7 Allowed and non-allowed use

These engine driven welders perform the following functions:

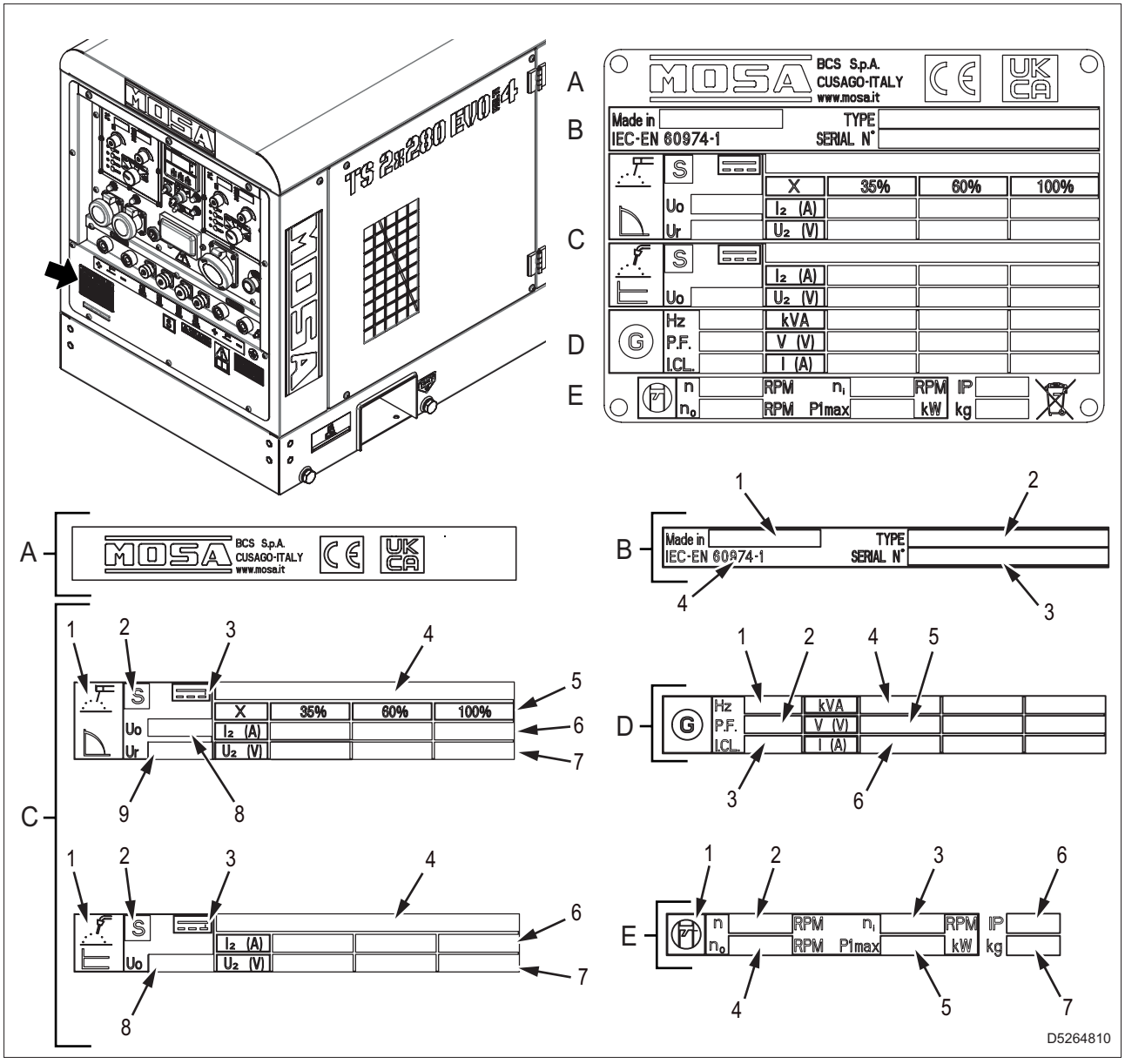
- Direct current generator for arc welding with manual electrode (stick).
- 50/60 Hz alternating current generator to supply power tools (grinding wheels, drills, etc.) used during welding operations.

WARNING

- **The engine driven welder is designed for industrial and professional use, and must only be used by qualified and/or trained personnel.**

1.8 Identification data

The data identifying the machine are specified on the ID plate applied in the area indicated in the figure.
They are necessary for spare parts requests and communications with the Customer Service Department.



A - Manufacturer 's data

B - Machine data
- (1) Country and year of manufacture
- (2) Model
- (3) Serial number
- (4) Technical standard reference

C - Welding data
- (1) Welding process
- (2) Symbol for engine driven welders that can be used in environments with a higher risk of electric shock
- (3) Welding current symbol
- (4) Minimum and maximum welding current value and corresponding voltage value

(5) Duty cycle values
(6) Rated welding current values
(7) Welding voltage values
(8) Rated no-load welding voltage or adjustment range between minimum and maximum value
(9) Reduced rated no-load welding voltage with a voltage reduction device (VRD)

D - Auxiliary generation data
(1) Rated frequency(Hz)
(2) Rated cos ϕ (power factor)
(3) Insulation class
(4) Rated power (kVA)
(5) Rated voltage (V)
(6) Rated current (A)

E - Engine and machine data
(1) Motor symbol
(2) Rated speed
(3) Rated minimum speed
(4) Rated no-load speed
(5) Rated engine power
(6) IP protection degree
(7) Dry weight

2. Safety

2.1 Safety information

Always respect the warnings contained in this manual and present on the decal applied to the machine.
This allows the machine to be used safely, avoiding damage to property and injury or death to people.
The following words and symbols were used to identify important safety messages.

Symbol ⚠ identifies important safety messages on the machine, in the manual and elsewhere. When you see this symbol, follow the instructions in the safety messages.

⚠ DANGER

- **This word indicates a situation of imminent risk that, if not avoided, could cause serious injury or even death to people and serious damage to property.**

⚠ WARNING

- **This word indicates a potential risk situation which, if not avoided, could result in serious injury or even death to people and serious damage to property.**

⚠ CAUTION

- **This word indicates a potential risk situation that, if not avoided, could cause minor or moderate injuries.**
  It can also be used to prevent dangerous operations that can cause damage to the machine.

The following terms are used to transmit the information to be followed to the user, to avoid damage to the machine.

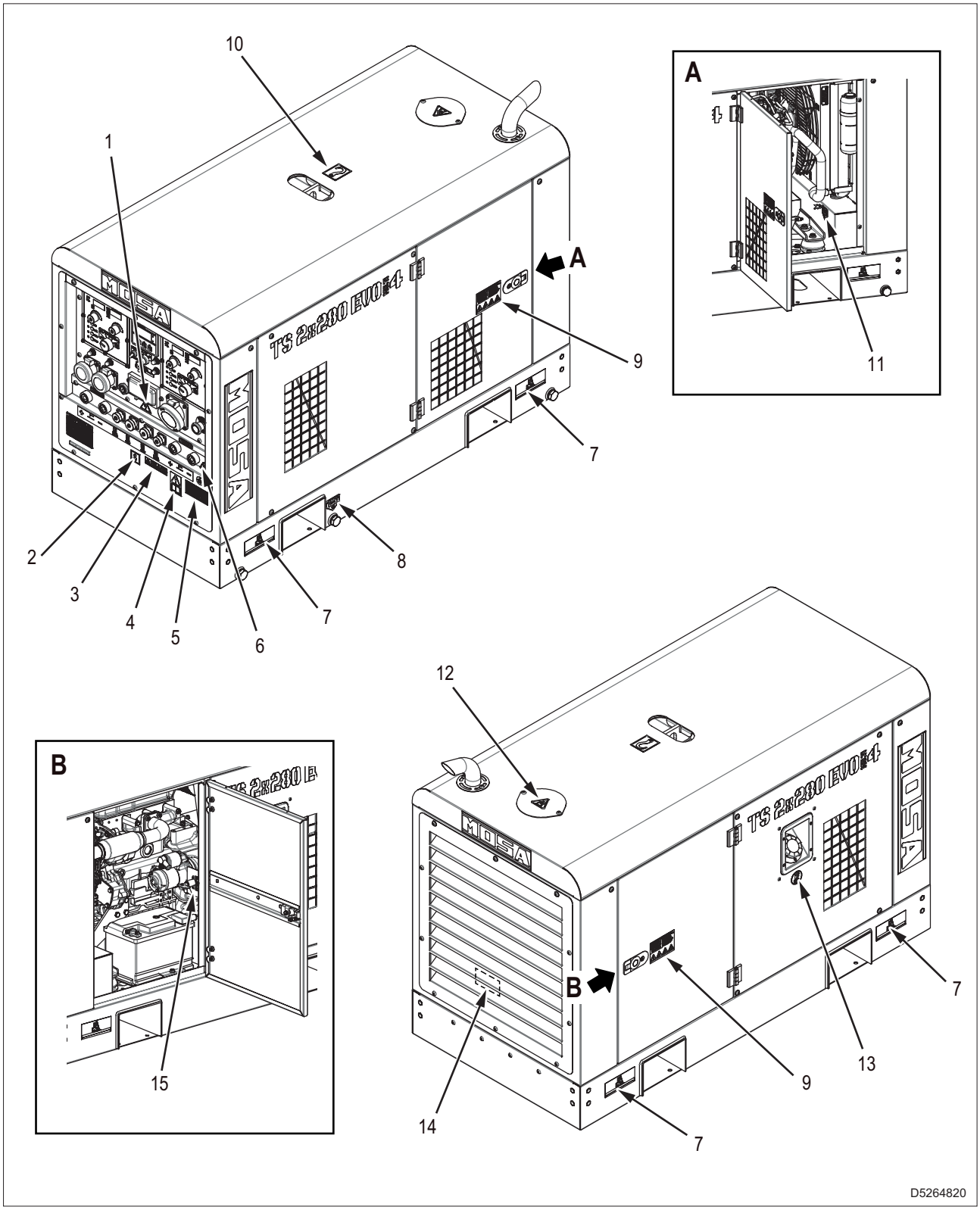
☛ Important

- If the precautions described are not observed, the machine could be damaged and its useful life reduced.

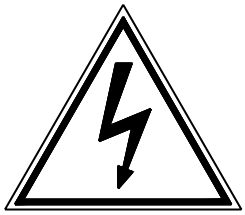
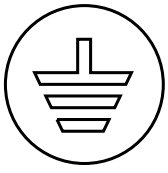
Note

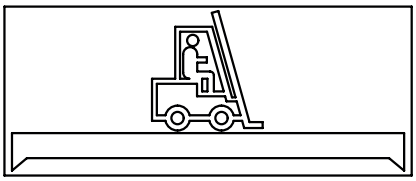
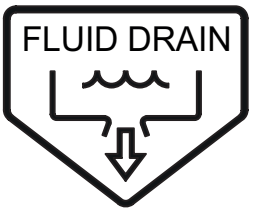
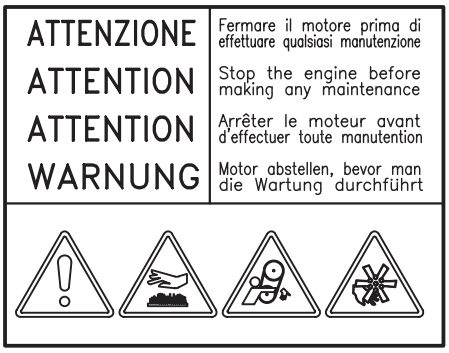
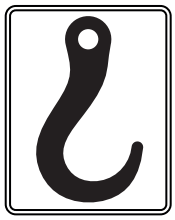
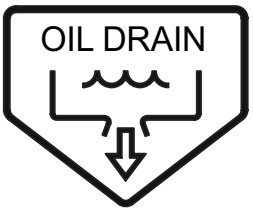
- This word is used to indicate further useful information.

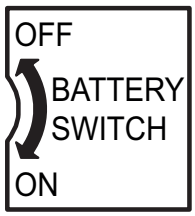
2.2 Positioning of safety decal and information



2.2.1 Decal explanation

 M734500250	**Pos. 1 - Electrical voltage hazard** Stop the machine before carrying out checks or maintenance.
 D5260960	**Pos. 2 - Safety marking** Indicates that the engine driven welder may used in environments with a higher risk of electric shock.
 D5263040	**Pos. 3 - Fire and exhaust gas inhalation hazard** Fuel is highly flammable. Turn the engine off and allow it to cool before fuelling. Engine carbon monoxide emissions are highly toxic and poisonous. Use the machine in outdoor and ventilated places.
 M734500253	**Pos. 4 Consult the manual** Read the contents of the manual carefully before using the machine or carrying out maintenance operations on it.
NEUTRO COLLEGATO A MASSA NEUTRO CONECTADO A MASA NEUTRAL BONDED TO FRAME NEUTRE RACCORDE AU BATI NULLEITER AUF MASSE NUL VERBODEN MET MASSA D5264030	**Pos. 5 - Neutral connected to ground** Indicates that the star centre of the generator (Neutral) is connected to the grounding system. ☛ **Important** The absence of the decal on the machine indicates that the star centre of the generator (Neutral) is floating.
 D5264830	**Pos. 6 - Ground terminal** Indicates the connection point of the machine to a grounding system.

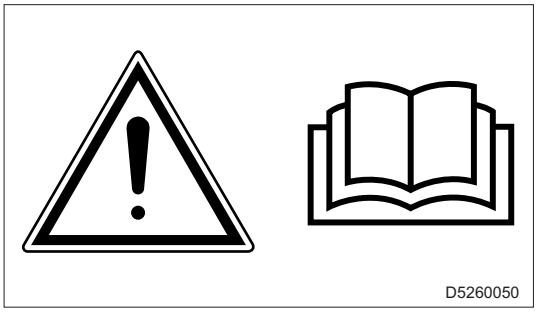
 M840760202	**Pos. 7 - Lifting points with forklift truck**
 MCN4F40510250	**Pos. 8 - Base liquids drainage**
 MCP2T50G10250	**Pos. 9 - Stop the engine before servicing** To avoid burns due to contact with hot parts, before carrying out checks or servicing of the machine, stop the engine and wait until they have cooled sufficiently. To avoid serious injury, do not insert limbs near the rotating parts without stopping the engine.
 M209710202	**Pos. 10 - Lifting hooking point**
 D5264840	**Pos. 11 - Engine oil drain**
 M8B9700250	**Pos. 12 - Coolant high temperature hazard** Do not remove the cap when the engine is at the working temperature (high). Steam or the high temperature of the coolant leaking from the radiator can cause injury and/or burns to people.

 M107011150	**Pos. 13 - Fuel filling neck**
 D5264860	**Pos. 14 - Coolant drain**
 MC1PN10430271	**Pos. 15 - Battery disconnect switch**

2.3 General precautions

Any errors during use, checks or maintenance could cause the risk of injury, even serious

- Before performing the operations, read this manual and the decals applied to the machine and follow the warnings.
  If you don't understand any part of the manual, ask your Safety Officer for explanations.
- The machine can only be used and repaired by trained and authorized personnel.
- Do not work if you feel unwell, have drunk alcohol or take medicines that impair your ability to work safely or repair the machine.
- Before starting the operations, check the machine. If anomalies are detected, do not operate on the machine before having completed the necessary repairs.
- Comply with the provisions and laws in force in the country in which you work.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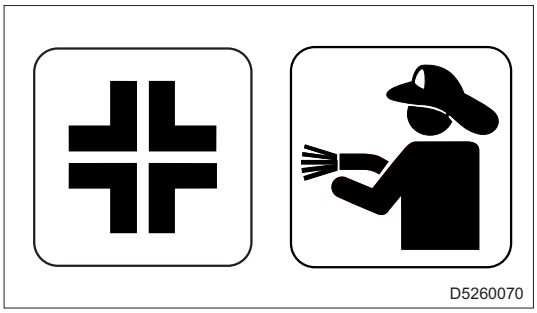
2.3.1 Personal protective equipment

- Do not wear clothes that are too loose or accessories, to prevent them from becoming entangled, causing personal injury.
- Always wear the personal protective equipment prescribed for the place where you work, such as a protective helmet, safety footwear, safety glasses, gloves and noise protection headphones.
- Before using personal protective equipment, check that it is in perfect condition.


D5260060

2.3.2 Check the work area

- Ask the site safety manager for information on the regulations to be observed.
- Understand the signs and indications on site.
- Make sure that fire extinguishers and first aid kit are available on site and inquire about where they are located.
- Check that the area is clear of materials that may be hazardous during the operation of the machine (such as flammable materials or liquids).
- Make sure that there are no unauthorized persons in the area.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2.4 Fire prevention

2.4.1 Fire due to fuel, oil, coolant

- Avoid approaching any flame to flammable substances such as fuel, oil, coolant.
- Do not smoke or use open flames near flammable substances.
- Stop the machine before refuelling.
- Make sure not to spill flammable substances on overheated surfaces or on parts of the electrical system.
- After refuelling, remove any spills and tighten all filling caps tightly.
- For safety in the workplace, store the cloths soaked in flammable materials in a container.
- Store oil and fuel in pre-established and well-ventilated locations and prohibit the entry of unauthorised personnel.
- When cleaning the machine, do not use flammable substances such as diesel or gasoline.

2.4.2 Fires caused by flammable material build-up

- Remove dry leaves, chips, pieces of paper, carbon dust, or other flammable materials accumulated from the engine, exhaust manifold, muffler, battery, or inside the bottom guards.

2.4.3 Fire caused by electrical wiring

- Always keep the electrical wiring clean and tightened.
- Periodically check that there are no loose or damaged parts. Tighten loose wiring connectors or terminals.
- Repair or replace any damaged cables.

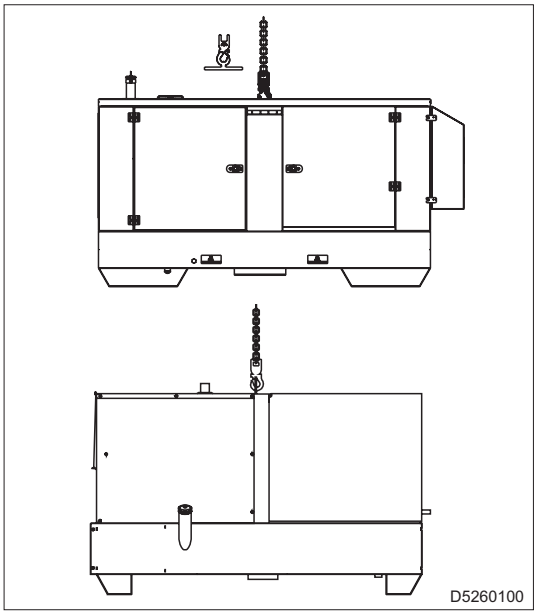
2.4.4 Fire caused by piping

- Periodically check that the hose clamps are firmly fixed.
- If loosened, they may vibrate during machine operation and cause leakage of liquids, provoking fires and serious injuries, including fatalities.

2.5 Handling precautions

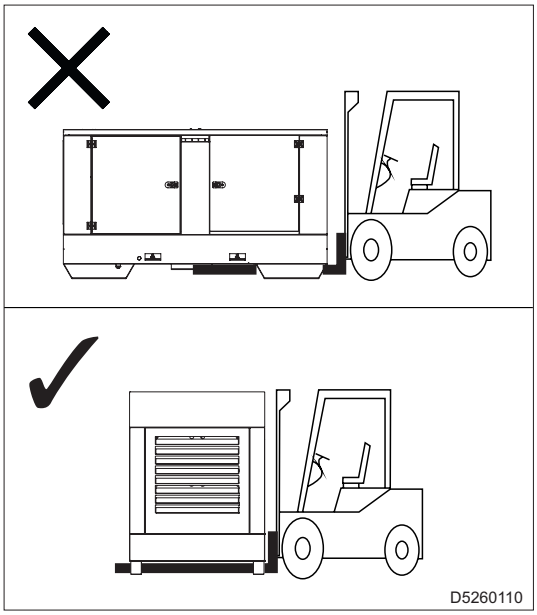
2.5.1 Lifting by chains or ropes

- Make sure that the handling area is clear of obstacles and people.
- Lift the machine using only the lifting points provided and indicated by the decals.
- The operator carrying out the lifting work must be qualified to work with the crane.
- Always use lifting equipment adequately sized and controlled by authorized bodies.
- Keep the machine in a horizontal position.
- Do not subject the machine and the lifting equipment used to undulating or abrupt movements that transmit dynamic stresses to the structure.
- It is forbidden to fix on the frame of the machine objects or accessories that modify the weight and centre of gravity and subject the lifting points to unexpected stresses.
- Do not lift the machine at a height higher than that necessary for handling.
- Do not leave the machine suspended for longer than necessary for handling.

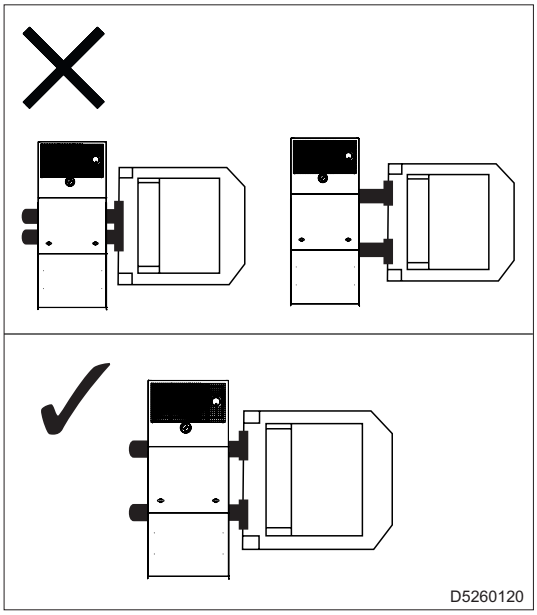


2.5.2 Lifting by forklift

- Insert the frame using the pockets indicated by the relative decals.
- Fork the machine sideways to allow the forks to protrude from the opposite side.



- Widen the forks as much as possible to distribute the weight evenly while keeping the machine horizontal.



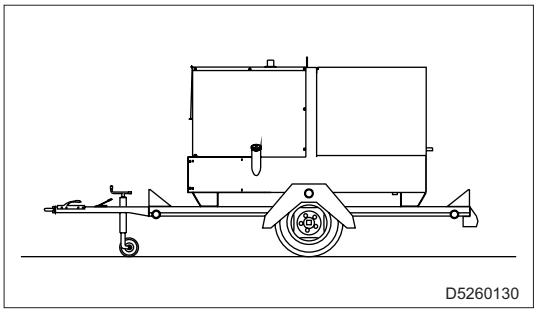
2.5.3 Transport with towing carriages

- Do not tow the machine manually or with tow vehicles without the intended towing carriage.
- Check the correct assembly of the machine to the drive device.
- Always check that the towing vehicle hook is suitable for towing the total mass (trolley+machine).
- Do not tow the trolley if the coupling devices are worn out or damaged.
- Check the correct pressure of the carriage tires.
  Do not replace the tyres with types other than the original ones.
- Check that the fixing bolts of the carriage wheels are present and pulled.
- Do not park the machine with the towing carriage on heavily tilted surfaces.
- In case of stops during transport, always apply the parking brake or lock the wheels with safety wedges.
- Do not tow the trolley on rough roads.

Transport with fast towing trolley

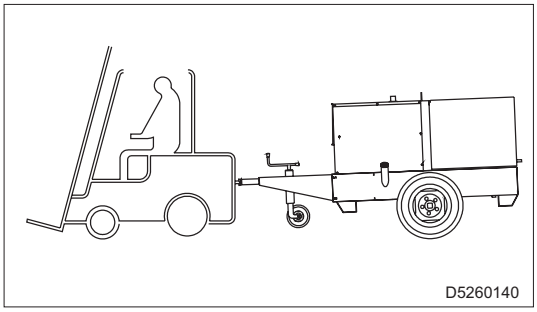
The fast towing trolley is approved for transport on public roads.

- Check the efficiency of the optical braking and signalling devices of the towing carriage.
- Do not exceed the maximum speed of 80 km/h with the towing carriage and comply with the regulations in force for road traffic.



Transport with slow towing trolley

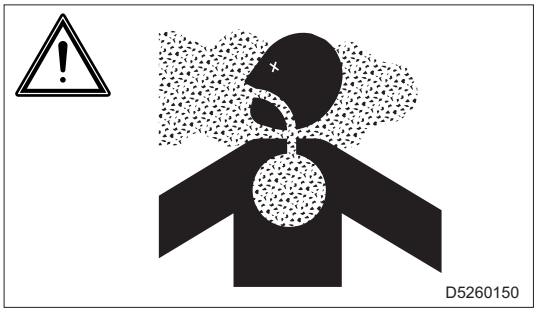
- Do not use the slow towing trolley on public roads.
  It can only be used in private and enclosed areas.
- The maximum speed allowed is 40 km/h on level surfaces (asphalt or concrete).
  In any case, adjust the speed to the type of terrain.



2.6 Precautions for positioning the machine

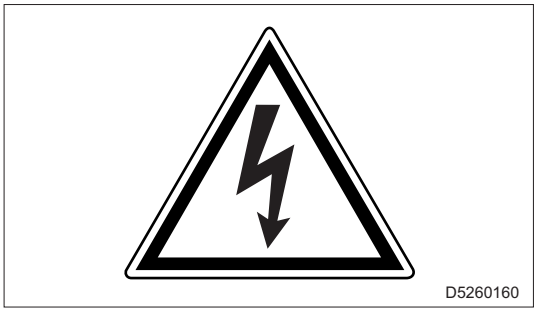
2.6.1 Positioning site precautions

- This machine has been designed for outdoor use and can therefore be positioned outdoors.
  In case of meteorological precipitation (rain, snow, etc.), place the machine in an adequately sheltered place. If this is not possible, do not use the machine.
- Do not place machines or equipment near heat sources, in areas at risk with explosion hazard or fire hazard.
  Place the machine at a safe distance from fuel tanks, from flammable material (rags, paper, etc.), from chemicals.
  Follow the instructions of the competent authorities.
- To limit potentially dangerous situations, isolate the area around the machine, thus preventing any unauthorized personnel from getting close to it.
- Although the machines produced comply with the regulations on electromagnetic compatibility, do not place the machine near equipment influenced by the presence of magnetic fields.
- Make sure that the area immediately surrounding the machine is clean and free of debris.
- Always place the machine on a flat, solid surface that is not subject to failure in order to avoid tipping, slipping or falling during operation.
  Avoid using the machine on land with a slope greater than 10°.
- The machine must always be positioned so that exhaust gases disperse into the air without being inhaled by people or animals.
  The exhaust gases of an engine contain carbon monoxide: this substance is harmful to health and, in high concentration, can cause poisoning and death.
- If the machine is used indoor, the installation should be designed by specialized technicians and carried out in a workmanlike manner.



2.6.2 Precautions for electric connections

- Connect the machine to a grounding system according to the regulations in force at the place of installation.
- Use the ground terminal located on the front of the machine.
- Use appropriate electrical plugs at the machine output sockets and make sure that the electrical cables are in good condition.
- Do not use the machine with wet or damp hands and/or clothing.



2.7 Precautions during operation

- Keep the doors closed during normal operation.
- Access to the internal parts of the machine must only be carried out for maintenance purposes.
- Keep the area near the muffler free from objects such as rags, paper, cartons.
  The high temperature of the muffler could cause the objects to burn and cause a fire.
- Immediately stop the machine in case of malfunctions.
  Do not restart the machine without first identifying and solving the problem.
- Do not wrap or cover the machine with cloths while it is running.
  When the machine is stopped, before covering it, make sure that the engine parts are cold
  If the engine parts are still warm, there is a risk of damage to the machine and fire.
- Do not place objects or obstacles near the air suction and expulsion windows; a possible overheating of the generator could cause a fire.
- Exhaust gases must be conveyed so that they are not sucked out of the fans of the alternator or engine.
- The cover materials must be non-combustible; incandescent pins can escape from the exhaust pipe.

2.8 Precautions during fuel and engine oil filling

- Fuel and engine oil are flammable.
  Refill with the engine off.
- Refuel only outdoors or in well-ventilated environments.
- Do not smoke or use naked flames during refuelling.
- Do not fuel with the engine running or hot.
- Clean and dry any leaks of engine oil and fuel before restarting the machine.
- After refuelling, fully tighten the tank caps.
- Do not fill the fuel tank completely to allow expansion of the fuel inside it.
- Do not exceed the MAX level line of the engine oil level dipstick.

2.9 Precautions against noise

- Excessive noise can cause temporary or permanent hearing problems.
  The actual risk arising from the use of the machine depends on its use conditions.
- Chapter “3. Technical data” shows the sound pressure dB(A) emitted by the machine. The value provides an indication of the noise level emitted by the machine when used, in order to assess the noise in the workplace.
- The adoption of specific measures (such as headphones or earplugs) must be assessed by the operator.

2.10 Electromagnetic Compatibility (EMC)[1]

The machine is compliant with European Directive 2014/30/EU on electromagnetic compatibility, and with harmonized standard: EN 60974-10 Electromagnetic Compatibility (EMC) Product Standard for Arc Welding Equipment.

All electrical equipment generates small amounts of electromagnetic emission.

Electrical emission may be transmitted through power lines or radiated through space, similar to a radio transmitter.

When emissions are received by other equipment, electrical interference may result.

Electrical emissions may affect many kinds of electrical equipment; other nearby welding equipment, radio and TV reception, numerical controlled machines, telephone systems, computers, etc.

⚠ WARNING

- **This Class A equipment is not intended for use in residential locations where the electrical power is provided by the public low-voltage supply system. There may be potential difficulties in ensuring electro-magnetic compatibility in those locations, due to conducted as well as radiated disturbances.**

2.10.1 Installation and use

- The user is responsible for installing and using the welding equipment according to the manufacturer's instructions.
- If electromagnetic disturbances are detected, the user of the welding equipment is responsible for solving the situation with the technical assistance of the manufacturer.
  In some cases, this remedial action may be as simple as grounding the welding circuit.
  In other cases, it could involve constructing an electromagnetic screen enclosing the generating set and the entire welding area, with related input filters.
  In all cases electromagnetic disturbances must be reduced to the point where they are no longer troublesome.

Note

The welding circuit could be earthed for safety reasons.
Follow your local and national standards for installation and use.
Changes to grounding connections should only be authorized by someone competent to assess whether the changes will increase the risk of injury, e.g., by allowing parallel welding current return paths which may damage the earth circuits of other equipment.

2.10.2 Assessment of the area

- Before installing the welding equipment, assess any potential electromagnetic problems in the surrounding area.
  Check for the presence of:
  - Supply cables, control cables, signalling and telephone cables, above, below and adjacent to the welding equipment.
  - Radio and television transmitters and receivers.
  - Computer and other control equipment.
  - Safety critical equipment, e.g., industrial equipment guards.
  - Presence of people with pacemakers, implantable defibrillators, neurostimulators and other active devices.

[1] Portions of this text are contained in EN 60974-10: "Electromagnetic Compatibility (EMC) product standard for arc welding equipment."

- Equipment used for calibration or measurement.

- Check that the other equipment in the environment is immune against electromagnetic disturbances. Ensure that the other equipment being used in the environment is compatible.
  This may require additional protection measures.
- Check the time of day that welding or other activities are to be carried out.
- The size of the surrounding area to be considered will depend on the structure of the building and other activities taking place there. The surrounding area may extend beyond the boundaries of the work site.

2.10.3 Emission-reducing methods

Welding equipment maintenance

The welding equipment should be routinely maintained according to the manufacturer's recommendations.

All access and service doors and covers should be closed and properly fastened when the welding equipment is running.

The welding equipment should not be modified in any way except for those changes and adjustments covered in the manufacturer's instructions.

Welding cables

The welding cables should be kept as short as possible and should be positioned close together, running at or close to floor level.

Equipotential bonding

Bonding of all metallic components in the welding installation and adjacent to it should be considered. However, metallic components bonded to the work piece will increase the risk that the operator could receive a shock by touching these metallic components and the electrode at the same time.

The operator should be insulated from all such bonded metallic components.

Earthing of the workpiece

Where the workpiece is not bonded to earth for electrical safety, not connected to earth because of its size and position, e.g., ships hull or building steelwork, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the grounding of the workpiece increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, grounding of the workpiece to should be achieved by a direct connection to the workpiece; however, in some countries where direct connection is not permitted, grounding should be achieved by suitable capacitors, selected according to national regulations.

Screening and shielding

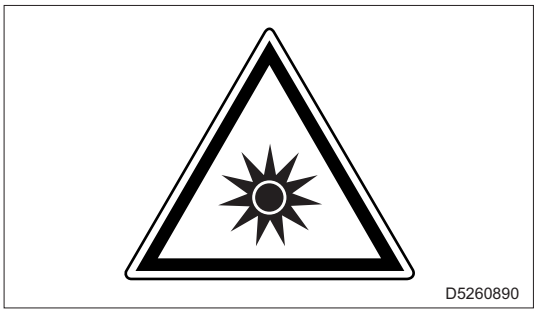
Selective screening and shielding of other cables and equipment in the surrounding area may alleviate problems of interference. Screening of the entire welding installation may be considered for special applications

2.11 Precautions during welding

- Access to the internal parts of the machine must only be carried out for maintenance purposes.
- Immediately stop the machine in case of malfunctions.
  Do not restart the machine without first identifying and solving the problem.

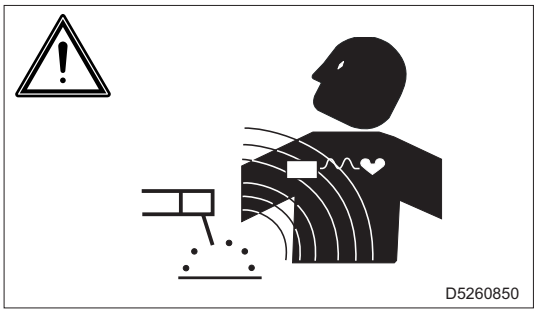
2.11.1 Precautions in the workplace

- Do not use the welding equipment near heat sources, in areas at risk with explosion hazard or fire hazard.
  Place the welding equipment at a safe distance from fuel tanks, from flammable material (rags, paper, etc.), from chemicals.
- Delimit the areas where welding operations are carried out with self-extinguishing curtains, to prevent people not directly involved in welding from being exposed to optical radiation emissions or being reached by flammable material.
- Make sure that the area immediately surrounding the welding site is clean and free of debris.

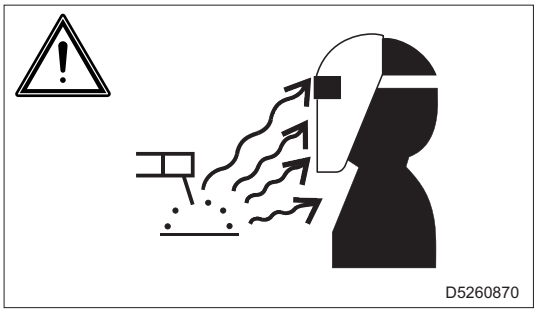


2.11.2 Welding precautions

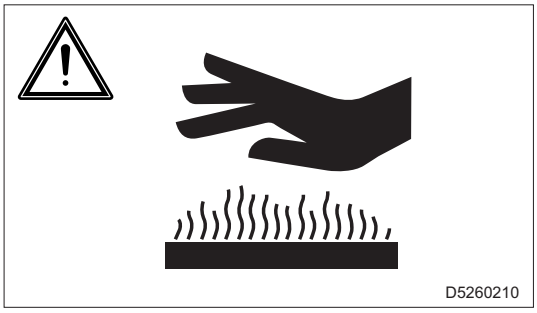
- The electric current flowing through the conductors creates electric and magnetic fields (EMF) that can interfere with pacemakers, implantable defibrillators, neurostimulators and other active devices. Consult your doctor before using the engine driven welder.



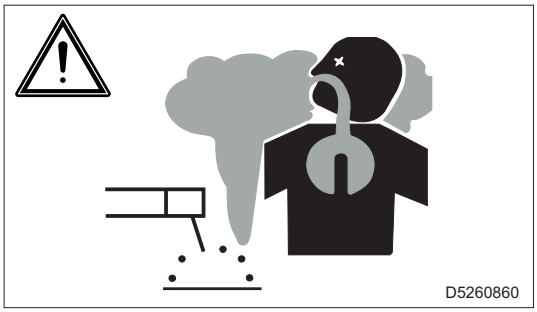
- During welding, sparks can cause burns.
  Adopt the following Personal Protection Equipment (PPE):
  - Welding mask with filters according to Standards EN169 or EN379.
  - Soldering iron caps for head protection.
  - Clothing and gloves resistant to heat and direct contact with flames or sparks.
  - Shoes with an antistatic sole resistant to high temperatures.
- Make sure that all the equipment is in good condition and that it is not cut, damaged, wet or oily.



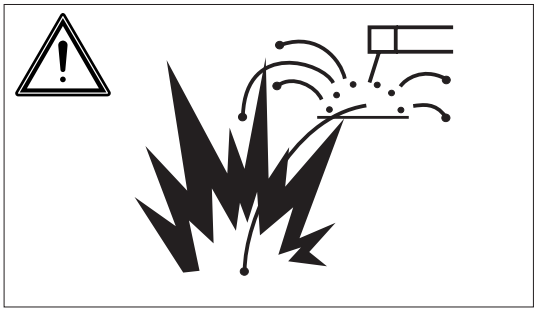
- Welding generates large amounts of heat. Welded surfaces and materials can cause serious burns. Use gloves and pliers when touching or moving materials in the work area.



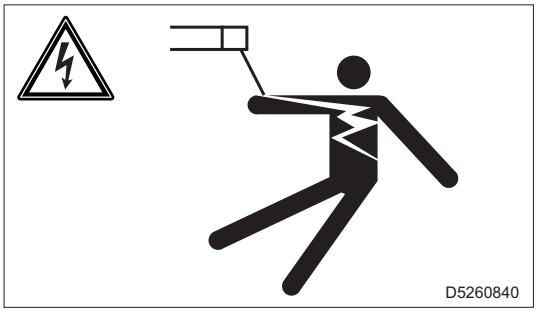
- Welding generates fumes and gases that are hazardous to health. Use sufficient ventilation or a fume extractor to keep fumes and gases away from the breathing area.



- Weld tanks, drums, or containers only when you are sure that there are no flammable or toxic vapours.
  Do not use the engine driven welder in the presence of flammable gases, vapours or liquid fuels.

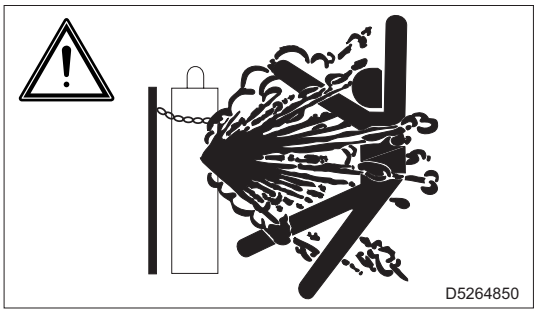


- The engine driven welder generates dangerous voltages. Do not touch the electrode, electrode holder or any connected parts when it is switched on.
- Check the cables, electrode and electrode holder regularly.
  In case of damage to the insulation, repair or replace it immediately.
  Do not place the electrode holder sealer on the welding table or on any other surface to prevent the risk of accidental ignition of the sealer.



2.12 Checks and precautions when using gas cylinders

- Follow the manufacturer's instructions and consult local safety regulations.
- Check that the gas cylinder is not damaged.
- Check that the gas cylinder contains the correct shielding gas for the process.
- Check that the control valve is in good working order, is suitable for the gas and pressure being used and is in good condition.
- Check that the hoses and fittings connected to the cylinder are suitable for the application and are in good condition.
- If necessary, use a soapy solution or a gas detector to check for gas leaks.

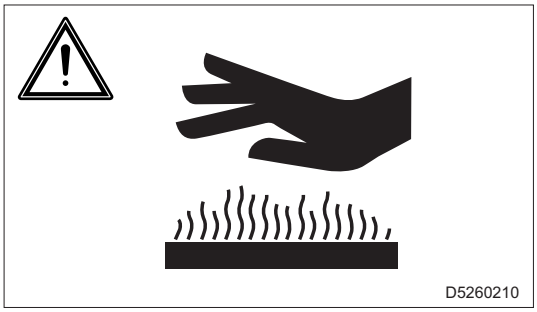


- Keep cylinders upright and securely chained to a trolley or fixed support.
- Do not drop or hit the cylinders to avoid damaging the valves or cylinder body.
  For transport, use suitable trolleys or supports.
- Position cylinders away from areas where they may be subject to impact or damage and away from welding areas and sources of heat, sparks or flame.
- Do not expose the cylinders to extremes of temperature, such as excessive heat or cold, as this may affect the internal pressure of the cylinders.
- Use gas cylinders in ventilated areas to prevent the accumulation of gas in the air.
- Keep your face away from the gas control valve when opening it.
- Observe the maximum working pressure specified for the cylinder.
  The use of higher pressures may cause damage to the cylinder and increase the risk of accidents.
- Do not use naked flames near gas cylinders.
- Carry out regular checks and maintenance.
- When the cylinder is not in use, put on the valve protection caps.

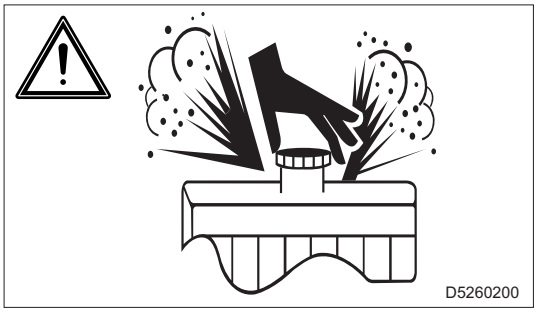
2.13 Maintenance precautions

- Maintenance must be performed by qualified personnel.
- During maintenance, if unauthorized persons start the machine, there is a danger of serious personal injury or death. Do not allow unauthorized persons to approach the machine.
- Stop the machine and turn the battery disconnect switch to off.
- To avoid injury, do not perform maintenance with the engine running, if it is not necessary.
  - Rotating parts, such as the fan, are dangerous and can get entangled on body parts or a worn object. When performing maintenance, be careful to approach rotating parts.
  - Make sure not to drop or insert tools or other objects in the fan or other rotating parts. They can touch the rotating parts and be projected.

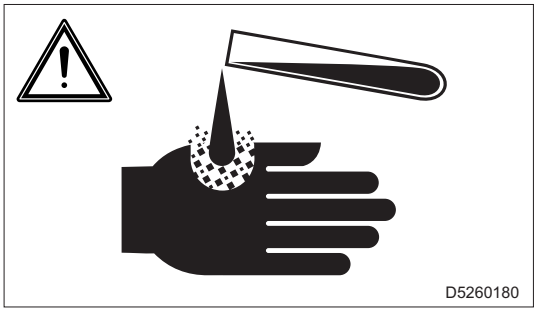
- Do not touch the engine, pipes and muffler during operation or immediately after shut-off. Allow the engine to cool before performing any operation.
- When discharging the engine oil, the engine must be hot. Engine oil may come into contact with the skin and cause burns.
- Do not remove the guards and safety devices.
  If it is necessary to remove them, after completing the maintenance, install the removed guards and restore the safety devices.



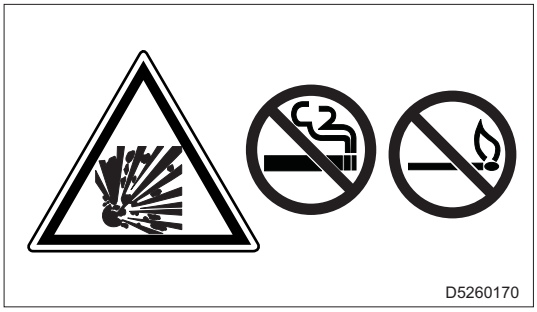
- Use work tools in good condition and suitable for the work to be performed.
  If you use a damaged or deformed tool or if you use a tool for a purpose other than its intended purpose, there is a danger of causing serious personal injury or death.
- Do not remove the radiator cap with the engine running or hot.
  The coolant may leak and cause serious burns.



- Do not operate the battery without using protective gloves.
  The battery liquid contains corrosive sulphuric acid.

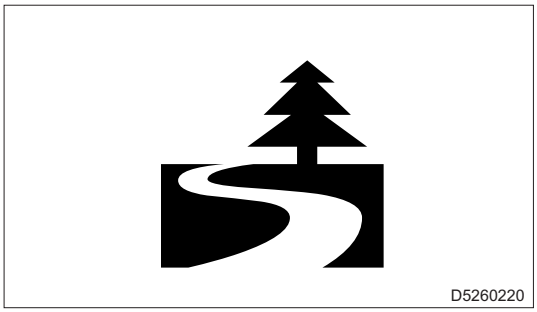


- Do not smoke, avoid open flames and sparks near the battery; exhaled vapours may cause the battery to explode.



2.14 Precautions for disposal of waste material

- Be sure to store the waste liquid in containers or tanks.
- Do not discharge the oil directly into the soil or sewage system, rivers, seas or lakes.
- When disposing of harmful waste such as oil, fuel, coolant, solvents, filters and batteries, follow current laws and regulations.
- Entrust the authorized companies with the disposal of rubber material, plastic and components that contain them (hoses, cables, wiring, etc.) in accordance with the applicable laws and regulations.



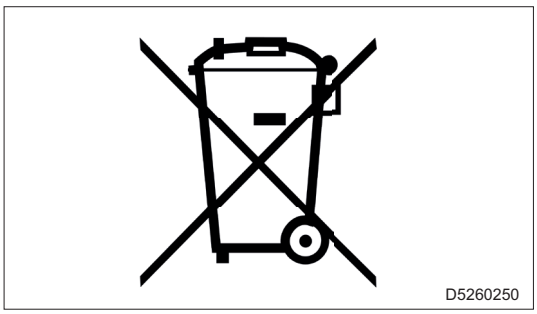
2.15 Disposal of the machine

This machine is classified as Electrical Equipment.

For disposal, comply with *Directive 2012/19/EU* on waste of electric and electronic equipment (WEEE).

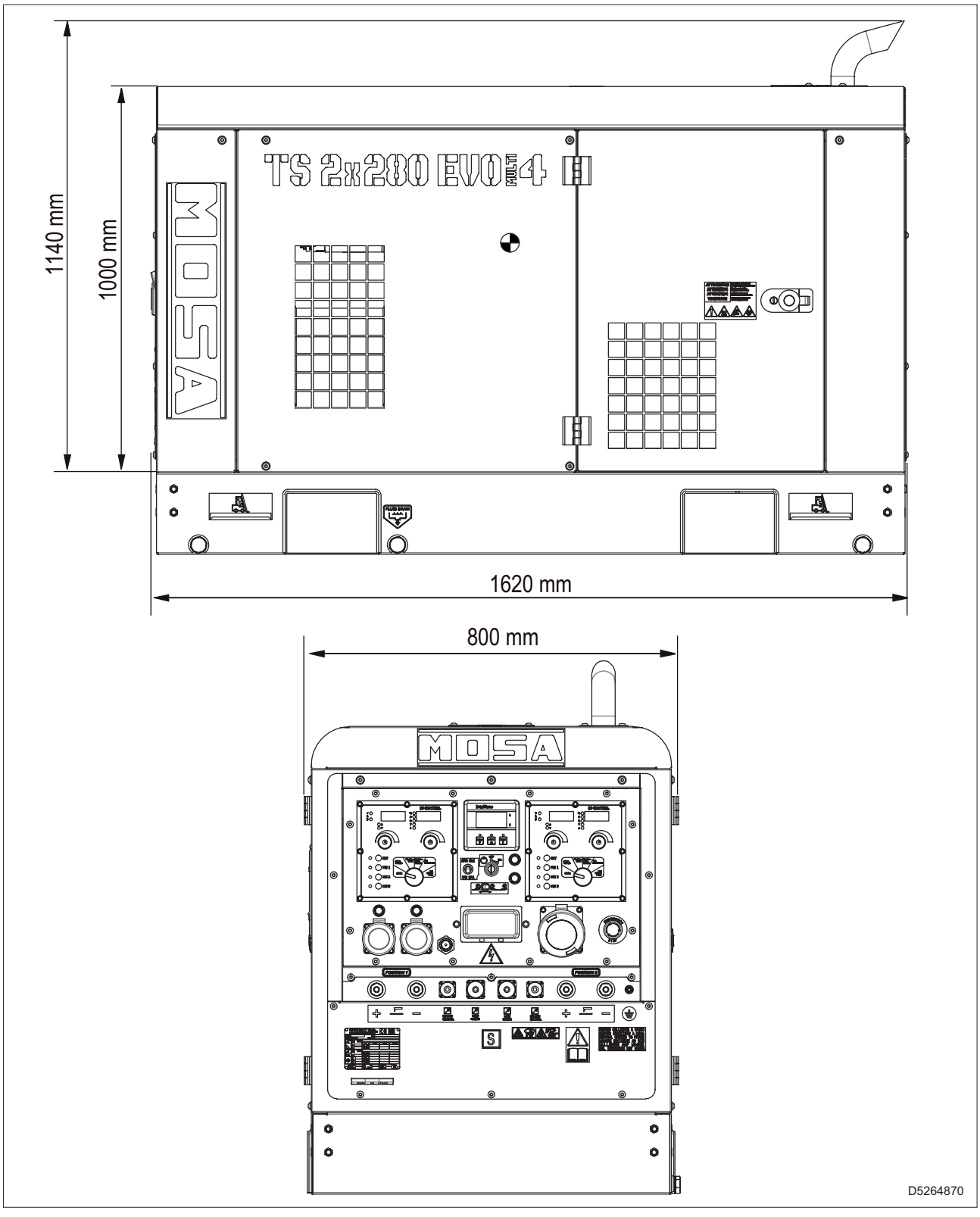
The symbol affixed to the product or to the documentation states that, at the end of its useful life, the machine must be disposed of separately.

Adequate separate collection helps avoid possible negative effects on the environment and health and promotes the reuse and/or recycling of the materials that make up the equipment.



3. Technical data

3.1 Machine dimensions



3.2 Technical data

Welding
SMAW (Stick - Coated Electrode) - DC Direct Current
GTAW (Tig - Tungsten Electrode) - DC Constant Current
GTAW (Pulsed Tig - Tungsten Electrode) - DC Constant Current
GOUGING - DC constant current
GMAW (Mig - Solid wire) - DC constant voltage
FCAW (Flux Cored Wire) - DC constant voltage

	Welding current range	
	Dual station	Single station
SMAW (Stick - Coated Electrode)	20A/20.8V - 250A/30V	40A/21.6V - 500A/32V
IEC - Rating		40A/21.6V - 425A/37V
Duty Cycle	250A / 30V / @ 60%	-
	230A / 29.2V @100%	425A / 37V @100%
Current adjustment	Continuous	
No-load voltage (ignition)	70 VDC (75 peak VDC)	
GTAW (Tig - Tungsten Electrode)	20A/10.8V - 250A/20V	500A/30V @35%
Duty Cycle	250A / 20V / @ 60%	480A / 29.2V @60%
	230A / 19.2V / @ 100%	440A / 27.5V @100%
Current adjustment	Continuous	
No-load voltage (ignition)	70 VDC (75 peak VDC)	
GMAW (Mig - Solid Wire) FCAW (Flux Cored wire)	20A/15V - 250A/26.5V	40A/16V - 500A/32V
IEC - Rating		40A/16V - 440A/36V
Duty Cycle	250A / 26.5V / @ 60%	-
	230A / 25.5V / @ 100%	440A / 36V @100%
Voltage regulation	Continuous : 15-45 V	

Auxiliary generation	
Auxiliary current generation 400V 3~	15 kVA (15 kW) / 400V / 21.6A
Auxiliary current generation 230V 1~	7 kVA (7 kW) / 230V / 30.4A
Auxiliary current generation 115V 1~	5 kVA (5 kW) / 115V / 43.5A
Frequency	50 Hz
Cosφ	0.8 - 1

Engine	
Brand/Model	YANMAR 3TNV88
Cooling system/type	4-stroke / water diesel
Cylinders / Displacement	3/1.642 l (1642 cm^3)
Net stand-by power ([1])	26.8 kWm (36.4 HP)
Net PRP power ([2])	24.0 kWm (32.6 HP)
Speed	3000 rpm
Fuel consumption (75% PRP)	5.3 ℓ/h
Oil sump capacity (max.)	6.0 ℓ
Starter	Electric

General specifications	
Fuel tank capacity	60 ℓ
Running time (60% welding)	13 h
Protection	IP 23
Weight (Dry)	725 kg
Acoustic pressure LpA	75dB(A) @ 7m

Alternator	
Type	Asynchronous three-phase-brushless
Insulation class	H

Power declared according to ISO 8528-1 (temperature 25°C, relative humidity 30%, altitude 100 m above sea level).

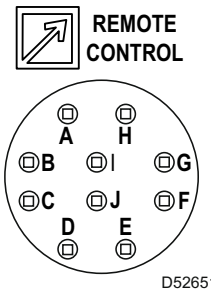
([1]) Stand-by = maximum power available for use at variable loads for a number of hours/year limited to 500h. Overloading is not allowed.

([2]) Prime power PRP = maximum power available for use at variable loads for an unlimited number of hours/year.

The average power withdrawable during a 24h period must not exceed 80% of the PRP.

An overload of 10% is allowed for one hour every 12 hours.

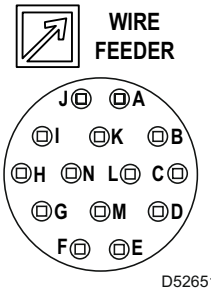
3.3 Remote Control connector wiring diagram (10-pin)



D5265100

Contacts	Description
A (ground)	Remote control - GND terminal
B	Remote control - terminal V check
C	Remote control - V terminal ref.
D	Not used
E	Reverse polarity control
F	Reverse polarity control
G	Enabling remote control
H	Enabling remote control
I	Torch contact for STICK Contact and TIG Lift Arc Pulse
J	Torch contact for STICK Contact and TIG Lift Arc Pulse

3.4 Wire Fender connector wiring diagram (14-pin)



D5265110

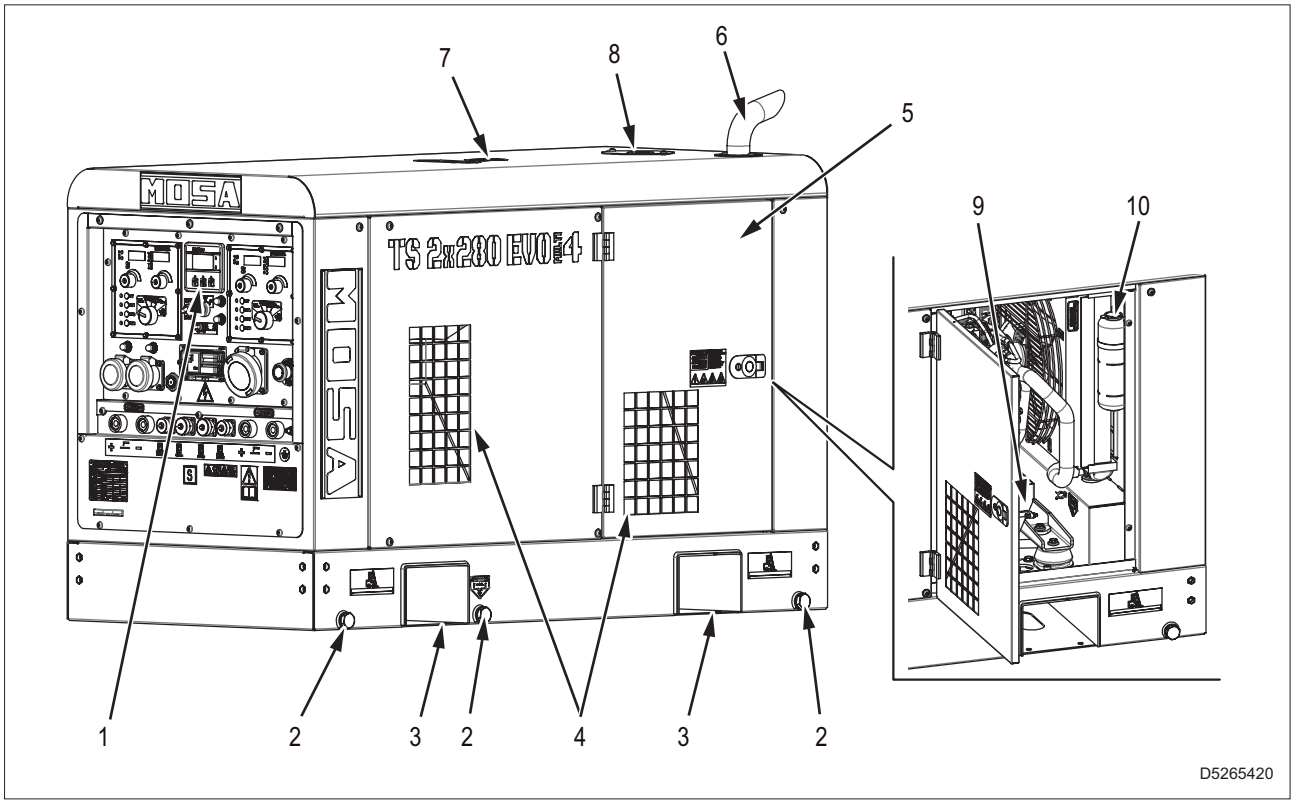
Contacts	Description
A	Wire feeder power supply 48 VAC
B	Wire feeder power supply 48 VAC
C	MIG torch contact / Flux Cored Contact
D	Not used
E	Volt regulation on wire feeder - V check
F	Volt regulation on wire feeder - V ref.
G (ground)	Voltage adjustment on wire feeder - GND terminal
H	Enabling Volt regulation on wire feeder
I	Torch contact for STICK Contact and TIG Lift Arc Pulse
J	Torch contact for STICK Contact and TIG Lift Arc Pulse
K	Enabling Volt regulation on wire feeder
L	Not used
M	Not used
N	Not used

4. Description

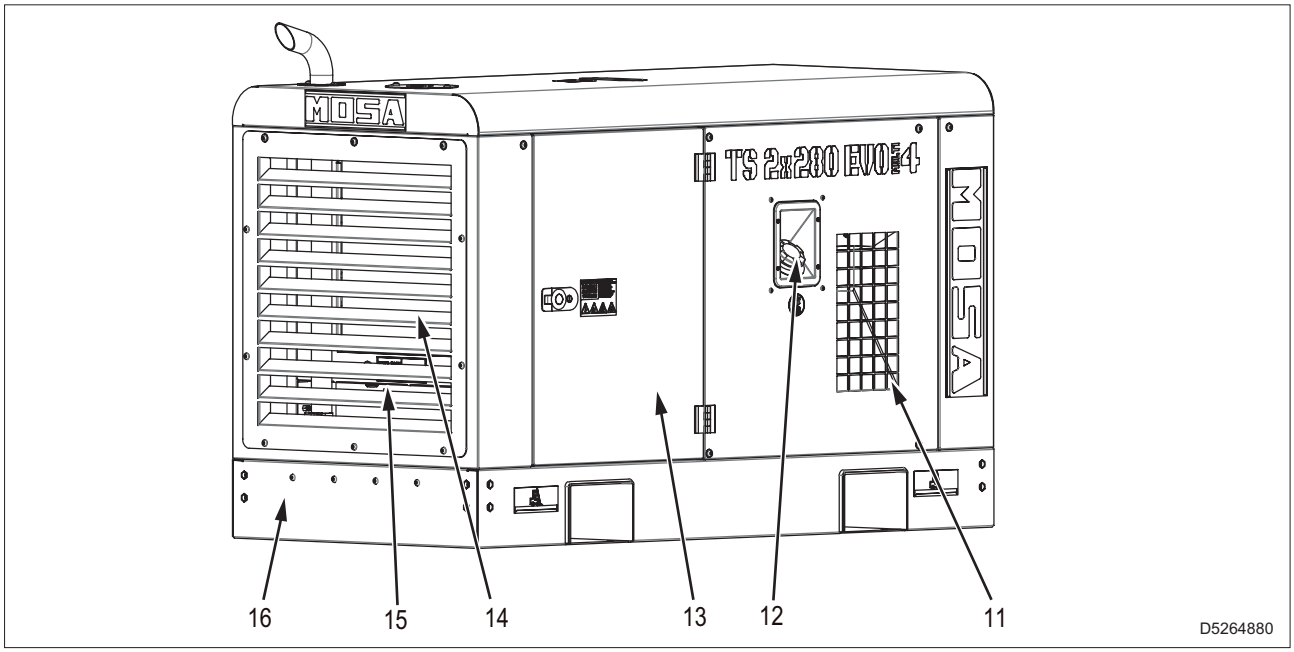
The engine driven welder is a machine that transforms the mechanical energy generated by a engine into a source of electrical energy suitable for arc welding processes.
It can also supply three-phase and single-phase alternating current to power electrical equipment.

4.1 Main components

4.1.1 External components

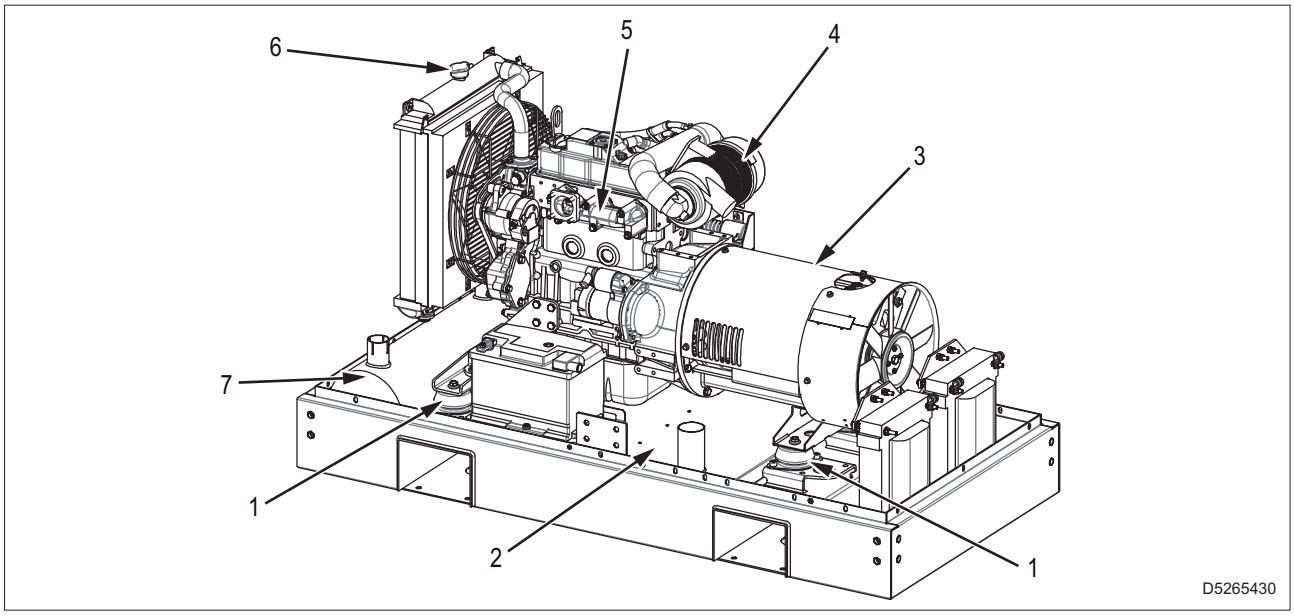


1 - Control panel
2 - Fluid drain plugs
3 - Anti-tip side pockets for handling with forklift trucks (2 per side)
4 - Air intake grids
5 - Engine compartment access door
6 - Engine exhaust gas outlet
7 - Lifting hook
8 - Radiator cap access door
9 - Oil drain hose
10 - Coolant expansion tank

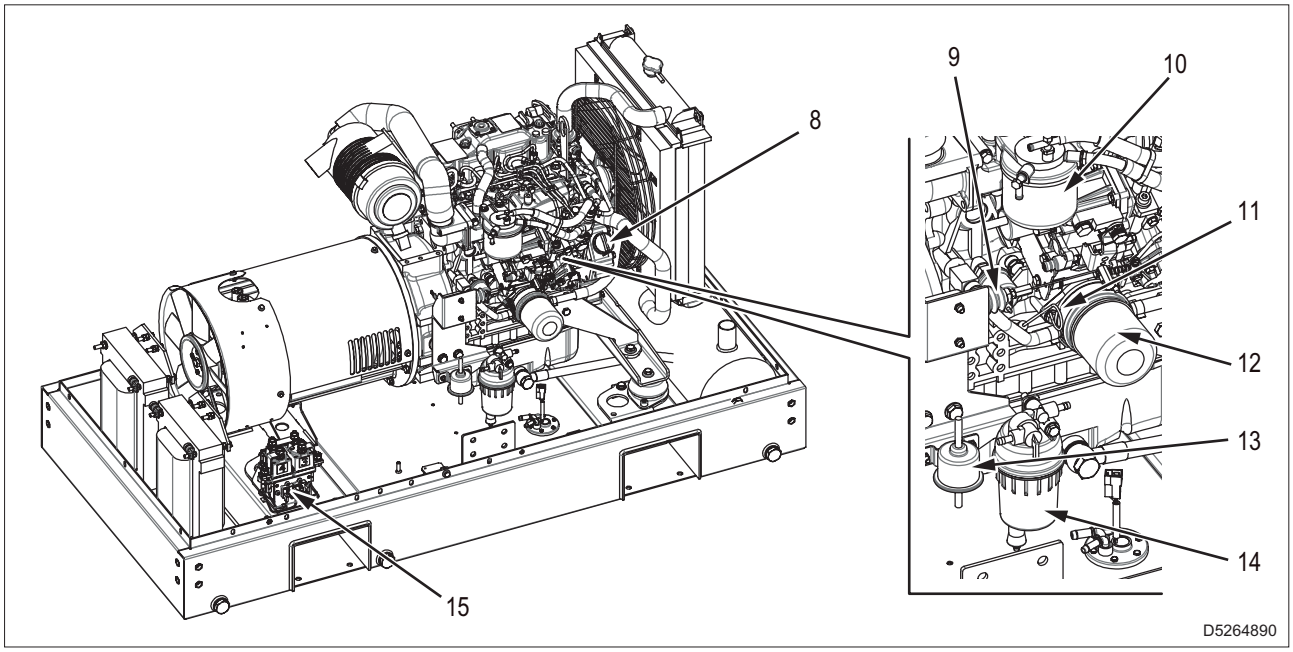


11 - Air intake grids
12 - Fuel tank cap
13 - Battery compartment access door
14 - Air ejection grid
15 - Coolant drain valve
16 - Liquid sealed base

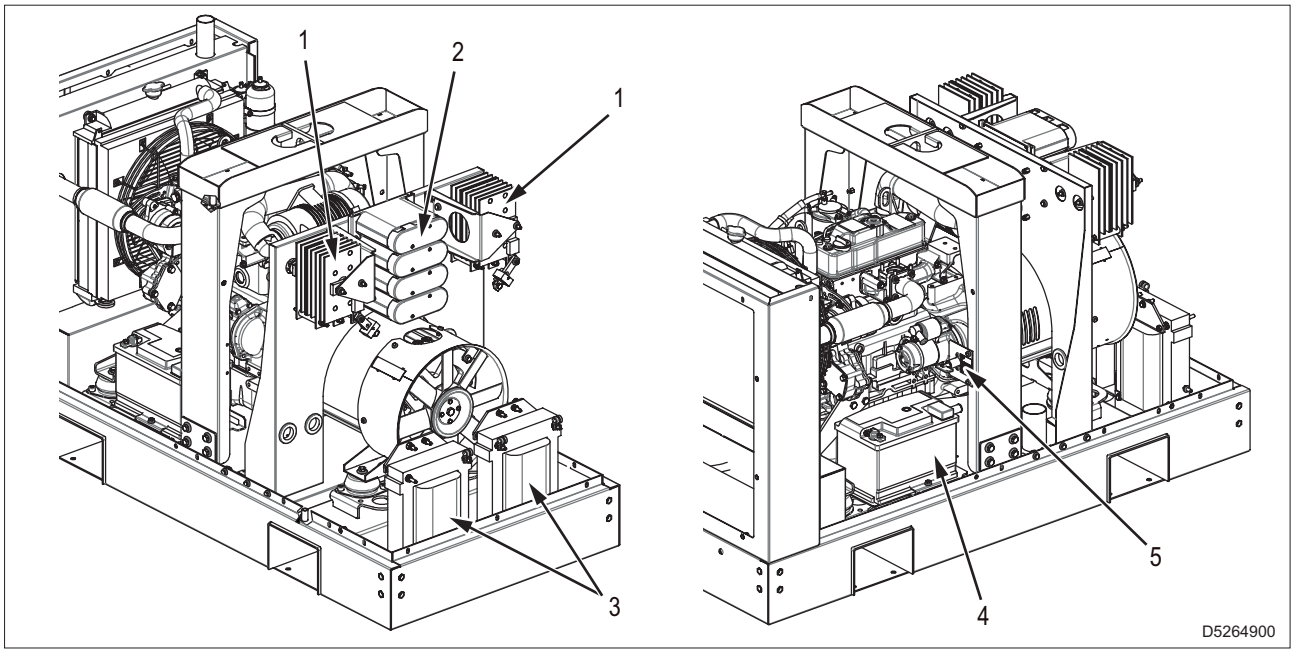
4.1.2 Internal components



1 - Vibration dampers
2 - Fuel tank
3 - Alternator
4 - Engine air filter
5 - Engine
6 - Radiator cap
7 - Exhaust silencer

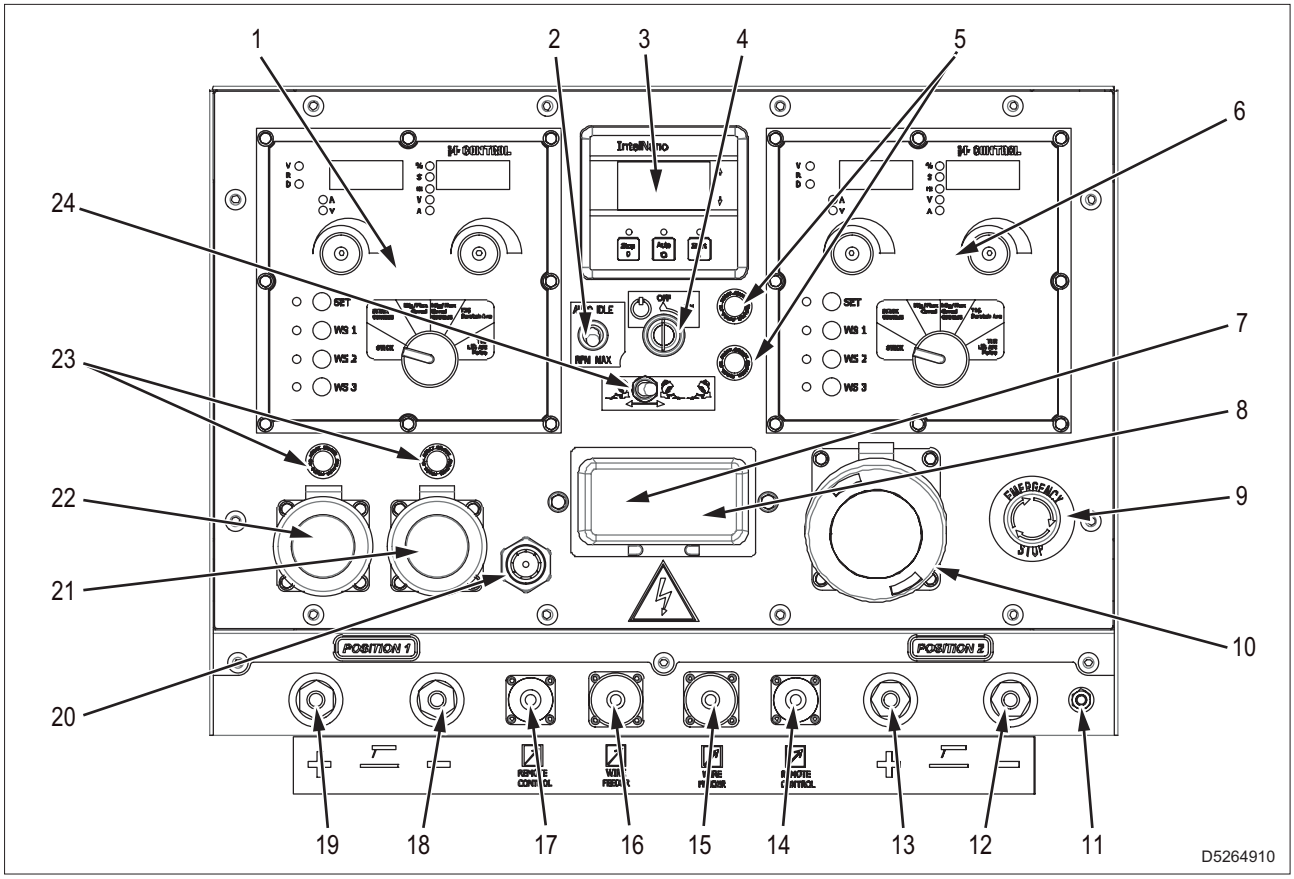


8 - Oil filler plug
9 - Auto Idle solenoid
10 - Fuel filter
11 - Oil level dipstick
12 - Oil filter
13 - Fuel supply pump
14 - Fuel pre-filter
15 - Parallel switching contactor



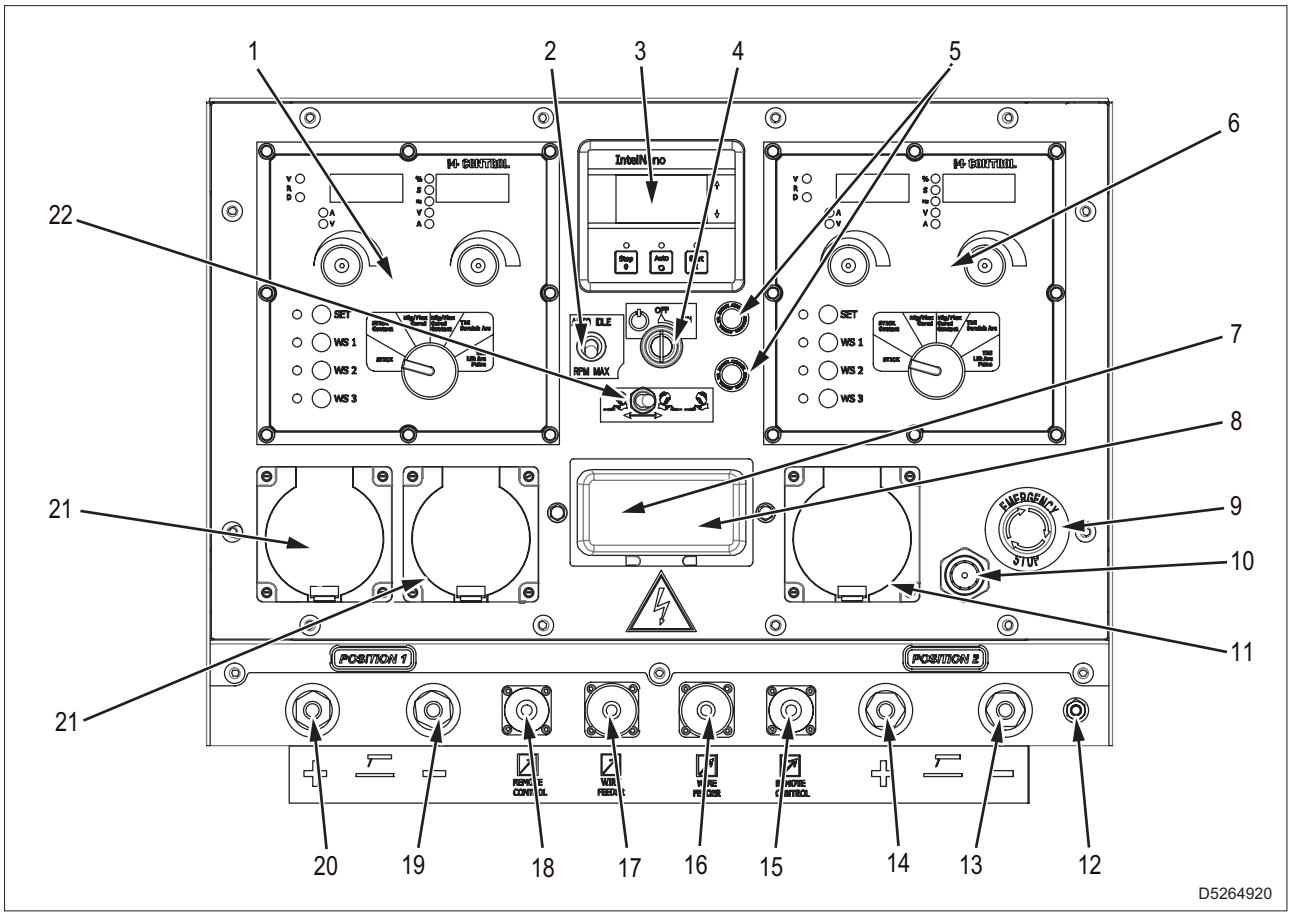
16 - Diode bridge
17 - Alternator excitation capacitors
18 - Welding level reactor
19 - Battery
20 - Battery disconnect switch

4.1.3 Control panel and electrical panel components

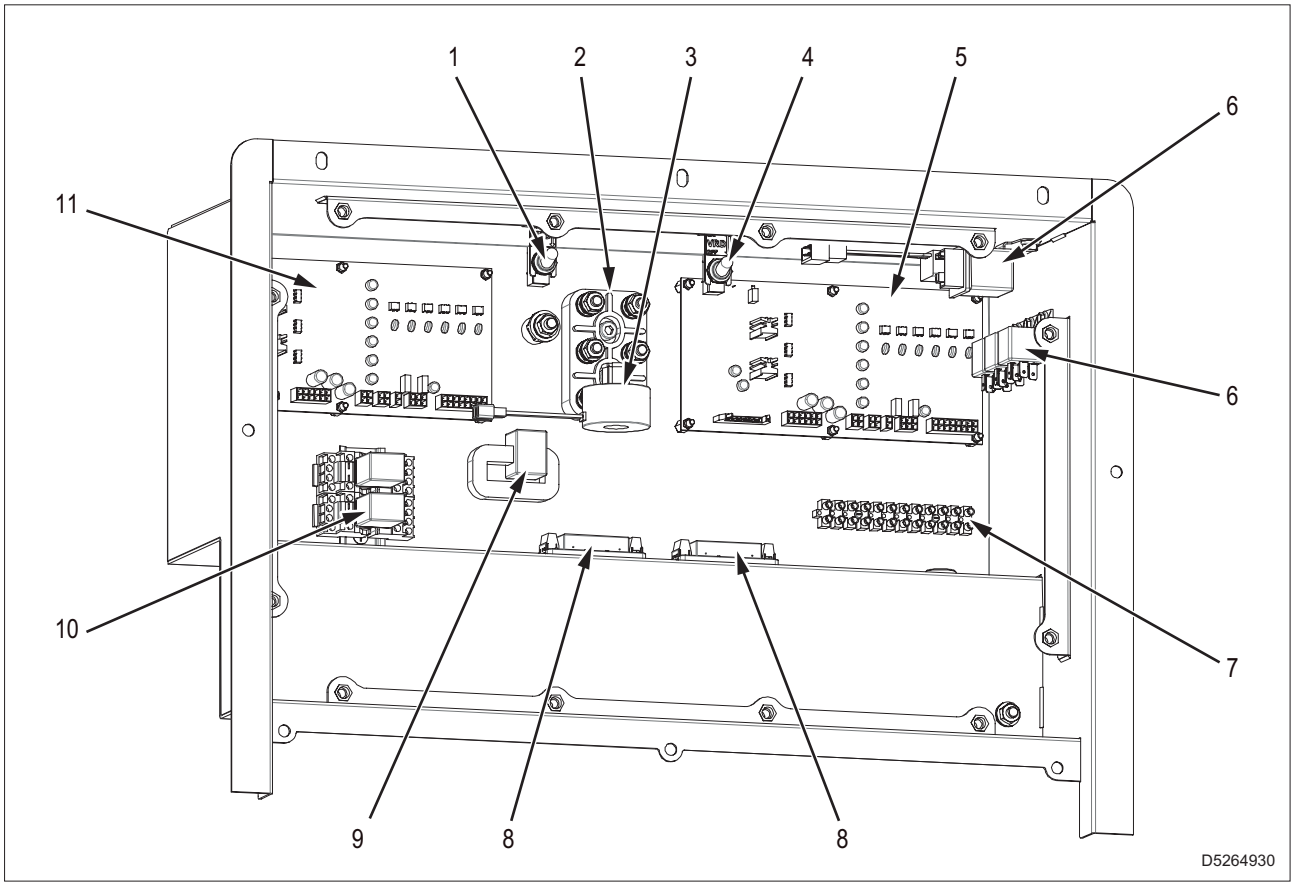


1 - EVO CONTROL MULTI4 welding control unit - Station 1 (Single)
2 - Auto Idle switch
3 - Engine control unit
4 - Engine control unit power switch (ON-OFF)
5 - Engine thermal protections
6 - EVO CONTROL MULTI4 welding control unit - Station 2
7 - 30mA Type A residual current circuit breaker for 110V socket
8 - 30mA Type A residual current circuit breaker for 230V / 400V sockets
9 - Emergency button
10 - 32A 400V 3P+N+T CEE IP67 socket
11 - Ground terminal
12 - Welding socket (-) Station 2
13 - Welding socket (+) Station 2
14 - Remote control connector for Station 2
15 - Wire feeder connector for Station 2
16 - Wire feeder connector for Station 1 (Single)
17 - Remote control connector for Station 1 (Single)
18 - Welding socket (-) Station 1 (Single)
19 - Welding socket (+) Station 1(Single)
20 - Buzzer
21 - 16A 230V 2P+T CEE IP67 socket
22 - 16A 110V 2P+T CEE IP67 socket
23 - 16A thermal protections for 230V and 110V sockets
24 - Station Selector (Single-Dual)

Australia version



1 - EVO CONTROL MULTI4 welding control unit - Station 1 (Single)
2 - Auto Idle switch
3 - Engine control unit
4 - Engine control unit power switch (ON-OFF)
5 - Engine thermal protections
6 - EVO CONTROL MULTI4 welding control unit - Station 2
7- Circuit breaker 2P 16A for 15A 230V sockets (No. 2)
8 - 30mA Type A residual current circuit breaker for 230V / 400V sockets
9 - Emergency button
10 - Buzzer
11 - 32A 400V 3P+N+G AUSTRALIA IP66 socket
12 - Ground terminal
13 - Welding socket (-) Station 2
14 - Welding socket (+) Station 2
15 - Remote control connector for Station 2
16 - Wire feeder connector for Station 2
17 - Wire feeder connector for Station 1 (Single)
18 - Remote control connector for Station 1 (Single)
19 - Welding socket (-) Station 1 (Single)
20 - Welding socket (+) Station 1(Single)
21 - 15A 400V 2P+G AUSTRALIA IP66 socket
22 - Station Selector (Single-Dual)



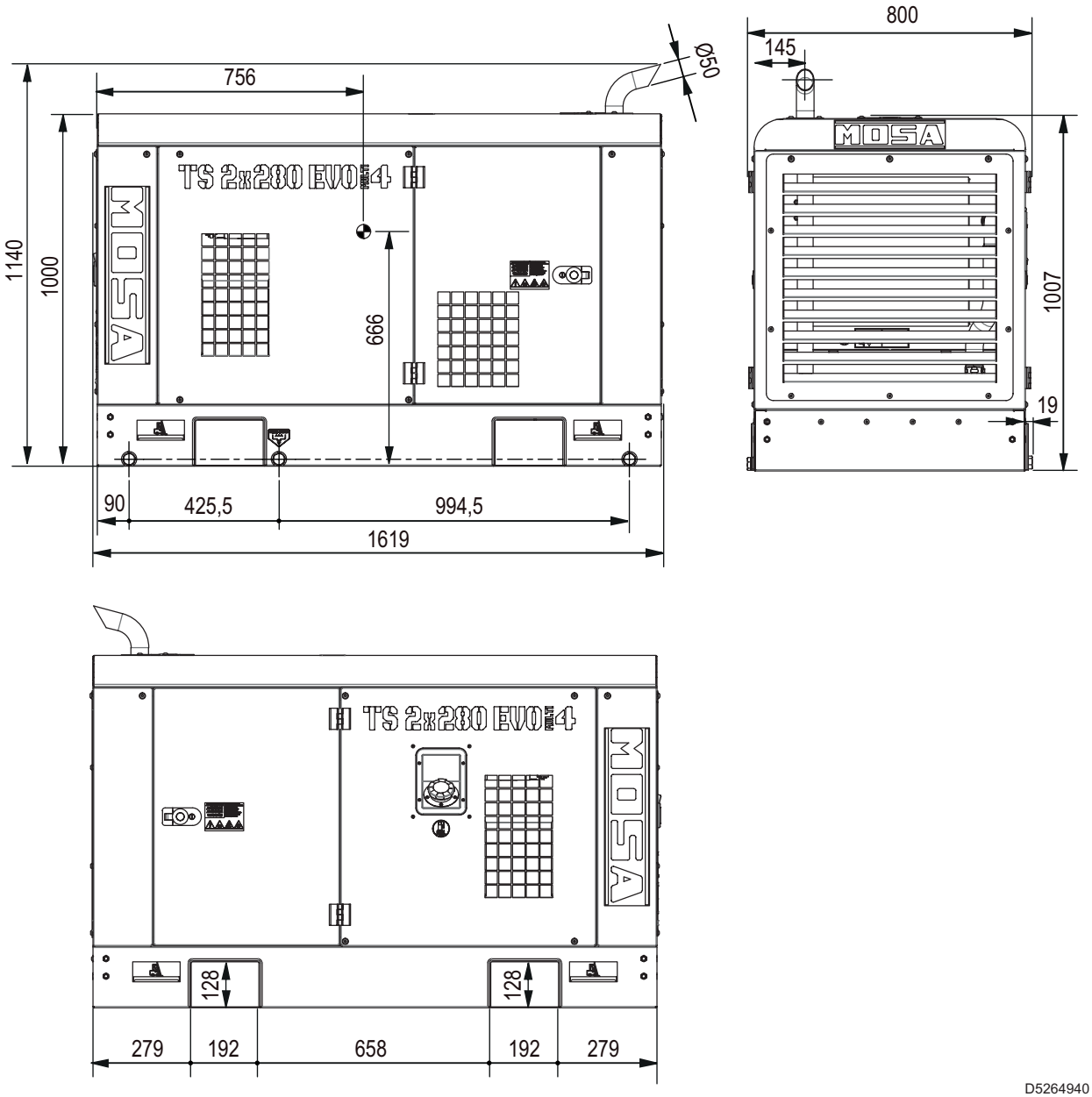
1 - VRD switch - Station 1 (Single)
2 - Current generation terminal board
3 - Current generation CT (current transformer)
4 - VRD switch - Station 2
5 - Welding current control board - Station 2
6 - Engine relay
7 - Engine terminal board
8 - Control board power pack
9 - TA (current transformer) Auto Idle
10 - Wire feeder control relay
11 - Welding current control board - Station 1 (Single)

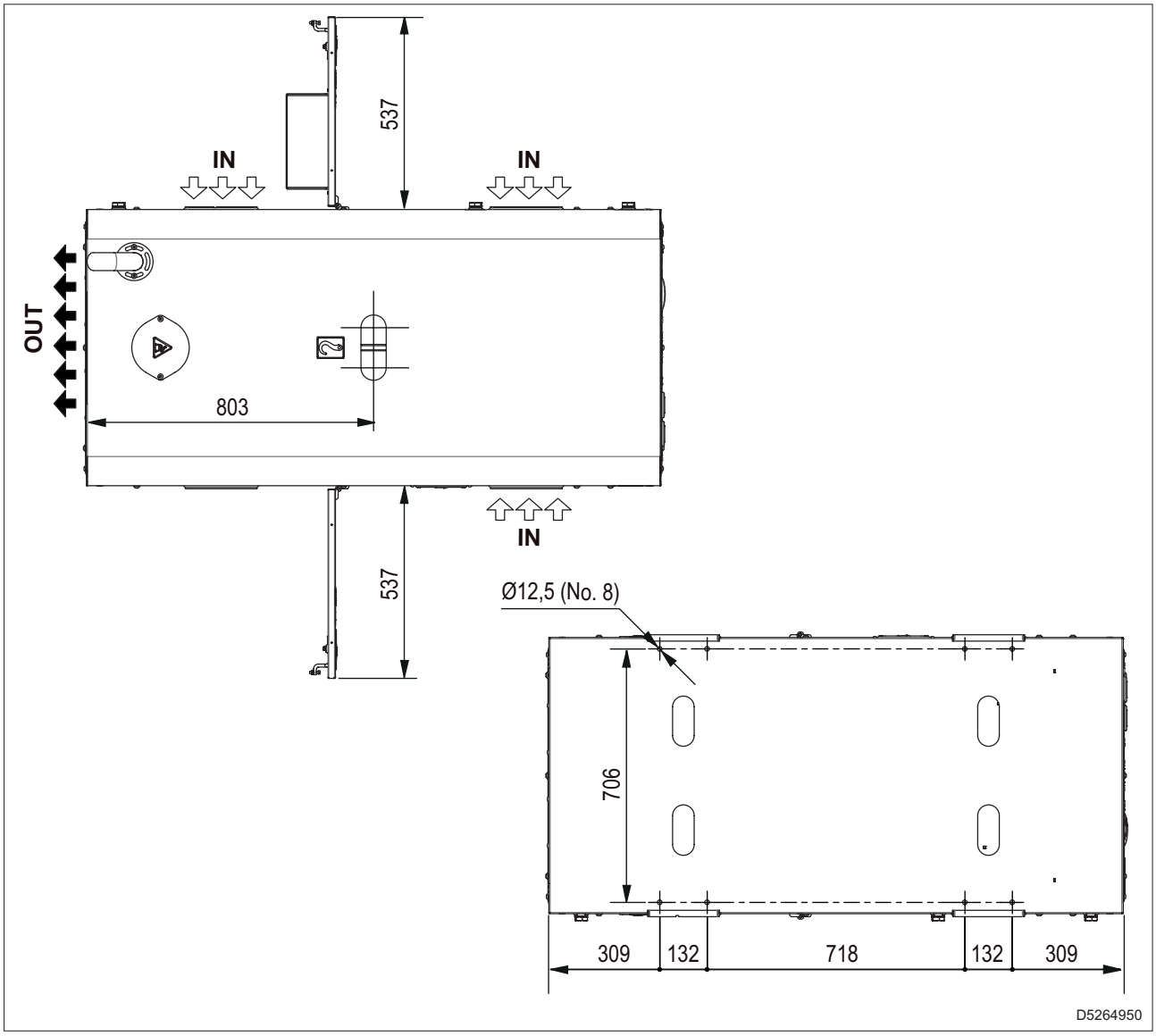
5. Installation

WARNING

- **Before proceeding with the installation, carefully read section Safety - "2.6 Precautions for positioning the machine" and "2.7 Precautions during operation".**
- **The installation and the electrical connection described in this chapter are indicative. For these operations, it is necessary to contact Specialized Technicians who must issue the necessary certifications.**

The following drawings show the measurements required to install the machine correctly.





5.1 Fixed installation

- Fix the machine on rigid pitches, isolated against vibrations coming from other structures and with a mass equal to at least three times the mass of the machine.
  This guarantees an adequate absorption of the vibrations produced by the machine.
- Do not place the machine on terraces or raised floors that have not been adequately sized and verified beforehand.

5.2 Installation on a vehicle

Incorrect machine's load distribution can cause vehicle instability and damage to tyres and other components.

To transport the machine, use only efficient vehicles suitable for transporting the load.

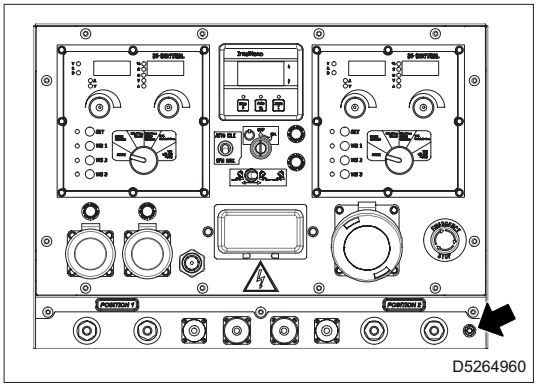
- Do not exceed the maximum load capacity of the vehicle components (suspension, axles and tyres).
- Distribute, balance and secure the machine so that the vehicle is stable.
- Place the base of the equipment on the metal vehicle floor.
- Consult and follow the instructions contained in the vehicle manual.

5.3 Grounding

☛ Important

- Comply with local and/or current regulations on installation and electrical safety.

The grounding terminal is in the position shown in figure.



5.3.1 Grounding with residual current circuit breaker

Connection to a grounding system is mandatory for all models equipped with a residual current circuit breaker.

Use the grounding terminal for connection.

In these groups, the star centre of the generating set is generally connected to the machine ground.
By adopting the TN or TT distribution system, the residual current circuit breakers guarantees protection against indirect contacts.

Grounding is also required when the machine is installed on a vehicle.

In this case, connect the ground terminal to the vehicle structure.

In the event that the machine supplies grounded electrical devices (not installed on the vehicle), the ground terminal must also be connected to a grounding system.

5.3.2 Grounding with isolation monitor

In machines equipped with an insulation monitor, connection of the grounding terminal to a grounding system is not required.

Located on the front of the machine, the isolation monitor continuously monitors the ground insulation of the active parts.

If the isolation resistance drops below the set fault value, the isolation monitor interrupts the power supply to the connected equipment.

It is important that the power cables of the equipment are equipped with the protective conductor (yellow-green cable) so as to ensure the equipotential connection between all the masses of the equipment and the mass of the machine.

This provision is not valid for double insulated or reinforced insulated equipment.

Note

You can connect the grounding terminal to your own grounding system.
In this case, an IT-type system is created, that is, with the active parts isolated from the ground and the ground plane earthed.
In this case, the isolation monitor controls the isolation resistance of the active parts both towards ground and towards earth (for example, ground insulation of the power cables).

NOTES:

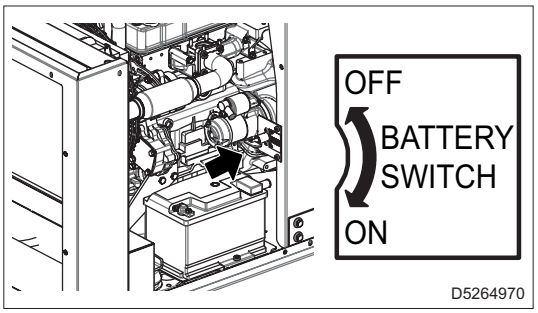
6. Operation

WARNING

- **Before starting the machine, carefully read section "2. Safety".**
- **It is forbidden to connect the machine to the public grid and/or other source of electricity.**
- **<u>Continuous operation at low load</u>**
  In general, all machinery (in particular those equipped with motors with after-treatment devices) must operate with a load (i.e. absorbed power) equal to or greater than 30% of the nominal mechanical power indicated on the ID plate (value expressed in kW). This ensures a consistent efficiency and performance throughout their lives.
  With loads below 30%, the machine should never be operated for more than 5 hours. Subsequently, the machine must be operated with a load greater than 30% for at least 30 consecutive minutes.

6.1 Checks before start-up

1 - Check that the battery disconnect switch is turned ON.
2 - Check the oil, fuel and coolant levels.
3 - Check that the engine compartment, radiator and battery access doors are locked.
4 - Check that there are no oil, fuel and coolant leaks.
5 - Check that there is no flammable or dirty material around the exhaust pipe.
6 - Check that there are no unauthorized persons in the area adjacent to the machine.
7 - Before each work session, if the distribution system adopted requires it, check the effectiveness of the ground connection of the machine (e.g., TT and TN systems).

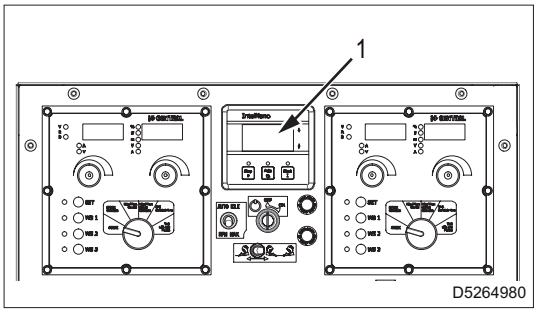


6.2 Starting the engine

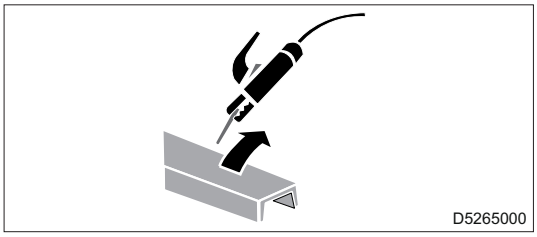
WARNING

- **Do not alter the primary adjustment conditions and do not tamper with sealed parts.**

The engine is started and stopped by acting directly on the InteliNano Plus (1) engine control unit.
Consult the control unit manual for complete knowledge of its characteristics and performance.



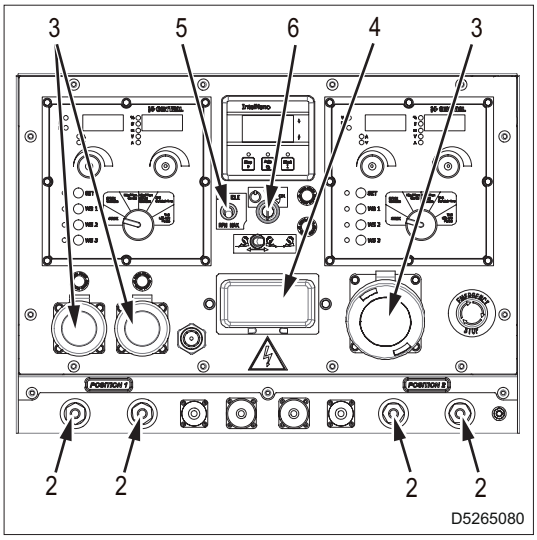
1 - Check that the welding cables are not plugged into the sockets (2) or that there is no electrical contact between the components of the external welding circuit (electrode, electrode holder, workpiece, etc.).
When the engine is started, the welding circuit is immediately operational, i.e. energized.


D5265000

2 - Check that the plugs of the electrical loads are disconnected from the sockets (3) or that the ground leakage circuit breaker(s) (4) is/are open (lever down), so as to ensure that the engine can be started without loads connected to it.

3 - Turn the Auto Idle switch (5) to the Auto Idle position to start the engine at idle speed.

4 - Turn the control panel power switch (6) ON.



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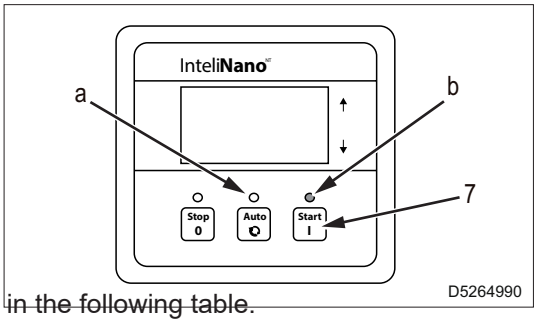
5 - Press the start button (7) on the engine control unit to initiate the starting sequence.

Note

- The start button only works when the LED (a) is off (MAN mode).
- LED (b) flashes during the starting phase and remains lit when the engine has started.



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6 - Before drawing a load, let the engine run for the time shown in the following table.

Ambient temperature	Time required
-10°C	2 minutes
-9°C – -5°C	1 minute
≤ -4°C	30 seconds

Note

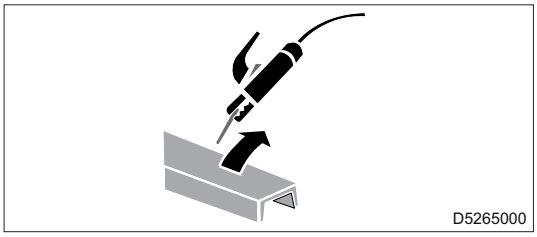
- For starting and use at temperatures below -10°C, refer to the engine instruction manual or contact the Technical Support Service.

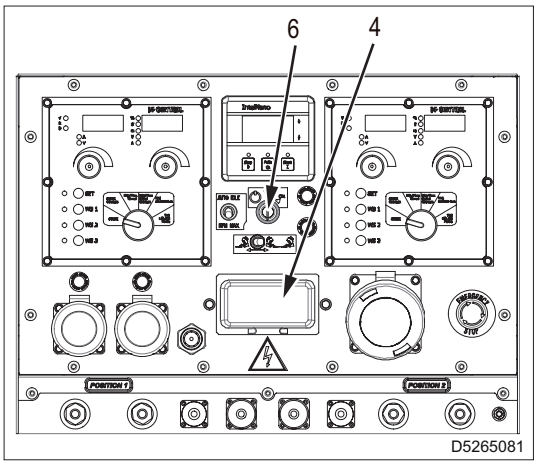
6.3 Stopping the engine

1 - Stop the welding process.

2 - Turn off the loads connected to the machine.

3 - Set the residual current circuit breaker(s) (4) to OFF (insertion lever downwards).

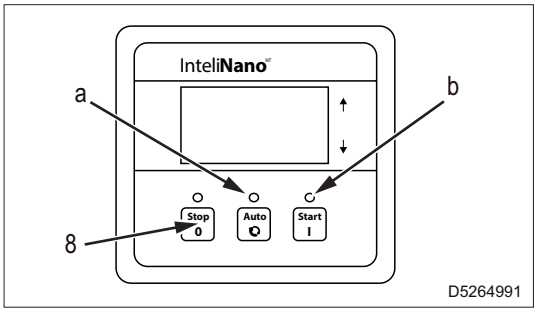




4 - Press the stop button (8) on the engine control unit to start the motor stop sequence.
The engine stops at the end of the cooling cycle.
For immediate stop, press the stop button (8) again.

Note

- The stop button only works when the LED (a) is off (MAN mode).
- LED (b) flashes during the cooling and stopping phases and goes out when the engine is stopped.

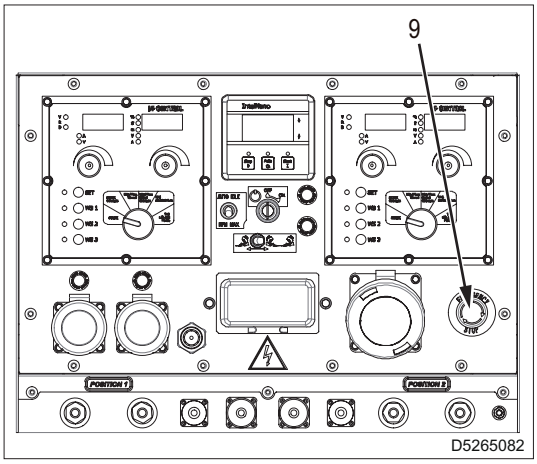


5 - Turn the engine control unit start switch (6) to OFF and remove the ignition key.

6 - Turn the battery disconnect switch to OFF.

6.4 Emergency stop

For an emergency stop, press the emergency button (9).
To reset the button, turn it clockwise.



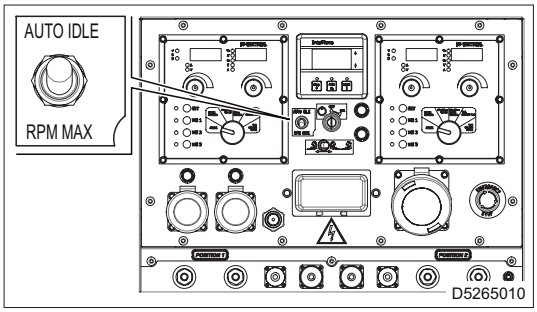
6.5 Auto Idle

☛ Important

- Run the engine for the time indicated in the table below before drawing power to supply loads.

Ambient temperature	Time required
– -10°C	2 minutes
-9°C – -5°C	1 minute
≤ -4°C	20 seconds

The 'Auto Idle' function is used to reduce the number of revolutions when the machine is not welding and no loads are connected and therefore no energy is required.
As a result, both the fuel consumption and the noise generated by the machine are reduced.



- **Selector switch set to AUTO IDLE.**
  When the machine is started, the engine runs at idle speed.
  The engine automatically switches to nominal speed, allowing power to be drawn when needed.
  When the power supply is disconnected, the engine will continue to run at nominal speed for approximately 15 seconds, after which it will return to idle speed.
- **Selector switch set to RPM MAX.**
  The engine always runs at the nominal speed.

6.6 Welding

WARNING

- **Before carrying out any welding operations, carefully read section "2. Safety".**
- **Do not use TS 2x280 EVO MULTI4 to defrost pipes.**

The machine model TS 2x280 EVO MULTI4 is a multi-process engine driven welder that supplies welding current in all permissible welding processes.

Constant Direct Current Processes (CC Constant Current):

- SMAW / STICK coated electrode
- GTAW / TIG tungsten electrode
- GTAW/ PULSED TIG - tungsten electrode

Continuous Constant Voltage (CV Constant Voltage) Processes:

- GMAW / MIG solid wire
- FCAW / FLUX CORED flux-cored wire with and without shielding gas.

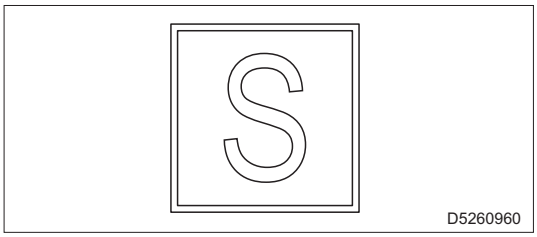
The machine can also be used for Arc Gouging with carbon electrodes up to 8-10mm in diameter.

Note

For arc gouging, the machine should be used in SINGLE mode.

6.6.1 Electrical safety

This symbol (standard EN 60974-1 – safety requirements for arc welding equipment) indicates that the engine driven welder is designed to be used in environments with an increased risk of electric shock.



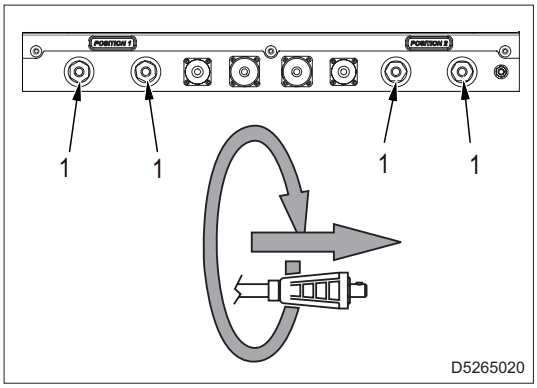
6.6.2 Welding cables connection

The cables must be connected with the engine off.

1 - Insert the welding cable plugs in sockets (1) and turn them clockwise to lock them.

2 - Make sure that the grounding clamp - whose cable must be connected to the negative socket or to the positive socket according to the type of electrode - makes a correct contact and that it is as close as possible to the welding position.

3 - Carefully tighten the output cables to the sockets. If they are loose, they can cause overheating issues and damage sockets, cables, etc.



Note

- Periodically check the connection of the welding cables to the sockets and tighten them if necessary.

6.6.3 Welding cables

- The welding cable cross-section depends on the welding current used, the duty cycle and the distance between the welding machine and the welding position.
  The following table gives the cross-section of the copper cables to be used under different conditions.

Cable Length	Cross-section sq. mm 300A @ 60%	Cross-section sq. mm 500A @ 60%
Up to 20m	50 sq. mm	50 sq. mm
Up to 40m	50 sq. mm	70 sq. mm
Up to 60m	70 sq. mm	90 sq. mm

  The cable cross-sections are increased for longer lengths, mainly in order to minimise the loss of tension in the cable.
- To reduce the risk of electromagnetic interference, use the minimum length of welding cables and keep them close and low (e.g. on the ground).
- Excessive cable inductance causes degradation of the welding performance.
  There are several factors that contribute to the overall inductance of the wiring system, including cable size, length and number of coils.
  To reduce cable inductance, avoid using welding cables wound in coils.
  If it is not possible to unwind the cables, separate them as much as possible so that the coil has a larger diameter.
- Maintain a straight or zig-zag course between the machine and the welding position.
- If a cable reel is used to store welding cables, unwind the cables as much as possible, leaving a minimum amount of cable on each reel.
  If possible, the welding cables should be completely unwound.
- When welding with two operators at the same time, keep the two sets of welding cables separate and always use single cables for the ground clamp connection.

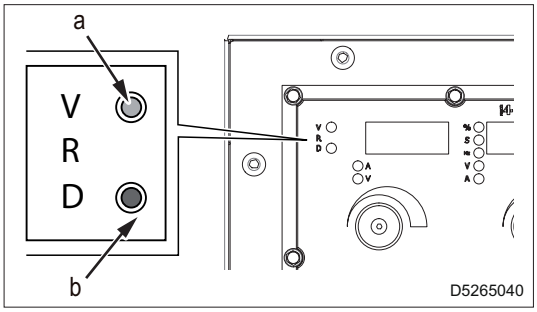
6.6.4 VRD (Voltage Reduction Device) function

DANGER

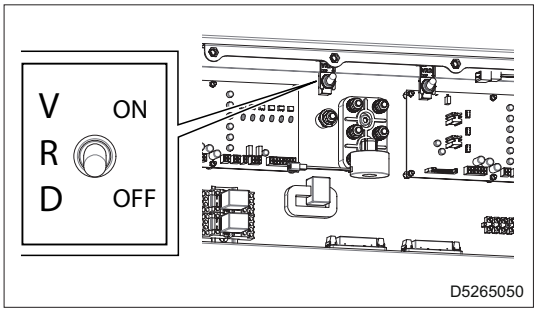
- **The VRD function should only be disabled on the machine after careful consideration by the person responsible for safety at work.**

The machine is supplied with the VRD function active, and is only present in the STICK welding process.
The purpose of the VRD function is to reduce the risk of electric shock caused by accidental operator contact with the electrode and workpiece during welding interruptions.

- The protection acts by reducing the open-circuit voltage (OCV) present at the welding output terminals to a safe value (<13V) whenever the welding process is interrupted for more than 3 seconds.
- A pair of LEDs, one green (a) and one red (b), monitor the correct operation of the VRD. During welding, the red LED (b) is off and the green LED (b) is on.
  When welding is interrupted, the red LED (b) lights up for 3 seconds and then the green LED (a) lights up. This indicates that the voltage present at the welding output terminals has been reduced to the safe value.



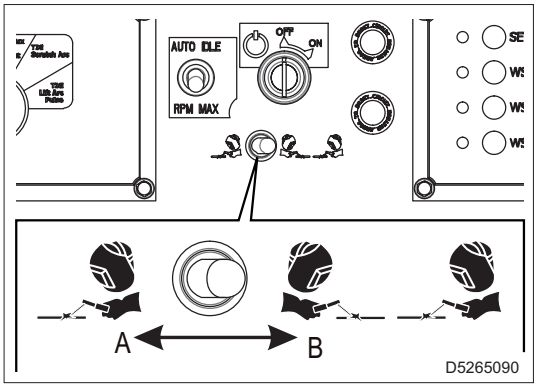
- The VRD function can be disabled by changing the settings in the EVO CONTROL MULTI4 control unit software (see "6.8 EVO CONTROL MULTI4") or by acting on the VRD switch located inside the electrical box.
  - Pos. ON (lever up): VRD activated
  - Pos. OFF (lever down): VRD disabled.



6.6.5 Single/Dual Workstation Selector

The Single/Dual workstation selector allows setting a welding operation to a single workstation (workstation 1) or to both (workstation 1 and workstation 2).

- Lever to the left (pos. A): Single position
- Lever to the right (pos. B): Dual position



Single position

- Welding is only enabled at station 1 (left station), from which the machine's maximum welding current can be drawn.
- Station 2 (right station) is disabled.
  The displays will only show dashes, all settings on the EVO CONTROL MULTI4 welding control unit are ignored and there is no voltage on the output terminals.

Dual position

- Both stations are enabled for welding.
- The two stations are completely autonomous and independent, they can work in any mode with any current without interfering with each other.

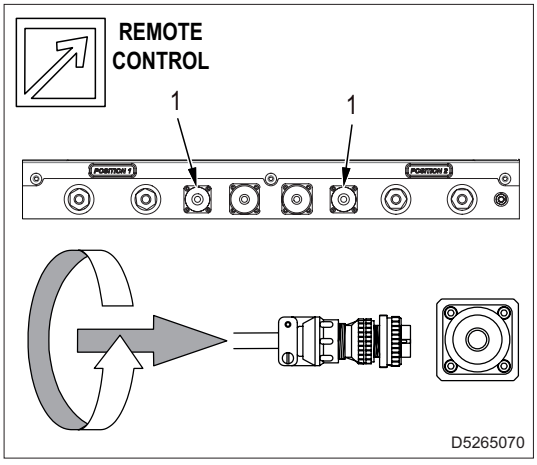
6.6.6 Remote control

The machine is ready for connection to a remote control (optional) for each welding station.

The connection is made via the 10-pin connectors (1) on the control panel.

When a remote control is connected, the welding current or voltage control function is automatically switched to the remote control potentiometer.

For details on 10-pin connectors see "3.3 Remote Control connector wiring diagram (10-pin)".



6.7 Duty cycle

WARNING

- **If the declared time or current values of the duty cycle are exceeded, the machine could be irreparably damaged.**

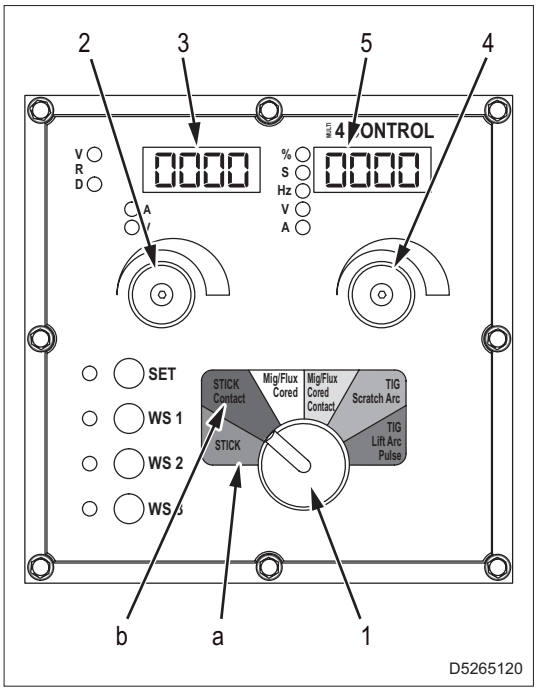
The duty cycle is the percentage of time for which it is possible to weld, at the declared welding current, in a 10 minute period.
For instance, a 60% duty or service cycle, with declared current of 200A, indicates that it is possible to weld for 6 minutes with a maximum welding current of 200A, and that in the next 4 minutes it is necessary to let the machine run without taking welding current.

6.7.1 DC-Constant Current Welding - SMAW/STICK coated electrode

STICK mode is designed for horizontal and vertical welding with all types of electrodes.
The machine has two STICK welding modes:

- STICK (a): the voltage is always present at the welding output terminals.
- STICK Contact (b): the voltage is only present after pressing the torch button

Select the desired mode using the mode knob (1).



Adjusting the welding current

The welding current is continuously regulated using the knob (2).
The display (3) shows the set current value in Amperes (A).

Adjusting the Arc Force

The term Arc Force refers to the possibility of adjusting the short-circuit current of the welding machine.
The adjustment is expressed as a percentage value between 10% and 100% of the set welding current value. The higher the set percentage, the higher the short-circuit current.
The knob (4) adjusts the Arc Force setting.
The display (5) shows the set percentage.
Setting this parameter changes the dynamic increase of the welding current when the welding arc is shortened.

- Values between 10 and 50% are ideal for rutile, rutile-basic and basic electrodes.
- Values between 50 and 100% are ideal for cellulosic electrodes where there is a need for greater material penetration according to different welding positions.

Note

- It is recommended that the knob is initially set at 30-40%.
  This value prevents the electrode from sticking to the workpiece.

Parameter display

During welding, display (3) shows the current and display (5) shows the voltage.
By turning the knob (4), display (5) shows the set Arc Force percentage.

Secondary parameters

It is possible to change certain parameters that have a smaller impact on welding than the main parameters. For STICK welding, the secondary parameters are:

- VRD on/off
- HOT START % current
- HOT START time

For the characteristics and settings of these parameters see "6.8.1 Stick and Stick Contact".

Anti-Stick Function

The Anti-Stick function makes it easier to remove the electrode from the workpiece in the event of electrode sticking, by preventing the welding circuit from overheating due to the persistence of the short-circuit current. In STICK and STICK Contact mode it is always enabled.

The function automatically reduces the welding current if it detects an arc voltage close to zero volts (0V) for a period of time that exceeds a limit defined in the design phase.

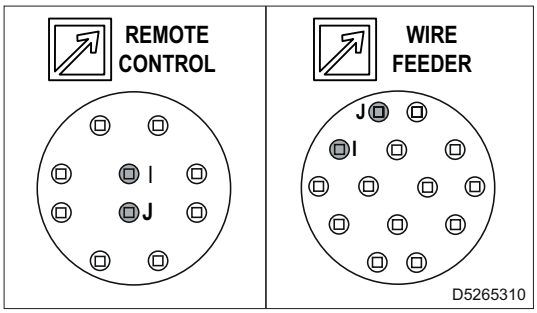
Welding arc striking

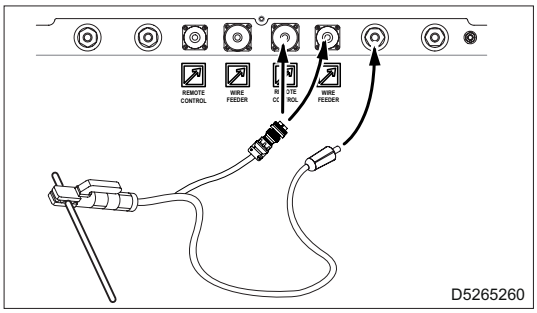
- A slight delay in electrode striking may occur due to the low open circuit voltage (OCV) of the machine in the following cases:
  - When the machine is running and the VRD is activated.
  - When the machine is running without load and the Auto Idle function is activated.
- Always ensure a good metal-to-metal contact between the metal core of the electrode and the workpiece.
- After the electric arc is interrupted, the tip of the electrode forms a cone.
  To use the same electrode it is necessary to remove the cone to allow the metal core of the electrode to make contact.

Torch button connection for STICK Contact

To use the machine in STICK Contact mode, the torch button must be connected.

1 - Connect the torch button to either one of the REMOTE CONTROL (10-pin) or the WIRE FEEDER (14-pin) connectors on the I and J contacts.





Connection to the external polarity inversion Box PL400

The external polarity inversion box PL400 can only be connected in STICK welding mode.
The polarity reverser allows the polarity of the welding output sockets to be reversed without having to switch off the machine to manually reverse the welding cables connected to the sockets.

WARNING

- **Connect the welding cables observing the correct polarity.**
- **The connection of the PL400 box must be carried out after the machine has been switched off.**
- **Do not reverse polarity during welding.**
- **In SINGLE mode, the current and performance of the machine are higher than the current and performance of the PL400 Box. DO NOT EXCEED THE DECLARED RATINGS OF THE PL400 Box.**

1 - Connect the control cable (1) of the PL400 Box to the connector (2) (WIRE FEEDER - 14 pins).

Note

- Connect the connector to the station with which the PL400 Box is used.
  If using SINGLE mode, connect the connector to station 1.

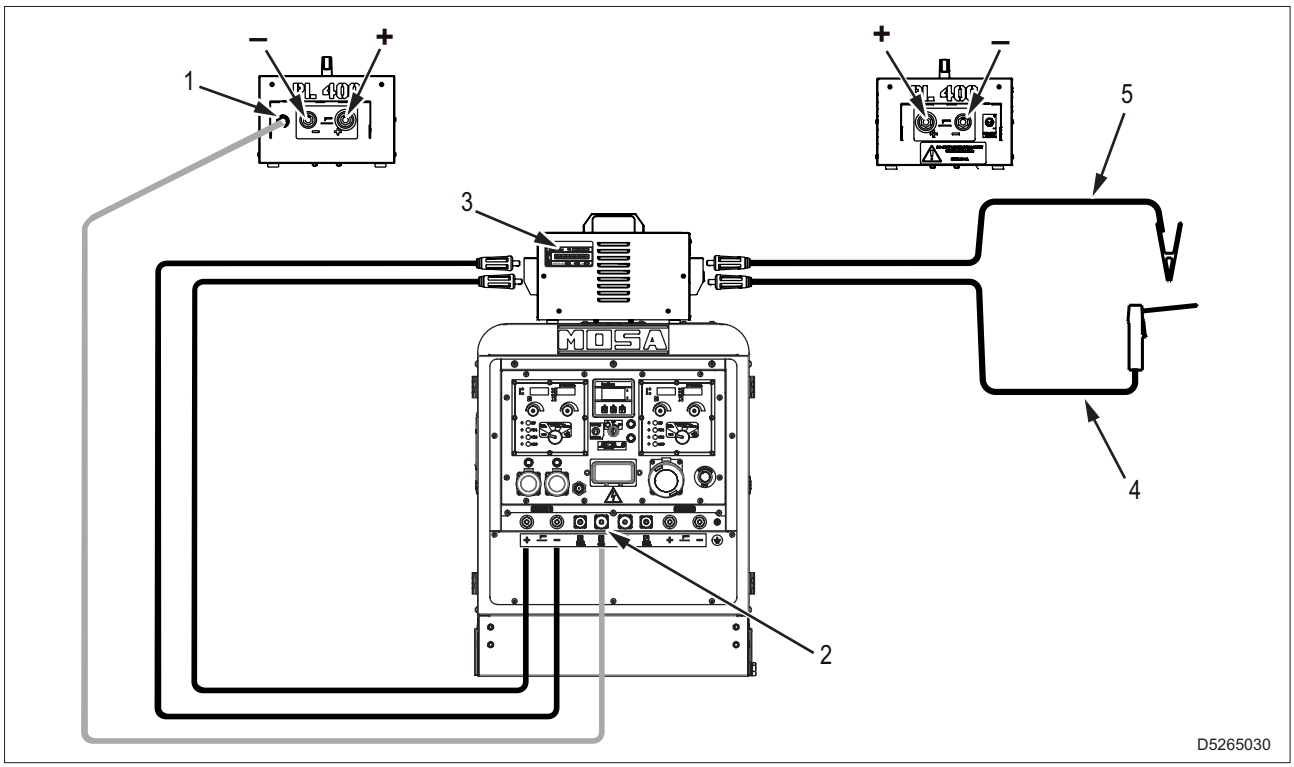
2 - Check that the welding cables have an adequate cross-section for the current and service factor X%.
Please refer to the identification plate (3) of the PL400 Box.

3 - Connect the output (+) of the machine to the input (+) of the PL400 Box.

4 - Connect the output (-) of the machine to the input (-) of the PL400 Box.

5 - Connect the cable (4) of the electrode holder clamp to the socket (+) of the PL400 Box.

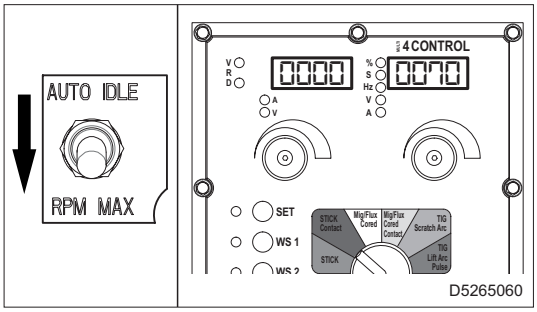
6 - Connect the ground cable (5) with clamp to the (-) socket of the PL400 Box.



PL400 polarity inversion operation

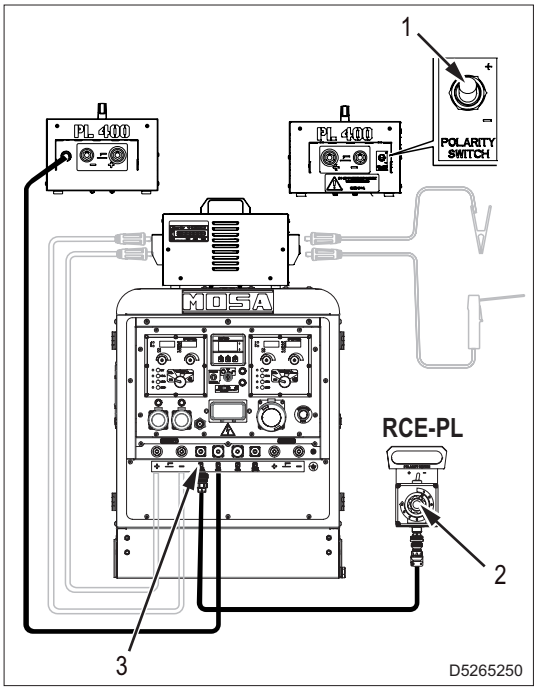
Polarity inversion with the PL400 Box can only be performed under the following operating conditions:

- The Auto Idle switch is in the RPM MAX position.
- The machine is switched on.
- The machine has no load (welding current).
- The left-hand display (or displays) of the EVO CONTROL MULTI4 control units shows the current 0.
- The right-hand display (or displays) of the EVO CONTROL MULTI4 control unit shows the open circuit voltage (OCV) 70 VDC.



1 - Reverse the polarity by means of the POLARITY SWITCH (1) on the PL400 Box.

2 - Polarity inversion can also be performed by connecting the RCE-PL remote control (2) to the 10-pin REMOTE CONTROL (3) connector on the machine.
For the details, see "6.6.6 Remote control".

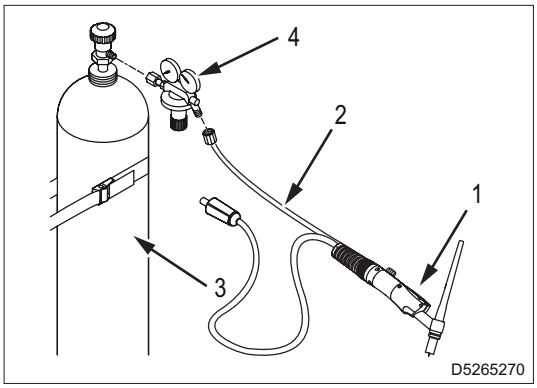


☛ Important

- Only the RCE-PL remote control is suitable for this application. Do not connect any other remote controls.
- By connecting the RCE-PL remote control, the POLARITY SWITCH (1) on the PL400 Box is automatically disabled.

CC Constant Current Welding - GTAW/TIG tungsten electrode

TIG mode is a type of constant current welding used without or with filler material.
The TS 2x280 EVO MULTI4 has 2 TIG welding modes:
- TIG SCRATCH ARC
- TIG LIFT ARC PULSE



Preliminary Operations

The following devices are required for GTAW/TIG welding:

- GTAW/TIG torch with gas valve (1) and accessories
- Hose (2) for connecting the torch to the gas regulator
- Argon gas cylinder (3)
- Argon gas regulator (4)
- Tungsten electrode

Gas pressure regulation

1 - Open the gas valve (1) of the TIG torch. The inert gas flow is activated.

2 - Adjust the desired gas flow rate on the pressure regulator (4).

3 - Close the gas valve (1) of the TIG torch.

Connections

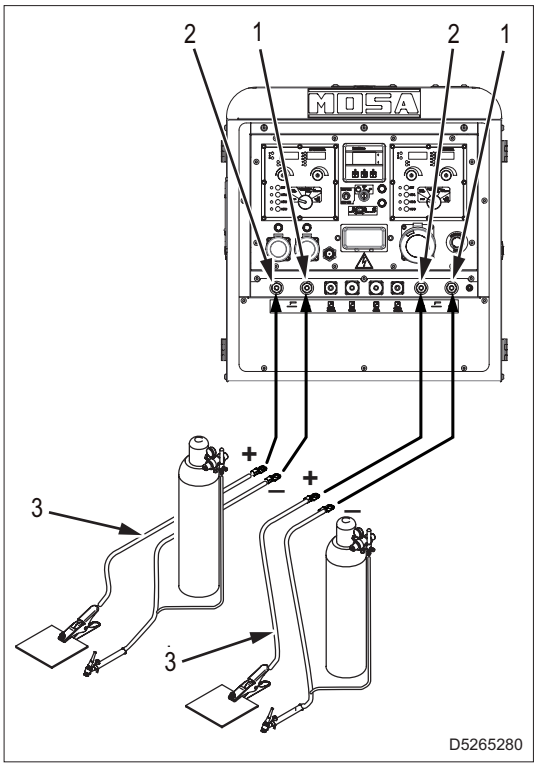
1 - The operations must be carried out after the machine has been stopped

2 - Insert the plug of the TIG welding torch into the welding socket (1) (-), turning clockwise to lock it.

3 - Mount the welding torch according to the torch operating instructions.

4 - Insert the ground cable plug in the welding sockets (2)(+) and turn it clockwise to lock it.

5 - Connect the other end of the ground cable (3) to the workpiece.



TIG Scratch Arc

Select the TIG Scratch Arc mode (a) using the mode knob (1).

Adjusting the welding current

The welding current is continuously regulated using the knob (2).

The display (3) shows the set current value in Amperes (A).

Turn off ramp time adjustment

The turn off ramp is used to avoid an abrupt interruption of the welding current and a deterioration in the quality of the weld.

The selection range is from 0 s (i.e. switched off) to 30 s.

Use the knob (4) to adjust the turn off ramp time shown on the display (5).

Parameter display

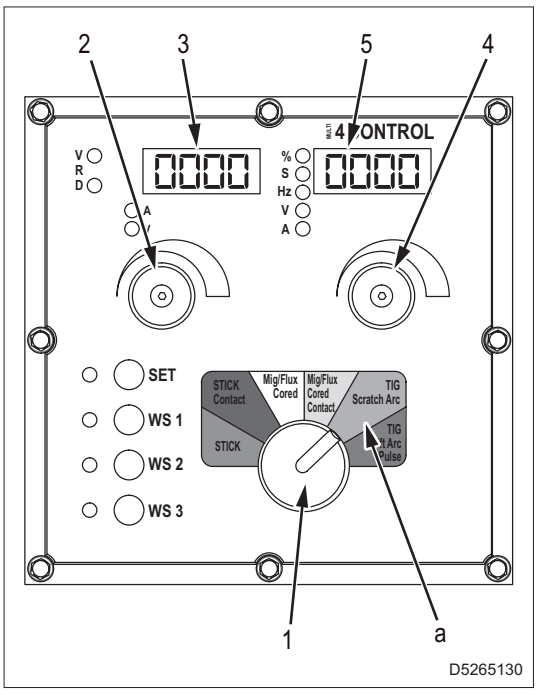
During welding, display (3) shows the current and display (5) shows the voltage.

By turning the knob (4), display (5) shows the set turn off ramp time.

Secondary parameters

In TIG scratch arc mode, only the turn off ramp time can be changed.

For the characteristics and settings of this parameter see "6.8 EVO CONTROL MULTI4".



Welding arc striking

1 - Set the Auto Idle selector to the RPM MAX position.

2 - Open the gas valve of the TIG torch.

3 - Scratch the tip of the tungsten electrode on the workpiece to generate the striking.

4 - Slowly disconnect the TIG torch and proceed with welding.

Welding arc quenching

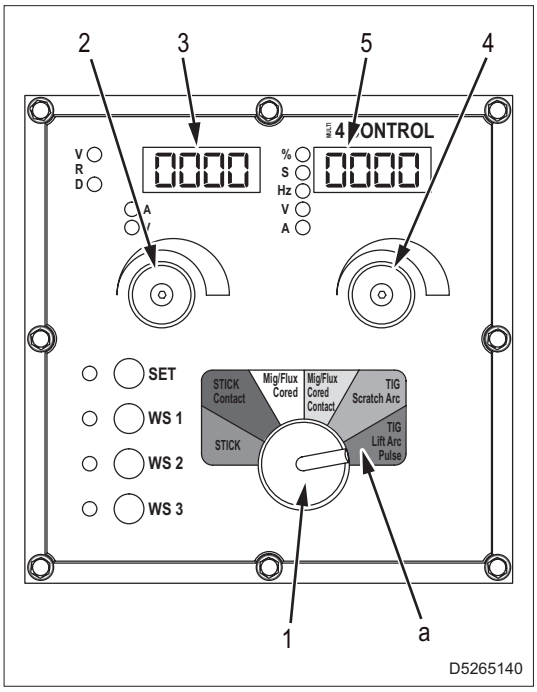
1 - Slowly move the torch away.
The electric arc is switched off at the end of the set turn off ramp time.

2 - Close the gas valve of the TIG torch.

TIG Lift Arc Pulse

TIG Lift Arc Pulse welding results in a reduction of the welding arc current for a short time.
This reduces the heat added to the weld pool

Select TIG Lift Arc Pulse mode (a) using the mode knob (1).



Adjusting the welding current

The welding current is continuously regulated using the knob (2). The display (3), located above the knob, will show the set current value in Amperes

The set current is the maximum value of the waveform of the welding current in this mode.

Adjusting the pulse frequency

The pulse frequency indicates how often the set welding current is reduced.

Use the knob (4) to adjust the pulse frequency shown on the display (5).

The selection range is 0.5 Hz to 10 Hz.

Parameter display

During welding, display (3) shows the current and display (5) shows the voltage.

By turning the knob (4), the display (5) shows the set pulse frequency.

Secondary parameters

For TIG Lift Arc Pulse welding, the secondary parameters are:

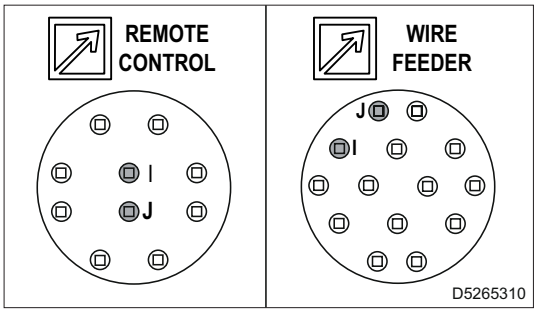
- DUTY CYCLE
- CURRENT DELTA
- Negative ramp time
- Negative ramp end CURRENT
- Preflow time
- Postflow time

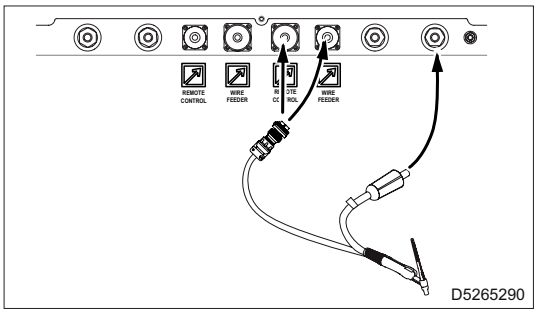
For the characteristics and settings of these parameters see "6.8 EVO CONTROL MULTI4".

Torch button connection for TIG Lift Arc Pulse

To use the machine in TIG Lift Arc Pulse mode, the torch button must be connected to the machine.

1 - Connect the torch button to either one of the REMOTE CONTROL (10-pin) or the WIRE FEEDER (14-pin) connectors on the I and J contacts.





Welding arc striking

1 - Open the gas valve of the TIG torch.

2 - Touch the workpiece with the tip of the tungsten electrode.

3 - Press the button on the TIG torch and slowly pull the tip of the tungsten electrode away from the workpiece to strike the arc.

- During arc striking, the welding current is minimal to avoid contamination of the weld bead with tungsten and the destruction of the electrode tip.
- The welding current gradually increases until it reaches the set value, allowing welding to take place.

Welding arc quenching

1 - Release the TIG torch button.
The arc is switched off depending on the setting of the following secondary parameters:

- Negative ramp time
- Negative ramp end CURRENT.

2 - Close the gas valve of the TIG torch.

6.7.2 CV Constant Direct Current Voltage Processes

GMAW / MIG solid wire - FCAW / FLUX CORED wire

The Mig/Flux Cored welding mode is a type of constant voltage welding.
For this process, it is necessary to connect a wire feeder to the welding machine (not supplied with the machine).
The machine has 2 welding modes, i.e. Mig/Flux Cored and Mig/Flux Cored Contact:

- Mig/Flux Cored: the voltage is always present at the welding output terminals.
- Mig/Flux Cored Contact: the voltage is only present after pressing the torch button.

In CV constant voltage welding processes, both welding current and welding voltage must be adjusted.
The welding voltage can be adjusted on the welding machine or the connected wire feeder.
The welding setting is directly proportional to the wire speed (set on the wire feeder).

- An increase in the wire egress speed corresponds to an increase in the current.
- A decrease in the speed corresponds to a decrease in the current.

Preliminary Operations

The following devices are required for Mig/Flux Cored welding:

- Wire feeder
- Reel of welding wire
- MIG torch
- Argon gas cylinder (MIG) or argon- CO_2 mixture (MAG)
- Gas hose connected to the wire feeder and gas regulator
- Gas regulator

Connections

WARNING

- **The connection must be carried out after the machine has been switched off.**

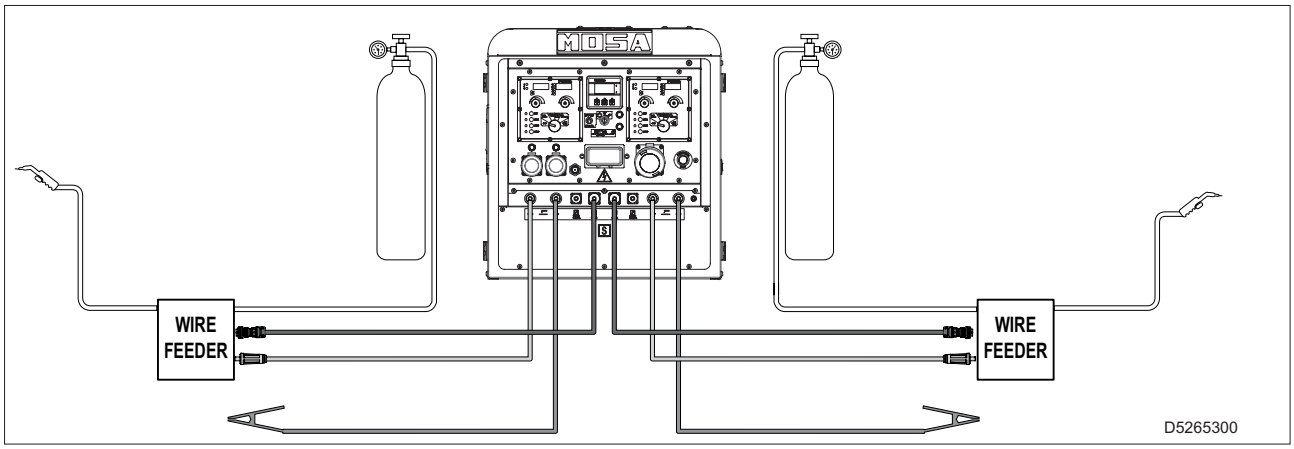
- **MOSA WF-4 wire feeder**

  1 - Connect the welding cable between the (+) welding socket on the machine and the socket on the rear of the wire feeder (20 m - 50 mm^2cable supplied with the WF-4 wire feeder).

  2 - Connect the control/power cable between the 14-pin connector on the machine and the corresponding connector on the rear of the wire feeder (20 m cable supplied with the WF-4 wire feeder).

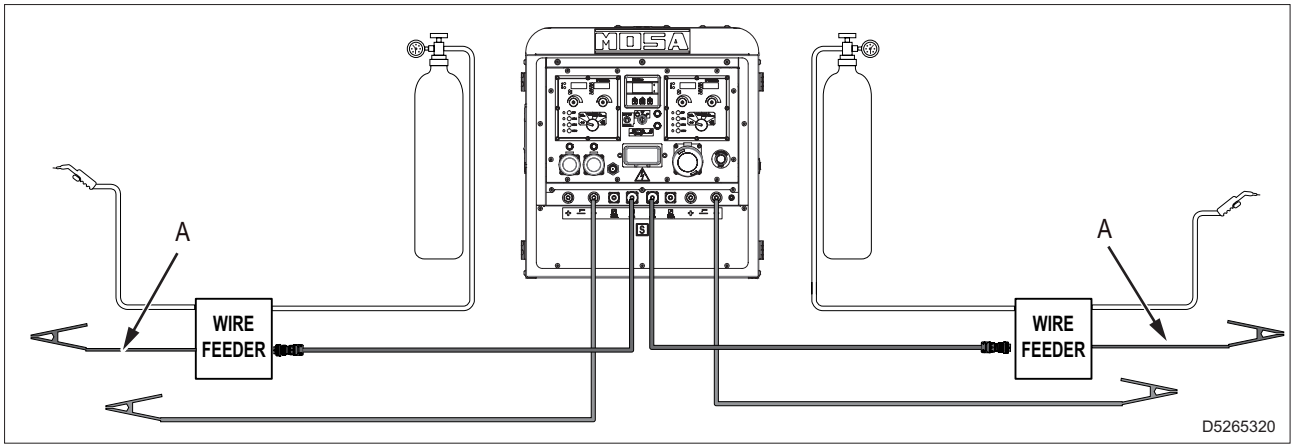
  3 - Connect the welding cable between the welding socket (-) of the machine and the workpiece. (not supplied with the WF-4 wire feeder).

  4 - Connect the gas cylinder to the wire feeder according to the instructions in the relevant manual.



- **SELF-POWERED wire feeder**

  It is possible to use the machine with self-powered wire feeders.
  The wire feeder is powered directly by the welding circuit.
  This type of wire feeder does not require a control/power cable connection between the machine and the wire feeder, and it is generally not possible to adjust the welding voltage from the wire feeder.

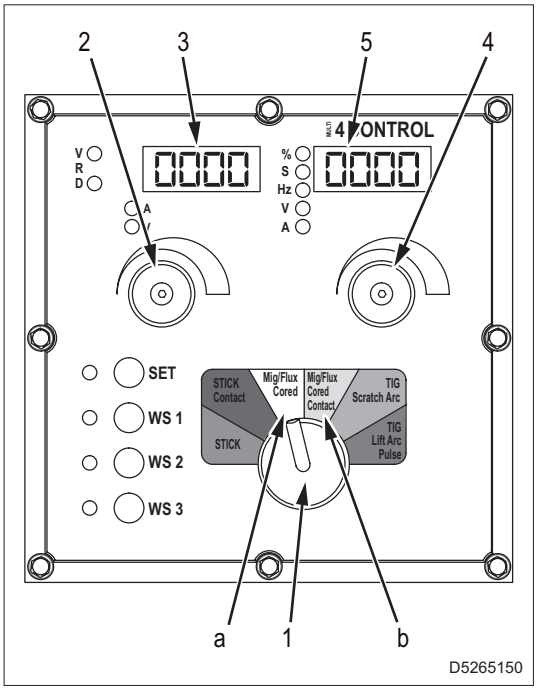


Note

- To power the wire feeder, the same needs to be connected to the workpiece (A). The welding current does not flow through this cable.

Mig/Flux Cored - Mig/Flux Cored Contact

Select Mig Flux Cored (a) or Mig Flux Cored Contact (b) mode using the mode selector knob (1).



Adjusting the welding voltage and current

The welding voltage is continuously adjusted using the knob (2).

The display (3) shows the set voltage value in volts (V).

The welding current must be set on the wire feeder by adjusting the wire egress speed.

Note

- When using the MOSA WF-4 wire feeder, the voltage setting is automatically switched on the potentiometer of the wire feeder.
- Using the SELF-POWERED wire feeders, the voltage can be adjusted by connecting the remote control. See paragraph "6.6.6 Remote control".

Hot Start adjustment

Use the knob (4) to adjust the Hot Start voltage, which is shown on the display (5).

The selection range is 0V to 2V.

Parameter display

During welding, display (3) shows the current and display (5) shows the voltage.

By turning the knob (4), the display (5) shows the set Hot Start voltage.

Secondary parameters

Only the Hot Start Time can be changed in Mig/Flux Cored and Mig/Flux Cored Contact modes.

This parameter adjusts the duration of the Hot Start function.

The range is from 0.5 s to 3 s.

For the characteristics and settings of this parameter see "6.8 EVO CONTROL MULTI4".

6.8 EVO CONTROL MULTI4

EVO CONTROL MULTI4 is the new panel for MOSA engine driven welders.
It gives the user control over every parameter:

- Welding voltage
- Welding current
- Arc force
- Striking voltage
- Current rise and fall time
- Frequency during pulsed Tig

EVO CONTROL MULTI4 exploits the potential of a 32-bit microcontroller to detect all welding parameters and control them.

There are 6 different welding modes each with 3 different welding profiles.
This allows the machine to have a total of 18 welding programmes saved.

The user can select and modify the programme to adapt the machine to their needs.

The displays not only show the voltage and current during welding, but also allow them to be set before welding.

When both stations are used, the boards use the CAN protocol to communicate with each other, having a real-time clock to generate log files.

6.8.1 Stick and Stick Contact

Secondary parameters

- **VRD on/off**
  The VRD (Voltage Reduction Device) function is used to reduce the voltage at the welding sockets to below 13V when the machine is not in use.
  It is useful in environments where there is a lot of moisture.
  If active, it can be deactivated from the panel software.
- **HOT START % current**
  The HOT START function is used to facilitate striking.
  At the start of welding operations, the current is higher than the set current.
  The current range is 15A to 30A
  By setting the percentage to 0%, the function is deactivated.
- **HOT START time**
  The HOT START time function defines for how long the delivered current is higher than the rated current.
  The setting range is 0.5s to 3s.

WELDING SETs

There are three Welding Sets for Stick and Stick Contact with the following default parameters:

	Primary parameters		Secondary parameters		
WELDING SETs	Current (A)	Arc Force (%)	VRD	Hot Start (%)	Hot Start (sec.)
WS 1	100	30	ON	100	1
WS 2	150	30	ON	100	1
WS 3	220	30	ON	100	1

Note

- In Stick and Stick Contact mode, the parameters are independent of each other.
  Each welding mode has its own welding sets and secondary parameters.
  When the parameters are changed in one mode, they are not changed in the other.

6.8.2 Mig/Flux Cored - Mig/Flux Cored Contact

Secondary parameters

- **HOT START time**
  This secondary parameter sets the duration of the HOT START between 0.5s and 3s.

WELDING SETs

There are three Welding Sets for Mig/Flux Cored e Mig/Flux Cored Contact with the following default parameters:

	Primary parameters	Secondary parameters	
WELDING SETs	Voltage (V)	Hot Start Voltage (V)	Hot Start time (s)
WS 1	20	0.5	2
WS 2	22.5	0.5	2
WS 3	25	0.5	2

Note

- In Mig/Flux Cored and Mig/Flux Cored Contact mode, the parameters are independent of each other. Each welding mode has its own welding sets and secondary parameters.
  When the parameters are changed in one mode, they are not changed in the other.

6.8.3 TIG Scratch Arc

Secondary parameters

- **Turn on ramp time**
  This parameter controls the time it takes for the current to reach the set nominal value and is used to prevent damage to the tungsten electrode tip with each striking.
  The range is from 0 s. to 10 s. Even when set to 0 s. the rise is never abrupt, but is always at least 1 s.

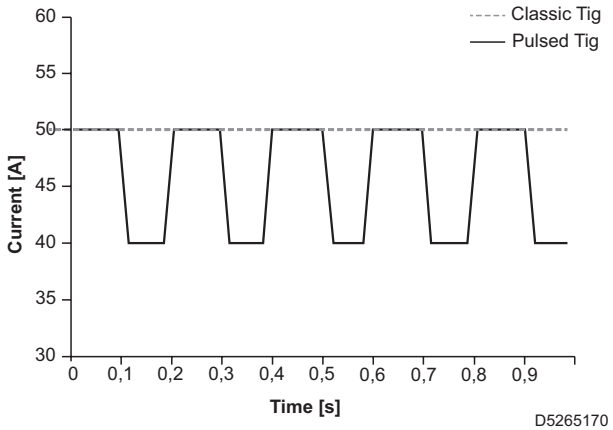
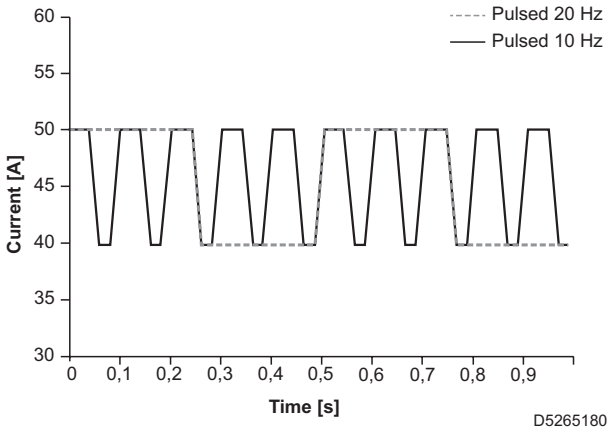
WELDING SETs

There are three Welding Sets for TIG Scratch Arc with the following default parameters:

	Primary parameters	Secondary parameters	
WELDING SETs	Current (A)	Turn off ramp time (s)	Turn on ramp time (s)
WS 1	50	15	0
WS 2	100	15	0
WS 3	150	15	0

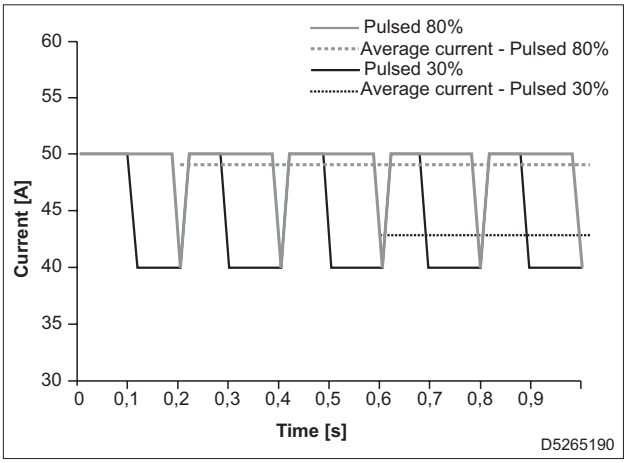
6.8.4 TIG Lift Arc Pulse

In the PULSED TIG welding mode, the arc current can be reduced for a short time to allow the heat of the weld pool to decrease.

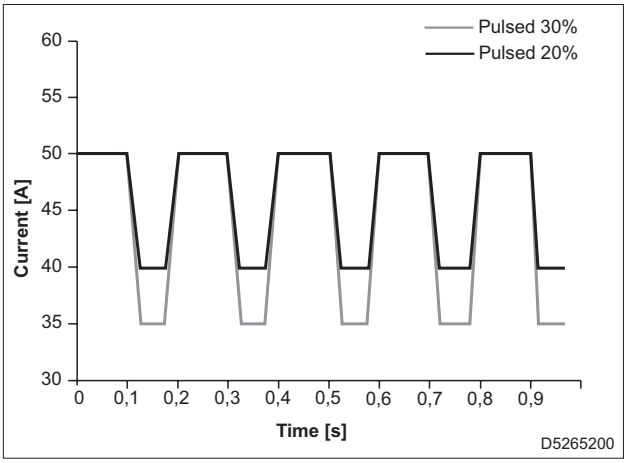
Current trend in classic and pulsed TIG	Different current patterns at different pulse frequencies
	

Secondary parameters

- **Duty cycle**
  The Duty Cycle indicates the percentage of time the current is at a high level compared to a low level.
  The figure shows that as the duty cycle varies, the maximum or minimum current does not vary.
  Only the average current (dashed line) varies.
  The range of values that can be varied is from 20% to 80%.



- **Delta Current**
  The delta current is an indication of how low the current should fall.
  The higher the delta, the lower the current when the arc is turned off.
  The parameter has a range between 0% and 50%.
  A value of 0 removes the pulse from the TIG.



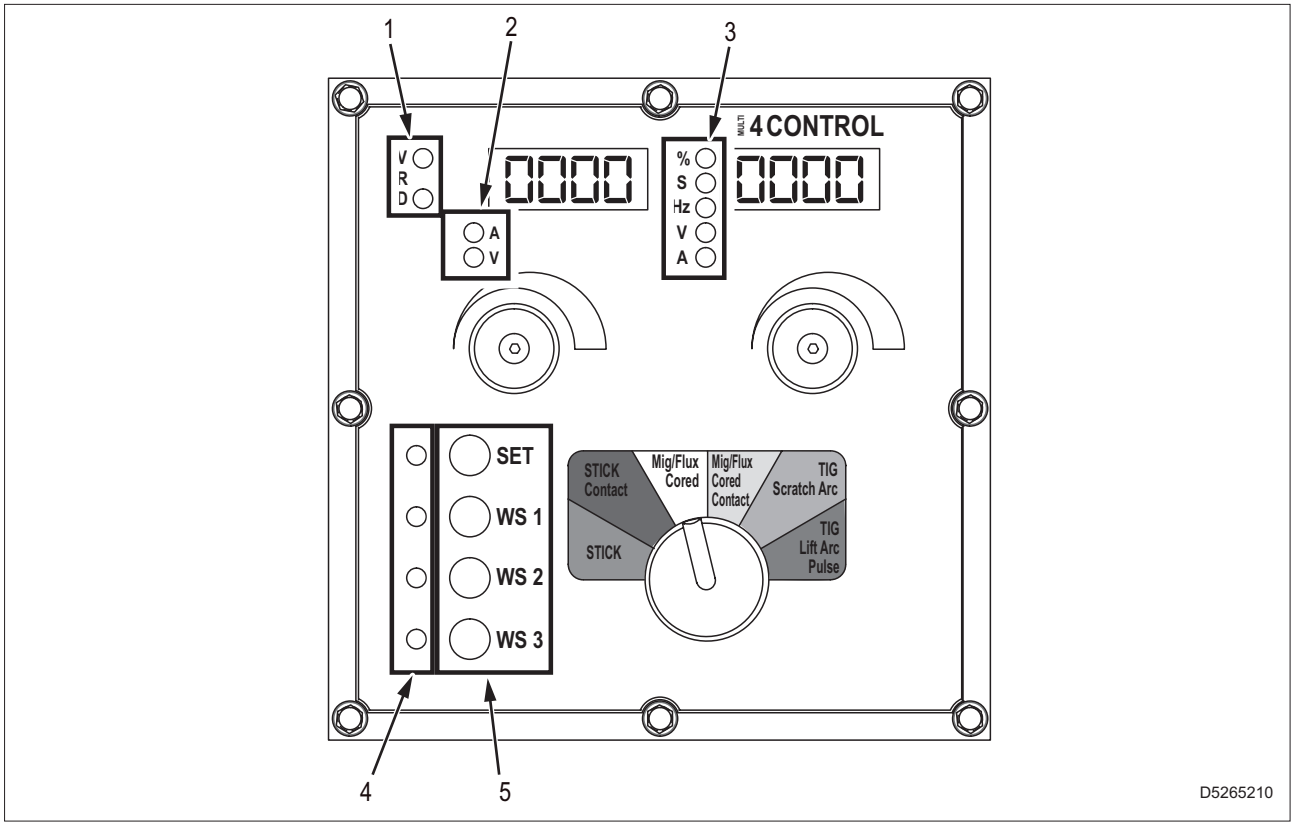
- **Negative ramp time**
  Indicates how long it takes for the current to drop when the torch button is released.
  The parameter has a range between 3 and 8 seconds.
- **Negative ramp end current**
  Indicates the current that is set at the end of the current turn off ramp for 2 seconds.
  The parameter has a range between 20A and 100A.
- **Preflow time**
  If the machine is equipped with a solenoid valve, this parameter indicates the time during which gas is supplied before the welding arc is ignited.
  The parameter has a range between 0 and 20 seconds.
- **Postflow time**
  If the machine is equipped with a solenoid valve, this parameter indicates the time during which gas is supplied after the welding arc is switched off.
  The parameter has a range between 0 and 20 seconds.

WELDING SETs

There are three Welding Sets for TIG Lift Arc Pulse with the following default parameters:
The Welding Sets for the TIG Lift Arc Pulse modes have the following default parameters:

	Primary parameters		**Secondary parameters**					
WELDING SETs	Current (A)	f Hz:	Duty cycle (%)	Delta Current (%)	Negative ramp time (s)	Negative end-of-ramp current (A)	Preflow time (s)	Postflow time (s)
WS 1	50	15	50	20	5	20	0	0
WS 2	100	15	50	20	5	20	0	0
WS 3	150	15	50	20	5	20	0	0

6.8.5 LEDs and buttons



(1) VRD LED.
For details on VRD operation see "6.6.4 VRD (Voltage Reduction Device) function".

(2) LED display 1
These LEDs light up to indicate the type of parameter shown on display 1

(3) LED display 2
These LEDs light up to indicate the type of parameter shown on display 2

(4) Button LEDs
These LEDs are located on the SET, WS1, WS2 and WS3 buttons. They light up when the buttons are pressed and flash differently depending on the operation being performed.
(when pressed from 3 to 7 seconds, they flash rapidly- when pressed fro more than 7 seconds, they flash briefly)

(5) BUTTONS

- SET. Pressing the button for less than 3 seconds shows the machine configuration parameters on the display (the time required to activate Auto Idle).
  Pressing the button for 3-7 seconds causes the corresponding LED to flash rapidly and saves the entered parameters if the machine configuration is changed.
- WS1. Pressing for less than 3 seconds uploads Welding Set 1 parameters for the selected weld type.
  When the button is pressed for 3 to 7 seconds, the corresponding LED flashes rapidly and the new parameters entered are saved when the primary and secondary parameters in the memory are changed.
- WS2. Pressing for less than 3 seconds uploads Welding Set 2 parameters for the selected weld type.
  When the button is pressed for 3 to 7 seconds, the corresponding LED flashes rapidly and the new parameters entered are saved when the primary and secondary parameters in the memory are changed.

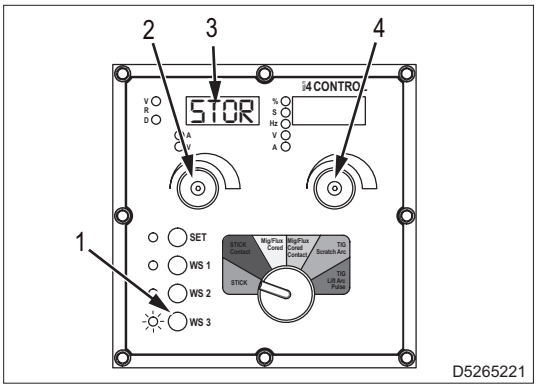
- WS3. Pressing for less than 3 seconds uploads Welding Set 3 parameters for the selected weld type.
  When the button is pressed for 3 to 7 seconds, the corresponding LED flashes rapidly and the new parameters entered are saved when the primary and secondary parameters in the memory are changed.
  When the button is pressed for more than 7 seconds, the corresponding LED flashes briefly and the primary and secondary parameters are accessed for modification.

  Note
  Pressing the WS3 button for more than 7 seconds also gives access to the parameters of welding set 1 (WS1) and welding set 2 (WS2).

6.8.6 Changing parameters and saving to memory

To save the new welding parameters in one of the three welding sets, proceed as follows

1 - Press for less than 3 seconds on the welding set (WS1, WS2 or WS3) whose parameters are to be changed.
2 - Press and hold WS3 (1) for more than 7 seconds to access secondary parameter modification.
3 - Using knobs (2) and (4), change the secondary parameters.
4 - Press and hold WS3 (1) for more than 7 seconds to access primary parameter modification.
5 - Using knobs (2) and (4), change the primary parameters.
6 - Press the welding set button selected in step 1 for 3-7 seconds to save the set parameters.
7 - The display (3) shows the message STORE.



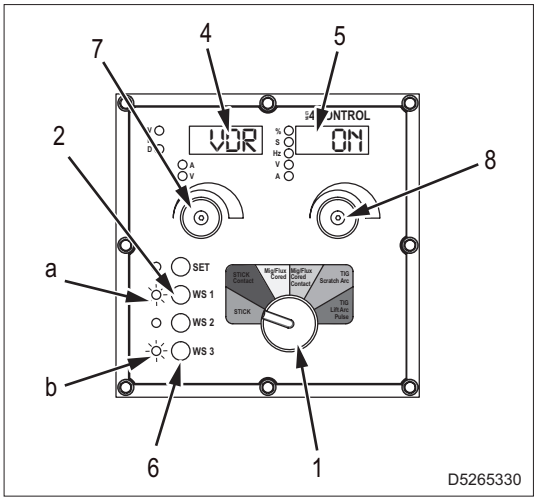
Example of parameter editing and saving

Values to be set:

Welding current	Arc Force	VRD	Hot Start (%)	Hot Start (s)
130A	50 %	ON	80 %	2 s

1 - Turn the knob (1) to STICK mode.
2 - Press the WS1 button (2) for less than 3 seconds. The corresponding LED (a) lights up and the displays (4) and (5) show the values of the primary parameters.
3 - Press and hold WS3 (6) for more than 7 seconds. The corresponding LED (b) flashes briefly to indicate that access to modify the secondary parameters has been gained.
4 - Display (4) shows the name of the first secondary parameter (VRD), display (5) shows the current value (ON). Use the knob (7) to select the parameter to be changed. Use the knob (8) to change the parameter value. Display (5) shows the set value

VRD	Hot Start (%)	Hot Start (s)
ON	80 %	2 s



5 - Press and hold button WS3 (6) for more than 7 seconds. The corresponding LED (b) flashes briefly to indicate that access to modify the primary parameters has been gained.

6 - Use the knob (8) to change the value shown on display (5)

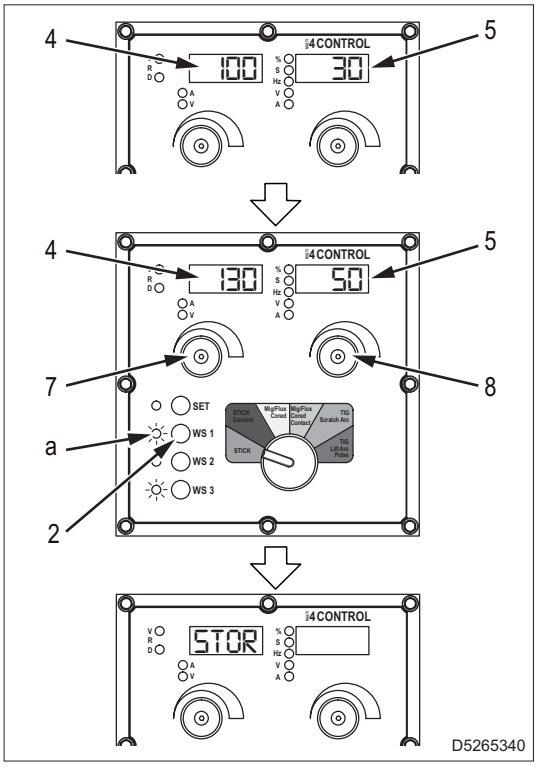
7 - Display (4) shows the value currently set on WS1 of the first primary parameter Welding current (100A).
Display (5) shows the value currently set on WS1 of the second primary parameter Arc Force (30%).

8 - Use the knob (7) to change the value of the Welding current.
Use the knob (8) to change the Arc Force value.

Welding current	Arc Force
130A	50 %

9 - Press and hold WS1 button (2) for 3-7 seconds to save the changes made.
The LED (a) flashes quickly.

10 - The STORE message on the display (4) confirms that the changes have been successfully stored.



6.8.7 Error Table

The following table shows the list of errors that can be shown on the display.

Code	Description	Solution
0	POWER FAIL	Damaged power supply module
1	+15V not found	Error on electronic board
2	/	/
3	VAUX not present	Error on electronic board
4	FLASH id error	Permanent memory is damaged
5	I2C not ready	I2C Protocol Error
6	/	/
7	/	/
8	SELECTION error	Selector position not defined
9	SELECTION not found	Selector disconnected
10	Overflow ADC Selection	Error on electronic board
11	SELECTION undefined	Welding type not defined
12	CAN bus error	Slave not connected
13	Buffer can FULL	CAN communication error
14	TIMOUT CAN	CAN communication error
15	/	/
16	PARAMETER-OUTOFRANGE	The welding parameter entered exceeds the threshold
17	PARAMETER-OUTOFRANGE	The controller parameter entered exceeds the threshold
18	PARAMETER-OUTOFRANGE	The password parameter entered exceeds the threshold

Code	Description	Solution
19	PARAMETER-OUTOFRANGE	The calibration parameter entered exceeds the threshold
20	PARAMETER-OUTOFRANGE	The rtcram parameter entered exceeds the threshold
21	PARAMETER-OUTOFRANGE	The tuning parameter entered exceeds the threshold
22	PARAMETER-OUTOFRANGE	The operator parameter entered exceeds the threshold
23	/	/
24	SLAVE BUSY	Slave in use when dual mode is requested
25	/	/
26	/	/
27	/	/
28	/	/
29	/	/
30	SLAVE ALARM	Presence of alarms on the slave
31	/	/

Error reset

If errors 16, 17, 18, 19, 20, 21, 22 are displayed, reset to factory settings by following the steps below to reset the errors.

1 - Switch off the machine.

2 - Set MIG FLUX CORED CONTACT

3 - Press the SET and WS1 buttons simultaneously until the firmware version is displayed.

4 - Set a welding mode.

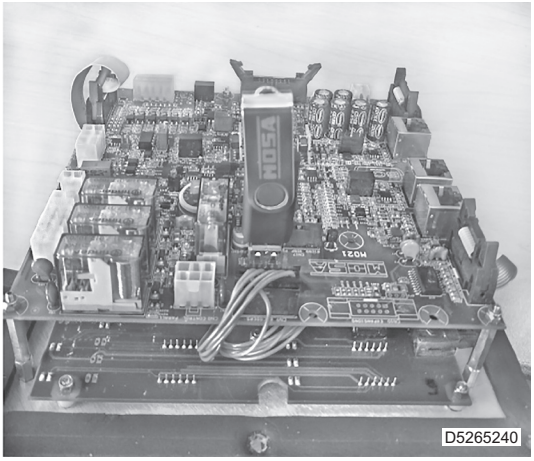
6.8.8 Firmware Update

If a new firmware version is available, there will be a USB update option.

1 - Switch off the machine.

2 - Remove the fixing screws of the EVO CONTROL MULTI4 welding control unit and turn it over.

3 - Insert the USB stick into the port.



☛ Important

- The USB stick must only contain the firmware for the update.

4 - Switch on the unit and if the new firmware version appears on the display after a few seconds, the update has been successful.

6.9 Simultaneous use of welding and auxiliary current generation functions

The welding currents indicated in paragraph "3. Technical data" refer to the absence of electrical power supplied; similarly, the declared electrical power refers to the absence of welding current supplied.
If welding and auxiliary current generation are used simultaneously, refer to the operating limits for the engine driven welder, shown in the following table.
The welding current values given in the table are to be understood as the total current delivered by the machine.
In the case of simultaneous use of the two stations, the sum of stations 1 and 2 must be considered.
The welding current values are valid for all welding processes used.

Welding current	≥ 250A	225A	200A	150A	100A	50A	0A
Power during current generation 400V 3~	0kVA	4.5kVA	6kVA	11kVA	15kVA	15kVA	15kVA
Power during current generation 230V 1~	0kVA	2.5kVA	4kVA	7kVA	7kVA	7kVA	7kVA
Power during current generation 110V 1~	0kVA	2.5kVA	4kVA	5kVA	5kVA	5kVA	5kVA

6.10 Generating set operation

WARNING

- **Before using the machine as generator, carefully read section "2. Safety".**
- **It is forbidden to connect the machine to the public grid and/or other source of electricity.**
- **The machine is not designed for emergency use in the event of a commercial grid power failure.**

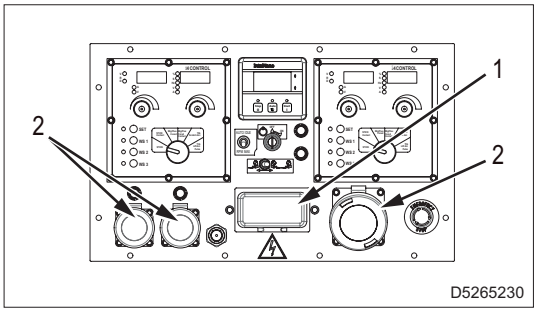
6.10.1 Auxiliary current generation in AC 400V/50Hz - 230V/50Hz - 110V/50H

The machine is capable of supplying three-phase and single-phase AC current, to power electrical equipment.

Important

- Check that the electrical characteristics of the devices to be supplied, power, voltage, and frequency, match the declared values.
- Connect the machine to a grounding system according to the regulations in force at the place of installation.
  Use the ground terminal located on the front of the machine.
  Check the efficiency of the ground connection before each work session if the distribution system used requires it, e.g. TT and TN systems.

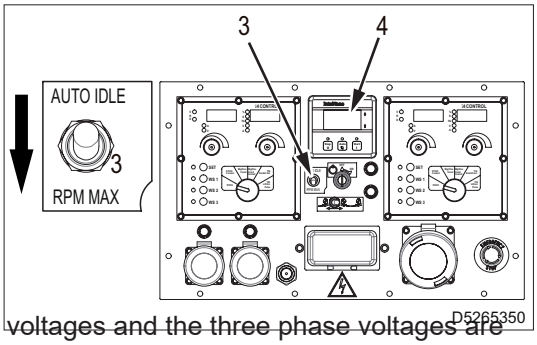
1 - Check that the machine's main switch (1), located under the protective cover, is set to OFF (insertion lever downwards).
2 - Connect the load cables to the output sockets (2) on the control panel
3 - Start the machine, set the machine's main switch to ON (insertion lever upwards).



4 - Set the Auto Idle switch (3) to the RPM MAX position.

5 - Check the operation of the machine's electrical safety device, residual current circuit breaker or insulation monitor located under the protective cover (2), by pressing the TEST button on the device and checking that the machine's main switch is open.

6 - Before supplying power to the equipment, check the voltage and frequency values on the display of the engine control unit (4).



7 - For three-phase electrical systems, check that the three line voltages and the three phase voltages are equal and that the direction of rotation is correct (clockwise rotation).

Note

- In the absence of a load, the voltage and frequency values may be higher than their nominal values. For details, see "Voltage" and "Frequency".

Auto Idle selector

It is possible to use the machine as an AC generator by setting the Auto Idle switch (3) to the AUTO IDLE position.
The motor automatically switches to the rated speed, allowing energy to be drawn when required by the connected load.
When powering equipment or devices with an electric motor (pumps, compressors, fans, etc.), keep the Auto Idle switch (3) in the RPM MAX position to facilitate starting the electric motor.

6.10.2 Operating conditions

Electrical powers

The declared electrical powers refer to the absence of welding current, (see "6.9 Simultaneous use of welding and auxiliary current generation functions") and the combined use of available AC currents.

The declared electrical powers are the maximum powers that can be supplied by the machine for single use.

The declared electrical power is usable for 100% continuous operation, but cannot be overloaded.

The electrical power of the generating set, expressed in kVA, is the available output power at the reference environmental conditions (Ambient temperature 25 °C - Relative humidity 30% - Altitude 100 m a.s.l.) and at the rated values of voltage, frequency, power factor (cos ϕ).

☛ Important

- During use, DO NOT EXCEED the declared powers, paying particular attention when powering multiple loads at the same time.

Voltage

For asynchronous generators, the voltage is specified with an accuracy of ± 10% of the nominal value.
In the absence of a powered electrical load, the open circuit voltage (e.g. 400V 3~) could have a value of 440V 3~; instead, while the maximum power/current is being drawn, the voltage could drop to 360V 3~.

Always check that the electrical devices to be powered have a supply voltage with an operating range of at least ± 10% of its nominal supply voltage. Failure to do so may cause the electrical equipment to malfunction, resulting in a dangerous situation or serious damage to the machine.

Frequency

Frequency is a parameter directly dependent on engine revolutions.

With a 2-pole alternator, you have a frequency of 50/60 Hz with a rotational speed of 3000/3600 rpm.

With a 4-pole alternator, you have a frequency of 50/60 Hz with a rotational speed of 1500/1800 rpm.

The frequency, and thus the engine speed, is kept constant by a mechanical regulator.

The mechanical speed regulator has an idle to full load speed droop of less than 5 %, while under static con-

ditions, the accuracy is maintained within ±1 %.

- For 50Hz generators, the no-load frequency is 52-52.5 Hz
- For 60Hz generators, the no-load frequency is 62.5-63 Hz.

In some engines or for special requirements, the speed controller is electronic.
In this case, the accuracy under static operating conditions reaches ±0.25% and the frequency remains constant from no-load to load operation (isochronous operation).
Always check that the supply frequency of the electrical equipment to be powered, particularly motors, is compatible with the declared frequency of the machine and has a working range of at least ± 5% of its rated supply frequency.
Failure to do so may cause the electrical equipment to malfunction, resulting in a dangerous situation or serious damage to the machine.

Power factor - cos ϕ

The power factor is a data that depends on the electrical characteristics of the load.
It indicates the ratio between the Active Power (kW) and the Apparent Power (kVA).
The apparent power is the total power required for the load, given by the sum of the active power delivered by the engine (after the alternator has transformed the mechanical power into electrical power) and the Reactive Power (kVAR) delivered by the alternator.
The rated value of the power factor is cos ϕ = 0.8.
If the electrical device and the power machine, voltage and frequency are the same, for cos ϕ values ranging between 0.8 ÷ 1, no precautions are necessary for connecting and operating the equipment.

Starting motors

Starting a motor with the machine can be critical due to the high starting current required by motors (Iavv. = up to 8-10 times the rated current In.).
Asynchronous type alternators are not recommended for starting electric motors, as the starting current of the motor must not exceed the rated current of the alternator.
Before connecting any equipment or device (pumps, compressors, fans, etc.) to an electric motor, always check that the starting or inrush current of the motor does not exceed the declared maximum current of the machine.

6.10.3 Connectable electrical devices

WARNING

- **MOSA, a division of BCS S.p.A., shall not be held responsible for any damage caused by electrical components incorrectly connected to this machine.**

This machine is not suitable for powering certain electrical devices.
The following table is an indicative and non-exhaustive list of the machine's compatibility with certain devices.

Electrical devices	Type	Connection possibilities
Heaters, toasters, incandescent light bulbs, electric cookers, electric pans	Resistive	These devices can be connected.
Motors, pumps, grinders, small refrigerators, lawn mowers and hedge trimmers.	Inductive	These devices can be connected, but it is necessary to follow the instructions given in paragraph "Starting motors". • These devices require a large inrush current for starting. Some motors can also be sensitive to frequency variation during their start-up.
Televisions, radios, microwave ovens, electronically controlled appliances.	Capacitive	These devices CANNOT be connected. • Voltage spikes or high voltages can cause the capacitive element to fail. • Surge and transient protection must be installed and an additional purely resistive load connected. • Even if these precautions are taken, the correct operation of the electrical device cannot be guaranteed.
Computers, high resolution televisions, complex electrical equipment.	Capacitive/ inductive	These devices CANNOT be connected. • Voltage spikes or high voltages can cause the capacitive element to fail. • Surge and transient protection must be installed and an additional purely resistive load connected. • Even if these precautions are taken, the correct operation of the electrical device cannot be guaranteed.

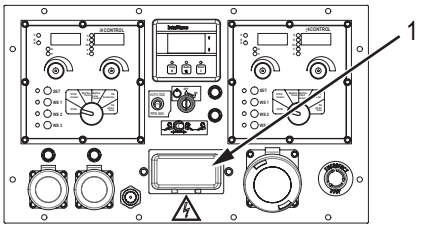
6.11 Electrical protection

6.11.1 Machine's main switch

These machines are manufactured with a three-phase asynchronous alternator and do not require electrical protection against short circuits and overcurrents, as the alternator protects itself by de-energising and the voltages generated by the asynchronous alternator cancel each other out.
The function of the main circuit breaker is taken over by the residual current circuit breaker.

6.11.2 Residual current circuit breaker

The residual current circuit breaker located on the control panel under the cover (1) guarantees protection against indirect contacts due to ground fault currents. When the switch detects a fault current greater than the rated one, it opens interrupting the electric circuit connected.
The residual current circuit breakers differ according to their characteristics: tripping differential current, maximum rated current, type of differential correction detected.



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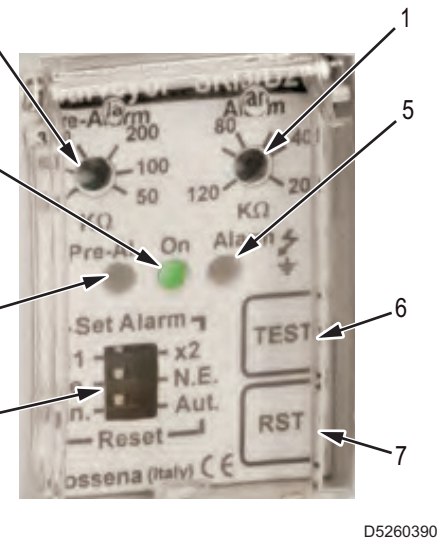
6.11.3 Insulation monitor

Important

- Isolation monitor calibration changes must only be performed by qualified personnel. If necessary, contact Technical Support.

The isolation monitor is a device that continuously controls the ground insulation of the electrical circuit.
When the device detects a resistance value (isolation) lower than the set value, it intervenes by signalling the fault and opening the main machine switch.

1 - Alarm threshold adjustment
2 - Dip-switch
3 - Pre-alarm indication led
4 - Power supply presence indication led
5 - Alarm indication led
6 - Test button
7 - Reset button
8 - Pre-alarm threshold adjustment



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SRI3/ D2 operation

- ON indicator (4) indicates that the equipment is powered.
- Pressing the test button (6) for at least 5 seconds, turns on the Alarm (5) and Pre-alarm (3) LEDs.
- When the button (6) is released, the Pre-alarm led (3) turns off and the Alarm led (5) remains ON. Press the test button (6) again to turn off the Alarm led (5).
- If the isolation resistance drops below the set pre-alarm value, the Pre-alarm led (3) lights up and the contact of the Pre-alarm relay switches.

- If the isolation resistance drops further below the alarm value threshold, the Alarm led (5) turns on, along with the contact of the Alarm switch relay.
- After checking the system and removing the cause of the problem, reset the circuit by pressing the reset button (7).

SRI3/ D2 model factory settings

- Microswitches
- Resistive value multiplier: x 1
- Output relay: N.De (Normally de-energized)
- Reset: Man. (manual)
- Potentiometers
- Alarm: 40 kΩ
- Pre-Al. : 100 kΩ

6.11.4 Circuit breaker

When the insulation monitor is present, a magnetic circuit breaker fulfils the function of the main switch.

In the electrical panel there are several magnetic circuit breakers that protect the equipment connected to the sockets on the machine.

Overload protection tripping is not instantaneous; it follows an overcurrent/time characteristic. The greater the overcurrent, the shorter the tripping time.

The rated tripping current refers to an operating temperature of 30 °C.

Each variation of 10°C corresponds approximately to a variation of 5% on the rated current value.

6.11.5 Thermal Protection

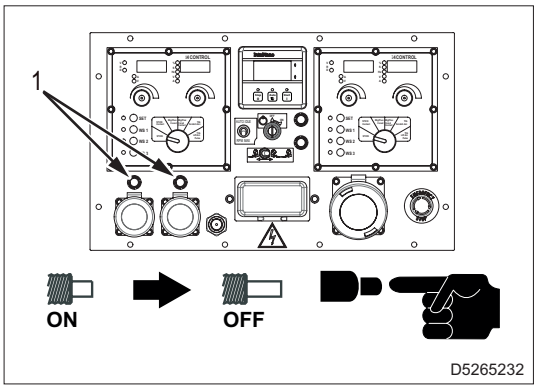
Located on the control panel, the thermal protections (1) are installed to protect against overcurrents on the individual AC socket.

When the rated tripping current is exceeded, the protection is triggered by disconnecting the power from the socket.

Overcurrent protection tripping is not instantaneous; it follows an overcurrent/time characteristic. The greater the overcurrent, the shorter the tripping time.

In case of tripping, check that the current drawn by the load does not exceed the rated tripping current of the protection.

Allow the protection to cool for a few minutes before resetting it by pressing the centre pole.



6.12 Troubleshooting

☛ Important

- Service and repairs may only be carried out by the Technical Support Service or Authorised Service Centres.
- Unauthorised repairs carried out on this machine may endanger people and invalidate the warranty.

This troubleshooting guide is provided to assist the technician in locating, identifying and repairing any machine malfunctions.

- Problem (first column): the faults or malfunction found on the machine are listed here.
- Possible cause (second column): the possible causes that could have generated the problem are listed here.
- Solution (third column): the actions to be performed to solve the problem are listed here.

6.12.1 Engine

Issue	Possible cause	Solution
The engine doesn't start	• Emergency button pressed	• Check and release
	• Battery cut-off switch open	• Check and close
	• Preheating failure	• Insufficient engine preheating phase, failure in the preheating circuit. Repair
	• Faulty engine control unit	• Replace
	• Flat battery	• Recharge or replace. Check the engine battery charging circuit.
	• Loose or corroded battery cable terminals	• Tighten and clean. Replace if corroded.
	• Faulty starter motor	• Repair or replace.
	• Lack of fuel or presence of air in the fuel circuit	• Refill tank and de-aerate the circuit.
	• Faulty power supply circuit: faulty pump, blocked injector, etc.	• Request the intervention of the Technical Support Service
	• Clogged air or fuel filter	• Clean or replace.
	• Faulty engine stop device	• Replace.
	• Faulty starter electrical circuit	• Check and repair.
Black smoke	• Air filter clogged.	• Clean or replace.
	• Overload.	• Check the connected load and reduce it.
	• Faulty injectors. Jogged injection pump	• Request the intervention of the Technical Support Service.
White smoke	• Oil level too high.	• Eliminate any excess oil.
	• Engine cold or in prolonged operation with little or no load.	• Insert the load only when the engine is sufficiently warm.
	• Worn-out segments and/or cylinders.	• Request the intervention of the Technical Support Service

Issue	Possible cause	Solution
The engine does not accelerate Unsteady speed	• In the absence of load	• Check the position of the Auto Idle switch
	• Fault in the Auto Idle system	• Check and repair or replace.
	• Clogged air or fuel filter	• Clean or replace.
	• Faulty power supply circuit: faulty pump, blocked injector, etc.	• Request the intervention of the Technical Support Service.
	• Oil level too high.	• Eliminate any excess oil.
	• Faulty engine speed controller	• Request the intervention of the Technical Support Service.
Poor power output from the engine	• Air filter clogged.	• Clean or replace
	• Insufficient supply of fuel; impurities or water in the power supply circuit.	• Check the supply circuit, clean and refuel.
	• Poor quality fuel or fuel that has been left in the tank too long.	• Empty the tank and the carburettor
	• Dirty or faulty injectors.	• Request the intervention of the Technical Support Service
Low oil pressure	• Low oil level	• Restore the level. Check that there are no leaks.
	• Oil filter clogged.	• Replace the filter.
	• Faulty oil pump.	• Request the intervention of the Technical Support Service
	• Alarm malfunction	• Check the sensor and the electrical circuit Repair or replace
High temperature	• Overload.	• Check the connected load and reduce it.
	• Insufficient ventilation	• Check the cooling fan and its drive belts
	• Insufficient amount of coolant	• Restore the level. Check the entire cooling circuit, pipes, sleeves, etc. for leaks or breaks.
	• Clogged water or oil radiator	• Clean radiator cooling fins
	• Faulty water circulation pump	• Request the intervention of the Technical Support Service
	• Faulty injectors. Jogged injection pump	• Request the intervention of the Technical Support Service
	• Alarm malfunction.	• Check the sensor and the electrical circuit Repair or replace

6.12.2 Welding circuit

Issue	Possible cause	Solution
No voltage on welding sockets.	• Welding mode selector switch on EVO MULTI4 control panel in position: - STICK Contact - Mig / Flux Cored Contact - TIG Lift Arc Pulse	• Close the torch contact
No current during welding or faulty welding: high spatter, unstable arc, etc.	• Unstable contact between the ground clamp and the workpiece.	• Check the ground clamp contact
	• Welding mode selector incorrect in relation to the welding process being used	• Check position
	• Loose connection of welding cables to sockets or incorrect polarity in relation to the welding process being used.	• Check connection and polarity
	• Welding cables that are too long and/ or coiled, damaged or undersized.	• Replace welding cables.
	• Failure in the welding control circuit	• Check the connections between the circuit components
	• Faulty current sensor	• Replace the current sensor
	• Faulty welding control board	• Replacing the welding control board
	• EVO MULTI4 control panel failure	• Replace the EVO MULTI4 control panel
	• Faulty control board power pack	• Replace the control board power pack
	• Failure in the welding circuit	• Check the connections between the circuit components
	• Faulty diode bridge	• Replacing the diode bridge
	• Welding level reactor failure	• Replace level reactor
No adjustment on the control panel.	• Presence of a remote control connected to one of the 10-14 pole connectors	• Disconnect the cable from the connector
	• EVO MULTI4 control panel failure	• Replace the EVO MULTI4 control panel
No adjustment on the remote control.	• Defective remote control cable.	• Repair or replace.
	• Defective remote control potentiometer.	• Replace.
Incorrect operation of the Single / Dual Station Selector	• Check circuit connections	• Check
	• Defective selector	• Replace
	• Defective parallel switching contactor	• Replace
Incorrect operation of the WF-4 wire feeder	• Defective wire feeder connection cable	• Repair or replace.
	• Defective wire feeder	• Repair or replace.

Issue	Possible cause	Solution
Incorrect operation of the PL400 Polarity Inversion Box	• Defective PL400 inversion box connection cable	• Repair or replace.
	• Faulty reversing contactor	• Replace
	• Defective PL400 inversion box	• Replace
No welding current and no output voltage	• Short circuit	• Check that there is no short circuit on the welding circuit or on the AC auxiliary current circuit.
	• Defective or discharged capacitors.	• Check the nominal capacity of the excitation capacitor boxes. The check must be carried out on the individual capacitor box not connected to the alternator and to the other capacitor boxes.
	• Faulty alternator	• Leave the alternator connected to the capacitor box battery only. Disconnect the welding cables from the diode bridge and the AC auxiliary current circuit cables from the terminal board inside the electrical box. If the alternator output voltages are incorrect in this condition, the alternator is faulty and must be replaced.
	• Diode bridge short circuit	• Leave the alternator connected to the capacitor box battery and the welding diode bridge. Disconnect the AC auxiliary current circuit cables from the terminal board inside the electrical box. If the alternator output voltages are incorrect in this condition, there may be a short circuit in the diode bridge, which must be replaced.
	• Short circuit on AC auxiliary current circuit	• Leave the alternator connected to the capacitor box battery and the AC auxiliary current circuit. Disconnect the alternator cables at the diode bridge. If the alternator output voltages are incorrect in this condition, check whether there is a short circuit in the AC auxiliary current circuit.

6.12.3 AC auxiliary current circuit

Issue	Possible cause	Solution
No voltage on output sockets	• Machine's main switch open, OFF position	• Check and close the switch, set to ON
	• Residual current circuit breaker tripped	• Check connected devices for insulation defects that cause ground fault currents.
	• Overcurrent protection tripped	• Check the current of the connected load.
	• Faulty electrical protections	• Replace
	• Defective or discharged capacitors.	• See "6.12.2 Welding circuit".
	• Faulty alternator	• See "6.12.2 Welding circuit".
Open circuit voltage too low or too high	• Incorrect engine speed	• Adjust the speed to its rated no-load value.
	• Defective or discharged capacitors.	• See "6.12.2 Welding circuit".
	• Faulty alternator	• See "6.12.2 Welding circuit".
Correct open circuit voltage too low at load	• Overload.	• Check the connected load.
	• Load with cos φ less than 0.8	• Type of load that cannot be supplied with this machine.
	• Defective or discharged capacitors.	• See "6.12.2 Welding circuit".
	• Faulty alternator	• See "6.12.2 Welding circuit".
Unstable voltage	• Loose electrical contacts	• Check and tighten the machine's electrical connections and the power cord.
	• Irregular engine rotation.	• Check and request the intervention of the Technical Support Service

NOTES:

7. Maintenance

WARNING

- **Before proceeding with maintenance, carefully read section “2. Safety”.**

7.1 Refuelling

Use fuel, coolant and lubricants according to the ambient temperature.

7.1.1 Fuel

The fuel must comply with EN590 and ASTM D975.
The cetane number of the fuel should be at least 45.
In order to ensure an efficient and long service life of the engine, the fuel must be sulphur-free diesel fuel:

- EN 590
- DIN 5168
- ASTM D975 Grade 2-D S15,
- ASTM D975 Grade 1-D S15

Using fuel with a high sulphur content could reduce the life of the engine, or cause damage to the machine or decrease its performance.
Do not use dirty diesel or mixtures of diesel and water, as this would cause serious engine failure.
Clean fuel prevents clogging of fuel injectors.
Do not store the diesel in zinc coated containers.
Use the fuel in the storage tank or the fuel tank of the machine within 6 months.
Fuel deterioration reduces the quality of combustion and can cause engine power loss, increased fuel consumption, and damage to engine components.
To use other types of fuel, such as low-temperature fuels, biodiesel, synthetic, non-road fuel, etc., consult the engine manual.

Refuelling

WARNING

- **Before refuelling, read “2.8 Precautions during fuel and engine oil filling” carefully.**

Do not fill the tank completely. Leave a gap of about 10 mm, between the fuel level and the top wall of the tank, to allow expansion.
Keep the engine off during refuelling.

7.1.2 Engine oil

- To ensure adequate protection of the engine and keep it efficient for a long time, use only the recommended oil. Using different oils can reduce the life of the engine.
- The viscosity must be appropriate to the ambient temperature.
- The oil to be used must comply with the following specifications:

API	CJ-4 Low S.A.P.S
ACEA	E6 Low S.A.P.S.

Low S.A.P.S. (low sulphated ash, phosphorus, sulphur oil) keeps the catalyst in good working condition.

SAE oil classification

In the SAE classification, oils are identified according to the viscosity.

The code is composed of two numbers, which indicate, and must correspond to the ambient temperature at which the engine operates.

The first number refers to the cold viscosity, for winter use (W), while the second number refers to the viscosity at high temperatures.

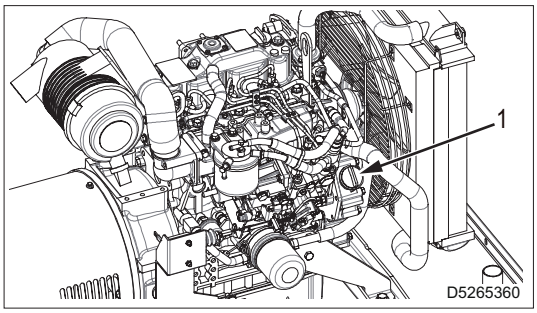
SAE 10W-30	-25°C to +40°C
SAE 10W-40	-25°C to +50°C
SAE 5W-30	-30°C to +40°C
SAE 0W-40	-40°C to +50°C

Refuelling and checks

WARNING

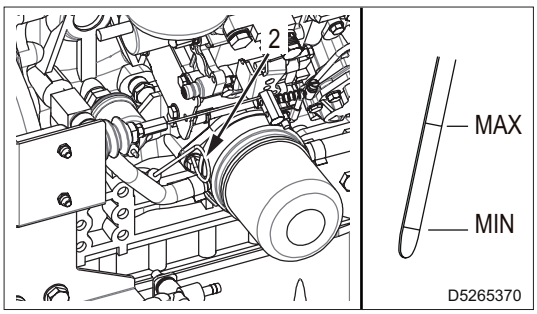
- **Before refuelling, read "2.8 Precautions during fuel and engine oil filling" carefully.**
- **Do not introduce more oil than indicated in the engine manual. Combustion of excess oil may result in increased engine revolutions.**

1 - Remove the engine fill cap (1).



2 - Refuel and refit the cap.

3 - Check the level with the rod (2).
The level must be between the minimum and maximum notches.



7.1.3 Coolant

The engine cooling system is fuelled with OAT: ENI ANTIFREEZE SPEZIAL coolant, mixed at 50% with demineralised water.

It is recommended to continue using the same coolant.

If the type of coolant is changed for refuelling, the system must be thoroughly washed.
By mixing with each other, the residues of additives of different types contained in the different liquids would create gelatinous substances that could obstruct the system.

Use a mixture of 50% demineralised water and 50% low silicate ethylene glycol coolant.

Use a coolant free from silicates, phosphates, borates, nitrites and amines.

The following ethylene glycol based engine coolants may be used:

- low silicate OAT (Organic Acid Technology): ASTM D-3306 D-6210
- low silicate HOAT (Hybrid Organic Acid Technology): ASTM D-3306 D-6210

☛ Important

- Do not mix OAT and HOAT coolants.
- Never use automotive coolants. These coolants do not contain the correct additives to protect heavy-duty diesel engines.

Oat coolants are maintenance-free for up to 6 years or 6000 operating hours, provided that the cooling system is topped up using the same type of coolant.

Do not mix different types of coolant.

Test the coolant condition annually with coolant test strips.

HOATs are not all maintenance-free and it is recommended to add SCA (Supplemental Coolant Additives) at the first maintenance interval.

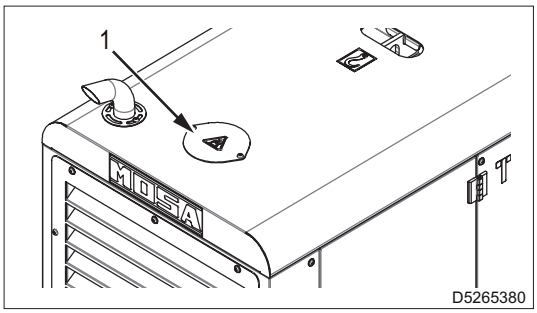
Refuelling

⚠ WARNING

- **Before refuelling, read “2.13 Maintenance precautions” carefully.**

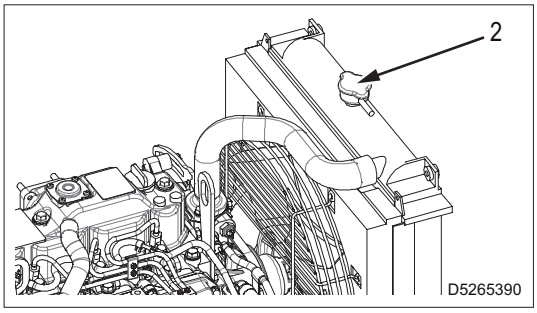
Check the coolant level when the engine is cold.

1 - Open the radiator cap access door (1).



2 - Remove the cap (2) and pour the coolant into the radiator.

3 - Top up the liquid until it covers the pipes inside the radiator by about 5 mm.



Note

- Do not overfill the radiator; allow room for coolant expansion.

4 - Refit the cap (2) and tighten securely.

5 - After the top-up operations, run the engine for a short period, check the coolant level again and refill if necessary.

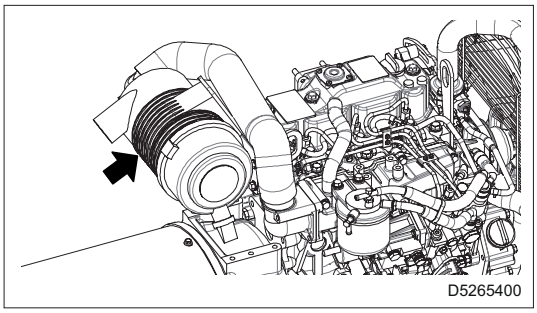
7.1.4 Checking and cleaning the engine air filter

1 - Release the hooks (1).

2 - Pull out the filter element (2).

3 - Using a damp cloth, clean the inside of the cover (3) and the outer element (4).

4 - Blow air through element (2) using compressed air at 0.29 - 0.49 MPa (3.0 - 5.0 kgf/cm^2).

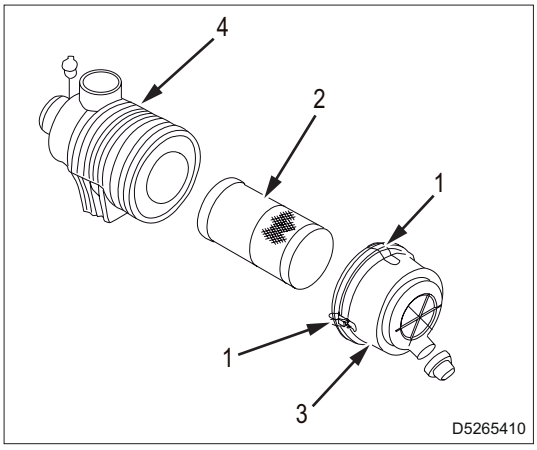


☛ Important

- Use low-pressure compressed air to prevent filter damages.

5 - Insert the filter element (2) into the outer element (4)

6 - Fit the cover (3) in the direction indicated on the cover arrow, and couple it using the hooks (1).



7.2 Routine maintenance

Note

For engine maintenance, refer to the engine maintenance manual.

Every day

- Check coolant level
- Check engine oil level
- Check fuel level
- Check for sediment and water in fuel filter/separator

After the first 50 hours

- Check cooling fan belt
- Replace the engine oil filter and engine oil

Every 50 hours

- Check and clean radiator fins
- Check battery charge
- Clean sediment and water in fuel filter/separator

Every 250 hours

- Check cooling fan belt
- Replace the engine oil filter and engine oil
- Check and adjust regulator lever, check engine speed
- Drain fuel from tank
- Clean air filter

Every 500 hours

- Clean fuel filter/separator
- Replace the fuel filter
- Replace the air filter element

Every 1000 hours

- Replace coolant (or every 1 year, even if the 1000 hours have not been reached)
- Adjust intake/discharge valve clearance

Every 1500 hours

- Check fuel injectors
- Check engine base ventilation system

Every 2000 hours

- Check fuel line, coolant, oil and ventilation pipes (or every 2 years, even if the 2000 hours have not been reached)

7.3 Storage

- Carefully clean the fairings and all other machine parts.
- Run the machine with load every 10 days for 15-30 minutes.
  Doing so ensures proper lubrication of the engine, keeps the battery charged and prevents any blockage of the injection system.
- If the machine is not used for more than 30 days, make sure that the machine is protected from heat sources and from weather phenomena that can cause rust, corrosion of the components and damage to the machine.
- Protect the machine with a case and store it in a dry place.

- Use qualified personnel to carry out the operations necessary for storage.
- For the correct engine storage, follow the instructions in the manual or contact the engine manufacturer's Technical Support.

7.4 Disposal

WARNING

- **Before refuelling, read “2.14 Precautions for disposal of waste material” and “2.15 Disposal of the machine”.**

In the event of disposal of the machine or parts of it (oils, hoses, plastic materials, etc.), comply with the regulations in force in the country in which this operation is carried out.

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