



Lasting Connections

# TERRA 320-400-500 MSE

INSTRUCTION MANUAL





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Rev.

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**CE - DECLARATION OF CONFORMITY**

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Company

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Tel. +39 049 9413111 - Fax +39 049 9413311 - E-mail: selco@selcoweld.com - www.selcoweld.com

hereby declares that the equipment:

**TERRA 320 MSE**  
**TERRA 400 MSE**  
**TERRA 500 MSE**

conforms to the EU directives:

**2014/35/EU      LOW VOLTAGE DIRECTIVE**  
**2014/30/EU      EMC DIRECTIVE**  
**2011/65/EU      RoHS DIRECTIVE**

and that following harmonized standards have been duly applied:

**EN 60974-1:2018**  
**EN 60974-10:2015 Class A**

Any operation or modification that has not been previously authorized by **SELCO s.r.l.** will invalidate this certificate.

Onara di Tombolo (PADOVA)

Selco s.r.l.



Lino Frasson  
Chief Executive

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## SYMBOLS

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Imminent danger of serious body harm and dangerous behaviours that may lead to serious body harm



Important advice to be followed in order to avoid minor injuries or damage to property



Technical notes to facilitate operations

## 1 WARNING



Before performing any operation on the machine, make sure that you have thoroughly read and understood the contents of this booklet.

Do not perform modifications or maintenance operations which are not prescribed.

The manufacturer cannot be held responsible for damages to persons or property caused by misuse or non-application of the contents of this booklet by the user.



Please consult qualified personnel if you have any doubts or difficulties in using the equipment.



### 1.1 Work environment

- All equipment shall be used exclusively for the operations for which it was designed, in the ways and ranges stated on the rating plate and/or in this booklet, according to the national and international directives regarding safety. Other uses than the one expressly declared by the manufacturer shall be considered totally inappropriate and dangerous and in this case the manufacturer disclaims all responsibility.
- This equipment shall be used for professional applications only, in industrial environments.  
The manufacturer shall not be held responsible for any damages caused by the use of the equipment in domestic environments.
- The equipment must be used in environments with a temperature between -10°C and +40°C (between +14°F and +104°F).  
The equipment must be transported and stored in environments with a temperature between -25°C and +55°C (between -13°F and 131°F).
- The equipment must be used in environments free from dust, acid, gas or any other corrosive substances.
- The equipment shall not be used in environments with a relative humidity higher than 50% at 40°C (104°F).  
The equipment shall not be used in environments with a relative humidity higher than 90% at 20°C (68°F).
- The system must not be used at an higher altitude than 2,000 metres (6,500 feet) above sea level.



Do not use this machine to defrost pipes.  
Do not use this equipment to charge batteries and/or accumulators.  
Do not use this equipment to jump-start engines.

### 1.2 User's and other persons' protection



The welding process is a noxious source of radiation, noise, heat and gas emissions.



Wear protective clothing to protect your skin from the arc rays, sparks or incandescent metal. Clothes must cover the whole body and must be:

- intact and in good conditions
- fireproof
- insulating and dry
- well-fitting and without cuffs or turn-ups



Always use regulation shoes that are strong and ensure insulation from water.



Always use regulation gloves ensuring electrical and thermal insulation.



Position a fire-retardant shield to protect the surrounding area from rays, sparks and incandescent slags.

Advise any person in the area not to stare at the arc or at the incandescent metal and to get an adequate protection.



Wear masks with side face guards and a suitable protection filter (at least NR10 or above) for the eyes.



Always wear safety goggles with side guards, especially during the manual or mechanical removal of welding slag.



Do not wear contact lenses!



Use headphones if dangerous noise levels are reached during the welding.  
If the noise level exceeds the limits prescribed by law, delimit the work area and make sure that anyone getting near it is protected with headphones or earphones.

- Always keep the side covers closed while welding.

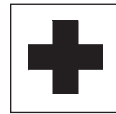


While loading and feeding the wire, keep your head away from the MIG/MAG torch. The wire that is coming out can seriously damage your hands, face and eyes.



Avoid touching items that have just been welded: the heat could cause serious burning or scorching.

- Follow all the precautions described above also in all operations carried out after welding since slag may detach from the items while they are cooling off.



Keep a first aid kit ready for use.  
Do not underestimate any burning or injury.



Before leaving work, make the area safe, in order to avoid accidental damage to people or property.



### 1.3 Protection against fumes and gases

- Fumes, gases and powders produced during the welding process can be noxious for your health. Under certain circumstances, the fumes caused by welding can cause cancer or harm the foetus of pregnant women.
- Keep your head away from any welding gas and fumes.
- Provide proper ventilation, either natural or forced, in the work area.
- In case of poor ventilation, use masks and breathing apparatus.
- In case of welding in extremely small places the work should be supervised by a colleague standing nearby outside.
- Do not use oxygen for ventilation.
- Ensure that the fumes extractor is working by regularly checking the quantity of harmful exhaust gases versus the values stated in the safety regulations.
- The quantity and the danger level of the fumes depends on the parent metal used, the filler metal and on any substances used to clean and degrease the pieces to be welded. Follow the manufacturer's instructions together with the instructions given in the technical sheets.
- Do not perform welding operations near degreasing or painting stations.  
Position gas cylinders outdoors or in places with good ventilation.



### 1.4 Fire/explosion prevention

- The welding process may cause fires and/or explosions.
- Clear the work area and the surrounding area from any flammable or combustible materials or objects. Flammable materials must be at least 11 metres (35 feet) from the welding area or they must be suitably protected. Sparks and incandescent particles might easily be sprayed quite far and reach the surrounding areas even through minute openings. Pay particular attention to keep people and property safe.
- Do not perform welding operations on or near containers under pressure.
- Do not perform welding operations on closed containers or pipes. Pay particular attention during welding operations on pipes or containers even if these are open, empty and have been cleaned thoroughly. Any residue of gas, fuel, oil or similar materials might cause an explosion.
- Do not weld in places where explosive powders, gases or vapours are present.
- When you finish welding, check that the live circuit cannot accidentally come in contact with any parts connected to the earth circuit.
- Position a fire-fighting device or material near the work area.



### 1.5 Prevention when using gas cylinders

- Inert gas cylinders contain pressurized gas and can explode if the minimum safe conditions for transport, storage and use are not ensured.
- Cylinders must be secured in a vertical position to a wall or other supporting structure, with suitable means so that they cannot fall or accidentally hit anything else.
- Screw the cap on to protect the valve during transport, commissioning and at the end of any welding operation.
- Do not expose cylinders to direct sunlight, sudden changes of temperature, too high or extreme temperatures. Do not expose cylinders to temperatures too low or too high.
- Keep cylinders away from naked flames, electric arcs, torches or electrode guns and incandescent material sprayed by welding.
- Keep cylinders away from welding circuits and electrical circuits in general.
- Keep your head away from the gas outlet when opening the cylinder valve.
- Always close the cylinder valve at the end of the welding operations.
- Never perform welding operations on a pressurized gas cylinder.



### 1.6 Protection from electrical shock

- Electric shocks can kill you.
- Avoid touching live parts both inside and outside the welding system while this is active (torches, guns, earth cables, electrodes, wires, rollers and spools are electrically connected to the welding circuit).
- Ensure the system and the welder are insulated electrically by using dry bases and floors that are sufficiently insulated from the earth.
- Ensure the system is connected correctly to a socket and a power source equipped with an earth conductor.
- Do not touch two torches or two electrode holders at the same time. If you feel an electric shock, interrupt the welding operations immediately.



## 1.7 Electromagnetic fields & interferences

- The welding current passing through the internal and external system cables creates an electromagnetic field in the proximity of the welding cables and the equipment itself.
- Electromagnetic fields can affect the health of people who are exposed to them for a long time (the exact effects are still unknown).  
Electromagnetic fields can interfere with some equipment like pacemakers or hearing aids.



Persons fitted with pacemakers must consult their doctor before undertaking arc welding or plasma cutting operations.

### EMC equipment classification in accordance with EN/IEC 60974-10 (See rating plate or technical data)

Class B equipment complies with electromagnetic compatibility requirements in industrial and residential environments, including residential locations where the electrical power is provided by the public low-voltage supply system.

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 electromagnetic compatibility of class A equipment in those locations, due to conducted as well as radiated disturbances.

### Installation, use and area examination

This equipment is manufactured in compliance with the requirements of the EN60974-10 harmonized standard and is identified as "CLASS A" equipment.

This unit must be used for professional applications only, in industrial environments.

The manufacturer will accept no responsibility for any damages caused by use in domestic environments.



The user must be an expert in the activity and as such is responsible for installation and use of the equipment according to the manufacturer's instructions. If any electromagnetic interference is noticed, the user must solve the problem, if necessary with the manufacturer's technical assistance.



In any case electromagnetic interference problems must be reduced until they are not a nuisance any longer.



Before installing this apparatus, the user must evaluate the potential electromagnetic problems that may arise in the surrounding area, considering in particular the health conditions of the persons in the vicinity, for example of persons fitted with pacemakers or hearing aids.

### Mains power supply requirements (See technical data)

High power equipment may, due to the primary current drawn from the mains supply, influence the power quality of the grid. Therefore connection restrictions or requirements regarding the maximum permissible mains impedance or the required minimum supply capacity at the interface point to the public grid (point of common coupling, PCC) may apply for some types of equipment (see technical data).

In this case it is the responsibility of the installer or user of the equipment to ensure, by consultation with the distribution network operator if necessary, that the equipment may be connected.

In case of interference, it may be necessary to take further precautions like the filtering of the mains power supply. It is also necessary to consider the possibility of shielding the power supply cable.

### Welding cables

To minimise the effects of electromagnetic fields follow the following instructions:

- Where possible, collect and secure the earth and power cables together.
- Never coil the welding cables around your body.
- Do not place your body in between the earth and power cables (keep both on the same side).
- The cables must be kept as short as possible, positioned as close as possible to each other and laid at or approximately at ground level.
- Position the equipment at some distance from the welding area.
- The cables must be kept away from any other cables.

### Earthing connection

The earth connection of all the metal components in the welding equipment and in the close area must be taken in consideration. The earthing connection must be made according to the local regulations.

### Earthing the workpiece

When the workpiece is not earthed for electrical safety reasons or due to its size and position, the earthing of the workpiece may reduce the emissions. It is important to remember that the earthing of the workpiece should neither increase the risk of accidents for the user nor damage other electric equipment. The earthing must be made according to the local regulations.

### Shielding

The selective shielding of other cables and equipment present in the surrounding area may reduce the problems due to electromagnetic interference. The shielding of the entire welding equipment can be taken in considered for special applications.



## 1.8 IP Protection rating

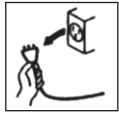
### IP23S

- Enclosure protected against access to dangerous parts by fingers and against ingress of solid foreign bodies with diameter greater than/equal to 12.5 mm
- Enclosure protected against rain at an angle of 60°.
- Enclosure protected against harmful effects due to the ingress of water when the moving parts of the equipment are not operating.

## 2 INSTALLATION



Installation should be performed only by expert personnel authorised by the manufacturer.



During installation, ensure that the power source is disconnected from the mains.



The multiple connection of power sources (series or parallel) is prohibited.



### 2.1 Lifting, transport & unloading

- The equipment is provided with a handle for hand transportation.
- The equipment is not equipped with specific lifting elements. Use a fork lift truck paying attention during operations in order to prevent the generator from tipping over.



Do not underestimate the weight of the equipment: see technical specifications.

Do not move or position the suspended load above persons or things.



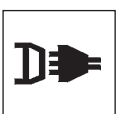
Do not drop or apply undue pressure on the equipment.



### 2.2 Positioning of the equipment

Keep to the following rules:

- Provide easy access to the equipment controls and connections.
- Do not position the equipment in very small spaces.
- Do not place the equipment on surfaces with inclination exceeding 10° from to the horizontal plane.
- Position the equipment in a dry, clean and suitably ventilated place.
- Protect the equipment against pouring rain and sun.



### 2.3 Connection

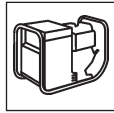
The equipment is provided with a power supply cable for connection to the mains.

The system can be powered by:

- three-phase 400V



Operation of the equipment is guaranteed for voltage tolerances up to  $\pm 15\%$  with respect to the rated value.



The equipment can be powered by a generating set guarantees a stable power supply voltage of  $\pm 15\%$  with respect to the rated voltage value declared by the manufacturer, under all possible operating conditions and at the maximum rated power.



Normally we recommend the use of generating sets with twice rated power of a single phase power source or 1.5 times that of a three-phase power source.



The use of electronic control type generating sets is recommended.



In order to protect users, the equipment must be correctly earthed. The power supply voltage is provided with an earth lead (yellow - green), which must be connected to a plug provided with earth contact.



The electrical connections must be made by skilled technicians with the specific professional and technical qualifications and in compliance with the regulations in force in the country where the equipment is installed.

The power source supply cable is provided with a yellow/green wire that must ALWAYS be earthed. This yellow/green wire shall NEVER be used with other voltage conductors.

Verify the existence of the earthing in the equipment used and the good condition of the sockets.

Install only certified plugs according to the safety regulations.

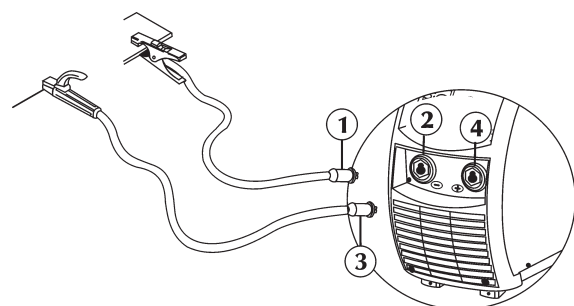


### 2.4 Installation

#### Connection for MMA welding



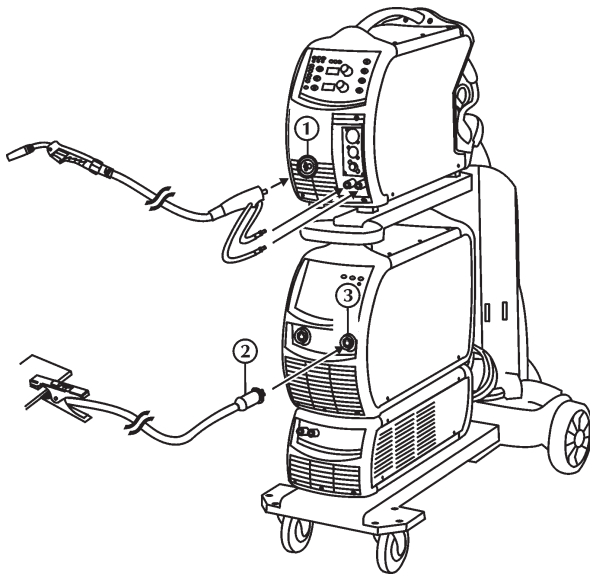
The connection shown in the figure produces reverse polarity welding. To obtain straight polarity welding, reserve the connection.



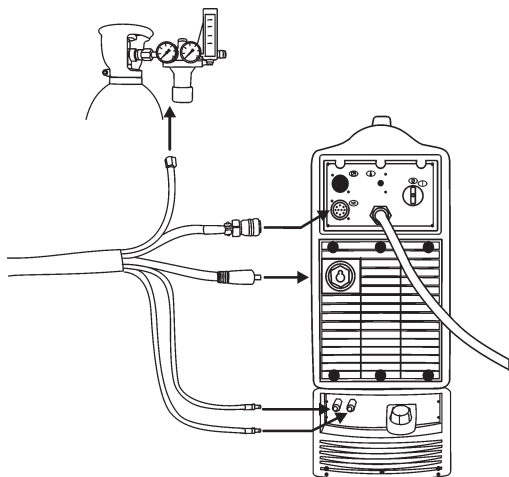
- Connect the earth clamp (1) to the negative socket (-) (2) of the power source.
- Connect the electrode holder (3) to the positive socket (+) (4) of the power source.





## Connection for MIG/MAG welding



- Disconnect the power supply from the power source.
- Connect the MIG torch to the central adapter (1), ensuring that the fastening ring is fully tightened.
- Connect the earth clamp (2) to the negative socket (-) (3) of the power source.



- Connect the power cable to the appropriate outlet. Insert the plug and turn clockwise until all parts are secured.
- Connect the signal cable to the appropriate connector. Insert the connector and screw the ring nut clockwise until all parts are secured.
- Connect the gas hose to the pressure reducing valve of the cylinder or to the gas supply connection.
- Connect the water pipe (blue colored ) to the outlet quick connector of the cooling unit.
- Connect the water pipe (red colored ) to the inlet quick connector of the cooling unit.

## 3 SYSTEM PRESENTATION

### 3.1 General

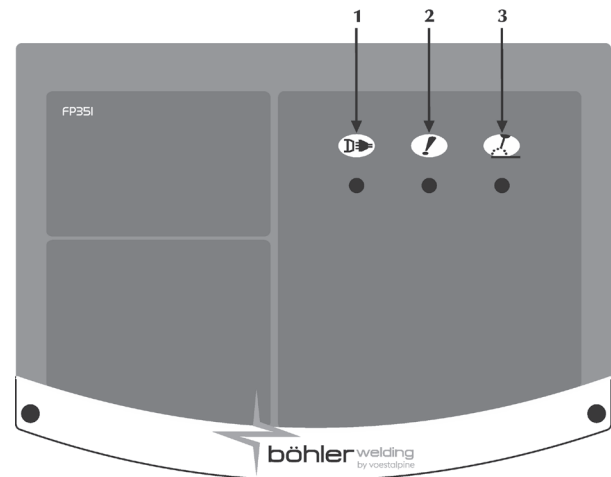
The semiautomatic TERRA... MSE Series systems for continuous wire welding in MIG/MAG ensure high performance and quality in welding with solid and core wires.

They are fully digital multiprocessor systems (data processing on DSP and communication over CAN-BUS), capable of meeting the various requirements of the welding world in the best possible way.

These welding power sources feature an innovative "SYNERGY" operating mode (WF...Smart, WF...RapiDeep Steel).

Synergy enable with setting of the type of material to be welded and diameter of the wire used permits automatic wire speed definition, simplifying system welding adjustment operations.


### 3.2 Front control panel




#### 1 Power supply

 Indicates that the equipment is connected to the mains and is on.

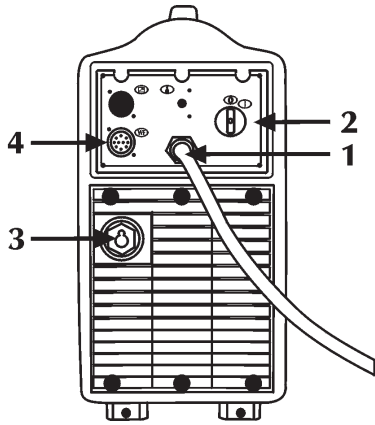
#### 2 General alarm



 Indicates the possible intervention of protection devices such as the temperature protection.

#### 3 Power on

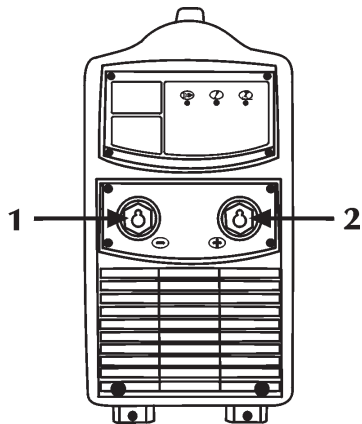
 Indicates the presence of voltage on the equipment outlet connections.



### 3.3 Rear panel



- 1 **Power supply cable**  
Connects the system to the mains.
- 2 **Off/On switch**  
Turns on the electric power to the welder.  
 It has two positions, "O" off, and "I" on.  

- 3 **Power cable input (WF)**
- 4 **Signal cable input (WF)**

### 3.4 Sockets panel



- 1 **Earth socket**  
 Earth wire connector.
- 2 **Positive power socket**  
 For connection of electrode torch in MMA.

## 4 MAINTENANCE



Routine maintenance must be carried out on the system according to the manufacturer's instructions.

Any maintenance operation must be performed by qualified personnel only.  
When the equipment is working, all the access and operating doors and covers must be closed and locked.  
Unauthorized changes to the system are strictly forbidden.  
Prevent conductive dust from accumulating near the louvers and over them.



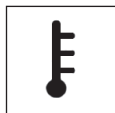
**Disconnect the power supply before every operation!**



Carry out the following periodic checks on the power source:

- Clean the power source inside by means of low-pressure compressed air and soft bristle brushes.
- Check the electric connections and all the connection cables.

For the maintenance or replacement of torch components, electrode holders and/or earth cables:



Check the temperature of the component and make sure that they are not overheated.



Always use gloves in compliance with the safety standards.



Use suitable wrenches and tools.

Failure to carry out the above maintenance will invalidate all warranties and exempt the manufacturer from any liability.

## 5 TROUBLESHOOTING



**The repair or replacement of any parts in the system must be carried out only by qualified personnel.**

**The repair or replacement of any parts in the system by unauthorised personnel will invalidate the product warranty.**

**The system must not be modified in any way.**

**The manufacturer disclaims any responsibility if the user fails to follow these instructions.**

### The system fails to come on (green LED off)

- |          |  |
|----------|--|
| Cause    | No mains voltage at the socket.  |
| Solution | Check and repair the electrical system as needed.<br>Use qualified personnel only.               |
| Cause    | Faulty plug or cable.  |
| Solution | Replace the faulty component.<br>Contact the nearest service centre to have the system repaired. |
| Cause    | Line fuse blown.   |
| Solution | Replace the faulty component.  |
| Cause    | Faulty on/off switch.  |
| Solution | Replace the faulty component.<br>Contact the nearest service centre to have the system repaired. |
| Cause    | Connection between wire feed carriage and generator incorrect or faulty.                         |
| Solution | Check that the various parts of the system are properly connected.                               |
| Cause    | Faulty electronics.  |
| Solution | Contact the nearest service centre to have the system repaired.                                  |

### No output power (the system does not weld)

- |          |   |
|----------|---|
| Cause    | The system has overheated (temperature alarm - yellow LED on).  |
| Solution | Wait for the system to cool down without switching it off.  |
| Cause    | Incorrect earth connection.   |
| Solution | Earth the system correctly.<br>Read the paragraph "Installation".   |
| Cause    | Mains voltage out of range (yellow LED on).   |
| Solution | Bring the mains voltage within the power source admissible range.<br>Connect the system correctly.<br>Read the paragraph "Connections". |
| Cause    | Faulty electronics.   |
| Solution | Contact the nearest service centre to have the system repaired.   |

### Incorrect output power

- |          |  |
|----------|--|
| Cause    | Mains voltage out of range   |
| Solution | Connect the system correctly.<br>Read the paragraph "Connections". |

- |          |   |
|----------|---|
| Cause    | Faulty electronics.   |
| Solution | Contact the nearest service centre to have the system repaired. |

### Arc instability

- |          |  |
|----------|--|
| Cause    | Insufficient shielding gas.  |
| Solution | Adjust the gas flow.<br>Check that the diffuser and the gas nozzle of the torch are in good condition.     |
| Cause    | Humidity in the welding gas.   |
| Solution | Always use quality materials and products.<br>Ensure the gas supply system is always in perfect condition. |
| Cause    | Incorrect welding parameters.  |
| Solution | Check the welding system carefully.<br>Contact the nearest service centre to have the system repaired.     |

### Excessive spatter

- |          |   |
|----------|---|
| Cause    | Incorrect arc length.   |
| Solution | Decrease the distance between the electrode and the piece.<br>Decrease the welding voltage.             |
| Cause    | Incorrect welding parameters.   |
| Solution | Decrease the welding voltage.   |
| Cause    | Incorrect arc regulation  |
| Solution | Increase the equivalent circuit inductive value setting.  |
| Cause    | Insufficient shielding gas.   |
| Solution | Adjust the gas flow.<br>Check that the diffuser and the gas nozzle of the torch are in good conditions. |
| Cause    | Incorrect welding mode.   |
| Solution | Decrease the torch angle.   |

### Insufficient penetration

- |          |  |
|----------|--|
| Cause    | Incorrect welding mode.  |
| Solution | Decrease the welding travel speed.                               |
| Cause    | Incorrect welding parameters.                                    |
| Solution | Increase the welding current.                                    |
| Cause    | Incorrect electrode.   |
| Solution | Use a smaller diameter electrode.                                |
| Cause    | Incorrect edge preparation.                                      |
| Solution | Increase the chamfering.   |
| Cause    | Incorrect earth connection.                                      |
| Solution | Earth the system correctly<br>Read the paragraph "Installation". |
| Cause    | Pieces to be welded too big.                                     |
| Solution | Increase the welding current.                                    |
| Cause    | Insufficient air pressure.                                       |
| Solution | Adjust the gas flow.<br>Read the paragraph "Installation".       |

### Slag inclusions

Cause	Poor cleanliness.
Solution	Clean the pieces accurately before welding.
Cause	Electrode diameter too big.
Solution	Use a smaller diameter electrode.
Cause	Incorrect edge preparation.
Solution	Increase the chamfering.
Cause	Incorrect welding mode.
Solution	Decrease the distance between the electrode and the piece. Move regularly during all the welding operations.

### Blowholes

Cause	Insufficient shielding gas.
Solution	Adjust the gas flow. Check that the diffuser and the gas nozzle of the torch are in good condition.

### Sticking

Cause	Incorrect arc length.
Solution	Increase the distance between the electrode and the piece. Increase the welding voltage.
Cause	Incorrect welding parameters.
Solution	Increase the welding current.
Cause	Incorrect welding mode.
Solution	Angle the torch more.
Cause	Pieces to be welded too big.
Solution	Increase the welding current. Increase the welding voltage.
Cause	Incorrect arc regulation.
Solution	Increase the equivalent circuit inductive value setting.

### Undercuts

Cause	Incorrect welding parameters.
Solution	Decrease the welding voltage. Use a smaller diameter electrode.
Cause	Incorrect arc length.
Solution	Increase the distance between the electrode and the piece. Increase the welding voltage.
Cause	Incorrect welding mode.
Solution	Decrease the side oscillation speed while filling. Decrease the travel speed while welding.
Cause	Insufficient shielding gas.
Solution	Use gases suitable for the materials to be welded.

### Oxidations

Cause	Insufficient gas protection.
Solution	Adjust the gas flow. Check that the diffuser and the gas nozzle of the torch are in good condition.

### Porosity

Cause	Grease, varnish, rust or dirt on the workpieces to be welded.
Solution	Clean the workpieces carefully before welding.

Cause	Grease, varnish, rust or dirt on the filler material.
Solution	Always use quality materials and products. Keep the filler metal always in perfect condition.

Cause	Humidity in the filler metal.
Solution	Always use quality materials and products. Keep the filler metal always in perfect condition.

Cause	Incorrect arc length.
Solution	Decrease the distance between the electrode and the piece. Decrease the welding voltage.

Cause	Humidity in the welding gas.
Solution	Always use quality materials and products. Ensure the gas supply system is always in perfect condition.

Cause	Insufficient shielding gas.
Solution	Adjust the gas flow. Check that the diffuser and the gas nozzle of the torch are in good condition.

Cause	The weld pool solidifies too quickly.
Solution	Decrease the travel speed while welding. Pre-heat the workpieces to be welded. Increase the welding current.

### Hot cracks

Cause	Incorrect welding parameters.
Solution	Decrease the welding voltage. Use a smaller diameter electrode.
Cause	Grease, varnish, rust or dirt on the workpieces to be welded.
Solution	Clean the workpieces carefully before welding.
Cause	Grease, varnish, rust or dirt on the filler metal.
Solution	Always use quality materials and products. Keep the filler metal always in perfect condition.

Cause	Incorrect welding mode.
Solution	Carry out the correct sequence of operations for the type of joint to be welded.

Cause	Pieces to be welded have different characteristics.
Solution	Carry out buttering before welding.

### Cold cracks

Cause	Humidity in the filler metal.
Solution	Always use quality materials and products. Keep the filler metal always in perfect condition.
Cause	Particular geometry of the joint to be welded.
Solution	Pre-heat the pieces to be welded. Carry out post-heating. Carry out the correct sequence of operations for the type of joint to be welded.

**For any doubts and/or problems do not hesitate to contact your nearest customer service centre.**

## 6 WELDING THEORY

### 6.1 Manual Metal Arc welding (MMA)

#### Preparing the edges

To obtain good welding joints it is advisable to work on clean parts, free from oxidations, rust or other contaminating agents.

#### Choosing the electrode

The diameter of the electrode to be used depends on the thickness of the material, the position, the type of joint and the type of preparation of the piece to be welded.

Electrodes of large diameter obviously require very high currents with consequent high heat supply during the welding.

Type of coating	Property	Use
Rutile	Easy to use	All positions
Acid	High melting speed	Flat
Basic	High quality of joint	All positions

#### Choosing the welding current

The range of welding current related to the type of electrode used is specified by the manufacturer usually on the electrode packaging.

#### Striking and maintaining the arc

The electric arc is produced by scratching the electrode tip on the workpiece connected to the earth cable and, once the arc has been struck, by rapidly withdrawing the electrode to the normal welding distance.

Generally, to improve the arc striking behaviour a higher initial current is given in order to heat suddenly the tip of the electrode and so aid the arc establishing (Hot Start).

Once the arc has been struck, the central part of the electrode starts melting forming tiny globules which are transferred into the molten weld pool on the workpiece surface through the arc stream.

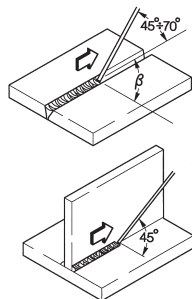
The external coating of the electrode is being consumed and this supplies the shielding gas for the weld pool, ensuring the good quality of the weld.

To prevent the molten material globules cause the extinguishing of the arc by short-circuiting and sticking the electrode to the weld pool, due to their proximity, a temporary increase of the welding current is given in order to melt the forming short-circuit (Arc Force).

If the electrode sticks to the workpiece, the short circuit current should be reduced to the minimum (antisticking).

#### Carrying out the welding

The welding position varies depending on the number of runs; the electrode movement is normally carried out with oscillations and stops at the sides of the bead, in such a way as to avoid an excessive accumulation of filler metal at the centre.



#### Removing the slag

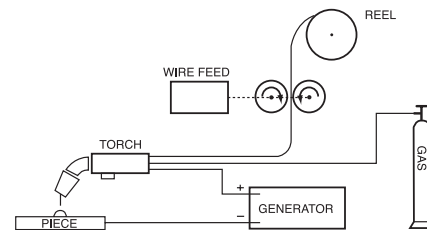
Welding using covered electrodes requires the removal of the slag after each run.

The slag is removed by a small hammer or is brushed away if friable.

### 6.2 Continuous wire welding (MIG/MAG)

#### Introduction

A MIG system consists of a direct current power source, wire feeder, wire spool, torch and gas.



MIG manual welding system

The current is transferred to the arc through the fusible electrode (wire connected to positive pole); in this procedure the melted metal is transferred onto the workpiece through the arc stream. The automatic feeding of the continuous filler material electrode (wire) is necessary to refill the wire that has melted during welding.

#### Methods

In MIG welding, two main metal transfer mechanisms are present and they can be classified according to the means by which metal is transferred from the electrode to the workpiece. The first one, defined "SHORT-ARC", produces a small, fast-solidifying weld pool where metal is transferred from the electrode to the workpiece only for a short period when the electrode is in contact with the weld pool. In this timeframe, the electrode comes into direct contact with the weld pool generating a short circuit that melts the wire which is therefore interrupted. The arc then turn on again and the cycle is repeated (Fig. 1a).

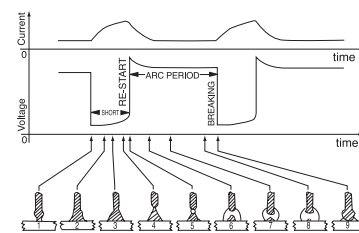


Fig. 1a

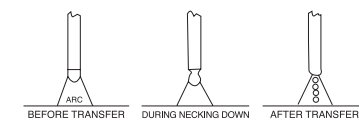


Fig. 1b

#### SHORT cycle (a) and SPRAY ARC welding (b)

Another mechanism for metal transfer is called the "SPRAY-ARC" method, where the metal transfer occurs in the form of very small drops that are formed and detached from the tip of the wire and transferred to the weld pool through the arc stream (Fig. 1b).

### Welding parameters

The visibility of the arc reduces the need for the user to strictly observe the adjustment tables as he can directly monitor the weld pool.

- The voltage directly affects the appearance of the bead, but the dimensions of the weld bead can be varied according to requirements by manually moving the torch to obtain variable deposits with constant voltage.
- The wire feeding speed is proportional to the welding current.

Fig. 2 and 3 show the relationships between the various welding parameters.

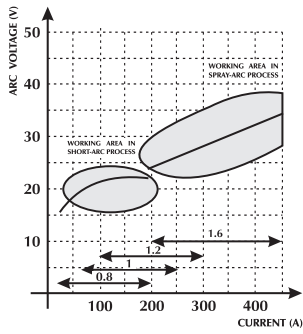


Fig. 2 Diagram for selection the of best working characteristic.

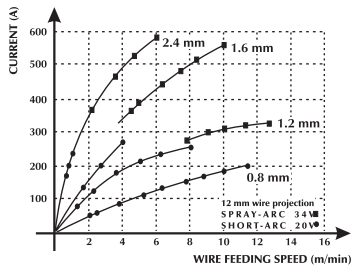
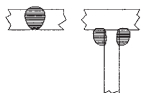
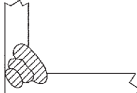

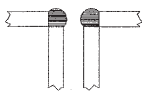

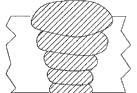






Fig. 3 Relationship between wire feeding speed and current amperage (melting characteristic) according to wire diameter.

**SELECTION GUIDE OF WELDING PARAMETERS WITH REFERENCE TO THE MOST TYPICAL APPLICATIONS AND MOST COMMONLY USED WIRES.**

Wire diameter - weight per metre				
Voltage arc (v)	0,8 mm	1,0-1,2 mm	1,6 mm	2,4 mm
<b>16 - 22</b> SHORT - ARC	Low penetration for thin materials  60 - 160 A	Good penetration and melting control  100 - 175 A	Good flat and vertical melting  120 - 180 A	Not used  150 - 200 A
<b>24 - 28</b> GLOBULAR-ARC (transition area)	Automatic fillet welding  150 - 250 A	Automatic welding with high voltage  200 - 300 A	Automatic welding downwards  250 - 350 A	Not used  300 - 400 A
<b>30 - 45</b> SPRAY - ARC	Low penetration with adjustment to 200 A  150 - 250 A	Automatic welding with multiple runs  200 - 350 A	Good penetration downwards  300 - 500 A	Good penetration, high deposit on thick materials  500 - 750 A

**Gases**

MIG-MAG welding is defined mainly by the type of gas used: inert for MIG welding (Metal Inert Gas), active for MAG welding (Metal Active Gas).

**- Carbon dioxide (CO<sub>2</sub>)**

Using CO<sub>2</sub> as a shielding gas, high penetrations and low operating cost are obtained with high feeding speed and good mechanical properties. On the other hand, the use of this gas creates considerable problems with the final chemical composition of the joints as there is a loss of easily oxidisable elements with simultaneous enrichment of carbon in the weld pool.

Welding with pure CO<sub>2</sub> also creates other types of problems such as excessive spatter and the formation of carbon monoxide porosity.

**- Argon**

This inert gas is used pure in the welding of light alloys whereas, in chrome-nickel stainless steel welding, it is preferable using argon with the addition of oxygen and CO<sub>2</sub> in a percentage of 2% as this contributes to the stability of the arc and improves the form of the bead.

**- Helium**

This gas is used as an alternative to argon and permits greater penetration (on thick material) and faster wire feeding.

**- Argon-Helium mixture**

Provides a more stable arc than pure helium, and greater penetration and travel speed than argon.

**- Argon-CO<sub>2</sub> and Argon-CO<sub>2</sub>-Oxygen mixture**


These mixtures are used in the welding of ferrous materials especially in SHORT-ARC operating mode as they improve the specific heat contribution. They can also be used in SPRAY-ARC. Normally the mixture contains a percentage of CO<sub>2</sub> ranging from 8% to 20% and O<sub>2</sub> around 5%.

## 7 TECHNICAL SPECIFICATIONS


	TERRA 320 MSE	TERRA 400 MSE	TERRA 500 MSE
Power supply voltage U1 (50/60Hz)	3x400V±15%	3x400V±15%	3x400V±15%
Zmax (@PCC) *	-	-	-
Slow blow line fuse	25A	30A	40A
Communication bus	DIGITAL	DIGITAL	DIGITAL
Maximum input power (kVA)	16.2kVA	22.0kVA	29.7kVA
Maximum input power (kW)	10.9kW	16.2kW	22.2kW
Power factor PF	0.68	0.74	0.74
Efficiency (μ)	88%	89%	90%
Cosp	0.99	0.99	0.99
Max. input current I1max	23.2A	31.5A	42.1A
Effective current I1eff	16.5A	22.3A	29.7A
MMA duty factor (40°C)			
(x=50%)	300A	400A	500A
(x=60%)	290A	360A	470A
(x=100%)	250A	340A	420A
MMA duty factor (25°C)			
(x=80%)	300A	400A	500A
(x=100%)	290A	360A	470A
MIG/MAG duty factor (40°C)			
(x=50%)	320A	400A	500A
(x=60%)	310A	360A	470A
(x=100%)	260A	340A	420A
MIG/MAG duty factor (25°C)			
(x=80%)	/	400A	500A
(x=90%)	320A	/	/
(x=100%)	310A	360A	470A
Adjustment range I2	3 ÷ 320A	3 ÷ 400A	3 ÷ 500A
MMA open circuit voltage Uo	61Vdc	61Vdc	61Vdc
MIG/MAG open circuit voltage Uo	61Vdc	61Vdc	61Vdc
IP Protection rating	IP23S	IP23S	IP23S
Insulation class	H	H	H
Dimensions (lxdxh)	620x240x460mm	620x240x460mm	620x240x460mm
Weight	20.2kg.	22.5kg.	27.3kg.
Manufacturing Standards	EN 60974-1/EN 60974-10	EN 60974-1/EN 60974-10	EN 60974-1/EN 60974-10
Power supply cable	4x2.5mm <sup>2</sup>	4x4mm <sup>2</sup>	4x6mm <sup>2</sup>
Length of power supply cable	5m	5m	5m


### TERRA 320 MSE

\* This equipment complies with EN/IEC 61000-3-11.

\*  This equipment does not comply with EN/IEC 61000-3-12. If it is connected to a public low voltage system, it is the responsibility of the installer or user of the equipment to ensure, by consultation with the distribution network operator if necessary, that the equipment may be connected. (Consult the "Electromagnetic fields & interferences" - "EMC equipment classification in accordance with EN/IEC 60974-10" section).









### TERRA 400-500 MSE









\*  This equipment complies with EN/IEC 61000-3-11 if the maximum permissible mains impedance at the interface point to the public grid (point of common coupling, PCC) is smaller than or equal to the Zmax stated value. If it is connected to a public low voltage system, it is the responsibility of the installer or user of the equipment to ensure, by consultation with the distribution network operator if necessary, that the equipment may be connected.









\*  This equipment does not comply with EN/IEC 61000-3-12. If it is connected to a public low voltage system, it is the responsibility of the installer or user of the equipment to ensure, by consultation with the distribution network operator if necessary, that the equipment may be connected. (Consult the "Electromagnetic fields & interferences" - "EMC equipment classification in accordance with EN/IEC 60974-10" section).



## 8 Rating plate

		SELCO S.R.L. Via Palladio,19 - ONARA (PADOVA) - ITALY			
Type TERRA 320 MSE		N°			
		EN 60974-1 EN 60974-10 Class A			
	---	3A/10V - 320A/30V			
		X <sub>(40°C)</sub>	50%	60%	100%
	U <sub>0</sub> V	I <sub>2</sub>	320A	310A	260A
	61	U <sub>2</sub>	30V	29.5V	27V
	---	3A/20V - 300A/32V			
		X <sub>(40°C)</sub>	50%	60%	100%
	U <sub>0</sub> V	I <sub>2</sub>	300A	290A	250A
	61	U <sub>2</sub>	32V	31.6V	30V
	3~	U <sub>1</sub>	V	I <sub>1max</sub>	A
	50/60 Hz	400		23.2	16.5
IP 23 S					

		SELCO S.R.L. Via Palladio,19 - ONARA (PADOVA) - ITALY			
Type TERRA 400 MSE		N°			
		EN 60974-1 EN 60974-10 Class A			
	---	3A/14V - 400A/34V			
		X <sub>(40°C)</sub>	50%	60%	100%
	U <sub>0</sub> V	I <sub>2</sub>	400A	360A	340A
	61	U <sub>2</sub>	34V	32V	31V
	---	3A/20V - 400A/36V			
		X <sub>(40°C)</sub>	50%	60%	100%
	U <sub>0</sub> V	I <sub>2</sub>	400A	360A	340A
	61	U <sub>2</sub>	36V	34.4V	33.6V
	3~	U <sub>1</sub>	V	I <sub>1max</sub>	A
	50/60 Hz	400		31.5	22.3
IP 23 S					

		SELCO S.R.L. Via Palladio,19 - ONARA (PADOVA) - ITALY			
Type TERRA 500 MSE		N°			
		EN 60974-1 EN 60974-10 Class A			
	---	3A/10V - 500A/39V			
		X <sub>(40°C)</sub>	50%	60%	100%
	U <sub>0</sub> V	I <sub>2</sub>	500A	470A	420A
	61	U <sub>2</sub>	39V	37.5V	35V
	---	3A/20V - 500A/40V			
		X <sub>(40°C)</sub>	50%	60%	100%
	U <sub>0</sub> V	I <sub>2</sub>	500A	470A	420A
	61	U <sub>2</sub>	40V	38.8V	36.8V
	3~	U <sub>1</sub>	V	I <sub>1max</sub>	A
	50/60 Hz	400		42	29.7
IP 23 S					

 European product



Do not dispose of electrical equipment together with normal waste!  
In observance of European Directive 2002/96/EC on Waste Electrical and Electronic Equipment and its implementation in accordance with national law, electrical equipment that has reached the end of its life must be collected separately and returned to an environmentally compatible recycling facility. As the owner of the equipment, you should get information on approved collection systems from our local representative.  
By applying this European Directive you will improve the environment and human health!

## 9 Meaning of power source rating plate

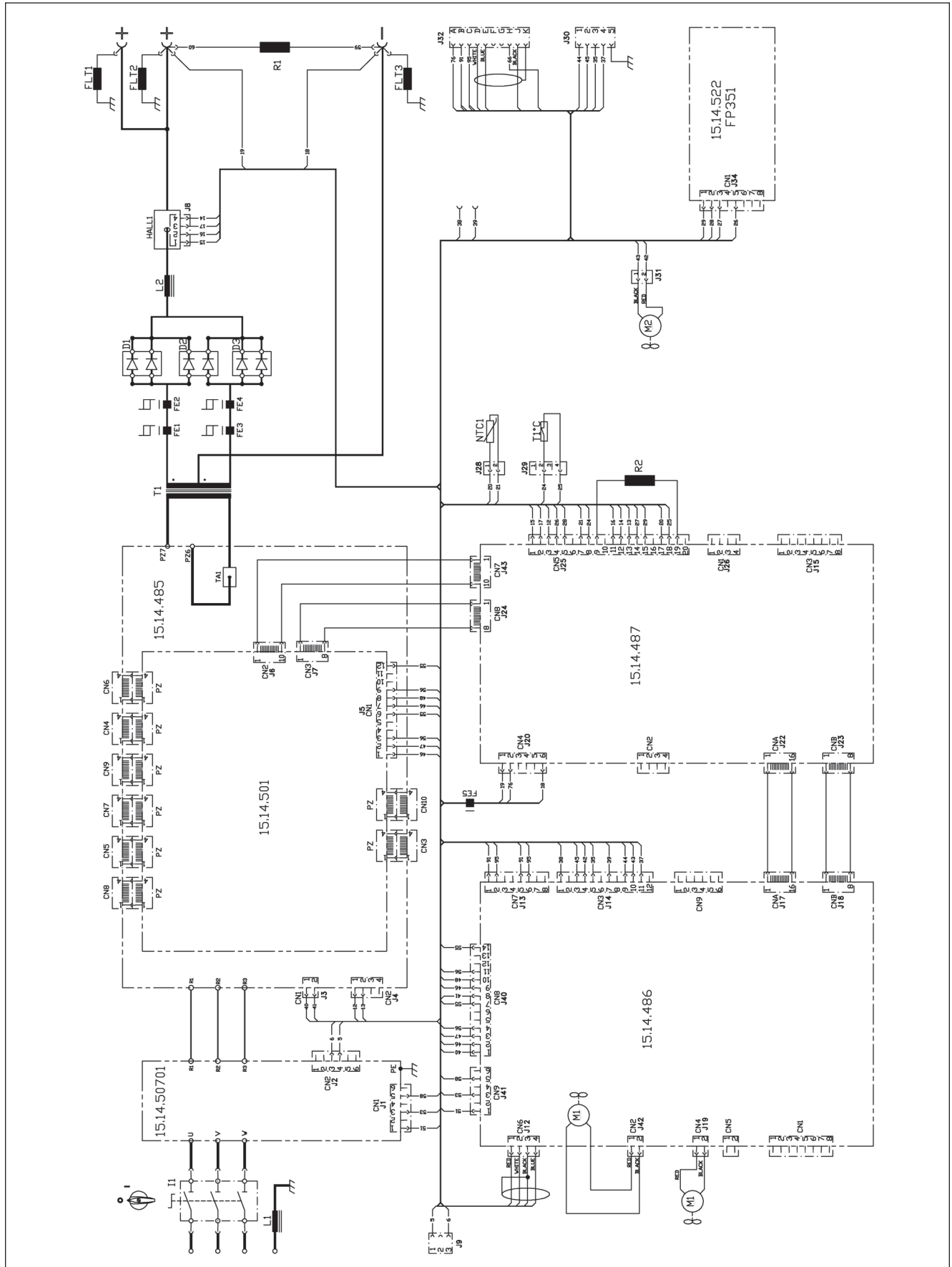
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<b>3</b>		<b>4</b>			
<b>5</b>		<b>6</b>			
<b>7</b>	<b>9</b>	<b>11</b>			
<b>8</b>	<b>10</b>	<b>12</b>	<b>15</b>	<b>16</b>	<b>17</b>
		<b>13</b>	<b>15 A</b>	<b>16 A</b>	<b>17 A</b>
		<b>14</b>	<b>15 B</b>	<b>16 B</b>	<b>17 B</b>
<b>7</b>	<b>9</b>	<b>11</b>			
<b>8</b>	<b>10</b>	<b>12</b>	<b>15</b>	<b>16</b>	<b>17</b>
		<b>13</b>	<b>15 A</b>	<b>16 A</b>	<b>17 A</b>
		<b>14</b>	<b>15 B</b>	<b>16 B</b>	<b>17 B</b>
<b>18</b>	<b>19</b>	<b>20</b>	<b>21</b>		
<b>22</b>					

### ENGLISH

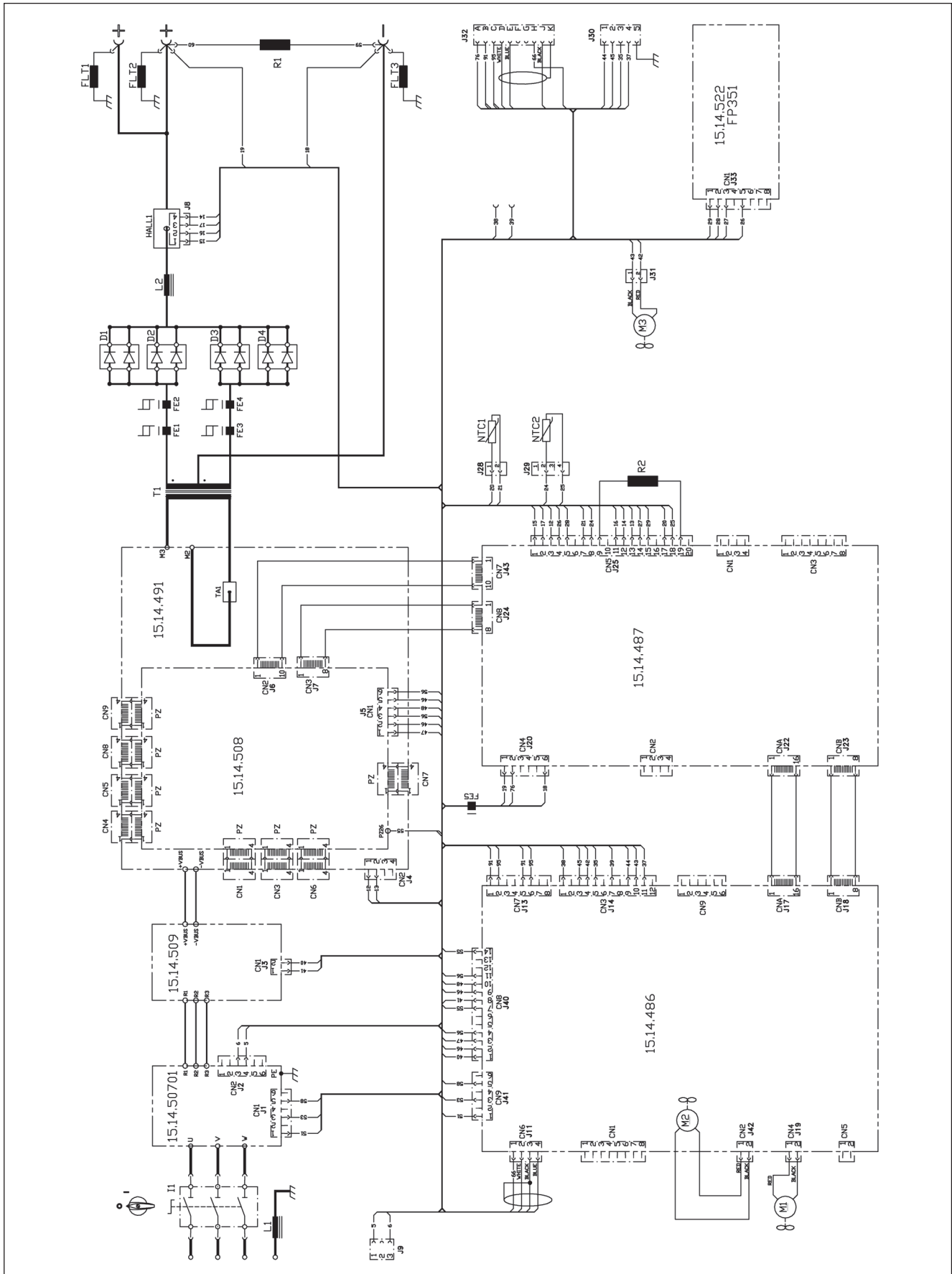
1. Trademark
2. Name and address of manufacturer
3. Machine model
4. Serial no.
5. Welding unit symbol
6. Reference to construction standards
7. Welding process symbol
8. Symbol for equipments suitable for operation in environments with increased electrical shock risk
9. Welding current symbol
10. Rated no load voltage
11. Max-Min current range and corresponding conventional load voltage
12. Intermittent cycle symbol
13. Rated welding current symbol
14. Rated welding voltage symbol
- 15-16-17 Intermittent cycle values
- 15A-16A-17A Rated welding current values
- 15B-16B-17B Conventional load voltage values
18. Power supply symbol
19. Rated power supply voltage
20. Maximum rated power supply current
21. Maximum effective power supply current
22. Protection rating

10 Diagram

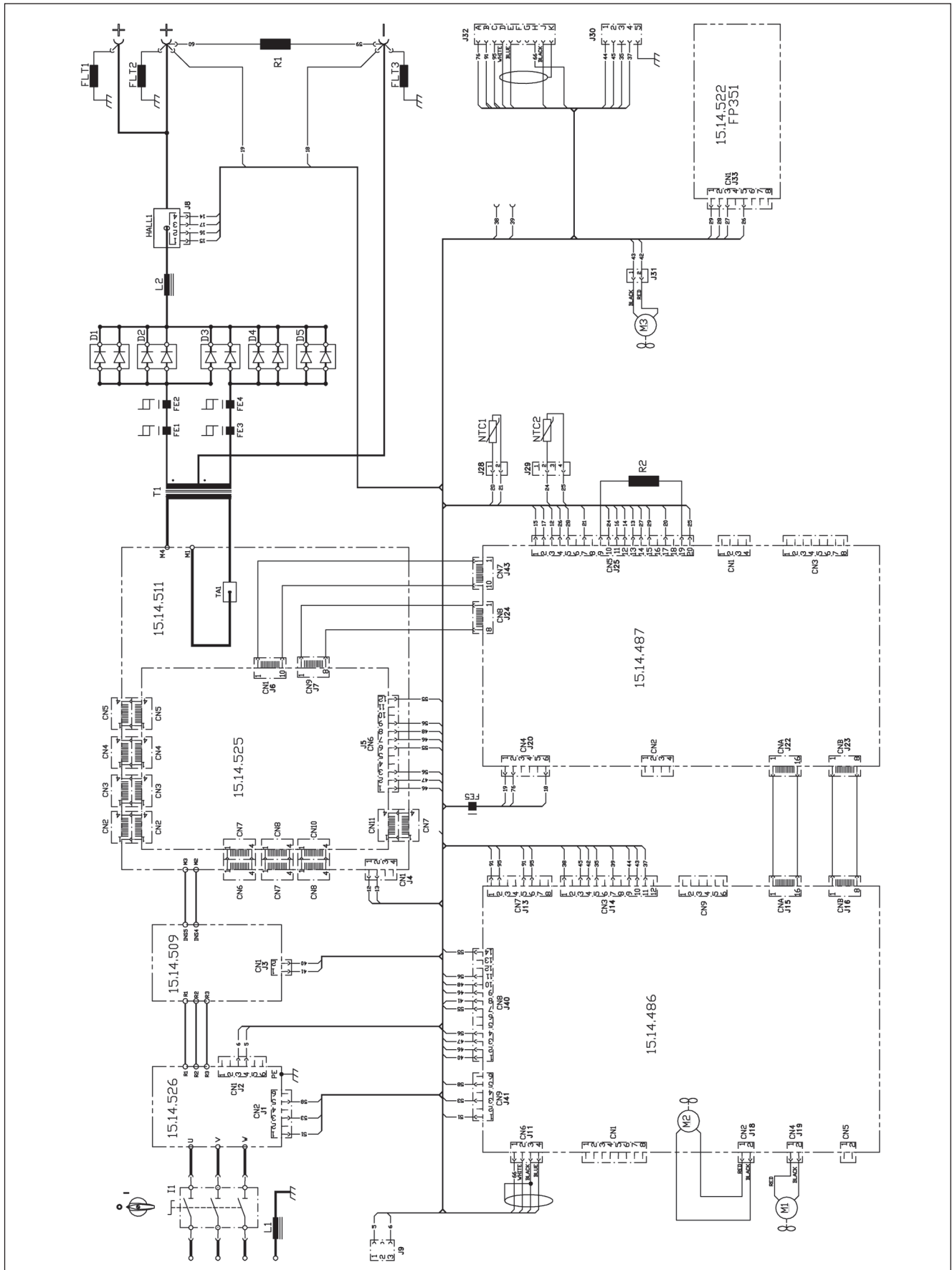
TERRA 320 MSE



TERRA 400 MSE

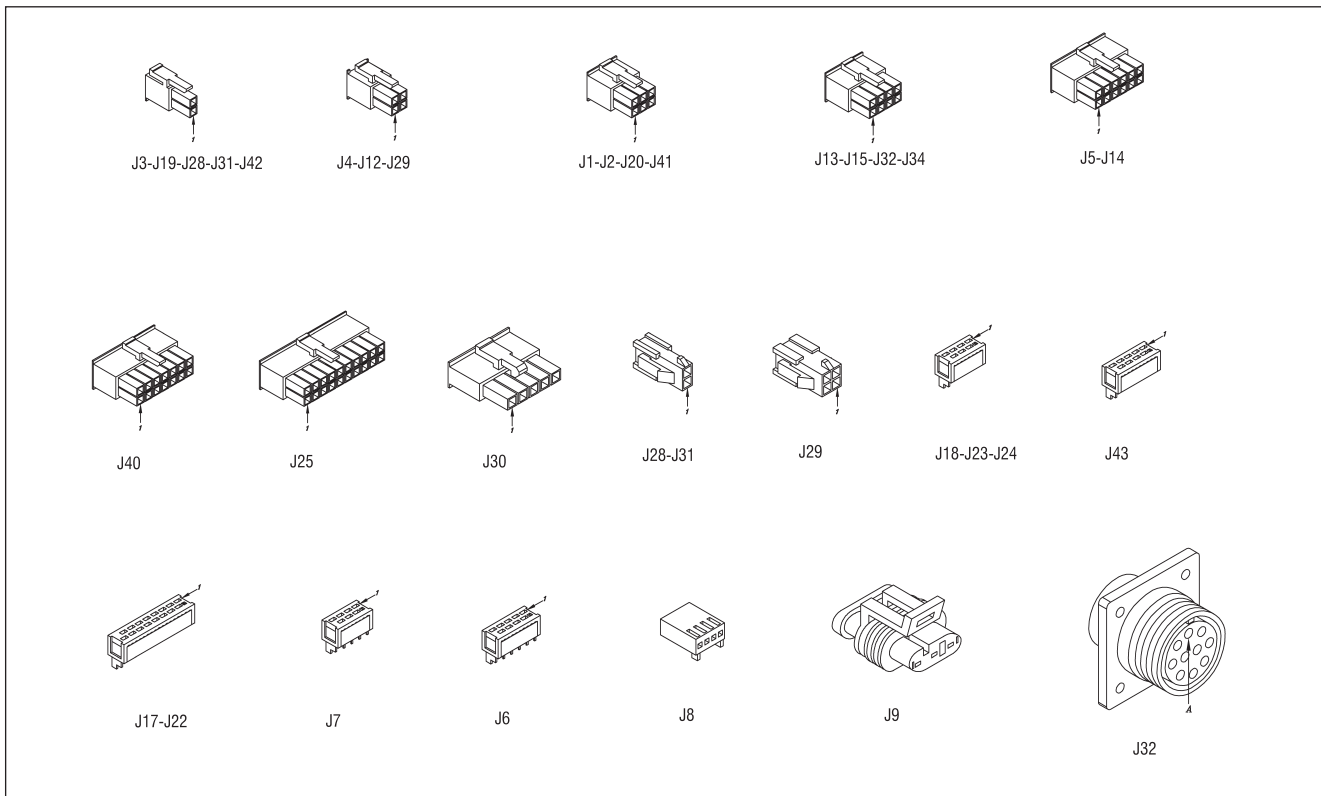


TERRA 500 MSE

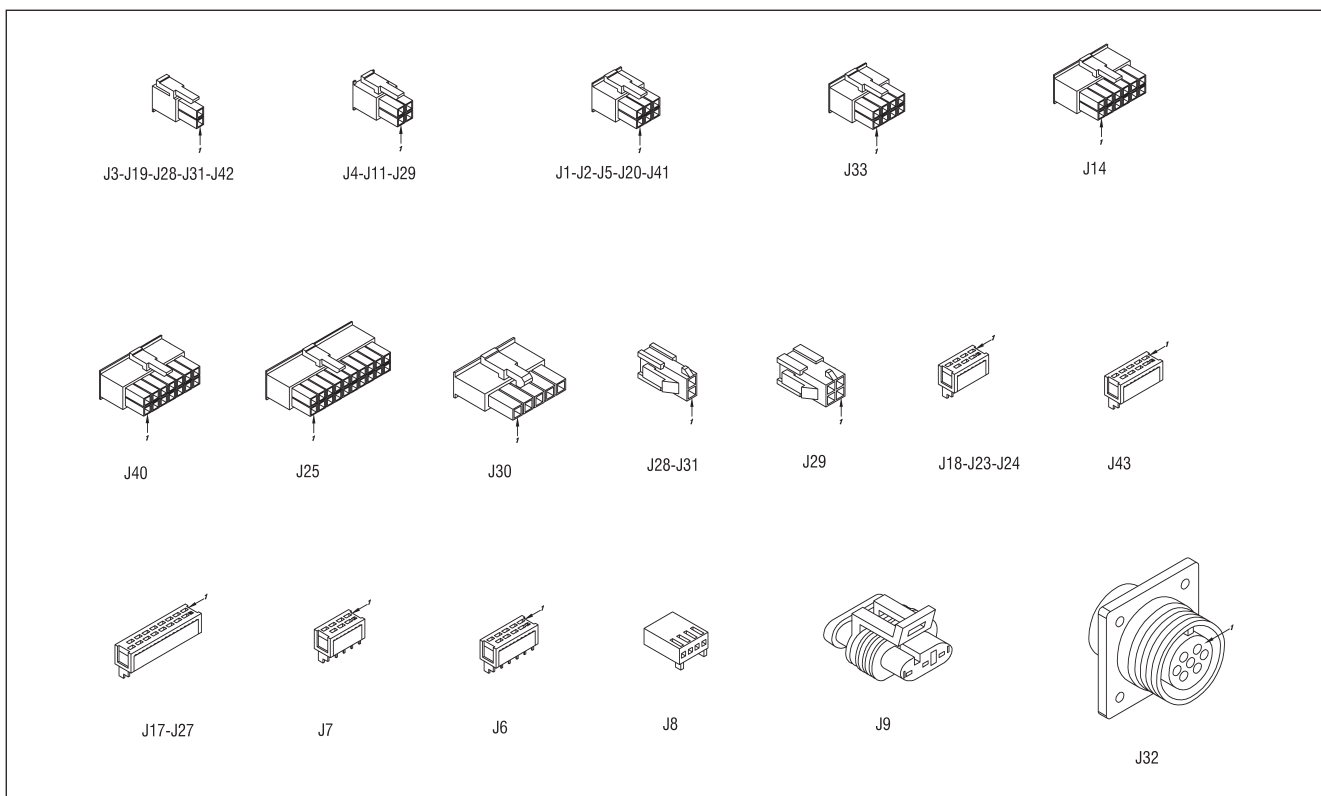


## 11 Connectors

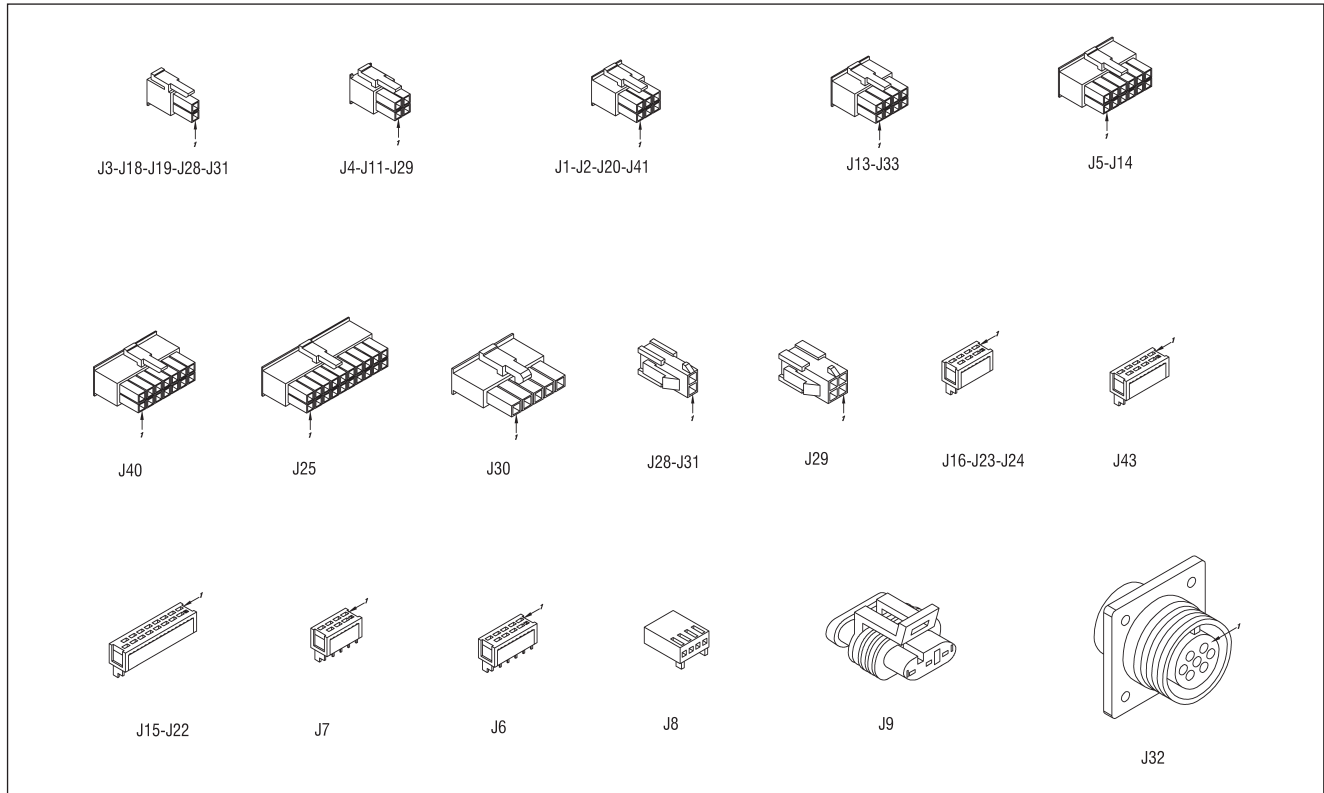
### TERRA 320 MSE



### TERRA 400 MSE

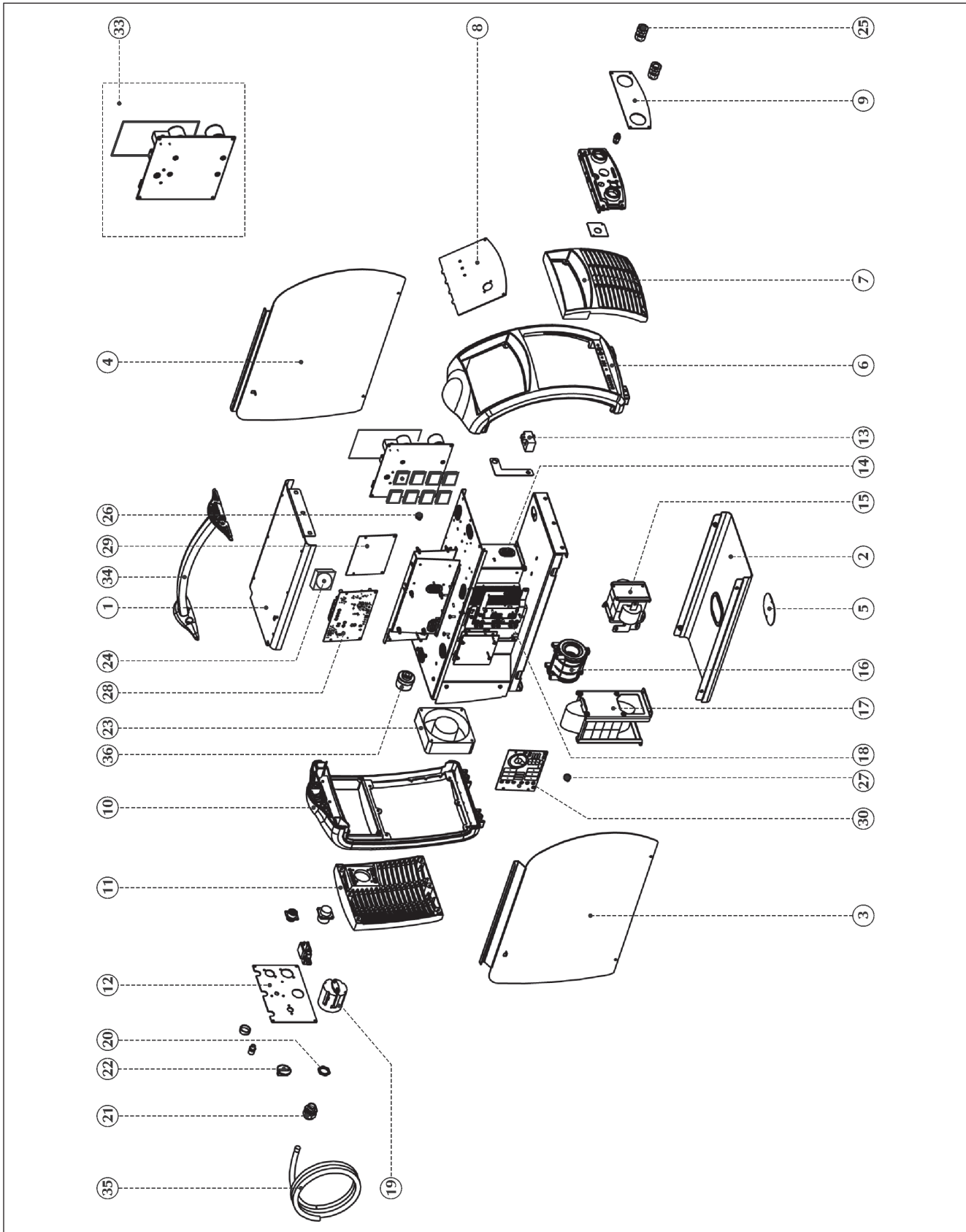


TERRA 500 MSE



## 12 Spare parts list

55.13.005 TERRA 320 MSE  
 55.13.006 TERRA 400 MSE  
 55.13.007 TERRA 500 MSE





POS. CODE	ENGLISH
1	Wraparound-upper cover (metal)
2	Base (metal)
3	Side panel - R
4	Side panel - L
	T 320 MSE
	T 400 MSE
	T 500 MSE
5	Cover
6	Front frame (plastic)
7	Front grid (plastic)
8	Control panel FP351
9	Front plate
10	Rear frame (plastic)
11	Rear grid (plastic)
12	Rear nameplate
	T 320 MSE
	T 400/500 MSE
13	Current sensor – 500A
14	Power transformer
15	Output choke
	T 320 MSE
	T 400 MSE
	T 500 MSE
16	Output choke
	T 320 MSE
	T 400/500 MSE
17	Cable clamp
	T 320 MSE
	T 400/500 MSE
18	Diode
19	Switch - 3 poles
	T 320 MSE
	T 400/500 MSE
20	Blocking nut
	T 320 MSE
	T 400/500 MSE
21	Blocking nut
	T 320 MSE
	T 400/500 MSE
22	Cable clamp
	T 320 MSE
	T 400/500 MSE
23	Knob
24	Fan
25	Fan
26	Current socket (panel) 70-95mm <sup>2</sup>
27	Thermal sensor
	T 400/500 MSE
28	Thermal sensor
	T 320 MSE
29	P.C. board
30	P.C. board
	T 320/400 MSE
	T 500 MSE
33	Power pc-board - spare kit
	T 320 MSE
	T 400 MSE
	T 500 MSE
34	Power pc-board - spare kit
	T 320 MSE
	T 400 MSE
	T 500 MSE
35	Handle kit
	T 320 MSE
	T 400 MSE
	T 500 MSE
36	Input line cord
	T 400 MSE
	T 500 MSE
	Current socket (panel) 70-95mm <sup>2</sup>
*	Thermal compound
*	Power cable 70mm <sup>2</sup>
*	Wiring (cable bundle)
*	Copper bus bar kit
*	Copper bus bar kit
*	Copper bus bar kit
*	Copper bus bar kit
*	Wiring (capacitor filter)
*	"A" instruction manual
*	"B" instruction manual

"A" = IT-CB-DE-FR-ES-NL-DK-FI-SE-NO-GR-PT

"B" = CZ-PL-RU-TR-RO-BG-SK

