IMPORTANT: BEFORE STARTING THE EQUIPMENT, READ THE CONTENTS OF THIS MANUAL, WHICH MUST BE STORED IN A PLACE FAMILIAR TO ALL USERS FOR THE ENTIRE OPERATIVE LIFE-SPAN OF THE MACHINE. THIS EQUIPMENT MUST BE USED SOLELY FOR WELDING OPERATIONS.

1 SAFETY PRECAUTIONS

WELDING AND ARC CUTTING CAN BE HARMFUL TO YOURSELF AND OTHERS. The user must therefore be educated against the hazards, summarized below, deriving from welding operations. For more detailed information, order the manual code 3.300.758

ELECTRIC SHOCK - May be fatal.
- Install and earth the welding machine according to the applicable regulations.
- Do not touch live electrical parts or electrodes with bare skin, gloves or wet clothing.
- Isolate yourselves from both the earth and the work-piece.
- Make sure your working position is safe.

FUMES AND GASES - May be hazardous to your health.
- Keep your head away from fumes.
- Work in the presence of adequate ventilation, and use ventilators around the arc to prevent gases from forming in the work area.

ARC RAYS - May injure the eyes and burn the skin.
- Protect your eyes with welding masks fitted with filtered lenses, and protect your body with appropriate safety garments.
- Protect others by installing adequate shields or curtains.

RISK OF FIRE AND BURNS
- Sparks (sprays) may cause fires and burn the skin; you should therefore make sure there are no flammable materials in the area, and wear appropriate protective garments.

NOISE
- This machine does not directly produce noise exceeding 80dB. The plasma cutting/welding procedure may produce noise levels beyond said limit; users must therefore implement all precautions required by law.

PACEMAKERS
- The magnetic fields created by high currents may affect the operation of pacemakers. Wearers of vital electronic equipment (pacemakers) should consult their physician before beginning any arc welding, cutting, gouging or spot welding operations.

EXPLOSIONS
- Do not weld in the vicinity of containers under pressure, or in the presence of explosive dust, gases or fumes. • All cylinders and pressure regulators used in welding operations should be handled with care.

2 GENERAL DESCRIPTIONS

2.1 SPECIFICATIONS

This welding machine is a power source made using INVERTER technology, suitable for synergic pulsed MIG/MAG welding, non-pulsed synergic MIG/MAG, conventional MIG/MAG. The equipment may be used only for the purposes described in the manual. The equipment must not be used to defrost pipes.

2.2 EXPLANATION OF TECHNICAL SPECIFICATIONS

IEC 60974.1 The welding machine is manufactured according to these international standards EN 50199 Serial number. Must be indicated on any request regarding the welding machine.

MIG Suitable for MIG welding.

U0. Secondary open-circuit voltage.
X. Duty cycle percentage

The duty cycle expresses the percentage of 10 minutes during which the welding machine may run at a certain current without overheating.

I2. Welding current
U2. Secondary voltage with current I2
U1. Rated supply voltage

1~ 50/60Hz 50- or 60-Hz single-phase power supply

I1 Max Max. absorbed current at the corresponding current I2 and voltage U2.
I1 eff This is the maximum value of the actual current absorbed, considering the duty cycle. This value usually corresponds to the capacity of the fuse (delayed type) to be used as a protection for the equipment.

IP23 C. Protection rating for the housing.

Grade 3 as the second digit means that this equipment is suitable for use outdoors in the rain. The additional letter C means that the equipment is protected against access to the live parts of the power circuit by a tool (diameter 2.5 mm).

Suitable for use in high-risk environments.

NOTE: The welding machine has also been designed for use in environments with a pollution rating of 3. (See IEC 664).
2.3 PROTECTIONS

2.3.1 Block protection
In the event of a malfunction, a number with the following meaning may appear on the display G:
52 = Start button pressed during start-up.
53 = Start button pressed during thermostat reset.
56 = Extended short-circuit between the welding electrode and the material to be welded.
Shut the machine off and turn it back on.
If different numbers appear on the display, contact technical service.

2.3.2 Mechanical protection (safety button)
When the movable side is opened, this activates the safety button which prevents operation of the welding machine. This protection, indicated when the flashing message "OPn" appears on display G, avoids hazardous situations when the operator replaces the roller of the wire feeder unit or the welding electrode.

2.3.3 Thermal protection
This machine is protected by a thermostat, which prevents the machine from operating if the allowable temperatures are exceeded. In these conditions the fan continues to operate and the display G flashes the abbreviation "OPn".

3 INSTALLATION

Make sure that the supply voltage matches the voltage indicated on the specifications plate of the welding machine.
Mount a plug with an adequate capacity for the supply cable, making sure that the yellow/green conductor is connected to the earth pin.
The capacity of the overload cutout switch or fuses installed in series with the power supply must be equivalent to the absorbed current I1 of the machine.

3.1 START-UP

The machine must be installed by skilled personnel. All connections must be carried out according to current regulations, and in full observance of safety laws (regulation CEI 26-10 - CENELEC HD 427)

3.2 CONTROLS ON THE FRONT PANEL.

A- Yellow Hold LED
Signals that the current shown on display G is the one actually used in welding. Activated at the end of each welding session.
**B - Wire speed adjustment knob.**

By adjusting this knob:

- when conventional programs are used, the display G shows the speed in meters per minute.
- when synergic programs are used (pulsed or conventional), the display G shows the current at which welding will take place.
- when pulsed synergic programs are used, the display Q shows, for approximately 2 seconds, the recommended thickness for the current being set; after which it returns to displaying the number of the selected welding program.

**C - Green LED.**

Signals activation of the spot or dash welding mode when lit together with LED M.

**D - Setting knob.**

This knob adjusts the spot welding or working time during dash welding.

**E - Central adapter**

This is where the welding torch is to be connected.

**F - Earth socket**

Grounding cable socket.

**G - 3-digit display**

This display shows:

- when selecting synergic programs (button R), the type of material corresponding to the program selected (FE = Iron, AL = Aluminium, SS = Stainless steel).
- in conventional programs, before welding, the wire speed and current after welding.
- in synergic programs, before welding, the speed or preset current, and after welding the actual current used.
- in conventional and pulsed or conventional synergic programs, the variations in arc length (knob I) and variations in impedance (knob P) from the recommended zero position.
- the abbreviation "OPn" (flashing) if the motor compartment door is opened.
- the message "OPn" (flashing) if the thermostat is tripped.
- in the service functions (see chapter 5 for further clarification) displays the messages: DSP, J ob, PrF, PoF, Acc, bb, HSA, SC, Len, Sio, 3L, CrC, 2-4, Fdp, Hzo.
- in the memory menu the letter P followed by two digits representing the memory number. Read chapter 6 for further clarification.

**H - Green LED.**

Signals that the program used for welding is pulsed synergic.

**I - Setting knob.**

Adjusts the welding voltage in conventional programs. Range from 1 to 10

In synergic and pulsed synergic programs, the indicator of this knob must be set to the "SYNERGIC " symbol in the center of the setting range; this symbol represents the setting recommended by the manufacturer. Adjusting this knob allows you to correct the arc length value. Changes to this figure, greater than or less than the "SYNERGIC " setting, are shown on the display G, which will show the previous size 2 seconds after the last correction.

**L - Green LED.**

Indicates that continuous welding mode is activated.

**M - Green LED.**

Indicates that dash welding mode is activated. It lights together with LED C.

**N - Setting knob.**

This knob adjusts the pause time between spot welds.

**O - Key.**

Pressing and releasing this key increases the numerical value of the display Q. When pressed together with the key R, allows selection of the service and memory functions and saves programs. (See chapter 6)

**P - Setting knob.**

In conventional programs adjustment from 1 to 10

This knob adjusts the impedance value. For each synergic program, the optimum value is position 0. The machine automatically sets the correct impedance value based on the program selected. The operator may correct the set value: adjusting the potentiometer towards + will produce warmer, less penetrating welds, while vice-versa adjusting towards - will produce colder and more penetrating welds.

When welding with a synergic program, adjusting + or - from the central 0 may require corrections to the working voltage using the potentiometer I. The variation is shown on the display G, which shows the previous setting 2 seconds after the last correction.

**Q - 2-digit display.**

This display shows:

- the number of the selected program.
- for 2 seconds, the value of the thickness when knob B is adjusted in pulsed synergic programs.
- within the service functions, the numerical value of the figure shown on the display G or the messages "On, OF, Au, A, SP, 0, 1, 2, 4". Read chapter 5 for further clarification.
- in the memory menu, indicates the program number to which the memory save or recall refers. Read chapter 6 for further clarification.

**R - Key.**

Pressing and releasing this key reduces the numerical value of the display Q. When pressed together with key O, it allows the user to select the service and memory functions. (See chapters on the functions listed)

**S - 10-pin connector.**

This connector must be connected to the 10-pin male of the Pull 2003 torch.
3.3 CONTROLS ON THE REAR PANEL

- **T** - Gas hose fitting.
- **U** - Switch.
  Turns the machine on and off.
- **V** - Points for attaching the 15Kg coil kit Art. 128.
- **X** - Fuse holder.
- **Y** - Power cord socket.
- **Z** - Pressure switch socket.

3.4 CONNECTOR TYPE DB9 (RS 232)  (Fig. 3)
To be used for updating the microprocessor programs.

4 WELDING

4.1 START-UP

Make sure that the wire diameter corresponds to the diameter indicated on the wire feeder roller, and that the selected program is compatible with the material and type of gas. Use wire feeder rollers with a "U"-shaped groove for aluminum wires, and with a "V"-shaped groove for other wires.

4.1.1 Connecting the gas hose

The gas cylinder must be equipped with a pressure regulator and flow gauge. If the cylinder is placed on the cylinder shelf of the trolley, it must be fastened using the strap provided. Connect the gas hose leaving the rear of the machine to the pressure regulator, only after positioning the cylinder. The gas flow must be adjusted to approximately 8-10 liters per minute.

4.2 THE MACHINE IS READY TO WELD

When using the Pull-2003 type torch, follow the instructions enclosed with the torch.
- Connect the earth clamp to the workpiece.
- Set the switch **U** to 1.
- Choose the program to be used from the list provided in an envelope on the mobile side panel (Fig. 4).

- Display the number corresponding to the program on display **Q** using the keys **O** and **R**.
- If a pulsed synergic program is used, turn the knob **B** until the display **Q** shows the thickness you will be using. At the same time the display **G** shows the current for the selected thickness.
- If a synergic program is used, make sure that the indicator of the knobs **I** and **P** show the message "SYNER-GIC" and the scale zero, respectively.
- Remove the gas nozzle.
- Unscrew the contact tip.
- Insert the wire in the wire liner of the torch, making sure that it is inside the roller groove and that the roller is in the correct position. Then close the door.
- Press the torch trigger to move the wire forward until it comes out of the torch. **Caution:** keep your face away from the gun tube assembly while the wire is coming out.
- Screw the contact tip back on, making sure that the hole diameter is the same as that of the wire used.
- Assemble the gas nozzle.
- Open the cylinder.
4.3 WELDING CARBON STEEL

In order to weld these materials you must:
- Use a welding gas with a binary composition, usually ARGON + CO2 with percentages of Argon ranging from 75% upward. With this blend, the welding bead will be well jointed and attractive.
- Use a welding wire of the same quality as the steel to be welded. It is best to always use good quality wires, avoiding welding with rusted wires that could cause welding defects.
- Avoid welding rusted parts, or those with oil or grease stains.
- Keep the welding area clean at all times, to avoid contaminating the joint to be welded.

4.4 WELDING STAINLESS STEEL

Series 300 stainless steels must be welded using a protection gas with a high Argon content, containing a small percentage of O2 or carbon dioxide CO2 (approximately 2%) to stabilize the arc. Do not touch the wire with your hands. It is important to keep the welding area clean at all times, to avoid contaminating the joint to be welded.

4.5 WELDING ALUMINUM

In order to weld aluminum you must use:
- Pure Argon as the protection gas.
- A welding wire with a composition suitable for the base material to be welded.
- Use mills and brushing machines specifically designed for aluminum, and never use them for other materials.
- For welding aluminum you must use the torch: PULL 2003 Art. 2003.

5 SERVICE FUNCTIONS

The abbreviations of these functions are shown on the display G. From within this menu, the operator may customize the machine according to his needs. To enter these functions press the key R and, while holding it down, briefly press and release the key O; release the key R when the message "dSp" appears. The same movement is used to exit these functions and return to the welding programs.

Press the torch trigger to switch from one function to another. Exiting the service functions confirms the changes made. CAUTION: Welding is not possible from within the service functions.

5.1 DESCRIPTION OF THE FUNCTIONS

- dSp (display)
  Active only in pulsed synergic welding programs.
  The display Q reads "A," which means that the display G in normal conditions displays the Amperes. Pressing the key O causes display Q to show SP (speed). This selection, in welding conditions, will make display G show the wire speed in meters per minute.

NOTE: The speed will be shown before welding, because after welding the display G shows the current used and LED A remains lit.

- Job
  Active in all welding programs.
  The display Q reads "0", LED L is lit, and the machine is ready for continuous welding.
  Pressing the key O causes LED L to shut off, and display Q reads "1"; LEDs C and M light, and the machine is ready for dash welding.
  Pressing the key O again makes the display Q read "2"; LED M shuts off and LED C remains lit, indicating that the machine is ready for spot-welding.

- 2 - 4 (manual-automatic)
  The display Q shows the number 2 = two-stage = manual welding
  If the key O is pressed, display Q shows the number 4 = 4-stage = Automatic.

- (HSA) Automatic Hot Start
  Active only in pulsed synergic welding programs.
  Caution: If the function HSA is activated, the function 3L is automatically not included.
  Display Q shows the message OF =OFF = Off.
  Pressing the key O causes the display Q to show the message On = Active.
  If this function is activated, pressing the torch trigger causes the following messages to appear in sequence:
  -SC (Start current)
    Range 1-20 (10-200%) of the wire speed corresponding to the welding current set using knob B in the welding programs. Manufacturer setting 13 (130%). Changed using keys O and R.
  -Len (Duration)
    This is the duration, expressed in seconds, of the previously displayed start current.
    Range 0.1-10 sec., manufacturer setting 0.7.
    Changed using keys O and R.
  -Slo (Slope)
    Range 0.1-10 sec., manufacturer setting 0.5.
    Defines the interface time between the first current (SC) and the welding current set using knob B in the welding programs.
  How it works in practice:
  Welding takes place in manual mode (two stages). The operator begins welding with the current corresponding to the percentage greater than or less than the wire speed set in SC (in this specific instance, 30% higher). This current will have a duration, in seconds, corresponding to the time set in Len (in this specific instance, 0.7 sec), after which the current will drop to the current set using knob B (welding) in the time set with Slo (in this specific instance, 0.5 sec). We recommended this function for spot welding sheet aluminum.

If this function is not activated, pressing the torch trigger activates the function:
- 3L (three levels)
  Active in pulsed synergic curves
  Caution: If the function 3L is activated, the function...
HSA is automatically not included.
Display Q shows the message OF = OFF = Off
Pressing the key O causes the display Q to show the message ON = Active.
If this function is activated, pressing the torch trigger causes the following messages to appear in sequence.

- SC (Start current)
  Range 1-20 (10-200%) of the wire speed corresponding to the welding current set using knob B in the welding programs. Manufacturer setting 13 (130%).
  Changed using keys O and R.

- Slo (Slope)
  Range 0.1-10 sec., manufacturer setting 0.5.
  Changed using keys O and R.
  Defines the interface time between the first current (SC) and the welding current set using the knob B in the welding programs, and between the welding current and the third "crater filler" current CrC.

- CrC "Crater filler" current
  Range 1-20 (10-200%) of the wire speed corresponding to the welding current set using knob B in the welding programs. Manufacturer setting 6 (60%).
  Changed using keys O and R.

How it works in practice:
Welding takes place in automatic mode, thus the execution times are decided by the operator.
Especially recommended for MIG welding of aluminium.
Three currents are available, which may be called up during welding using the torch start button.
Welding begins when the torch button is pressed. The welding current used will be the one set using the SC function (in this specific instance 13 = 130%). This current will be kept for as long as the torch trigger is held down; when released, the first current changes to the welding current, set with the knob B, within the time established by the Slo function (in this specific instance, 0.5 sec.), and will be kept until the torch trigger is pressed again. The next time the torch trigger is pressed, the welding current will switch to the third or "crater-filler" current CrC (in this specific instance, 6 = 60%), in the time established by the function Slo (in this specific instance, 0.5 sec), and will be maintained as long as the torch trigger is held down. Welding stops when the trigger is released.
If this function is not activated, pressing the torch trigger activates the next function.

- PrF (Pre-gas)
  Active in all welding programs.
  Range 0.0 - 9.9 sec. Setting 0.1 sec. Changed using keys O and R.

- PoF (post-gas)
  Active in all welding programs.
  Range 0.1 - 9.9 sec. Setting 3.0 sec. Changed using keys O and R.

- Acc (Soft Start)
  Active only in pulsed synergic welding programs.
  Range Auto - 1-99%
  This is the wire speed, expressed as a percentage of the speed set for the welding, before the wire touches the workpiece.

Note: This adjustment is important in order to always achieve good starts.
Manufacturer setting "Au" automatic.
Changed using keys O and R. If, after changing, you wish to return to the manufacturer setting, press keys O and R simultaneously until the abbreviation "Au" appears on display Q.

- bb (Burn-back)
  Active in all welding programs.
  Range 00 - 99. Manufacturer setting "Au" automatic.
  Serves to adjust the length of the wire leaving the gas nozzle after welding. The higher the number, the more the wire burns.

- PPF (Push Pull Force)
  Adjusts the drive torque of the push-pull torch motor.
  Serves to make the wire advance in a linear fashion.
  Range 9/-9, manufacturer setting 0.
  Changed using keys O and R.

- Fdp (Double pulse)
  The display G shows the abbreviation Fdp (double pulse frequency).
  The display Q reads OFF.
  Press the O key to select the working frequency (adjustment from 0.5 to 5 Hz).
  The selected value is shown on the display Q.

Once the Fdp working frequency has been adjusted, pressing the torch trigger will cause the following to appear:

- ddP (difference in meters/minute of the double pulse).
  Turn the knob Q to select the meters per minute (range from 0.1 to 3m/min) that will be added to and subtracted from the reference speed (default 1m/min).
  The selected value is shown on the display Q.

- bdP
  This is the duration of the highest wire speed, thus the highest current. It is expressed as a percentage of the time gained from the Fdp frequency (see figure 5).
  Press the O key to adjust the percentage.
  Range between 25 and 75% (default 50%).

- AdP (arc length of the highest current).
  Press the O key to adjust from -9.9 to 9.9 (default 0).
  When welding, check that the arc length is the same for both currents; press the O key to correct it if necessary.
  Note: it is possible to weld within the double pulse functions.
  Should it be necessary to adjust the arc length of the lowest current/lowest speed, adjust the arc length of the reference speed.
  When the reference speed moves, the above settings must also be adjusted for the new speed.

- H2O (cooling unit).
  The display G reads H2O.
  Press the O key to select the type of operation.
When the machine starts, the unit is running. The unit shuts off automatically if welding does not begin within 15 seconds. If welding begins, the unit starts operating and shuts off 3 minutes after the torch trigger is released.

If the coolant pressure is too low, the power source delivers no current and on the display G will flash the message H2O.

6 SAVING AND CALLING UP MEMORIES

Ten memory slots are available, from P01 to P10.
• To save, weld a small section using the parameters you wish to save, then:
  - Press the key R and, holding it down, press the key O until the flashing abbreviation P01 appears on the display G, then release the buttons.
  NOTE: The flashing abbreviation indicates free programs, those that do not flash are saved programs.
  Display Q indicates the number of the program to which that saved welding program refers.
  - Use the keys O and R to choose the program number to save, then press the key O until the program abbreviation no longer flashes.
  - Release the key O to exit saving.
  - Should you intend to overwrite a program, when the button O is held down for longer than 3 sec, the number starts flashing, then returns to steady mode to signal overwriting.
  Overwriting must take place while the display G shows the program number (5 sec).

• To call up a saved program, repeat the same steps described above (keys R and O held down until the abbreviation PXX appears); the last program saved appears. Five seconds after the last time the keys R and O are pressed, the machine is ready to weld.
Before welding with a saved program, display G shows its number. When welding begins display G shows the current, and when it ends LED A lights. All knobs are disabled.
To see the setting of the service function related to the saved program, press the key R and hold it down; after 2 sec. the display G shows the first message dSP. Pressing the torch trigger will display the abbreviations of the various functions in sequence, and display Q shows the setting.
To return to welding with a saved program, release the key R.
To exit saved programs, press the key R and, while holding it down, briefly press and release the key O.

7 MAINTENANCE

• Safety gas nozzle
  This nozzle must be periodically cleaned to remove splattered metal. Replace if distorted or squashed.
• Contact tip.
  Only a good contact between this contact tip and the wire can ensure a stable arc and optimum current output; you must therefore observe the following precautions:
  A) The contact tip hole must be kept free of grime and oxidation.
  B) Splattered metal sticks more easily after long welding sessions, blocking the wire flow.
  The tip must therefore be cleaned more often, and replaced if necessary.
  C) The contact tip must always be firmly screwed onto the torch body. The thermal cycles to which the torch is subjected can cause it to loosen, thus heating the torch body and tip and causing the wire to advance unevenly.
• Wire liner.
  This is an important part that must be checked often, because the wire may deposit copper dust or tiny shavings. Clean it periodically along with the gas lines, using dry compressed air.
  The liners are subjected to constant wear and tear, and therefore must be replaced after a certain amount of time.
• Gearmotor group.
  Periodically clean the set of feeder rollers, to remove any rust or metal residue left by the coils. You must periodically check the entire wire feeder group: hasp, wire guide rollers, liner and contact tip.

8 ACCESSORIES

Art. 1656  Trolley.
Art. 1242  Torch 3.5mt
Art. 128  Kit for coil diameter 300 Kg 15
Art. 1241  Water-cooled MIG torch.
Art. 1432  Trolley
Art. 1341  Cooling unit