

# INSTRUCTION MANUAL FOR CAPACITOR DISCHARGE WELDING MACHINE

**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 workpiece.
- 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.

**ELECTROMAGNETIC COMPATIBILITY**

This machine is manufactured in compliance with the instructions contained in the harmonized standard EN50199, and must be used solely for professional purposes in an industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in non-industrial environments.



IN CASE OF MALFUNCTIONS, REQUEST ASSISTANCE FROM QUALIFIED PERSONNEL.

## 2 GENERAL DESCRIPTIONS

### 2.1 SPECIFICATIONS

The machine has been designed and built for welding ferrous and non-ferrous threaded stud bolts, Ø 4.5 and 6 mm. This welding system uses the extremely rapid (2-3 ms) discharge of a battery of capacitors, which allows the welding of threaded stud bolts with contact point start-up.

### 2.2 EXPLANATION OF THE TECHNICAL SPECIFICATIONS LISTED ON THE MACHINE PLATE

N°	Serial number, which must be indicated on any request regarding the welding machine
IEC 60974-1	The welding machine is manufactured according to these international standards.
1- 	Single-phase transformer-rectifier with device for charging and discharging the capacitors
U0	Secondary open-circuit voltage
E	Welding energy
C	Capacity value
Uc	Voltage adjustable on the capacitors
U1	Rated supply voltage. The machine is set up for voltages of 115V and 230V with automatic voltage change.
1-50/60Hz	50- or 60-Hz single-phase power supply
I1 Max	Max. absorbed current at the corresponding supply voltage.
IP23C	Protection rating for the housing. Grade 3 as the second digit means that the equipment is suitable for use outdoors in the rain. C: 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.
NOTES:	Suitable for use in environments with a pollution rating of 3 (see IEC 60664-1)

### 2.3 DESCRIPTION OF PROTECTIVE DEVICES

#### 2.3.1 Thermal protection

This machine is protected by a thermostat, which prevents the machine from operating if the allowable temperatures are exceeded. Under these conditions the fan keeps running and the display will show error code E1.

### 3 INSTALLATION

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

1. Place the welding machine in a stable and safe position. Air must circulate freely, both incoming and outgoing, and the welding machine must be protected from entry by liquids, dirt, metal filings, etc.
2. Make sure that the supply voltage matches the voltage indicated on the specifications plate of the welding machine. When mounting a plug, make sure it has an adequate capacity, and that the yellow/green conductor of the power supply cable 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  $I_1$  of the machine. Any extension cords must be sized appropriately for the absorbed current  $I_1$ .  
If the power supply is 115V, the machine may run for voltages between 96V and 140V.  
If the power supply is 230V, the machine may run for voltages between 190V and 260V.  
The machine must be switched off when changing the power supply.
3. Pacemaker wearers are prohibited from using the

machine or approach the cables.

4. Fully insert the earth cable plug into the + socket and turn clockwise.
5. Fully insert the gun plug into the - socket and turn clockwise.
6. Turn on the welding machine using the I switch. (start-up and shutdown should not be repeated frequently, because dissipating the energy contained in the capacitors may cause overheating and damage).
7. To limit exposure to the magnetic field, keep the gun cable on the side of the hand holding it, avoiding wrapping the cable around.

#### 3.1 DESCRIPTION OF THE EQUIPMENT

- A- Key to increase the capacitor charge voltage
- B- Key to reduce the capacitor charge voltage
- C- LED indicating that the machine is on
- D- LED that lights during welding
- E- Displaying showing the capacitor charge voltage
- F- Positive output terminal
- G- Negative output terminal
- H- Torch trigger connector
- I- Main switch
- J- Fuse  $\varnothing$  6.3x32 (delayed type). The equipment is fitted with a 16A fuse for 115V power supply; a 10A fuse may be used for 230V power supply.

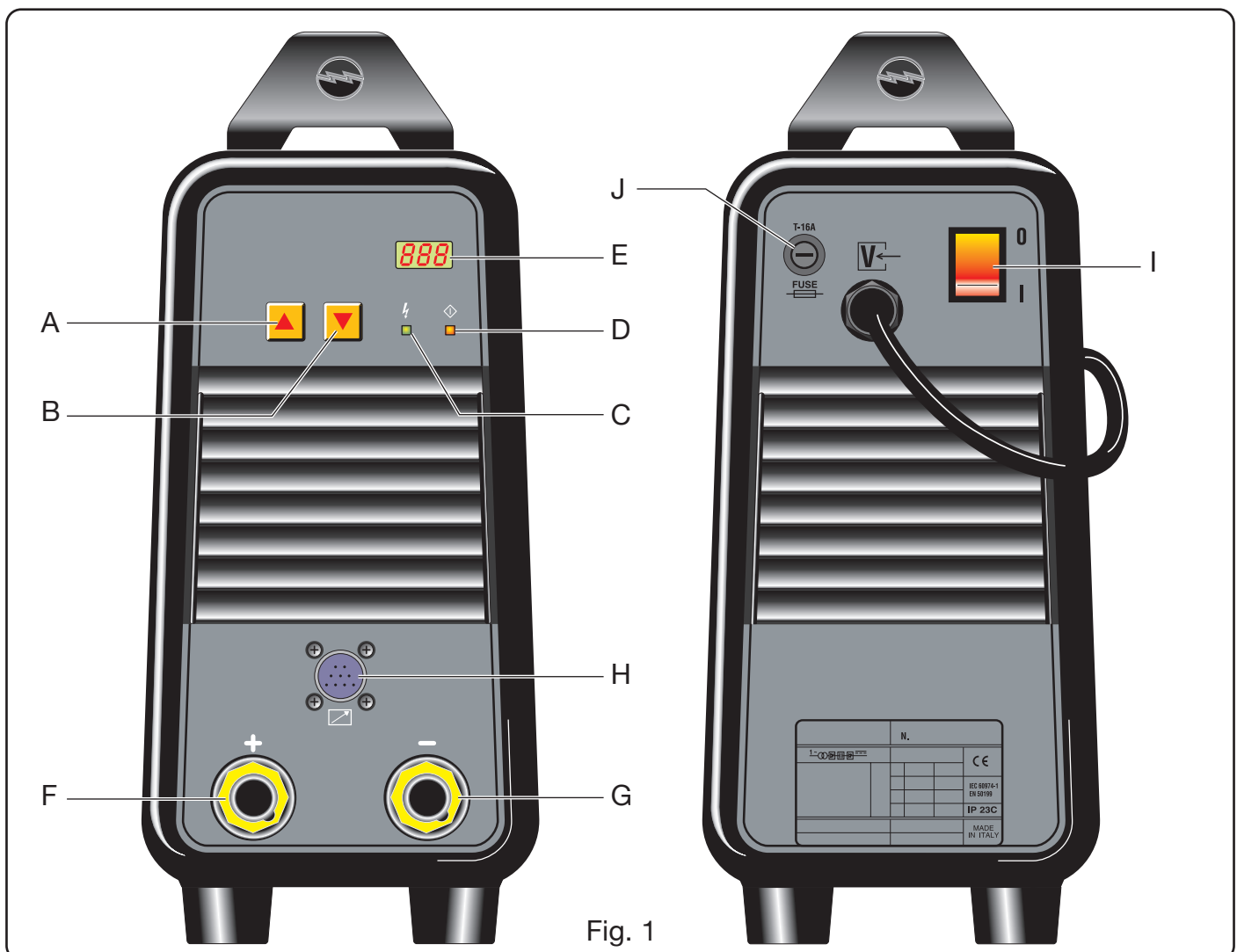


Fig. 1

### 3.2 GUN DESCRIPTION



- K- Gun body
- L- Grip
- M- Control cable
- N- Welding current cable
- O- Welding command button (works only with the gun pressed against the sheet metal)
- P- Force setting indicator
- Q- Force adjustment screw (increases when turned clockwise)

- R- Ring to hold spacer Z
- S- Clamp locking ring-nut
- T- Safety bellows
- U- Holding screws for ring R
- V- Screw to adjust stud bolt protrusion
- W- Holding nut.
- X- Stud bolt gripping clamp
- Y- Screw
- Z- Spacer

#### 3.2.1 Preparing the gun

Always use high-quality pins with contact point start-up for capacitor discharge welding, which comply with standards and are made of a metal compatible with the welding to be done.

Having selected the stud bolt to be welded for type, diameter, length and material, use and adjust the clamp according to the corresponding diameter.

Insert the stud bolt in the clamp X so that it is firmly held in place by the four springs.

Adjust the protrusion of the stud bolt from the front of the clamp to  $0.8 \div 1.2$  mm using the screw V, then tighten with the nut W (figure 2).

Insert the clamp X into the chuck of the gun (fig. 2), press until you feel it rest all the way down, and tighten the nut S using the 17-mm hexagon wrench provided.

#### 4 OPERATING PRINCIPLE OF WELDING THREADED STUD BOLTS WITH CONTACT POINT START-UP (Fig. 3)

The stud bolt is inserted in the clamp X (phase 1), then positioned and pressed with its start-up contact directly against the surface of the sheet metal to be welded (phase 2). The spring of the gun presses the stud bolt against the metal, the start command begins sending current which melts the start-up contact, and the electrical arc is propagated along the entire surface of the stud bolt (phase 4) pushed against the metal surface. The molten metal solidifies, thereby welding the stud bolt (phase 5).

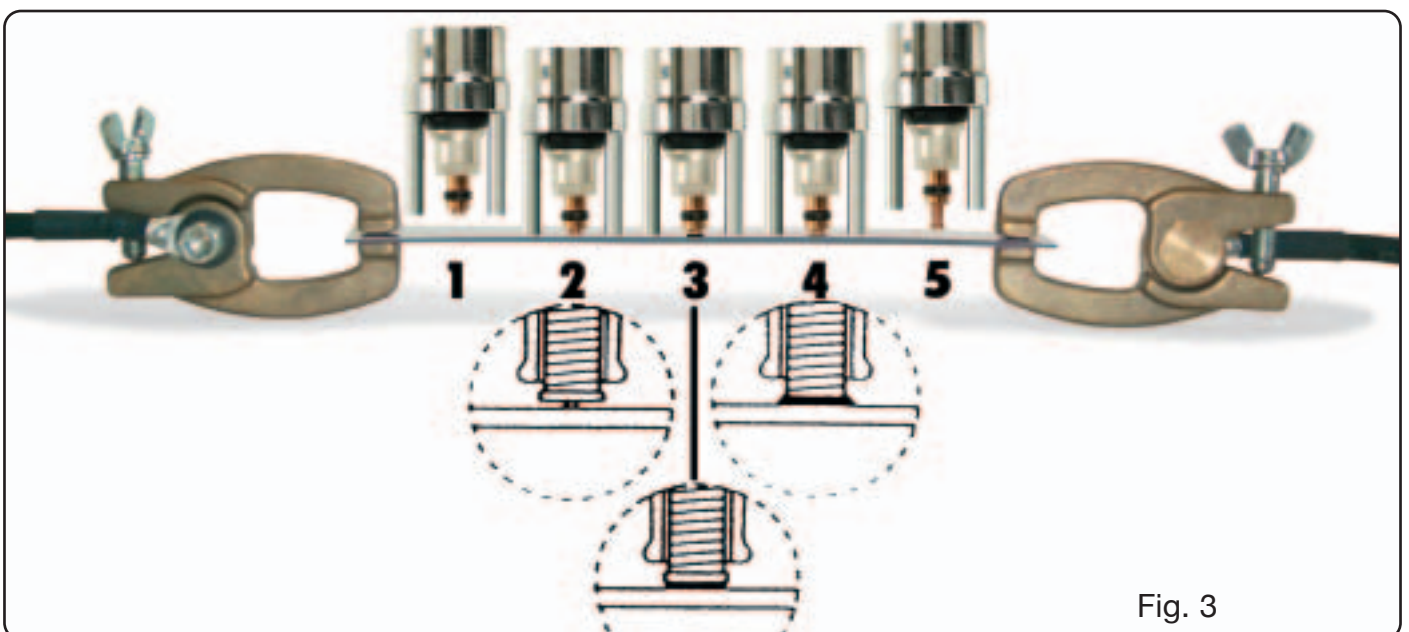


Fig. 3

Stud bolt metal Base metal	Copper plated steel 0.2 C	Stainless steel	Brass Cu Zn 38	Al. Mg 3	AlSi 12	Al. 99,5
Steel up to 0.30 C %	A	A	A	-	-	A
Galvanized steel	B	B	A	-	-	-
Stainless steel	A	A	B	-	-	-
Brass	A	B	A	-	-	-
Copper	B	-	A	-	-	-
Al 99,5	-	-	-	A	B	B
Al Mg 1	-	-	-	B	A	B
Al Mg 3 - Al Mg 5	-	-	-	B	A	B
Al Mg Si	-	-	-	B	A	B

High weldability: A      Low weldability: B      Not weldable: -

Tab.1

The gun must be extracted in perfect alignment with the bolt to avoid deforming the clamp, and thus ensuring its long life-span (phase 6).

### 5 WELDABILITY OF TYPICAL STUD BOLT/BASE METAL COMBINATIONS FOR CAPACITOR DISCHARGE WELDING. (Table 1)

It is important to pay careful attention to the resistance and deformity at the welding point between the stud bolt and base metal. In the case of steel, you must pay particular attention to brittleness.

The material and resistance of the stud bolt have limited tolerance; the carbon content in steel threaded stud bolts must be < 0.20%.

The surface of the base metal must be clean. Layers of paint, rust, waste, grease and non-weldable metal coatings must be removed from the welding area. This must be done using appropriate means. Base metals with layers of waste and rust must be cleaned thoroughly.

### 6 WELDING

This technology makes it possible to weld threaded stud bolts on clean, but not oxidized, surfaces of mild steel, galvanized steel, stainless steel, aluminum and brass.

The rapidity of the process does not alter the surfaces on the side opposite from the welding. Welding is not possible on case-hardened steel, oxidized or painted metal.

Before beginning production it is essential to carry out a few test welds to determine the proper setting of the power source and gun (spring force), proceeding as follows:

- insert the chosen stud bolt in the clamp X (previously adjusted as described in Fig. 2)
- arrange the base sheet metal in conditions identical to those that will be used for the job in terms of thickness, earth connection area, size of the workpiece, material quality.
- the terminals of the earth cable should be placed symmetrically, and as close as possible to the welding point.
- activate the power source by means of the lighted switch I.
- grip the gun and press it against the sheet metal, making sure that its axis remains perpendicular to the surface. If the

surface of the material on which the stud bolt is to be welded is flat, we recommend mounting the three spacers Z after first unscrewing the screws Y.

· carry out a few welds, adjusting the voltage using the keys A and B, and the force of the gun using the setting knob Q, until the welding is perfect.

The gun should be removed keeping it perfectly aligned with the bolt, to avoid deforming the clamp (Fig4).

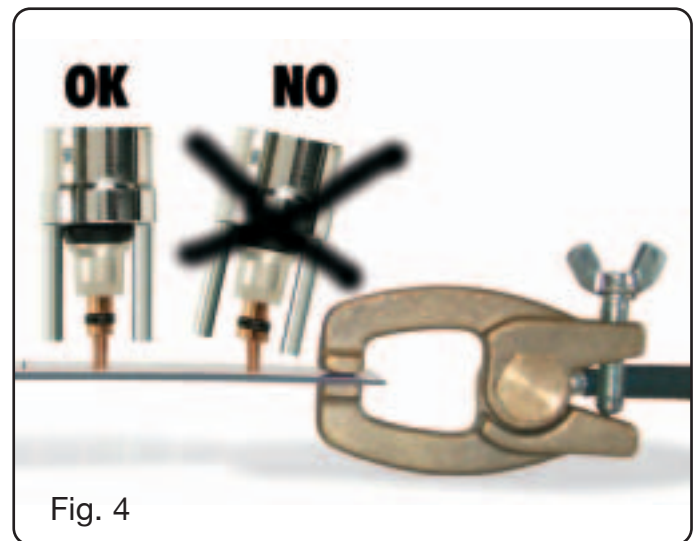


Fig. 4

#### 6.1 WELDING ALUMINUM

To weld M4 threaded stud bolts in aluminum alloy Al Si 12 on sheet aluminum for auto body work, adjust the voltage to 105/115V. The gun spring that adjusts the pressure during welding will be adjusted so that the index P is on 2/2.5.

### 7 MAINTENANCE

#### 7.1 ROUTINE

Keep all instructions and figures on the welding machine clear and legible.

The mains cable and welding cables must be insulated and

in perfect condition; be careful with the tips, which flex: near the connection terminals, earth clamps and gun input.

Keep the welding current connectors to sockets F and G clean and firmly tightened (see Fig. 1)

The terminals for connecting to the base metal must make good contact to avoid overheating, sparks, uneven current circulation, damage to the components where the pins are welded, and welding of uneven quality.

Prevent dirt, dust and filings from getting into the welding machine.

Always make sure the cooling air circulates freely.

Make sure that the fan functions properly.

Make sure that the clamps hold the stud bolts firmly, with all contact springs.

The clamp chuck must slide freely throughout its length, without changes due to friction or foreign matter.

## 7.2 SPECIAL

Only qualified personnel should perform maintenance.

Some functional errors are highlighted by the appearance of an error code on the display E.

Error code	Malfunction	Solution
E 1	Thermostat tripped	Wait a few minutes
E 2	SCR short-circuited	Contact technical service
E 2	Connectors not inserted correctly	Insert the connector
E 3	Irregular voltage at the capacitor tips	Contact technical service
E 4	Irregular capacitor charging	Contact technical service
E 5	Irregular capacitor discharging	Contact technical service

Wait at least 5 minutes after shutting off the switch I before opening the welding machine, and unplug the plug from the power socket.

Use a volt meter to make sure that the capacitors are discharged.

Carefully remove any dust, metal fragments and filings from the machine using compressed air to avoid damaging or projecting metal fragments onto the electronic or electrical parts.

Make sure that all connectors are fully inserted.

Make sure that all welding circuit terminals are firmly tightened.

After making a repair, make sure to rearrange the wiring so that there is secure insulation between the primary and secondary sides of the machine. Do not allow wires to come into contact with moving parts or those that heat up during operation. Reassemble all of the clamps as they were on the original machine, to prevent an accidental connection between the primary and secondary circuits if a conductor should break or disconnect.

Also remount the screws with geared washers as on the original equipment.