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.

1  SAFETY PRECAUTIONS

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 EN 50199 to these international standards.

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).

NOTES: Suitable for use in high-risk environments.

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

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

<table>
<thead>
<tr>
<th>Base metal</th>
<th>Stud bolt metal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper plated steel 0.2 C</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>Steel up to 0.30 C %</td>
<td>A</td>
</tr>
<tr>
<td>Galvanized steel</td>
<td>B</td>
</tr>
<tr>
<td>Stainless steel</td>
<td>A</td>
</tr>
<tr>
<td>Brass</td>
<td>A</td>
</tr>
<tr>
<td>Copper</td>
<td>B</td>
</tr>
<tr>
<td>Al 99.5</td>
<td>-</td>
</tr>
<tr>
<td>Al Mg 1</td>
<td>-</td>
</tr>
<tr>
<td>Al Mg 3 - Al Mg 5</td>
<td>-</td>
</tr>
<tr>
<td>Al Mg Si</td>
<td>-</td>
</tr>
</tbody>
</table>

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

Tab.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).

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.

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

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 dis-
charged.
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 tight-
ened.
After making a repair, make sure to rearrange the wiring so
that there is secure insulation between the primary and sec-
ondary sides of the machine. Do not allow wires to come into
contact with moving parts or those that heat up during oper-
ation. Reassemble all of the clamps as they were on the orig-
inal 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.