

Operating Instructions

THE **STUD WELDER XL**

by **HYBROCO**

Serial Number _____

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1. General

1.1 Introduction to stud welding

Your new stud welding equipment is carefully constructed of the finest components and materials available. Used properly, this equipment will give you years of efficient service.

The system incorporates the latest in engineering advances, for completely reliable end welding of mild steel, stainless steel, aluminum, copper and lead-free brass fasteners.

A careful study of this manual will enable you to understand how the welder operates to insure proper performance under all operating conditions.

You have purchased a product which:

- Conforms to machinery directives 2006/42/EC
- Conforms to low voltage directives 2006/95/EC
- Complies IEC 60974 for ARC welding equipment
- Conforms to IPC-A-610-Class II
- RoHS Compliant 2002/95/EC

Before putting the stud welder into operation, always observe the following:

- Store the operating instructions in a place accessible to every operator.
- Ensure that the respective operator has read and understood the operating instructions prior to installation. Each operator should confirm this by signature.
- Prevent the stud welder being operated by unauthorized persons.
- Only trained personnel must operate the stud welder.



MORTAL DANGER

Persons with pacemakers must not operate the stud welder and must not stay in the vicinity of the stud welder while it is running. Ensure that the stud welder is not operated near electronically sensitive life-supporting equipment, such as in intensive care units in hospitals.

**WARNING**

Keep sufficient distance from electronic devices. When stud welding, highly intensive electromagnetic fields are created which may permanently damage these devices (e.g. television sets).

- Observe the safety instructions in Section 3.
- Call a doctor in case of an accident.

1.2 Application

The **STUD WELDER XL by HYBROCO** allows you to weld pins and threaded studs size #4 through 3/8" as well as various fastening elements made of steel, stainless steel, aluminum, copper and lead-free brass.

The visible side of the work piece is spared to a large extent from pressure marks or deformations, so that even thin sheet metals down to 0.060 thick retain their decorative appearance.

If you need consultation or assistance in solving problems, please contact your sales representative or the Hybroco Sales offices.

1.3 Information on the product

Manufactured for: Hybroco Sales, INC.
400 N. Clinton St
Stockbridge, MI 49285

Tel: 517-851-8757
Fax: 517-851-7722

Product Designation: **STUD WELDER XL by HYBROCO**
(herein noted as **STUD WELDERXL**)

Country of Origin: USA

1.4 Serial Plate

The serial plate is located on the rear side of the stud welder. It contains information regarding the country of origin, product designation, method of welding, date of manufacture, production number and main connection values.

1.5 Information on documentation

The following operating instructions are supplied with the **STUD WELDER XL**:

- Operating instructions for the **STUD WELDER XL**
- 1,2,3 Quick Setup Guide to Gap Welding
- Control PCB schematic
- **STUD WELDER XL** fault indicator list
- **STUD WELDER XL** Insulation Supplement

1.5.1 Information on operating instructions

The contents of these operating instructions are neither part of any former or existing arrangement, pledge or legal relationship nor are designed for modifying the latter. All obligations of HYBROCO SALES, INC. result from the respective contract of sale (invoice), which also comprises the complete and generally valid warranties. These contractual warranty terms are neither extended nor restricted by the implementation of these operating instructions.



WARNING

Do not carry out any activities on the stud welding system without specifically knowing the operating instructions or the respective part. Ensure that only qualified personnel familiar with the operating instructions and the necessary technical activities (training!) operate the system.

1.5.2 Conduct in the case of malfunctions

If malfunctions occur, first try to detect and eliminate the causes according to the list in Section 8 “Troubleshooting”. In all other cases, contact our service department.

If you require service, please make sure that you supply the following information:

- Customer number
- Product designation
- Serial number
- Year of construction
- Options
- Material of stud and work piece
- Stud dimensions

This information will help us both to save time and unnecessary costs, e.g. caused by delivering the wrong spare parts.

1.6 Contacts and service address

If you have any questions regarding the operation of the stud welding system, retrofits or if you require service, please contact your responsible service office or the following address:

**HYBROCO SALES, INC.
400 NORTH CLINTON
STOCKBRIDGE, MI 49285**

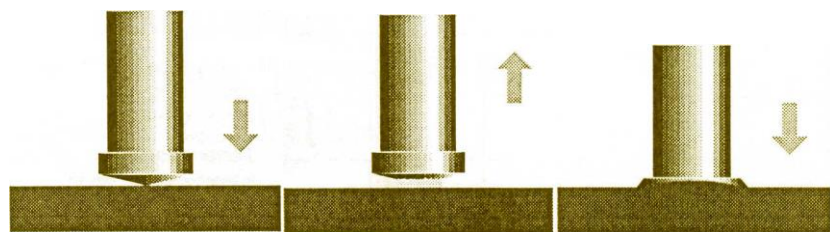
Tel: 517-851-8757

www.hybrocosales.com

2. Description of stud welder

2.1 Capacitor discharge technology

The **STUD WELDER XL** operates according to the principle of capacitor discharge as defined in the American Welding Society Welding Handbook and in DVS Leaflet 0903 (German Welding Society). This system uses the abrupt discharge of a capacitor bank to generate an electric arc.



Stud tip or gun foot touches work piece.

Stud lifts off and drops under spring pressure. Arc is initiated.

Stud immerses into weld pool. Material solidifies rapidly.

Note the final picture in the sequence above; in order for a weld to be good, it should have an even fillet completely around it. Any voids at all indicate a weakness in the weld zone that could only cause weld failure later. Also, the stud should appear to penetrate the parent material -- it should never appear to be 'sitting on top' of the weld.

What actually happens during a capacitor discharge weld? The work surface (or ground) is connected to one side of the capacitor bank. The stud, through the collet, gun, and an electronic switching device (SCR) is connected to the other side of the capacitor bank. When the stud is placed against the work surface, only the tip touches. When the trigger is squeezed, the switching device conducts, and the capacitor bank is shorted out through the tip of the stud. Because of the high welding current, the tip disintegrates and an arc is established. The arc melts the interface surfaces, and the spring pressure of the gun combined with velocity of the gun spindle movement pushes the stud into the parent material to complete the weld. The process lasts about 1 - 3 milliseconds.

To make a good weld occur, two things are needed: heat and pressure. A weld must have sufficient heat to melt the weld zone, and enough pressure to provide good fusion.

In the **STUD WELDERXL**, heat is easily regulated by the voltage on the capacitor bank. The length of weld cable used also affects the heat. You should always use the supplied cables; otherwise the weld arc is too erratic. Pressure is controlled by protrusion; the amount of stud that extends beyond the gun's foot and the spring pressure setting on the gun. If gap welding, adjustments made to the spring will influence the velocity at which the stud is propelled to the work. It should be mentioned that the more pressure the weld has, the shorter the weld time will be. This will result in a cooler weld with less penetration and less reverse side marking.

Besides heat and pressure, some of the other aspects of capacitor discharge welding should be mentioned. Grounding is very important. The ground connections must be clean and tight, but it must also be positioned properly. Whenever the weld consistently "blows" to one side (referred to as "arc blow"), the grounding is usually inadequate.

Another important subject is polarity. Straight polarity is when the work surface is positive and the gun is negative. Whenever the work is clean, straight polarity is used. On the other hand, reverse polarity (work surface is negative) is used for welding brass or whenever impurities such as galvanizing are present (see Section 5.9 for a discussion of polarity).

2.2 Stud welder set-up

The standard pistol to be connected to the **STUD WELDER XL** is the G1 gap gun or C1 contact gun. See additional information on the weld guns in Section 5.

2.3 Dimensions

The **STUD WELDER XL** is a powerful but lightweight system that is easily carried into the work place. The unit weighs 37 lbs. The dimensions are:

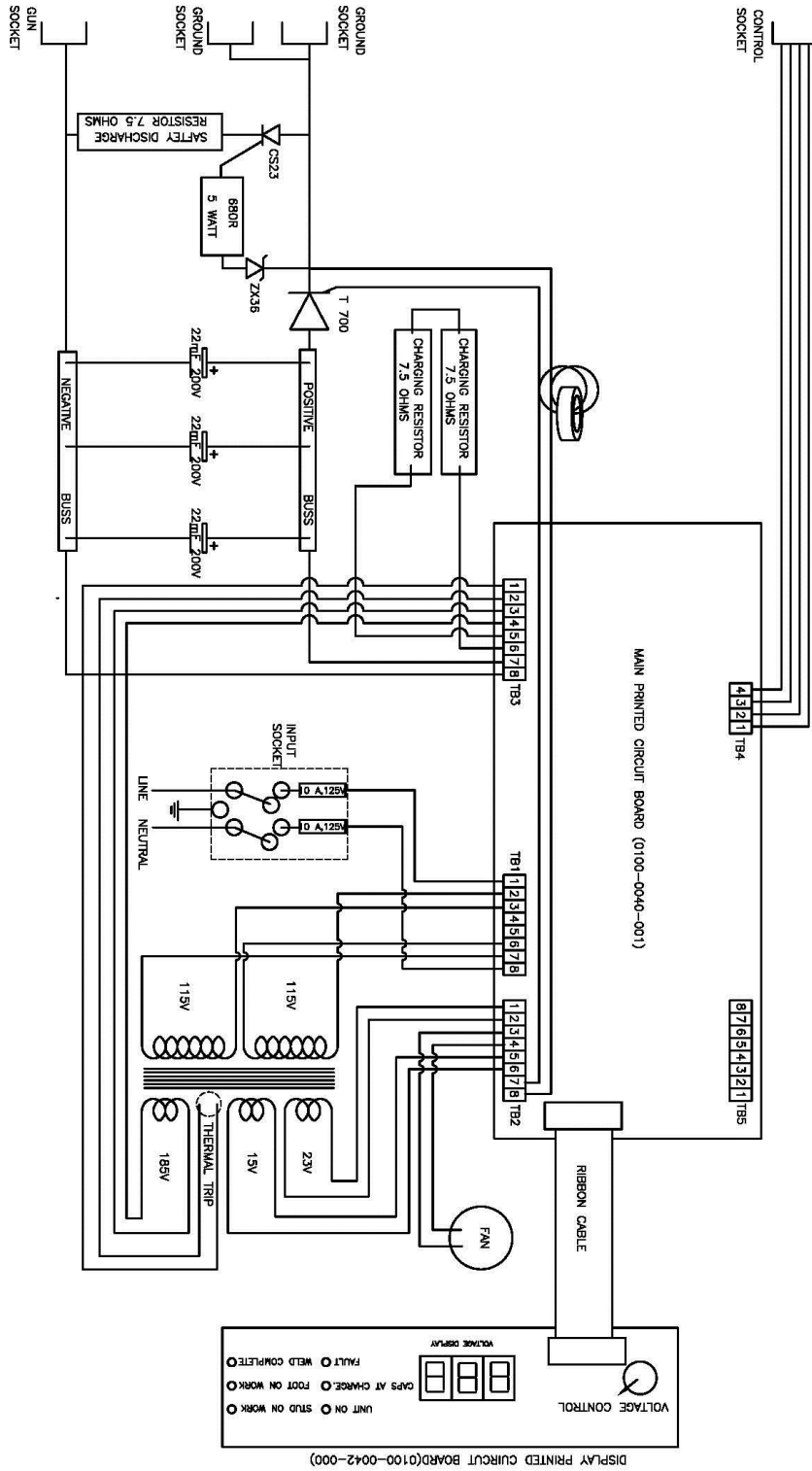
13" Wide x 15.5" Long x 6.5" High



2.4 Technical Data

Description	<i>STUD WELDER XL</i>
Welding Range	#4/12ga through 3/8"
Material	Steel, Stainless Steel, Aluminum, Copper, Lead Free Brass
Welding Method	Capacitor Discharge Tip Ignition
Standard Pistol(s)	G1 gap, C1 contact or Ci insulation gun
Current Source	Capacitor Bank
Charging Capacity	162,000 micro Farads
Charging Voltage	50 – 195 V adjustable
Welding Time	0.001 – 0.003 seconds
Welding Duty Cycle	Up to 20 studs per minute
Mains Supply	110 or 220 VAC 50/60 Hz. Switchable on the main board
Fuses	2 x 16A slow blow, 250 V
Welding Cable	#2 highly flexible weld cable
Ground Cables	Two, #1 highly flexible weld cable
Weight	37 lbs.
Color	Black Jack
Subject to technical change without notice.	

2.5 Block Diagram



3. Safety instructions

These operating instructions contain basic instructions that have to be complied with during installation and/or operation. It is therefore absolutely necessary that the operator and responsible specialist staff read these operating instructions prior to assembly and initiation. They must always be available at the installation site.

Not only the general "safety instructions" listed under this main item, but also the special safety instructions e.g. for high temperatures, voltages, etc. listed under the other main items have to be complied with.

3.1 Description of reference signs in the operating instructions

The non-observance of safety instructions can cause damage to the operator and observers. The safety instructions of this manual are marked with the general symbol for danger safety symbol in compliance with DIN 4844-W9.



Warning of electrical voltage is specifically marked with the safety symbol in compliance with DIN 488-W8.



In addition to these symbols, the words "DANGER TO HEALTH" or "MORTAL DANGER" refer to the degree of a possible danger.

Safety instructions the non-observance of which may endanger the machine and its functions are marked with the terms

"CAUTION" or "WARNING".

General instructions are marked with the hand symbol.



3.2 Staff qualification and training

The staff responsible for operation, maintenance, inspection and assembly must have the respective qualification for carrying out these works. Field of responsibility, competence and the supervision of staff has to be exactly regulated by the user. If your personnel do not have the necessary knowledge they must be trained and instructed. If necessary, this can be done by the manufacturer/supplier on behalf of the welding equipment user. Furthermore, the user must ensure that the contents of the operating instructions are fully understood by the staff.

3.3 Dangers in the case of non-compliance with safety instructions

The non-compliance with safety instructions may not only endanger persons, but also the welding system and its environment. Any non-compliance with safety instructions may result in a complete loss of damage claims.

Non-compliance with safety instructions may have the following consequences:

- Failure of important system functions.
- Failure of prescribed methods for maintenance.
- Danger to persons through electric, mechanic, thermal and acoustic influences.

3.4 Safety-conscious working

The safety instructions listed in this manual, existing national accident prevention regulations, and possible international working, operating, and safety regulations of the user must be complied with.

3.5 Safety instructions for the operator/user

When stud welding, danger may result from

- Electric current
- Optical radiation
- Harmful substances (smoke)
- Acoustic shock
- Spraying sparks

You are therefore obliged to restrict the dangers to an inevitable degree and to point these dangers out to the operator and other persons involved.

**MORTAL DANGER**

Persons with pacemakers must neither operate the stud welder nor stay near it.

3.6 The following should be observed before starting the system...

Before starting the system, pay attention to the following information:

- Do not touch live electrical parts.
- Juveniles under the age of 16 years must not operate the stud welding system.
- Read all of the operating instructions before starting the system.
- Only qualified personnel are allowed to operate the system.
- Prevent unauthorized use of the system by children or unqualified personnel.
- Wear non-combustible, closed working clothes.
- Wear a leather apron to protect your clothes from welding spatters that are generated during the welding process.
- Wear head protection when carrying out welding work above your head.

**MORTAL DANGER**

When welding, do not wear clothes soiled with easily combustible substances such as oil, gasoline, thinners, etc.

- Wear gauntlet gloves made of leather.
- Never wear rings, watches nor electrically conductive jewelry.
- Wear protective goggles to protect your eyes from welding spatters and flashes of light that are generated during the process.
- Wear ear protection. Capacitor discharge generates a loud bang.
- Disconnect input power before installing or servicing this equipment according to OSHA 29 CFR 1910.147.
- Turn off all equipment when not in use.
- Do not use worn, damaged, undersized or poorly spliced cables.
- Do not drape cables over your body.
- Welding on closed containers, such as tanks, drums, or pipes can cause them to blow up. Sparks can fly off from the welding arc. The flying sparks, hot work pieces, and hot equipment can cause fires.

3.7 Before starting to weld...

- Check the state of all cables.
- Immediately replace defective cables and cable connections.
- Ensure that the air apertures of the housing are not covered. Heat accumulation may damage the stud welder.
- Look around for potential safety or fire hazards.

3.8 Safety precautions at installation site

- When placing the stud welder on tables or similar workshop furniture, ensure that the stud welding system stands firmly and that the table can bear its weight.
- Make sure mains socket and stud welder are properly grounded.
- Comply with fire prevention regulations and do not weld in hazardous locations.
- Make sure room is well ventilated or extract welding fumes, if necessary.



DANGER TO HEALTH

When welding, fumes and suspended matters may be generated. Beware of fumes detrimental to health, particularly when using surface-treated materials. If possible, only weld in rooms that are higher than 10 ft. As per VBG 15, special regulations are applicable for narrow rooms.

3.9 Working with the stud welder

- Comply with all accident prevention regulations which apply to the operation of your stud welder



One of the accident prevention applicable for stud welders is VBG15 "Welding, cutting and similar working methods". For more information, contact the Employer's Liability Insurance Association.



DANGER TO HEALTH

When welding, do not wear clothes soiled with easily combustible substances such as oil, grease, paraffin oil, etc.

If an accident happens,

- Switch off the stud welder and disconnect it from the mains supply
- Call 911.

3.10 Safety instructions for maintenance, inspection and assembly works

Only carry out maintenance works when stud welder has been switched off and unplugged—follow lockout/tagout procedures.

The user must ensure that all maintenance, inspection and assembly work is carried out by authorized and qualified technical personnel.

Generally, only work on the system when it has been switched off and after having disconnected it from the mains supply. It is necessary to comply with the procedure for stopping the stud welding system described in the operating instructions (chapter 3.13).

Immediately after having completed your work, re-install and activate all safety and protective devices.

3.11 Unauthorized retrofit and spare parts production

The system may only be retrofitted and modified after consultation with the manufacturer. Original spare parts and accessories authorized by the manufacturer guarantee safety. The use of other parts may result in the cancellation of warranty for any consequences thus caused.

3.12 Inadmissible operating methods

Limit values

Working safety of the stud welding system supplied can only be guaranteed when the stud welder is used in accordance with its purpose. The limit values indicated in the chapter "Technical data" must never be exceeded.

3.13 Storing the stud welder

- Switch off the mains switch (chapter 5.1.2, item 8) located at the stud welder's rear side.
- Disconnect the mains plug from the socket.
- Disconnect:
 - the ground cables (chapter 5.1.1, item 4)
 - the control cable (chapter 5.1.1, item 6)
 - the welding cable (chapter 5.1.1, item 5)from the stud welder.
- Roll up the cables without buckling them.
- Make sure stud welder cannot be used by unauthorized persons.
- Check the welding cable and connections of the stud welder for damage such as burn-off, mechanical wear etc. and have damaged parts replaced by Hybroco Sales, Inc. customer service.

4. Installation of the **STUD WELDER XL**

- Only install the stud welder on an even surface. The four anti-vibration pads located on the bottom of the stud welder guarantee its anti-skid position and serve as vibration dampers.
- Although the stud welder is resistant to environmental influences, it should be protected against dampness and dust. Under no circumstance should the unit be placed next to a grinding station. Metallic particles will be drawn into the enclosure through the fan.
- The stud welder should not be placed in close proximity to any high frequency welding equipment, share a common ground and/or common power supply. Doing so could damage sensitive electronics and will void the stud welder's warranty.
- Please pay particular attention to the bearing strength of the workshop furniture and ensure a safe and stable position.
- Make sure there is sufficient free space around the louvers.
- Install the stud welder close to the welding location.
- Ensure correct connected loads with mains operation.
- The electrical connecting cable used for mains operation is of adequate length. Additional extension cables cause a voltage drop, possibly leading to unit disturbances.
- Do not use extension cords unless approved by the manufacturer.
- Ensure sufficient ventilation of the working room when operating the system.
- Never hoist or suspend the machine by its' carrying handle.



The housing of **STUD WELDER XL** corresponds to safety class IP 21, IEC 60974-1. Please observe that this system of protection is not suitable for being operated or transported in the rain.

5. Initiation

5.1 Exterior components

5.1.1 Front View



Item	Description
1	Voltage Control Knob
2	Voltage Display
3	Informational Display
4	Ground Connectors
5	Gun Weld Cable Connector
6	Gun Control Cable Connector
7	Voltage Reference Chart

5.1.2 Rear View



Item	Description
8	Power Socket/Switch
9	Serial Plate
10	Cooling Louvers

5.2 Operating elements

- Mains switch (Section 5.1.2., Item 8)
The mains switch is located at the rear of the stud welding unit and serves to switch the stud welder on and off.
- Voltage control knob (Section 5.1.1., Item 1)
The voltage control knob is located on the front of the stud welder. This knob functions to increase or decrease the capacitor charge voltage. Refer to the chart on the front of the stud welder to determine the approximate voltage for different fastener diameters. Turning the knob clockwise will increase the voltage. Turning the knob counter-clockwise will cause the stud welder to discharge excess voltage to internal resistors and recharge to a lower setting.



WARNING

Repeatedly charging and discharging the capacitors quickly using the voltage control knob may damage the unit. Allow the unit's internal fan sufficient time to cool the resistors upon discharge.

- Voltage chart (Section 5.1.1., Item 7)
The voltage chart located on the front panel of the stud welder provides the approximate voltage settings for steel and aluminum fasteners. These numbers are approximate starting values and the actual voltage should be adjusted either up or down for your particular application. Please note that voltages are provided for "flanged" fasteners. Voltages for mini-flange, DIN, or non-flanged fasteners will be lower.

5.3 Connection Elements

- Ground cable connector (Section 5.1.1., Item 4)
There are two ground cable connectors on the front of the **STUD WELDER XL**. Insert each cable connector into the ground socket and twist in a clockwise direction to tighten. **Ensure these connectors are tight.** These cables provide the return path for the welding current. For good grounding, attach each ground cable to the work piece. When possible, weld between the ground cables to minimize the effects of “arc blow” on weld quality.
- Weld cable connector (Section 5.1.1., Item 5)
The welding pistol weld cable connector attaches to the front of the unit in the gun connector socket. Insert the connector into the socket and twist in a clockwise direction to tighten. **Ensure this connector is tight.**
- Control cable connector (Section 5.1.1., Item 6)
The welding pistol control cable connector attaches to a four-pin connector on the front of the stud welder. This connector provides the gun trigger signal and “foot on work” indicator for gap mode welding.
- Mains connector (Section 5.1.2., Item 8)
The mains connector is located in the rear of the stud welder. Use the mains cable supplied to connect the stud welder to the power supply. The stud welder is configured at the manufacturer to use a 12 Amp, 120V 50/60 Hz supply.

5.4 Display elements

The **STUD WELDER XL** is equipped with seven indicator displays:

- **Charge voltage** (Section 5.1.1., Item 2)
This three panel RED digital LED displays the actual charge voltage on the capacitor bank.
- **“Power” on light**
This AMBER single LED indicates the power switch is on and is connected to the mains.
- **“Capacitors at charge” ready light**
This GREEN single LED indicates that the capacitor has successfully charged to the correct voltage as determined by the voltage selection knob.
- **“Fault” light**
This RED single LED indicates a fault with the stud welder. A solid fault light indicates safety circuit activated. A blinking fault light indicates transformer has overheated. **See section 8.1**
- **“Stud on work surface” light**
The GREEN “stud on work surface” indicator is used to indicate a complete electrical path from the stud to the welding system. When this light is activated, the unit is ready to weld a fastener. This indicator is used in contact welding mode.
- **“Foot on work surface” light**
The GREEN “foot on work surface” indicator is used to indicate a complete electrical path for gun foot piece to the welding system. When this light is activated, the unit is ready to weld a fastener in gap mode.



The operator will note that when welding with an G1 gap gun, the “stud on work surface” LED will initially be activated, then when the trigger is pulled the “foot on work surface” LED will be activated. When welding with an C1 contact gun, only the “stud on work surface” LED will be activated.

Weld complete light

The GREEN “weld complete” indicator is a momentary LED that is activated at the end of the weld cycle after the gun is removed from the welded fastener. This LED indicates that the weld has been completed successfully with the selected energy being completely discharged within the time requirements. This LED indicates the base unit is working as designed.

5.5 Fuse elements

The **STUD WELDER XL** is protected by the following fuses:

Mains fuse: 2 x 16A 250 V slow blow

Charging fuse: 10A 250 V slow blow

Control fuse: 2A 250 V slow blow

Fuse for Fan: 2A 250 V slow blow



MORTAL DANGER

Always replace fuses with the correct replacement value. Do not use oversized fuses that may damage the unit.

Always disconnect the stud welder from the mains power supply when replacing fuses or servicing the stud welder.

5.6 Preparation for initiation

Connect the stud welding pistol and the ground cables to the stud welder as indicated in Section 5.3.

5.6.1 Ground connection

- Connect the ground cables into the indicated ground sockets.
- Turn the connectors clockwise until they stop.
- Connect the quick clamps to the work piece.



Ensure optimum contact with work piece.

5.6.2 Connect stud welding pistol

- Connect welding cable of the stud welding pistol into the indicated socket.
- Turn the connector clockwise until it stops.
- Connect the control cable connector into the four-pin socket.
- Turn the screw connector on the outside of the plug to secure the plug to the socket.

5.6.3 Mains supply connection

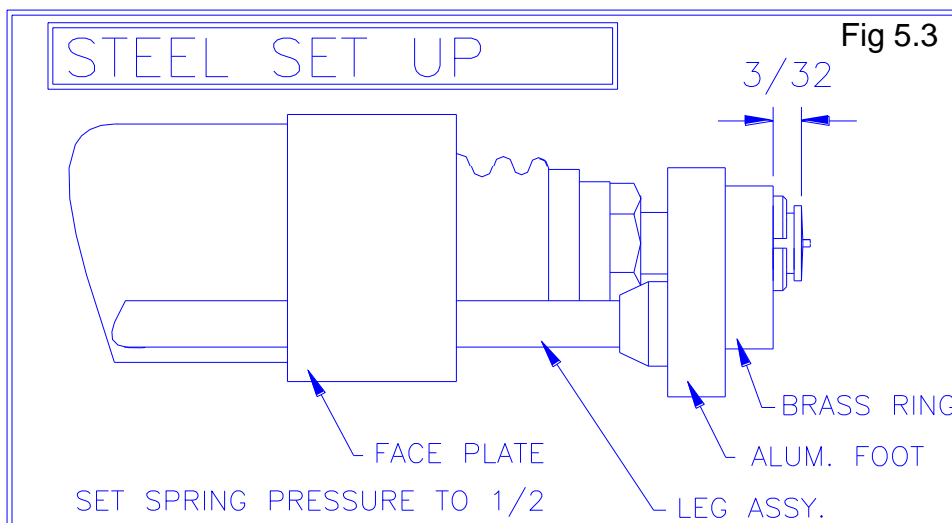
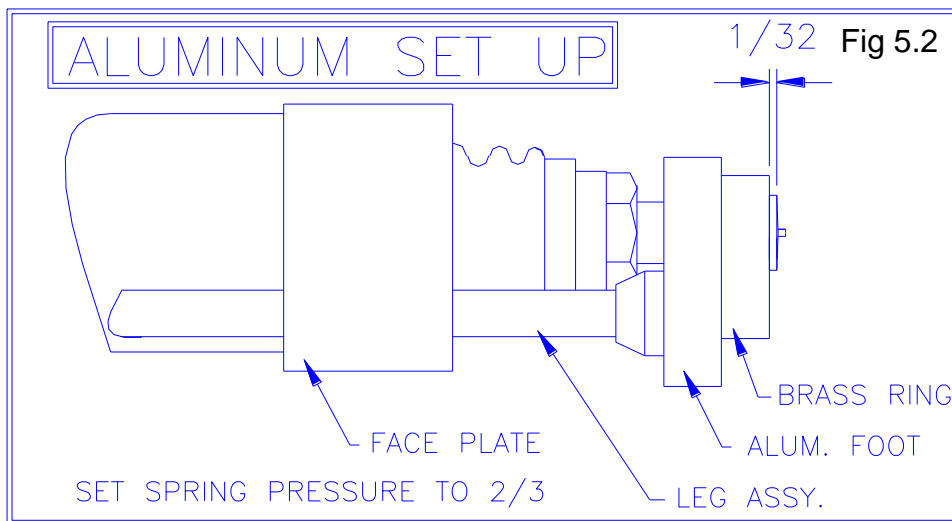
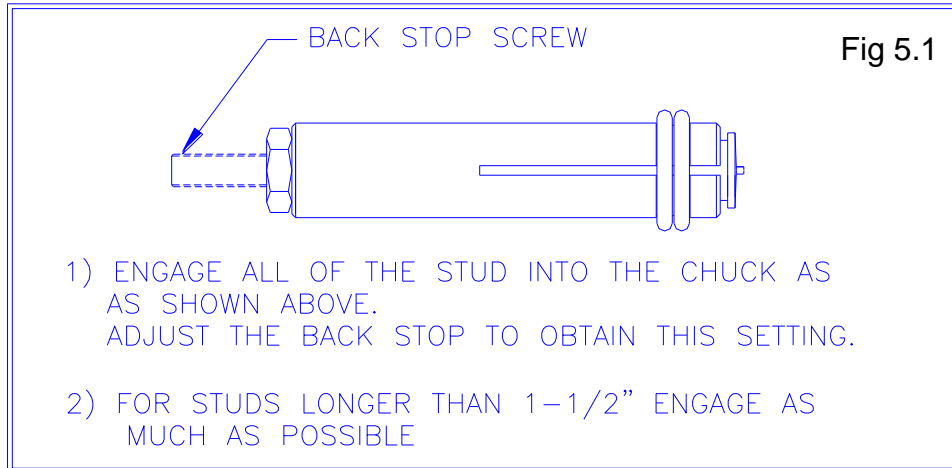
Connect the power cable supplied with the **STUD WELDER XL** into the rear of the unit. Connect the three-pronged plug into a grounded shock proof supply. Do not use an extension cord with this unit.

5.7 Gun Setup

Figure 5.1 on the next page depicts the optimal set-up for the fastener in the chuck. To set the stud in the chuck, loosen the backstop screw until the fastener extends approximately $\frac{1}{8}$ inch from the front of the chuck. Tighten the back-stop locking nut to preserve this setting. For fasteners longer than $1\frac{1}{2}$ inch, back the stop all the way out to obtain as much engagement in the chuck as possible.

If you are welding to aluminum, the set-up of the gun will be as depicted in Figure 5.2. First follow the directions for Figure 5.1. Then fully insert the chuck into the gun and tighten the chuck-locking nut. Loosen the two legs by releasing the four (4) set screws in the faceplate. Adjust the legs so that only the flange (approximately $\frac{1}{32}$ inch) of the fastener is observed beyond the brass ring. Tighten the four (4) set screws in the legs. Finally, adjust the spring pressure at the slot screw in the rear of the gun. The pressure should be set to +.

If you are welding to mild (carbon) or stainless steel, the set-up of the gun will be as depicted in Figure 5.3. First follow the directions for Figure 5.1. Then fully insert the chuck into the gun and tighten the chuck-locking nut. Loosen the two legs by releasing the four (4) set screws in the faceplate. Adjust the legs so that approximately $\frac{3}{32}$ inch of the fastener is observed beyond the brass ring. Tighten the four (4) set screws in the legs. Finally, adjust the spring pressure at the slot screw in the rear of the gun. The pressure should be set to -. The gun set-up is now complete.



5.8 Operation

Switch on the mains switch. The unit will power all LED's and run a quick diagnostic check. The amber LED will then illuminate indicating line voltage (110VAC or 220VAC). The digital LED on the front panel will indicate the charge voltage. Once the charge voltage is reached, the "ready" LED will light.

Adjust charging voltage by means of the front panel knob. Refer to the table on the front panel to establish approximate voltage setting for the selected fastener.

Position the weld pistol with a fastener in the gun on the work piece. The "stud on work" LED will be lit.

Depress to trigger on the welding gun. In gap mode only, the "foot on work" light will activate. Pull the trigger rapidly to discharge the unit.

After the stud is welded, remove the gun from the stud by pulling the gun away perpendicular to the work surface. The "weld complete" light will activate momentarily and the unit will recharge. Upon successful recharge, the "ready" light will turn on.

5.9 Welding parameters

The table on the front of the **STUD WELDER XL** provides standard values for welding different size fasteners. The charge voltage is selected based on the diameter of the fastener. These estimated voltages listed below are for "flanged" fasteners and may not be appropriate for mini-flange, DIN, or non-flange fasteners. Voltage should be adjusted for your particular application.

DIA.	#4/12GA	#6/10GA	#8	#10	1/4"	5/16"	GUN
STEEL	55	65	80	100	135	175	(-)
ALUM	85	90	105	115	155	NA	(+)

**When using a Ci Insulation Gun, please find insulation supplement on page 38*

In the above chart, "GUN" indicates the spring pressure setting on the G1 gap gun. "-" indicates decreased spring pressure on the gun spindle. "+" indicates increased spring pressure on the gun spindle resulting in greater velocity at the instant the weld is made.

5.10 Reverse Polarity

Sometimes it may be beneficial to use reverse polarity during stud welding. Reverse polarity is often recommended when welding to brass material or through galvanized materials.

Normally, straight polarity is used in stud welding. In straight polarity the work surface is the positive electrode and the stud is negative. Current flows from the negative electrode to the positive electrode. Typically, the positive electrode runs approximately 20% hotter than the negative electrode. This increase in temperature is caused by the electron bombardment on the position electrode. Using straight polarity concentrates the heat on the work and gives maximum penetration into the base material.

Reverse polarity is used to enhance the welding of galvanized steel because the current flow is from the work surface to the stud. This direction in current has a tendency to lift off and expel impurities from the work surface thereby providing a stronger weld.

To initiate reverse polarity welding with the **STUD WELDER XL**, unplug all weld cables from the unit. Then, plug the gun weld cable into one of the ground sockets. LEAVE THE OTHER GROUND SOCKET VACANT. Plug one ground cable into the gun weld cable connector. Alternatively, contact HYBROCO SALES for a “Y” connector so that two ground cables can be used in this configuration. Now the current is flowing from the ground to the gun.

5.11 Modular circuitry

If your **STUD WELDER XL** has already been configured for automatic capability, you will find a 15-pin sub-miniature “D” connector on the rear of the unit. This connector provides inputs and outputs for use in automation. The following signals are provided:

- External triggering input (pins 1 and 6)
- Capacitors at charge signal (pins 4 and 9)
- Stud on work signal (pins 3 and 8)
- Fastener reload signal (pins 2 and 7)
- Weld complete signal (same as reload)
- Foot on work (pins 10 and 11)

**Refer to Appendix C for further information regarding this function.*

6. Quality Control

6.1 General

The 0905 DVS Guideline, part 2, of April 1979 is applicable with regard to quality assurance of stud weld joints. The tests described in this section are written in simplified terms, following above regulation. They refer to work tests that are carried out and supervised by the user prior to and during welding.

6.2 Demands on the company

The company must employ a technical supervisor responsible for welding matters, as well as qualified operating personnel for stud welding (see DVS Guideline 0905, part 2, section 4).

6.3 Proof of qualification

In the case of components which documentation must be provided for, or stud welding works which as per DIN 4100, DIN 4113 are subject to acceptance, the processing company must submit a certificate of competence or a proof of qualification for working with stud welding equipment (see DVS Guideline 0905, part 2, sections 4.1 and 4.2). The proof of qualification applies in particular to the fastening of structures that are relevant in terms of safety regulations. When being used in the building industry, only approved base and stud materials may be used (for example, see DIN 4100. section 2.1, certificate of approval for stainless steel ifBT; DIN 4113, part 2).

6.4 Type and scope of test

Provided that the **STUD WELDER XL** is used properly and the materials are appropriately selected, the strength of the welding joint (welding zone) will always be stronger than that of the stud or base material. The best method of quality control for capacitor discharge stud welding is to destructively test studs that have been welded to the same base material to be used in actual production.

6.4.1 Standard work test

Generally, standard work tests have to be carried out and supervised by the user before welding at a structure and after a certain number of welds has been made. The number of welds after which a standard work test is required is agreed upon with the customer.

The standard work test is restricted to the stud diameter, base material and type of equipment used. It comprises the following tests:

- Visual inspection (all samples)
- Tensile test
- Torque test
- Bend test

In case of doubt, the test scope should be extended in compliance *AWS Welding Handbook* or with *DVS Guideline 0905*, part 2, section 5.1.1.

6.4.2 Simplified work test

Simplified work tests serve to check the correct setting and function of the equipment. They are carried out at the beginning of every working shift and after several hours of production.

Simplified work tests include:

- Visual inspection (all samples)

6.5 Test execution

6.5.1 Production of samples

The studs for the work test are welded on sheet metal using the same welding positions and edge distances as on the component to be welded later. If it is possible and sensible from an economical point of view, use parts that are identical to those used in later production.

The visual inspection serves as a rough check for major defects. The uniformity of the weld is assessed. When in doubt, tensile and bend tests should be carried out.

7. Maintenance

7.1 Stud welder

The stud welder is constructed in such a way that only a minimum of maintenance is required. The interior of the stud welder should, however, be cleaned at regular intervals depending on the environmental conditions at the location of use. Clean the unit with compressed air only.

7.2 Replacement of components

Defective components may only be replaced by trained manufacturers servicemen. Perfect function of your stud welder can only be guaranteed when original manufacturer spare parts are used.

7.3 Fuses

The **STUD WELDER XL** is protected by the following fuses:

Mains fuse: 2 x 16A 250V slow blow
Charging fuse: 10A 250V slow blow
Control fuse: 2A 250V slow blow
Fuse for Fan: 2A 250V slow blow



MORTAL DANGER

Always replace fuses with the correct replacement value. Do not use oversized fuses that may damage the unit.

Always disconnect the stud welder from the mains power supply when replacing fuses or servicing the stud welder.

7.4 Electronic Waste (WEEE), Directive 2002/96/EC:



Please help minimize the effects we have on the environment by not disposing electronic waste (e-waste) with household trash. Please follow your local instructions for disposal and/or recycling of electronic equipment and batteries.

8. Troubleshooting

8.1 Troubleshooting the *STUD WELDER XL*:

There are a few basic rules to follow when trouble shooting any C.D. welding system. They are as follows:

- When approaching a welder and the studs "aren't sticking," stand back and look at the entire situation. More often than not the problem will be something simple, such as wrong polarity, bad grounding, coiled cables, etc.
- After you have determined that the welder has everything it needs externally to work, examine the cables. This is the part of the welder that receives the most wear and naturally is most subjected to failure. If possible, switch the cables and use a set that you are certain is good.
- Only after you are certain that the trouble is with the stud welder, unplug the ground and gun cables before proceeding. It is possible for a defective cable to keep the unit from charging up its capacitor bank.

Another point to be aware of before actually trouble shooting the system is that it's a common misconception that whenever the welds are inconsistent, it is the fault of a defective control unit. This is rarely the case -- if the welder is defective, it will very seldom fire at all. Usually when inconsistency occurs, it means that the set-up is marginal, or there may be a problem in the parent metal. This would account for the differences in the welds. Review Section 8.2 below.


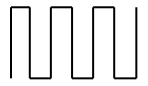


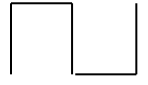
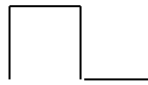
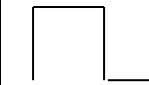



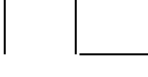
If the problem cannot be corrected by adjustments on the control, look at the gun. Is there enough engagement of the stud within the collet or chuck, and is it tight? If nothing is apparent on the outside of the gun, check it internally. Is it able to move back and forth freely in the bearing? Very seldom is the problem in the control. Almost the only thing that could cause inconsistency in the control unit would be a loose connection that would be readily apparent, such as arcing on the capacitor buss bars or at the connections.




Remember, before suspecting the equipment, step back and look at the whole situation. Often it isn't anything that cannot readily be corrected by proper set-up.

If, after observing all of the preliminary pointers, it is obvious there is a defect within the system, contact our service center for information on servicing your system.

8.2 Fault light indications

The **STUD WELDER XL** is powered by an intelligent microcontroller which can notify the operator if a problem occurs during the welding, with a fault code. Some fault codes will reset themselves within a few seconds, while others will require the operator to power down the machine. If particular fault code continues, please contact us for information on servicing your system.

	LEDs				
	Fault	Ready	Stud	Foot	Weld Complete
Safety Actuated Fault		X	X	X	X
High Temperature Fault		X	X	X	X
Low 28V Fault			X	X	X
Charge Fault				X	X
Discharge Fault		X	X		X
Gun Not Removed Fault		X	X	X	

On Continuous 
 Fast Flash 
 Slow Flash 
 Off X

*A **HIGH TEMPERATURE FAULT** (fast blinking fault light) indicated that the transformer is over its' operational temperature. In this case **do not turn the machine off**. Instead let the internal cooling fan cool the transformer until it automatically resets.

8.3 Causes of poor or erratic welds

1. **Loose collet. The collet does not grip the stud tightly.**
Solution: Change collet
2. **Not enough engagement of the stud in the collet.**
Solution: Remove the collet from the gun, loosen the back-stop so that approximately 1/8" of the stud is protruding from the collet, and reinstall the collet in the gun.
3. **Faulty or loose ground connection**
Solution: Repair or tighten ground connectors
4. **Poor surface condition**
Solution: Grind the surface to be welded. Grind through mill scale or anodizing.
5. **Broken or loose cables**
Solution: Repair cables
6. **Dirt in gun/gun binding**
Solution: Clean gun with compressed air and soft cloth
7. **Incorrect Polarity**
Solution: Change cable hookup as described in Section 5.9.
8. **Use of center punch**
Solution: Do not use punches that leave a deep indentation. Do not use permanent markers or grease pencils. Use a graphite pencil or scribe line only.
9. **Cables coiled**
Solution: Uncoil cables
10. **Arc Blow**
Solution: In severe cases there will be no melting under one edge of the flange while the opposite side appears excessively hot. The principle cause of arc blow is a magnetic field induced by current flow during the weld. It occurs most often in long, narrow strips of metal or near edges of sheets or plates. In some cases, a change in grounding position will correct the problem. Always try to weld between the two ground cables provided.
11. **Incorrect fastener stick-out**
Solution: Adjust the backstop and/or foot piece so that approximately 3/32" of the fastener sticks beyond the foot piece to weld aluminum or 1/8" of the fastener sticks beyond the foot piece to weld steel.
12. **Incorrect spring pressure**
Solution: Set spring pressure to "-" for steels and to "+" for aluminum.
13. **Poor stud quality**
Solution: Use only approved and pre-cleaned fasteners to assure quality.

8.4 Troubleshooting poor welds

1. Weld too hot
 - Decrease voltage
 - Set protrusion as indicated in Section 5.7
 - Increase spring pressure
2. Weld too cold
 - Increase voltage
 - Set protrusion as indicated in Section 5.7
 - Decrease spring pressure
3. Arc blow
 - Use double ground cables
 - Change ground cable position
4. Weld not perpendicular
 - Use supplied foot piece
 - Use template adaptor
 - Use tripod legs (available through Hybroco)

9. **WARRANTY**

Hybroco Sales, Inc. (Hybroco) mechanical components are warranted against manufacturer's defects in material and workmanship for a period of one (1) year from the time of shipment from Hybroco's facility. Hybroco's electrical components are similarly warranted for a period of one (1) year from the time of shipment from Hybroco's facility. Hybroco's sole obligation under this warranty is limited to repairing the product or, at its option, replacing the product without additional charge, provided the item is properly returned to Hybroco for repair as described below. The provisions of this warranty shall not apply to any product that has been subjected to tampering, abuse, improper setup or operating conditions, misuse, lack of proper maintenance, or unauthorized user adjustment. Hybroco makes no warranty that its products are fit for any use or purpose to which they may be put by the customer, whether or not such use or purpose has been disclosed to Hybroco in specifications or drawings previously or subsequently provided, and whether or not Hybroco's products are specifically designed and/or manufactured for such a purpose.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED. ALL OTHER WARRANTIES, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHETHER EXPRESSED, IMPLIED, OR ARISING BY OPERATION OF LAW, TRADE USAGE, OR COURSE OF DEALING, ARE HEREBY DISCLAIMED. THERE ARE NO WARRANTIES THAT EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF.

LIMITATION OF REMEDY

In no event shall Hybroco be liable for any incidental, consequential, or special damages of any kind or nature whatsoever. Hybroco is in no way liable for any lost profits arising from or connected to this agreement or items sold under this agreement, whether alleged to arise from breach of contract, expressed or implied warranty, or in tort, including, without limitation, negligence, failure to warn, or strict liability.

RETURN PROCEDURE

Before returning any equipment in or out of warranty, the customer must first obtain a return authorization number and packing instructions from Hybroco. No claim will be allowed nor credit given for products returned without such authorization. Proper packaging and insurance for transportation is solely the customer's responsibility. After approval from Hybroco, the product should be returned with a statement of the problem and transportation prepaid. If, upon examination, warranted defects exist, the product will be repaired or replaced at no charge, and shipped prepaid and add back to the customer. Return shipment will be by common carrier (i.e., UPS). If an out-of-warranty situation exists, the customer will be notified of the repair costs immediately. At such time, the customer must issue a purchase order to cover the cost of the repair or authorize the product to be shipped back as is, at the customer's expense. In any case, a restocking charge of 25% (\$75 minimum) will be charged on all items returned to stock.

FIELD SERVICE

Repairs are ordinarily done at Hybroco's MI or TN facilities where all necessary tools are available. Field service is only supplied at Hybroco's discretion. If field service is required and is performed at Hybroco's sole discretion, all relevant expenses, including transportation, travel time, subsistence costs, and the prevailing cost per hour (eight-hour minimum) are the responsibility of the customer.

UNFORESEEN CIRCUMSTANCES

Hybroco is not liable for delay or failure to perform any obligations hereunder by reason of circumstances beyond its reasonable control. These circumstances include, but are not limited to, accidents, acts of God, strikes or labor disputes, laws, rules, or regulations of any government or government agency, fires, floods, delays or failures in delivery of carriers or suppliers, shortages of materials, and any other event beyond Hybroco's control.

ENTIRE AGREEMENT/GOVERNING LAW

The terms and conditions contained herein shall constitute the entire agreement concerning the terms and conditions for the limited warranty described hereunder. No oral or other representations are in effect. This Agreement shall be governed in all respects by the laws of State of Michigan. No legal action may be taken by any party more than one (1) year after the date of purchase.

THE **STUD WELDER XL** OPERATION MANUAL SUPPLEMENT - WELDING INSULATION PIN

The **STUD WELDER XL** is a state-of-the-art welding system capable of welding pins, threaded fasteners and insulation fasteners. Depending on your application, your system may have been shipped with a Gap or (G1) gun, Contact (C1) gun, or Insulation Gun (Ci) gun. This supplement addresses only the setup and operation of the **STUD WELDER XL** with the Ci. Please also refer to Section 5.7 for gap or contact mode welding.

BACKGROUND/TECHNICAL INTRODUCTION

For welding cupped head pins (CHP) and 10GA or 12GA insulation pins, the **STUD WELDER XL** is supplied with *Ci Insulation Gun* with 33-ft lead and one 25-ft ground cable. The leads on both the gun and ground cable are integral to the successful welding of insulation fasteners as discussed below. Since the condition known as “arc blow” (see section 8.2) is not a concern with insulation fasteners, only one long ground cable is required. The gauge and length of the gun and ground cables are specifically selected to increase the time of the capacitor discharge weld pulse. This weld pulse is typically increased from 2 milliseconds to 11 milliseconds using this special cable set. While many stud welding systems that are designed only for insulation fasteners use internal resistance to extend this pulse, we have chosen to provide an extended cable set thereby providing the operator with increased working flexibility (up to 50-ft. working radius).

GUN SETUP FOR INSULATION FASTENERS

First determine which type of insulation fastener will be welded and select the appropriate collet supplied with your gun:

<u>Fastener Type</u>	<u>Appropriate Collet</u>	<u>Part Number</u>
Cupped Head Pins	Magnetic Chuck	AC41500
10GA INSULATION PIN	#6/10GA Std Chuck	AC4120-0135
12GA INSULATION PIN	#4/12GA Std Chuck	AC4120-0105

If previously installed, remove the adjustable leg assembly from the gun by loosening 4 set screws in the based on the assembly (you will not need this foot piece assembly for CHP). Insert the correct collet into your gun and tighten the locking nut with either a 17mm or 11/16 wrench. If you are welding 10GA or 12GA insulation pins, you may wish to re-install the adjustable leg set at this point. Set the foot piece so that approximately 3/16” of the insulation pins’ head extends beyond the foot piece.

Attach the *Ci Insulation Gun* to the locking terminals indicated on the front panel of the unit. Install the ground cable in either of the indicated ground terminals. Ensure that all connections are tight. Attach the clamp end of the ground cable to your work piece.

Switch the unit on and set the voltage on the **STUD WELDER XL** unit as follows:

10GA INSULATION PINS and 10GA CHP	125-150V
12GA INSULATION PINS and 12GA CHP	100-125V

You are now ready to weld. Press the gun against your work piece or pierce through the insulation with the CHP. Once the pin makes contact with the work piece, the “Stud on Work” light will be lit. The gun spring should compress; however, it is not necessary to “bottom the gun out”. You may now make a weld by depressing the trigger on the gun. Inspect the weld to ensure the fastener is attached firmly. If necessary, adjust the weld voltage and/or the gun spring pressure to achieve desired results. Excessive voltage will not produce a better weld.

See also Section 5.10 for a discussion of reverse polarity welding.