MUREX

Operating Manual

Transtig AC/DC 250 HF Square Wave

Please ensure that this Instruction Manual and Parts List is made available to the user of the equipment

£2.50

WARNING

This welding equipment has been designed, manufactured and tested to the highest standards to ensure long and trouble free life. However, regular maintenance is an essential part of keeping the machine operating in a reliable and safe manner and your attention is drawn to any maintenance instructions that are contained in this manual.

In general, all welding equipment should be thoroughly inspected, tested and serviced at least annually. More frequent checking will be required when the equipment is heavily used.

Wear and tear, particularly in electro-mechanical and moving components, are gradual processes. Caught in time, repair and costs are small and the benefits in performance reliability and safety are significant. Left alone, they can put the equipment, and you, at risk.

Have this equipment regularly inspected and maintained by an approved service centre.

WARNING

ARC WELDING AND CUTTING CAN BE INJURIOUS TO YOURSELF AND OTHERS. TAKE PRECAUTIONS WHEN WELDING. ASK FOR YOUR EMPLOYER'S SAFETY PRACTICES WHICH SHOULD BE BASED ON MANUFACTURERS' HAZARD DATA.

ELECTRIC SHOCK - Can Kill

- Install and earth the welding unit in accordance with applicable standards.
- Do not touch live electrical parts or electrodes with bare skin, wet gloves, or wet clothing.
- Insulate yourself from earth and work.
- Ensure your working position is secure.

FUMES AND GASES – Can be Dangerous to Health

- Keep your head out of the fumes.
- Use ventilation, extraction at the arc, or both, to keep fumes and gases from your breathing zone and the general area.

ARC RAYS – Can Injure Eyes and Burn Skin

- Protect your eyes and body. Use the correct welding screen and filter lens and wear protective clothing.
- Protect bystanders with suitable screens or curtains.

NOISE– Excessive noise can damage hearing

- Protect your ears. Use ear defenders or other hearing protection.
- Warn bystanders of the risks.

READ AND UNDERSTAND THE INSTRUCTION MANUAL BEFORE INSTALLING OR OPERATING AND SEE WMA PUBLICATION 237 'The arc welder at work' AVAILABLE FROM THE MANUFACTURER.

PROTECT YOURSELF AND OTHERS

SAFETY

In any arc welding or gouging operation, it is the responsibility of the user to observe certain safety rules to ensure his personal safety and to protect those working near him.

Read all safety articles relevant to arc welding published by the WMA. Pay particular attention to any CAUTION or WARNING Notes included in this manual. CAUTION indicates possible equipment damage. WARNING indicates possible hazard to life.

> ⚠ **WARNING** ⚠
>
> *The ON/OFF switch on this equipment does not isolate the unit from the mains electrical supply.* ***AC POWER IS PRESENT ON THE ON/OFF SWITCH TERMINALS.*** *The On/Off lamp is an indication that the supply is switched on and does not imply that the unit is isolated from the supply.* ***BEFORE REMOVING THE COVERS FOR MAINTENANCE, ISOLATE THE UNIT FROM THE MAINS ELECTRICAL SUPPLY.***

1. Electrical

⚠ Treat electricity with respect. Even the open circuit voltage of this equipment can be dangerous. Adjustments to the torch or replacement of torch parts should be undertaken with the mains supply isolated from the unit.

If damaged torch cables or torch components are found, the unit must be disconnected from the mains and defective parts must be replaced using only Murex spare parts.

⚠ Do not work on live circuits or cables. Disconnect the main power supply before checking the machine or performing any maintenance operation.

⚠ Be sure the case of the welding machine is properly connected to a good electrical earth.

⚠ Have the wiring for the welding machine installed by a qualified electrician. All connections must be made according to specifications in force and to general safety standards.

⚠ Do not stand in water or on damp floors while using an arc welder or cutter. Do not use in the rain.

⚠ Do not operate with worn or poorly connected cables. Inspect all cables frequently for insulation failure, exposed wires and loose connections.

⚠ Do not overload cables or continue to operate with overheating cables. Cables which are too small for the current carried will overheat, causing rapid deterioration of the insulation.

⚠ Pay attention that live parts of the torch do not touch any metal which is connected to the work return cable. Fix an insulated hook to hang the torch on when it is not in use.

2. Ventilation

⚠ Do not weld or cut on containers which have held combustible or flammable materials, or materials which give off flammable or toxic vapours when heated, without proper cleaning.

⚠ Locate the welding/cutting operation far enough from any vapour-type degreaser using trichlorethylene or other chlorinated hydrocarbons as solvents. The ultraviolet light from the arc can decompose these vapours into toxic gases at a considerable distance from the arc, even though the concentration of the gases is low enough to be undetectable by smell.

⚠ Be sure to provide adequate ventilation for removal and dilution of fume and gases. Fume exhaust facilities near the arc, or a ventilated helmet should be used when cutting in confined spaces or on toxic material.

3. Glare

⚠ Never look at the arc without wearing eye protection. Always use the proper protective clothing, filter glasses, and gloves. Be careful to avoid exposed skin areas. Do not use cracked or defective helmets or shields.

⚠ Never strike an arc when there is someone near who is not protected from the strong light of the arc.

⚠ Warn bystanders who are not aware of the dangers of ultra-violet light.

4. General

⚠ Take care when lifting the unit.

⚠ Ensure that cylinders are secured by chains.

⚠ Locate the unit so that there is adequate air flow to the ventilation louvres.

⚠ Always dress correctly to protect against glare, radiation and spatter.

5. Fire

⚠ Ensure that the correct type of fire extinguisher is available in the welding area.

⚠ Do not weld near flammable materials or liquids, in or near explosive atmospheres, or on pipes carrying explosive gases.

6. Vehicle Electrics

⚠ When working on motor vehicles, remove the battery and any circuits which may be damaged by the arc.

⚠ Whilst welding be aware of the possibility of 'hidden wires' behind panels or bulkheads.

INTRODUCTION

The Transtig AC/DC 250 HF Welding Power Supplies are constant current AC/DC welding power sources for high quality TIG and MMA welding in both the AC and DC mode. The unique characteristics of the magnetic and solid state circuits provide excellent arc conditions for all TIG welding as well as high alloy MMA electrodes. The non-saturating current limiting reactor and electronic feedback control prohibits high current surges inherent with saturable reactors or solid state SCR control alone, therefore reducing spatter on MMA electrodes as well as tungsten spitting when TIG welding. The electronic firing circuit utilises a voltage compensating circuit which compensates for mains voltage variations of +/- 10 percent.

Through its unique design, the AC/DC 250 HF combines all of the latest state-of-the-art magnetic and solid state concepts to provide the wide range of volt-ampere curve characteristics needed for a constant current AC/DC power supply - see Figure 1.

Equipment Features Include:

(a) Local/Remote control of welding output.
(b) AC Waveform balance control.
(c) Post weld gas flow timer.
(d) Thermal overload protection.
(e) Power factor correction
(f) Arc force control (for MMA welding).
(g) Auxiliary power output (115v AC).

Optional Extras Available:

Foot Control Unit.	Part No 558000169
Analogue Volt/Ammeter Unit.	Part No 1414917
Pulse Control Unit.	Part No 1414918
Water Cooling Unit	Part No 1414060
Water Cooling Hose Kit	Part No 365943881

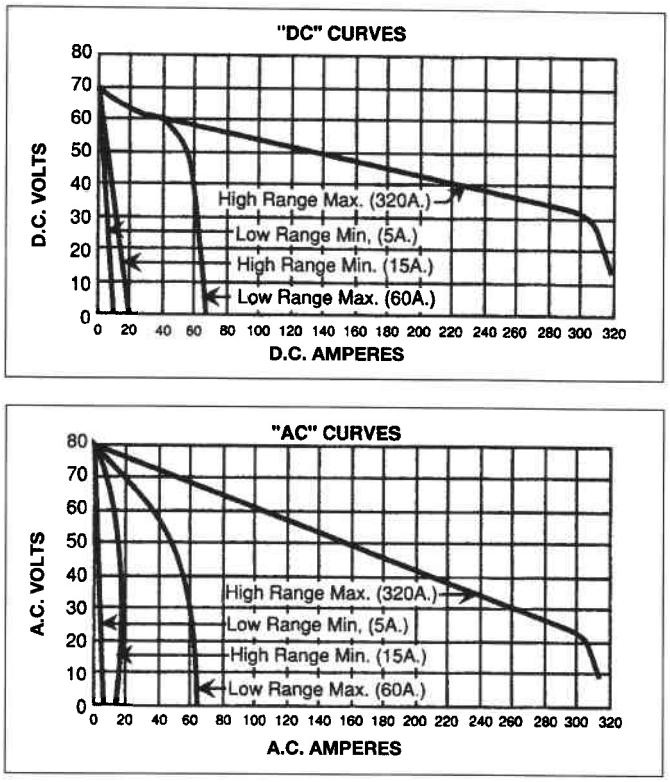


Fig. 1 - Volt-Ampere Curves
with Arc Force control turned to minimum

DUTY CYCLE

Duty cycle is defined as the ratio of load time to the total time. Standard current ratings are based on a ten minute cycle. This machine is rated at 40 percent duty cycle which means the **rated load** (250 amps) is applied for a total of four minutes and shut off for a total of six minutes in a ten minute period. However, if the welding current is decreased, the duty cycle can be increased. Conversely, if the welding current is increased, the duty cycle must be decreased. Figure 2 enables the operator to determine the safe output of the power supply at various duty cycles.

CAUTION

Exceeding the indicated duty cycle will cause the welding power source to overheat and may cause damage to the equipment.

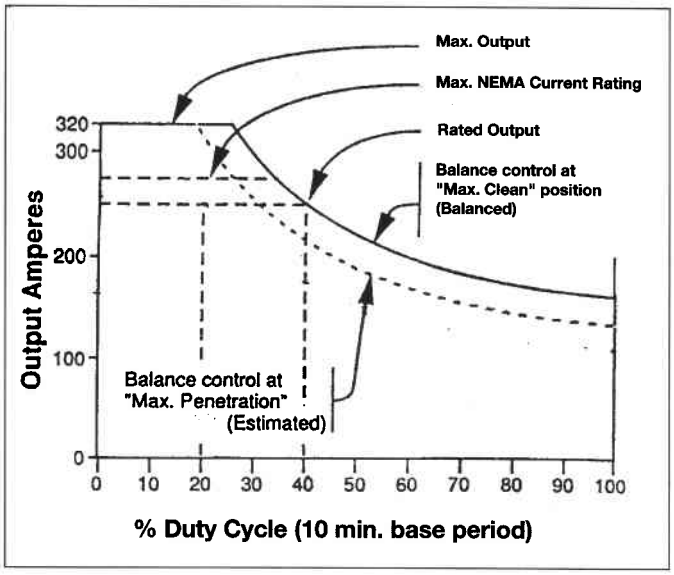


Fig. 2 - Duty Cycle Chart

INSTALLATION

WARNING

Review the safety section at the front of this manual and comply with all applicable precautions.
Follow the instructions included elsewhere in this manual relative to proper installation to reduce radio interference.

To prepare the unit for installation, several items should be checked. Clear all packing materials from around the unit and carefully inspect for damage which may have been caused by shipping. Be sure to read all the instructions before attempting to operate the unit. If a fork lift is used for lifting the unit, be sure that the lift forks are long enough to extend completely though under the base.

IMPORTANT

The use of lift forks too short to extend out of the opposite side of the base could cause internal damage should the tip of the lift forks penetrate the bottom of the unit. See 'Safety'.

Location

A proper installation site should be selected for the welding equipment if the unit is to provide dependable service, and remain relatively maintenance free.

The site should allow air movement into and out of the welding unit, and be free from excessive dust, dirt, moisture, and corrosive vapours. The location should also permit easy removal of the welding unit panels for maintenance.

IMPORTANT

Do not place any filtering device over the air intake passages of the unit as this will restrict the movement of air and could cause overheating and possible failure. Warranty is void if any type of filtering device is used.

▲ **Double Links Provided**

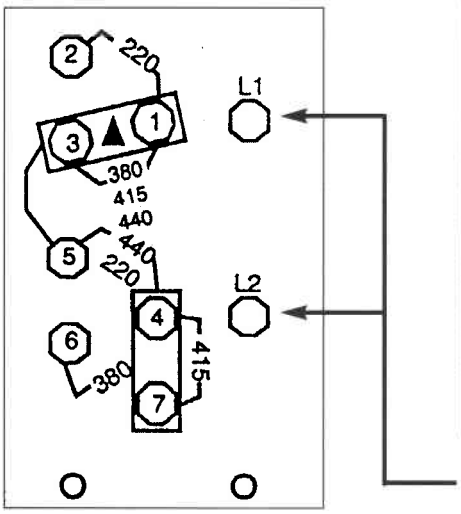


Fig. 3. Voltage Changeover Board
Terminal Board (TB)

Electrical Input Connections

WARNING

Before making electrical input connections to the welding unit, use 'machinery lockout procedures': If the connection is to be made from a mains disconnect switch, the switch should be padlocked in the off position. If the connection is made from a fuse box, remove the fuses from the box and padlock the cover in the closed position. If locking facilities are not available, attach a red tag to the mains disconnect switch (or fuse box) to warn others that the circuit is being worked on.
Placing the welding unit power switch in the 'Off' position does not shut off all power within the equipment.
Be sure that the switch box is attached directly or by cable to a suitable ground such as a water pipe or ground rod. Do not ground to gas piping or electrical conduits. Comply with local electrical inspection authorities.

Input Electrical Requirements

This AC/DC welding unit is a SINGLE-phase unit and must be connected to a SINGLE-phase power line or any two phases of a three-phase system of the proper voltage.

If there is any question about the type of system used locally, or the proper connections to obtain a single-phase primary input voltage to the welding unit, consult the local power authorities.

Input Connections

The welding unit should be operated from a separately fused or circuit breaker-protected circuit. The maximum capacity of the welding unit is affected by the mains voltage and if the circuit is overloaded, the performance of the welding equipment will be impaired.

CAUTION

Connect the input cable to the unit before making connections to the single phase power line.

CAUTION

Be sure when installing the welding unit that an earth wire is connected from the ground lug to a suitable ground. This is absolutely necessary as any development of stray currents may give a severe shock should anyone touch the welding unit and at the same time touch any grounded object. The ground lug is connected to the welding equipment chassis and is for ground purposes only. If the welding unit is to be connected to two phases of a three-phase line, do not connect the third wire from a three-phase line to the ground lug as this will result in a 'live' welding unit chassis.

The input cable wires connect to terminals labelled 'L1 and L2'. A third conductor, ground connections, should be fastened to the ground lug, and leave sufficient slack in the earth wire so that, in the event of strain on the cable, the earth wire is the last to be affected.

Welding Connections

NOTE

To obtain the full rated output from this unit, it is necessary to select, install and maintain proper welding cables. failure to comply in any of these areas may result in less than satisfactory welding performance.

Cable Length

It is recommended that the welding cables be kept as short as possible, spaced as described below, and be of adequate current carrying capacity. The resistance of the welding cables and connections causes a voltage drop which is added to the voltage of the arc. Excessive cable resistance may result in overloading as well as reducing the maximum current output of the welding unit. The proper operation of any welding unit is to a great extent dependent on the use of welding cables and connections that are in good condition and of adequate size. An insulated electrode holder should be used to ensure operator's safety.

Cable Insulation

It is important, especially where high frequency is used, that lugs or uninsulated portions of the welding cable do not touch or come too close to the case of the welding equipment.

Cable Spacing

When welding with AC or DC, if the welding cables are coiled up they will operate a magnetic field which will seriously affect the operation of the welding equipment. Always lay the welding cables out. The welding cables should not be taped together when using high-frequency, they should be placed about 1.9 to 2.5cm (3/4 inch to 1 inch) apart on a suitable board and fastened with plastic clamps or clips. Do not use metal clamps as they will tend to serve as an antenna and radiate high-frequency.

Gas Connections

CAUTION

When connecting to gas solenoid valve, use non-conductive hose.

1. The gas inlet is located on the front panel. Connect the gas hose from the gas supply, to the gas valve connection labelled 'Gas In'.
2. The gas flow must be controlled accurately with the aid of a regulator and a flow-meter. No specific recommendations for rates of flow can be given, as this depends entirely on the specific welding conditions. Correct argon flow is usually between 227 to 991 litres (8 to 35 cubic feet) of gas per hour. The helium flow is between 510 to 991 litres (18 and 35 cubic feet) per hour.

CONTROLS

See also 'Operational Safety'

1. Power

The power switch, in the on position, energises the fan and control circuitry, and places the welding equipment in a ready-to-weld status. Placing the power switch in the off position shuts down the welding unit.

WARNING

Placing the power switch in the off position does not remove power from all the welding unit internal circuits. Completely isolate all electrical power to the power source by employing 'machinery lockout procedures' before attempting any inspection work on the inside of the unit. If the power source is connected to a disconnect switch, padlock the switch in an open position. If connected to a fuse box, remove the fuses and padlock the cover in the closed position. If the unit is connected to a circuit breaker, or other disconnecting device without locking facilities, attach a red tag to the device to warn others that circuit is being worked on.

2. AC Wave Balance Control

When the AC wave balance control is set in the 'O' balance position, the output waveform is balanced between positive and negative polarity. By rotating the control clockwise to more negative polarity less tungsten heating results and a higher welding current may be applied to the tungsten to obtain more penetration. Sufficient cleaning action is obtained for most applications over the entire range of the control, but set the control to the 'O' position when maximum cleaning is required, and for MMA welding.

NOTE

The AC wave balance control is a continuous type control and may be adjusted whilst welding.
The scale surrounding the control does not relate to current or voltage values. It only adjusts the AC wave shape.

IMPORTANT

For the AC wave balance control to work properly, it is required that the electrode and work cables be connected to the correct terminals on the welding power source (electrode cable to the electrode terminal, work cable to the work terminal). If the cables are reversed, the AC balance control will appear to function backwards.

Fig 4.

3. Arc Force Control

This control is used in the MMA mode only. The lower settings provide less short circuit current and a softer, more stable arc. The higher settings provide more short circuit current and a forceful, more penetrating arc. For most MMA welding, set the knob at 3 or 4 and readjust up (forceful) or down (softer) as desired. Note that with the knob in the MIN. position a longer arc length can be maintained; and at MAX., the arc will extinguish much easier when drawing the electrode away from the work.

4. High Frequency (Solenoid) Selector Switch

A three position toggle switch (an integral part of the Logic P.C.B.) controls high frequency and shielding gas in the welding operation.

The functional positions are: **Off** - no high frequency and gas solenoid valve is de-energised (this is the normal position for all MMA welding); **Continuous** - high frequency and shielding gas are provided throughout the entire welding cycle (this is the normal position for all AC TIG welding); and, **Start** - high frequency initiates immediately and cuts off when the arc is established, and the gas solenoid energises and remain on throughout the welding cycle (this last position is normal for most DC TIG Welding applications.)

5. Post Flow Control

This potentiometer (an integral part of the Logic P.C.B.) provides a timed (from 5 to 45 seconds) post-flow of shielding gas after the welding arc is broken.

7. Current Control Potentiometer

This potentiometer (an integral part of SCR Control P.C.B.) provides fine adjustment of welding current within the range selected on the Range Switch. The panel-faced dial provides an accurate reference for resetting and/or adjusting the potentiometer.

NOTE

The contacts of the weld current control are of the continuous type, thereby making it possible to adjust the output while welding.

6. **Current Range Selector Switch**

This two-position switch (an integral part of the SCR Control P.C.B.) permits quick coarse selection of the output current ranges which can be used. The current ranges are marked (low) 5-60 Amps and (high) 15-320 Amps. The low Range provides exceptional cleaning action for all low current TIG A.C. applications. For higher current TIG welding, always try to select the appropriate minimum current range that adequately covers your welding requirements. For MMA electrode welding, position the switch to the desired current output range. **Do not change the position of this switch while welding or under load.**

8. **Mode Selector Switch**

This two-position toggle switch sets the operational modes which can be used. In the MMA position the solid-state contactor circuits immediately energise and welding power is continuously present at the output terminals. In the TIG position, the solid-state contactor and other TIG sequencing circuits are controlled by a external device (foot or torch switch) through the Remote Control socket.9. **Current Control Switch**

This two-position toggle switch determines the location from which welding current will be operated; LOCAL position from the power supply Weld Current potentiometer, or REMOTE position from an optional foot or hand control that plugs into the Remote Control socket.

When the REMOTE position is selected, the optional remote control will vary the welding current, but only within the range preset on the power supply Weld Current potentiometer.

10. **Control Circuit Fuse (5A)**

Protects the internal electronic circuits from overload. If the fuse fails, investigate the cause of the failure prior to replacing it.

11. **Work Return Connection**

Must be connected to the workpiece.

12. **Gas Out Connection**

Gas connection to TIG torch.

13. **Gas In Connection**

Gas connection from TIG gas regulator and flowmeter.

14. **Electrode Connection**

For connection to a MMA electrode holder or TIG torch.

15. **Remote Control Socket**

This socket allows you to plug in a remote accessory (eg. foot or hand control) to provide remote current and torch switch control depending on the selection of switches described in items 8 and 9.

16. **Current Selector Switch**

A three-position switch offers a choice of AC, DC- or DC+ output current to suit your particular welding applications. Placing the switch in its DC- mode causes the output terminal to assume the following polarities; work is positive, and torch/electrode is negative. Conversely, when the torch is in DC+; the work is negative and torch/electrode is positive.

IMPORTANT

Do not change the position of the polarity switch whilst welding or under load as this will cause the contacts of the switch to arc. Arcing across the contacts will cause the contacts to become pitted and prematurely fail.

REAR PANEL

Auxiliary 115-Volt Socket

This duplex socket can be utilised to supply 115-volt power for auxiliary equipment (grinder, etc.) and is protected by 15 amp circuit breaker.

ACCESSORIES

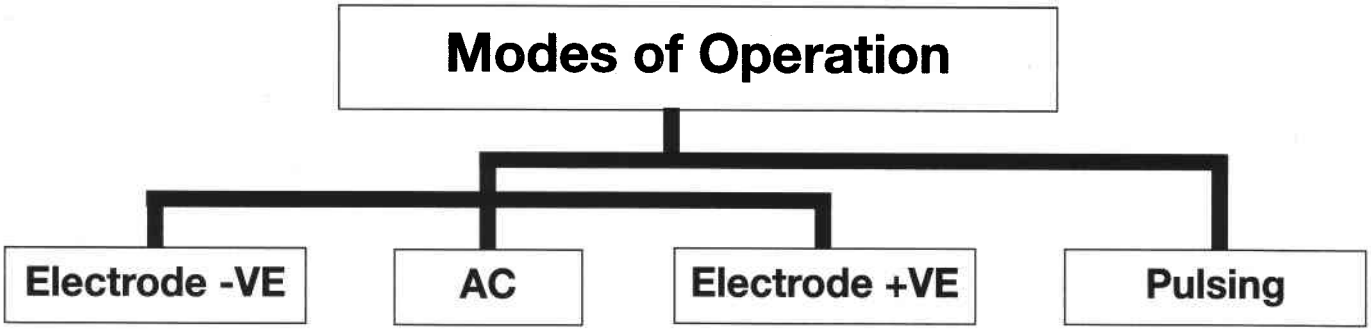
1. Remote Foot Current and Contactor Control

This device provides the operator with remote control of current and contactor operation at the welding station. Interconnection of these functions to the main unit is provided by a 25-foot cable/plug assembly. By depressing the foot pedal, the weld-start circuit will energise, and the welding current will increase or decrease within the range preset on the power supply Current Control potentiometer.

2. Torch Current and Contactor Control

This remote fingertip control is designed to be attached to any TIG Torch handle and it allows the operator complete contactor control and variable control of the welding current. By simply rotating the knob clockwise (off of zero) the integral switch will energise the contactor, and further regulation (clockwise) will increase the output current up to the limit preset on the power supply main control.

THE TIG WELDING PROCESS



The polarity of the electrode determines the heat balance in the arc. 'Electrode negative' gives the greater heat input to the workpiece.

Normally 'electrode negative' is used, but with 'electrode positive' cathodic (workpiece) cleaning occurs.

These phenomena are exploited in the A.C. mode when the electrode changes alternately from negative to positive.

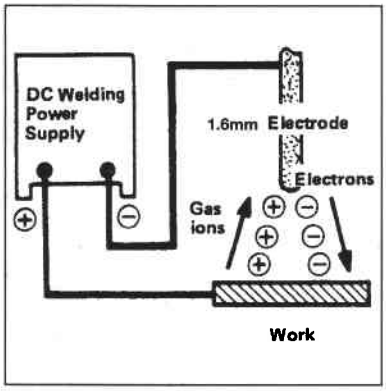
Pulsed D.C. mode allows greater control of heat input into the weld area.

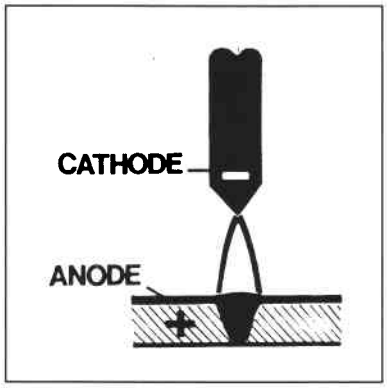
Welding Power

When TIG welding, the operator has three choices of welding current. They are: direct current negative electrode polarity, direct current positive electrode polarity, and alternating current. Each of these current types has its applications, and its advantages and disadvantages. A look at each type and its uses will help the operator select the best current type for the job.

The type of current used will have a greater effect on the penetration pattern as well as the bead configuration. The illustrations below show details of the arc with each current type.

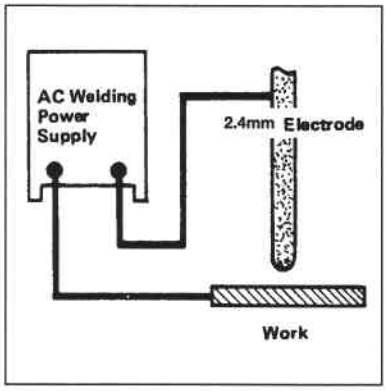
DC Electrode Negative

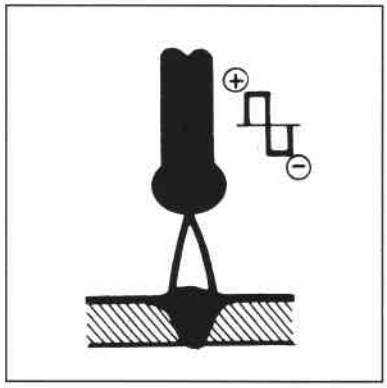




TIG welding with electrode negative gives deep penetration because it concentrates the heat in the joint area. No cleaning action occurs with this polarity. The process is particularly suited to Stainless Steel, Copper, Nickel, Alloy Steels, Nickel alloys and Titanium.

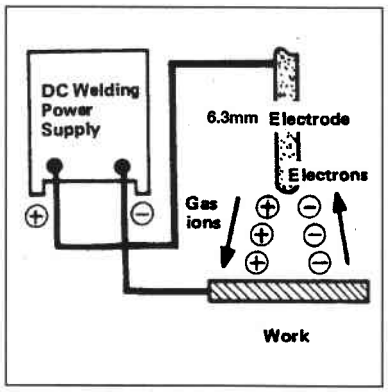
AC

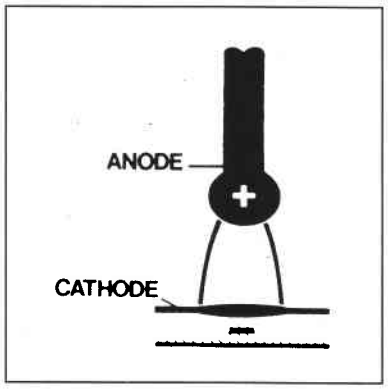




TIG welding with AC combines the good weld penetration on the negative half cycle with the desired cleaning action of the positive half, giving improved welding quality when working with Aluminium and Magnesium Alloys.

DC Electrode Positive





TIG welding with electrode positive produces good cleaning action as the argon ions flowing towards the work strike with sufficient force to break up oxides on the surface. Since the electrons flowing towards the electrode cause a heating effect at the electrode, weld penetration is shallow.

DC Electrode Negative

DC electrode negative polarity (D.C. normal) is used for TIG welding of practically all metals except magnesium. The torch is connected to the negative terminal of the power source and the work lead is connected to the positive terminal. When the arc is established, electron flow is from the negative electrode to the positive workpiece. In a D.C. arc approximately 70% of the heat will be concentrated at the positive side of the arc, therefore the greatest amount of heat is distributed into the workpiece. This accounts for the deep penetration obtained when using D.C. for TIG welding. The electrode itself receives a smaller portion of the heat energy, and will operate at a lower temperature than when using alternating current or D.C. reverse polarity. This accounts for the higher current capacity of a given size tungsten electrode with D.C. normal than with A.C. or D.C. reverse. The electron flow leaving the electrode results in a cooling effect on the tungsten; therefore it operates at a lower temperature. At the same time the electrons striking the work result in considerable heat being liberated at this point. The gas ions which are positively charged, are attracted towards the negative electrode.

Alternating Current

When using alternating current the terms positive and negative which were applied to the workpiece and electrode lose their significance. The current is now alternating or changing its direction of flow. During a complete cycle of alternating current there is theoretically one half cycle of negative polarity and one half cycle of positive polarity. In theory, the half cycles of alternating current are of equal time and magnitude.

The waveform 'balance' between positive and negative half cycles can be adjusted on the Transtig AC/DC 250 HF squarewaves (see Controls Section).

DC Electrode Positive

When D.C. electrode positive polarity (D.C. reverse) is used the torch is connected to the positive terminal, and the work lead is connected to the negative terminal. When using this polarity, the electron flow is still from negative to positive, however, the electrode is now the positive side of the arc and the work is the negative side. The electrons now are leaving the work with the same cooling effect as before, and are impinging on the electrode with the resulting heating effect. The electrode receives the greatest amount of heat and becomes very hot. The electrode must be large even when low current is used to prevent overheating and possibly melting the electrode. The workpiece receives a smaller amount of the total heat resulting in shallow penetration. The positive gas ions are now attracted to the negative workpiece. They strike the work with sufficient energy to chip away the brittle aluminium oxides and provide "cleaning action".

Cleaning action refers to the breaking up and removal of the oxide coating. Because of this beneficial oxide removal, this polarity would seem to be excellent for welding aluminium and magnesium. There are, however, some disadvantages. As was previously mentioned the tungsten electrode becomes very hot, therefore, a large electrode must be used for relatively low current.

As an example, a 6.3mm diameter electrode would be necessary to weld with D.C. reverse at 125 amperes. The large diameter electrode will naturally produce a wide puddle resulting in the heat being widely spread over the joint area. If D.C. normal were used at 125 amperes, a 1.6mm electrode would be adequate. The small electrode produces a more highly concentrated arc resulting in the heat energy being confined to a smaller area.

Since most of the heat is liberated in the electrode, the resulting penetration pattern will prove to be shallow when using D.C. reverse. When used on aluminium the arc would be somewhat erratic as aluminium is not a good emitter of electrons.

The good cleaning action of positive polarity plus the stable arc and good penetration of negative polarity, would seem to be the best combination for welding aluminium. A compromise to obtain the advantages of both D.C. normal and D.C. reverse is to use alternating current.

Pulsed TIG (optional)

Pulsed TIG in its simplest form is a system in which the arc current alternates between two levels, heating and fusion taking place during the periods of higher current, with cooling and solidification during the periods of low current.

Continuous fusion along a seam is achieved by ensuring that the individual weld 'spots' overlap.

A low level 'background' current provides a pilot arc. Onto this background current pulses of current are superimposed usually at a rate of up to 10 pulses per second.

Research has shown that a pulse rate between 1/2 and 3 pulses per second provide optimum control of welding conditions for high specification work in such industries as aerospace and nuclear engineering.

The background current maintains the arc during pulse off conditions.

Using the pulsing facilities the operator can obtain a very fine control of heat into the weldpool achieving maximum penetration and a high quality finished result.

Improvements include:

a. Reduced distortion

b. Reduced heat build-up

c. Improved tolerance to joint fit up

Pulsed TIG is normally used with D.C. electrode negative.

The effect of varying the pulse controls can be summarised as follows:

Pulse Width/Peak Controls - Provide control of heat input.

Frequency - various setting of frequency rates (pulse-per-second p.p.s.) allows the optimum traverse speed to be selected to match the material being welded.

Background - Provides control of penetration width and depth. Reduces thermal shock and improves grain size refinement.

Electrode Selection Guide

Supply			**DC**				
			Electrode Current (Max.) Amps				
Thoriated	20	60	70	120	200	300	370
Electrode Dia. (mm)	0.5	1.0	1.6	2.4	3.2	4.0	4.8
Supply			**AC**				
			Electrode Current (Max.) Amps				
Thoriated	15	25	50	80	120	160	200
Zirconiated	15	25	50	80	120	160	200
Electrode Dia. (mm)	0.5	1.0	1.6	2.4	3.2	4.0	4.8

Note: *The figures given in the above table are recommended for Class 1 welded (balanced wave-form on ac) by British Standard 3019 Parts 1 and 2. Higher welded currents may be used by experience welders.*

Although thoriated electrodes may be used for A.C. welding, zirconiated electrodes are preferred when welding aluminium as the risk of tungsten contamination is reduced.

HIGH FREQUENCY RADIATION NOTES PREVENTATIVE MEASURES

To prevent the possibility of interferring with authorised radio communication services it is necessary to install the welding equipment properly. Field experience has shown that if the instructions outlined in this manual are followed in detail, the installation is unlikely to radiate disturbing energy.

The importance of correct installation cannot be over-emphasised since case histories of interference due to high frequency stabilised arc welding machines have shown that invariably an inadequate installation was at fault.

Under certain conditions, especially when this equipment is operated in very close proximity to sensitive radio frequency receivers, interference may still be caused in spite of the fact that field strengths may be within specified limits. In these cases the user is obligated to take any additional steps to clean up the interfering situation provided the receiver being subjected to interference is of good design and properly installed.

General Information

In a high frequency stabilised arc welding installation, interfering radiation can escape in four distinct ways as outlined below:

(a) Direct Radiation from the Welding Unit

This is radiation which escapes directly from the welding unit case. This is very pronounced if access doors are left open and unfastened and if the welding unit case is not properly grounded.

Any opening in the metal case will allow some radiation to escape.

The high frequency unit of this equipment is adequately shielded to prevent direct radiation of any consequence of proper grounding is carried out.

(b) Direct Feedback to the Mains Cable

High frequency energy may get on the mains cable by direct coupling inside the equipment of the high frequency unit, the cable then serving as a radiating antenna.

By properly shielding and filtering, direct coupling is prevented in this equipment.

(c) Direct Radiation from Welding Leads

Direct radiation from the welding leads, although very pronounced, decreases rapidly with distance from the welding leads. By keeping the welding leads as short as possible, the operator can do a great deal to minimise interference from the source.

The intensity and frequency of the radiation can be altered over wide limits by changing the location and relative position of the welding leads and work. If possible, loops and suspended sections should be avoided.

(d) Pick-up and Reradiation

Even though welding lead radiation falls off rapidly with distance, the field strength in the immediate vicinity of the welding area may be extremely high. Unshielded wiring and ungrounded metallic objects in this strong field may pick up the direct radiation, conduct the energy from some distance, and produce a strong interference field in another area.

This is usually the most troublesome source of interference, but careful adherences to proper installation procedure as outlined in this manual will minimise this type of interference.

Power Service

The specific installation instructions for making the proper primary connections to the equipment as outlined in this instruction manual should be followed carefully.

Ordinary helically wrapped conduit is designed for mechanical protection and is not suitable for electrical shielding. Only solid metallic conduit or conduit of 'equivalent electrical shielding ability' should be used to enclose the primary power service leads.

Solid metallic shielding shall enclose the primary power supply to the equipment from a point 15m (50 feet) from the equipment in an unbroken run.

This shielding shall be grounded at the farthest point from the equipment and should make good electrical contact with the casing of the equipment. Care should be taken that paint or corrosion at the junction of conduit and case, does not make good electrical contact.

There shall be no gap in this shielding run. This simply means that within 15m (50 feet) of the equipment, no portion of the power wires serving the equipment shall be unshielded. If there is any question about the electrical efficiency of the joints between individual conduit sections, outlet boxes and the equipment case, bonding should be carried out by soldering a copper strap or wire across the joint as shown.

No change in the wiring or the location of parts inside the equipment, other than power supply tap changes or other adjustments specifically covered, shall be made. The equipment shall not be modified in any way since changes in the equipment can affect the radiation characteristics.

While the equipment is in operation, all access and service doors shall be closed and properly fastened.

Spark gap settings shall be maintained at the minimum separation consistent with satisfactory welding results.

Welding Leads

To minimise direct weld lead radiation, the welding cables (electrode cable and work cable) must be kept as short as possible. Tests have been made with cables 7.6m (25 feet) long. Considerable improvement in radiation minimisation can be made by shortening the cables as much as possible.

Keeping the electrode cable and the work cable as close as possible and on the floor serves to reduce the radiation.

Wiring in the Vicinity of the Welding Area

As discussed in the general information section, the most serious source of interference is reradiation from wires located near the welding area.

Any ungrounded electrical conductor in the strong 'directly radiated' field, produced by the welding cables, serves as a pick-up device and may conduct the interference for some distance and reradiate strongly at another location.

For purpose of simplification and standardisation, the space all around the weld zone at a distance of 15m (50 feet) in all directions is referred to as the High Field Intensity (H.F.I.) zone.

To minimise radiation of this type, all wiring in the H.F.I. zone shall be in rigid metallic conduit, lead covered cable, copper braid, or material of equivalent shielding efficiency. Ordinary flexible helically wrapped metallic conduit is not satisfactory for shielding, and should not be used. The shield on all wiring should be grounded at intervals of 15m (50 feet) and good electrical bonding between sections shall be maintained.

This shielding requirement applied to all wiring, including telephone, intercommunication, signal and control, and incidental service.

Extreme precaution should be taken to make sure that the location of the zone is chosen so that none of the conditions is voided by unshielded wires off the premises but still within the radial dimensions of the H.F.I. zone.

This 15m (50 feet) H.F.I. zone is a minimum that is imposed On the installation. Tests by the manufacturer are based on this limit.

Keeping unshielded wires farther than 15m (50 feet) from the weld zone will materially aid in minimising interference.

If it is impossible to relocate unshielded wires, that section within the H.F.I. zone, should be placed in conduit and each end of the conduit section grounded.

NOTE

It must be emphasised that all changes in power and lighting should be made by a qualified electrician. Any shielding or relocation of telephone or signal wires must be done either by the service company concerned or with the specific permission of said company.

'Good Ground'

Frequent reference is made to a 'good ground' in previous sections. Although there is considerable leeway in the interpretation of this term, for the purpose covered here the following specifications apply:

A 'ground' connection should be made to a driven rod at least 2.4m (8 feet) long and driven into moist soil.

A cold water pipe can be used in place of the ground rod provided it enters the ground within 3m (10 feet) of the equipment to be grounded.

All leads connecting the point to be grounded to the ground rod or pipe should be as short as possible since the ground lead itself can become an effective radiating antenna.

The effectiveness of a ground in reducing interference depends upon the ground conductivity. In certain locations it may become necessary to improve the ground conductivity by treating the soil around the ground rod with a salt solution.

Metal Building

It is frequently thought that the operation of high frequency stabilised arc welding equipment in metallic buildings will completely eliminate troublesome radiation. This, however, is a false assumption. A metallic building structure, if properly grounded, may serve to reduce direct radiation from the weld zone but will have no effect on conducted interference and radiation. As a result, all installation requirements must be complied with.

If the metallic building is not properly grounded, bonding to several good electrical grounds placed around the periphery of the building itself is not contributing to the radiation.

Check List

The following questions may be used by the installer as a check to see if all installation requirements have been met.

1. Has the equipment been located so that ground leads can be kept short?
2. Are the mains cables, serving the unit, in conduit?
3. Is there good electrical contact between power conduit and case?
4. Do the conduit couplings make good electrical contact? (If in doubt, use bonding).
5. Is there good electrical contact between conduit and switch boxes?
6. If rigid metallic conduit is not used, is the shielding used of equivalent shielding efficiency? (Copper sleeving, lead covered cable, etc. is satisfactory. Spirally wound flexible metallic conduit is not suitable).
7. Is the conduit system ground to a point at least 15m (50 feet) from the equipment?
8. Is the conduit run complete (without any gap) in the H.F.I. zone?
9. Is the equipment case connected to the work terminal of the secondary?
10. Is the wire used for this connection of sufficient size?
11. Is the work terminal connected to a good electrical ground?
12. Is the cable or copper braid used for this connection equal to or greater in current carrying capacity than the welding cable?
13. Is the cable as short as possible? 0.062
14. Are the spark gaps set at 0.[illegible]cm ([illegible])? (0.025")
15. Are all service and access doors closed and bolted?
16. Are the welding cables less than 7.6m (25 feet) long?
17. Are they as short as possible?
18. Are the welding cables on the floor or placed on a suitable board?
19. Are the welding cables a minimum of 1.9 to 2.5cm (3/4in to 1in) apart?
20. Have you visualised the H.F.I. zone, a sphere with 15m (50 feet) radius centred on the weld zone?
21. Have the unshielded power and light wires originally in the H.F.I. zone been placed in grounded shields or been relocated outside the zone?
22. Have all large metallic objects and any long guy or supporting wires in the H.F.I. zone been grounded?
23. Have you checked so that no external power or telephone lines off the premises are within the zone?
24. Are the grounds driven ground rods?
25. Is a cold water pipe used as a ground?
26. If so, does it enter the ground 3m (10 feet) or less from the connection?
27. Are the connections to the ground clean and tight?
28. If operated within a metal building, is the building properly grounded?

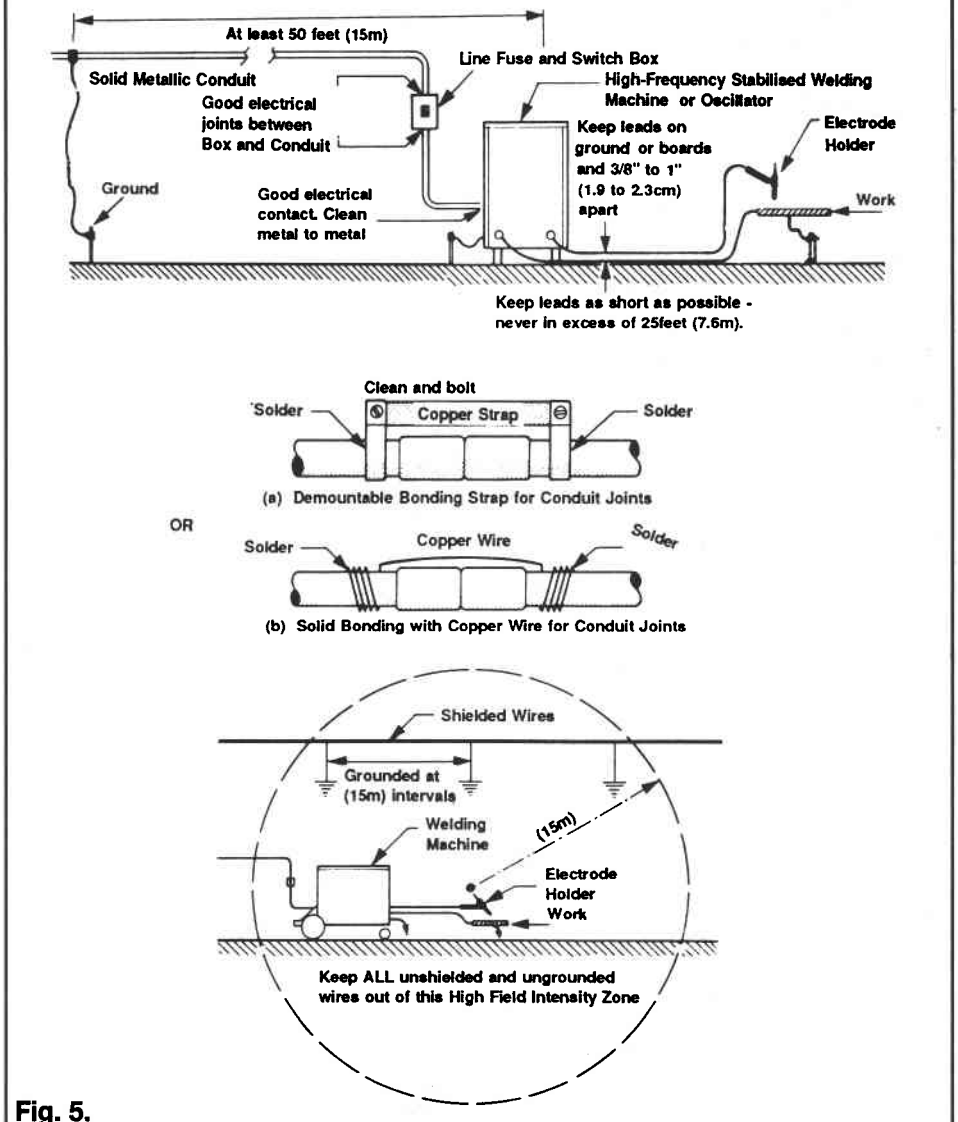


Fig. 5.

OPERATION

WARNING

Review and comply with all the safety notes at the front of this manual

TUNGSTEN INERT GAS WELDING (TIG)

1. Make all necessary connections as instructed under 'installation'.

2. Place the TIG/MMA switch in the TIG position.

3. Place the polarity switch as required; DC negative or AC.

4. Place the current range switch in the desired position.

5. If a remote current control device is not to be used, place the current control switch in the local position. If a remote current control is to be used, place the current control switch in the remote position.

6. Rotate the weld current control to the desired setting.

7. Set the desired Post Gas flow time.

8. For AC TIG, set the AC wave balance control as required. Set the control fully anticlockwise (50/50 balance) if welding DC.

9. Ensure the pump on/off switch is in its On position when using water cooled TIG torch.

10. For AC TIG welding set the high frequency switch to the continuous position.

11. For DC TIG welding using HF start, set the high frequency switch to its start position.

12. Place the power switch in the ON position.

WARNING

Prior to welding, it is imperative that proper protective clothing (welding coat and gloves) and eye protection (glass and/or welding helmet) be put on. Failure to comply may result in serious injury.

13. Commence welding.

NOTE

For DC TIG welding, 1% or 2% thoriated tungsten electrodes are normally used.

For AC TIG welding, pure or zirconium tungsten electrodes are normally used.

Welding

WARNING

When changing tungsten electrodes or when converting the unit for manual welding, the unit must be isolated from the mains supply.

Always commence with a last minute check for safety and protection.

Check for correct and secure torch and work return lead connections.

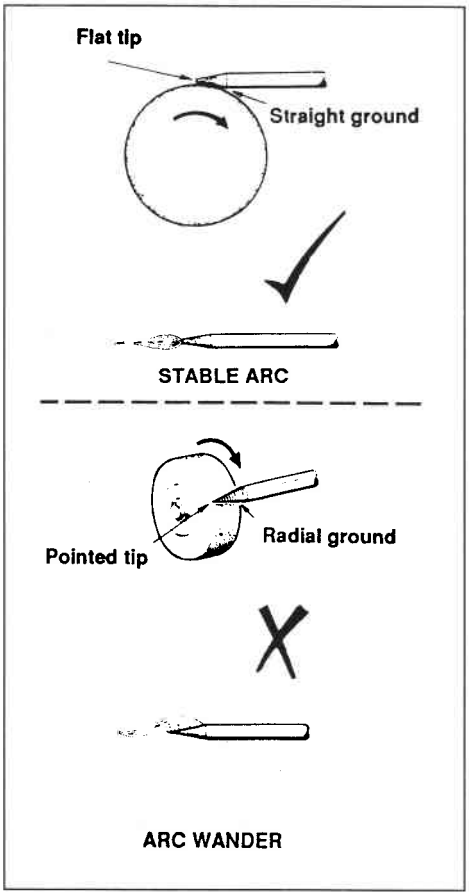
Check or correct position of controls.

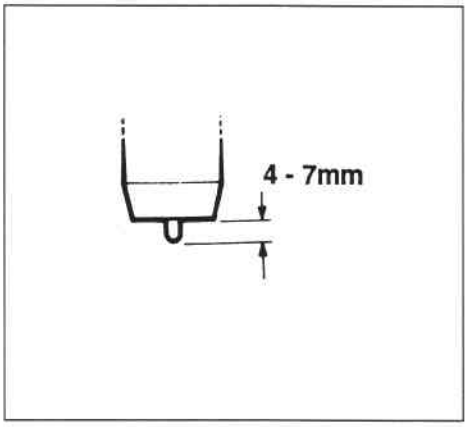
Check that the electrode tip sticks out by 4 to 7mm and that it is ground correctly.

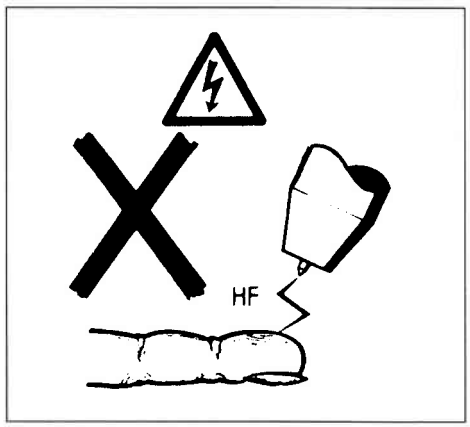
Using the cylinder key, turn on the gas and adjust the gas flow for a 6 to 7.5 litres/minute (12-15cu ft/hr) indication on the flowmeter.

AC or DC TIG Arc Initiation using High Frequency

Position the torch, warn bystanders to shield their eyes and lower your headscreen. Press the torch switch and slowly lower the torch. **(DO NOT TOUCH THE WORKPIECE WITH THE ELECTRODE).** The High Frequency output will allow the arc to strike without the electrode touching the workpiece.







Do not strike the HF on your finger or any part of the body.

MANUAL METAL-ARC WELDING MMA

1. Make all necessary connections as instructed in 'Installation'.

2. Place the TIG/MMA switch in the MMA position.

3. Place the H.F. switch in the centre OFF position.

4. Set the polarity switch as desired DC positive, AC, or DC negative.

5. Set the range switch as required.

6. Select the desired weld current control setting.

7. Set the AC wave balance control to the fully anti-clockwise to the O position (50/50 balance).

8. Place the power switch in the ON position.

WARNING

Prior to welding, it is imperative that proper protective clothing (welding coat and gloves) and eye protection (glasses and/or welding helmet) be put on. Failure to comply may result in serious and even permanent bodily damage.

Welding

1. Position the electrode close to the point where welding is to commence, without actually touching the work.

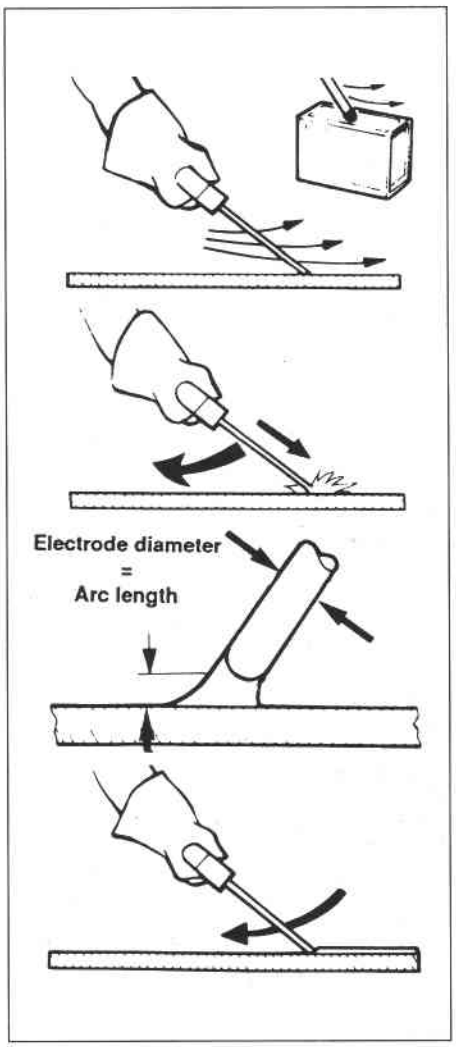
2. Cover the eyes with a headscreen or handshield and warn bystanders.

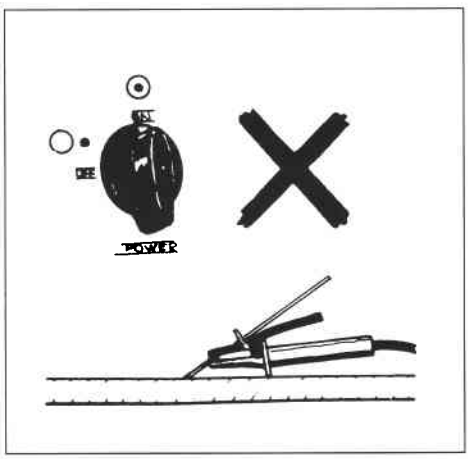
3. (a) Scrape the electrode on the work surface near the start point (as though striking a match). The arc should strike.

(b) Carry on scraping the electrode across the surface of the workpiece until the arc is almost continuous, then feed the electrode into the hot pool of molten metal keeping the electrode at approximately 65-80° to the workpiece.

(c) Correct length of arc, (size of weld bead) is acquired by feeding the electrode backwards and downwards into the weld.

This downwards movement requires a little skill which will be acquired after a few practice welds.





Don't switch on with the electrode touched down on a metal surface

MAINTENANCE

WARNING

Be sure that the circuit or mains isolation switch is open or electrical input circuit fuses are removed before attempting any inspection or work on the inside of the welding unit. Placing the POWER switch on the welding nit in the OFF position does not remove all power from inside the welding unit.

IMPORTANT

Inspection, troubleshooting, and repair of this equipment may ordinarily be undertaken by a competent individual having at least general experience in the maintenance and repair of semiconductor electronic equipment. Maintenance should not be undertaken or attempted by anyone not having such qualifications.

Fan Motor

The Transtig AC/DC 250HF is equipped with a fan and relies on forced draft for adequate cooling for high duty cycles and loads. The fan motor is manufactured with lifetime lubricated sealed ball bearings and no attention should be required.

Transformer

Occasional blowing out of the dust and dirt from around the transformer is recommended. This should be done periodically depending upon the location of the unit and the amount of dust and dirt in the atmosphere. The welding unit case cover should be removed and a clean dry air stream should be used for this cleaning operation.

Input Power and Welding Cables

These cables should be inspected periodically. Fraying and broken wires may occur at the electrode holder and work clamp. The insulation should be checked for cracks and bare spots.

Thermal Protection

This unit is protected with a normally closed overload thermostat. Any excessive overloading will cause the contactor to open, stopping the welding unit's output. If this occurs, allow the unit about three minutes cooling off time. Normal operation can then be resumed. (See Duty Cycle page 4.)

High Voltage Capacitor

This part requires no attention and is rarely a source of trouble. A defective capacitor, however, is evident usually by the appearance of melted sealing material at the bottom of the housing or evidence of oil leakage in certain cases.

Spark Gaps

The spark gaps can be readily inspected by removing the left side access panel of the unit.

25 0.625

The spark gaps are set at [redacted]mm (0.0[redacted]ins) at the factory. It will be necessary to re-adjust these periodically after extended operation. Usually inspection, cleaning by blowing out dust and dirt and adjustment every three or four months will suffice. Re-adjustment is also indicated when intermittent operation of the gaps is noted. Usually this occurs when the setting has increased to [redacted]mm [redacted] or greater. 1 mm

Adjustment

CAUTION

Widening the spark gaps though normal operation may, if not corrected, increase the loading of the high voltage capacitor discussed in a previous section, and thus contribute to its premature failure. Cleaning or dressing of the points of the spark gaps is not recommendeds the material at the points is tungsten and is impossible to file.

Generally speaking, the high-frequency output varies directly (up to a certain point) with the spark gap spacing. In extreme cases where the greatest amplitude of high-frequency is needed, it may be necessary to adjust the spark gap setting to 1.00 [redacted]mm (0.040 ins). [redacted]. This naturally also increases the high-frequency radiation and it is suggested that the minimum gap setting 0.6 [redacted] to 0.8 [redacted]mm [redacted] consistent with good welding operation be used.

Proceed as follows to adjust the spark gap:

1. Disconnect all power to the unit

WARNING

Be sure the branch circuit or main isolation switch is open or electrical input circuit fuses are removed before attempting any inspection or work on the inside of the welding unit. Placing the 'Power' switch on the High-Frequency' in the 'off' position does not remove all power from inside the unit.

2. Loosen retaining screw (A) that secures the spark gap contact point assembly.

0.625 40

3. Insert [redacted]mm (0.0[redacted] ins) feeler gauge between the spark gap contact points (B).

4. Apply slight pressure against loosened electrode point (C) so the feeler gauge is held firmly in the gap. Tighten retaining screw (A).

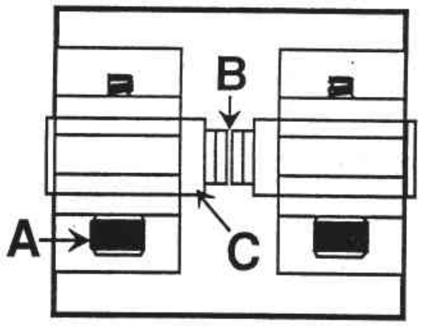


Fig. 6.

Failure of High-Frequency

Check the following when no high-frequency is apparent on the welding cables:

1. Be sure the switch in the control panel labelled high-frequency is in either start or continuous position.

2. Be sure that spark gaps are set between the allowable limits.

3. Check for broken leads to the high-voltage transformer.

4. Check for voltage across terminals to which primary of the high-voltage transformer is connected. Voltage at this point and not at transformer terminals may indicate a defective high-frequency switch or relay.

5. Check capacitors for failure.

6. Check by-pass filter for defective capacitor or resistor.

Circuit Breakers

The auxiliary power circuit breaker is rated at 15 amperes and is mounted on the rear panel. The purpose of this circuit breaker is to provide protection for the transformer winding.

In the event of failure before resetting the breaker, examine the equipment fitted to the 115V a.c. supply for overload or shorts. Equipment drawing a total exceeding 15 amperes will cause the circuit breaker to open.

MAINTENANCE

WARNING

Be sure that the circuit or main isolation switch is open or electrical input circuit fuses are removed before attempting any inspection or work on the inside of the welding unit. Placing the POWER switch on the welding nit in the OFF position does not remove all power from inside the welding unit.

IMPORTANT

Inspection, troubleshooting, and repair of this equipment may ordinarily be undertaken by a competent individual having at least general experience in the maintenance and repair of semiconductor electronic equipment. Maintenance should not be undertaken or attempted by anyone not having such qualifications.

Daily (Operator Task)

1 Check all welding and electrical cables for signs of cracking or general deterioration.

2. Check that all welding connections are in good physical condition.

3. Check the electrode holder for damage. Replace any suspect part(s).

ALWAYS CHECK THE WELDING AREA DAILY FOR POSSIBLE SAFETY HAZARDS. IF IN DOUBT CONSULT YOUR SAFETY OFFICER.

Monthly (Maintenance Department Task)

1. Switch off the unit and disconnect from the mains electrical supply.

2. Remove the cover (retain the fixing screws).

3. Using a soft brush, remove any dust or dirt from the interior of the unit. If compressed air is used to clean the unit, the pressure must not exceed 2kg/cm^2 (30lbs/in2) and the air must be dry.

SUITABLE EYE AND MOUTH PROTECTION SHOULD BE WORN.

4 Replace the cover.

5 Reconnect the unit to the mains supply.

TROUBLE SYMPTOM GUIDE

1. UNIT COMPLETELY INOPERATIVE. FAN DOES NOT RUN.

a. Open line fuses - check the line fuses for continuity and replace if necessary. If the fuses continue to open, the jumper links may not be in proper position. See primary electrical connections.
b. No power input - check position of line disconnect switch.
c. Improper jumper link placement on input terminal board. See primary electrical connections.
d. Defective ROS and/or wiring - check continuity of ROS and replace if necessary.

2. NO WELDING OUTPUT. FAN OPERATIVE.

a. Improper jumper link placement on input terminal board - See primary electrical connections.
b. Power supply overheating - thermal switch (TS) tripped due to restricted cooling air flow., or overextended duty cycle. Allow unit to cool down for at least 5 minutes with fan running to let TS reset.
c. Current Control switch TSS in the REMOTE position without a remote contactor control connected to the Remote Control socket. Place TSS in the LOCAL position or make remote torch connection.
d. Defective TSS and/or wiring. Check continuity and replace if necessary.
e. Defective SCR P.C.B.
f. Defective Current Range switch SW1 (located on SCR P.C.B). Check continuity of SW1 and ensure that all connections are secure and correct. Replace SW1 if defective.
g. Defective current selector switch CSS and/or wiring. Check continuity of CSS and ensure that all connections are secure and correct. Replace CSS if defective.
h. Defective Current Control Potentiometer CCP (located on SCR P.C.B). To check continuity of CCP, put Current Control switch (PRS) in REMOTE position. Disconnect remote foot or torch control. Check resistance between terminals "H" & "F" of Remote Control socket by rotating Current Control potentiometer (CCP). Resistance should vary between "O" and "13.3 K to 16.7 K ohms". If pot checks good, replace SCR P.C.B.

3. LOW OR UNSTABLE OPEN CIRCUIT VOLTAGE.

a. Current control pot set too low for welding application. Increase setting of CCP.
b. Defective SCR in main bridge. Check the resistance across the SCR on the R x 1 scale. if the reading is high the SCR is working. if the resistance is low or zero the SCR is defective. To check the gate, connect the gate lead to the anode of the SCR and read the forward resistance across the SCR anode to cathode. If the internal voltage of the meter is high enough, the meter should read a low resistance.
c. Defective diode in main bridge. Place the current selector switch between positions so as to provide an open circuit across diodes. On the R x 1 scale check the resistance in the forward and reverse directions. A good diode will read high in the reverse direction and low in the forward direction. Replace defective parts.
d. Defective CSS and/or wiring. See troubleshooting 2-g.

4. ERRATIC OUTPUT WELDING CURRENT

a. Intermittent shunt connections. Check connections to shunt.
b. Defective SCR and/or diode in main bridge. See troubleshooting 3-b and 3-c.
c. Defective SCR P.C.B. Replace SCR P.C.B.
d. Excessive high frequency. Check spark gaps and adjust if necessary (see maintenance Section). Check all connections and components in high frequence bypass circuit and replace any defective components.

5. LOW WELDING OUTPUT IN HIGH RANGE.

a. Current range Switch SW1 (located on SCR P.C.B.) may not be closing when positioned in HIGH range. Check continuity of SW1 on SCR P.C.B. - replace if defective.

6. MINIMUM WELDING OUTPUT IN BOTH CURRENT RANGES.

a. Check for defective Current Control Potentiometer CCP (located on SCR P.C.B.) using procedure outlined in Step 2-h.

7. HIGH WELD OUTPUT, CURRENT CONTROL DOES NOT VARY THE OUTPUT.

a. Open shunt connection. Check connections to shunt.
b. Defective SCR P.C.B. Replace if defective.

8. ABSENCE OF HIGH FREQUENCY WHILE SELECTOR SWITCH (HFS) IS IN START MODE ONLY.

a. Open circuit voltage low - check remote contactor switch, or Contactor Control Mode Switch TSS.
b. SCR P.C.B. may be defective.

9. INSUFFICIENT OR ABSENCE OF H.F.

a. High frequency switch in the OFF position. Check HFS and place in START or CONTINUOUS position.
b. Improper spark gap. Clean and adjust spark gaps, if necessary. See Spark gap Servicing.
c. Defective HFS and/or wiring. make continuity check and replace if necessary.
d. Defective Logic P.C.B.

10. NO GAS FLOW.

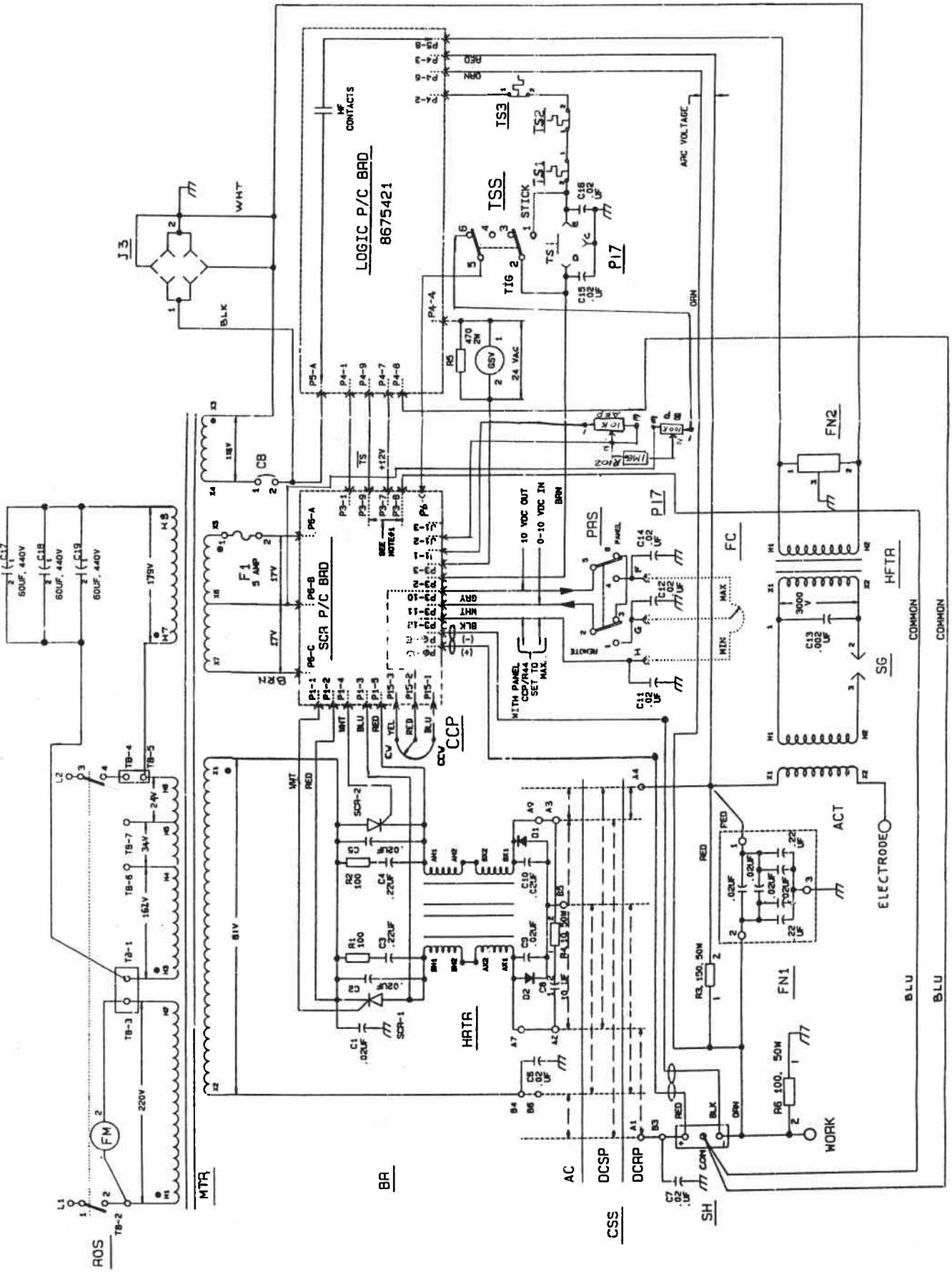
a. High Frequency Switch (HFS) in OFF (Stick) position - place in Start or Continuous Mode(s). Make continuity check, if necessary, and replace if defective.
b. GS solenoid defective. Check 24V AC across solenoid coil. If present and solenoid does not energise, replace it.

11. NO REMOTE CONTACTOR CONTROL.

a. Contactor Control switch in the LOCAL position. Place TSS switch in the REMOTE position.

MUREX

Circuit Diagram



220/380/415/440 volts, 1 PH, 50/60 HZ. With Power Factor Correction.
(Connection shown for 440v, 50/60 HZ)

Transtig AC/DC 250 HF Technical Notes

Specification

Transtig AC/DC 250 HF

Input	
Voltage	220/380/415/440 VAC
Frequency	50/60 Hz
Phase	1 (2)
KVA	20 KVA
Rated Load Amps (415V)	41A
Recommended Fuse (415V)	60A
Output	
Range AC/DC	8 - 320A
Duty 40%	250 - 30V
Duty 60%	200 - 28V
Duty 100%	160 - 26V
OCV AC	79V
OCV DC	72V
Controls	
Post Flow	5 - 45 secs
Dimensions (excl. undergear)	
Length	762mm
Height	559mm
Width	406mm
Weight (net)	179 Kg

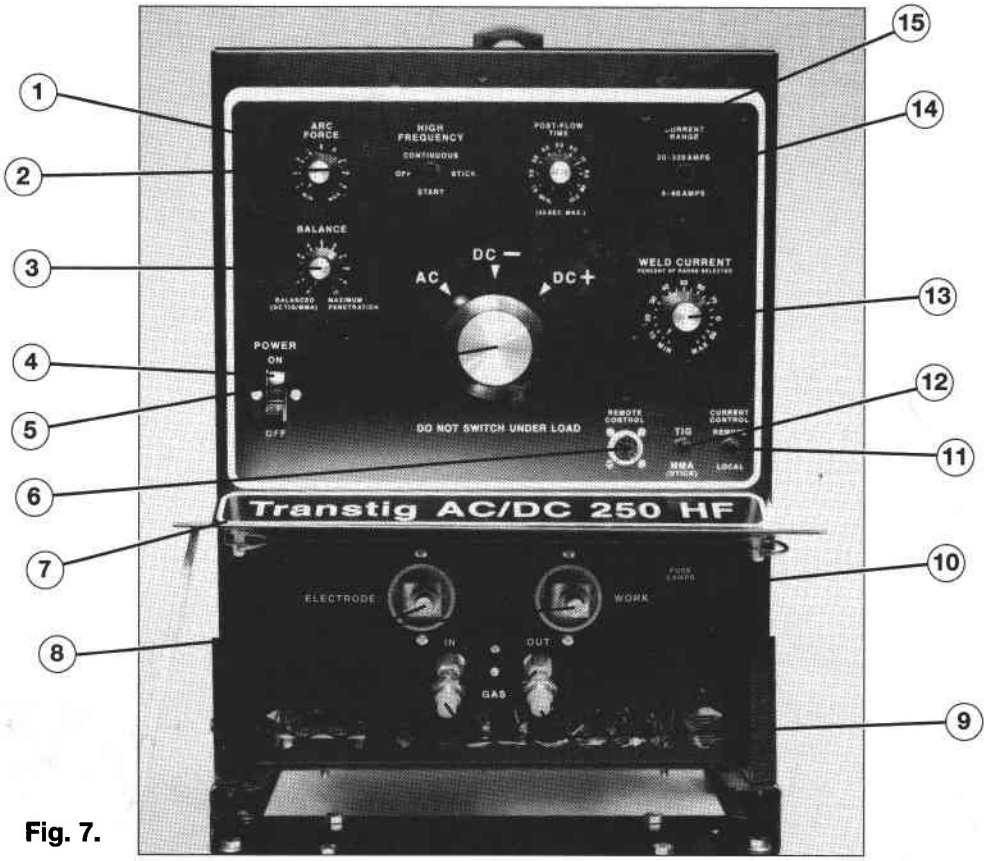


Fig. 7.

ITEM NO.	QTY	ELECTRICAL SYMBOL	PART NO.	DESCRIPTION
1	1	HFS	1415081	High Frequency Switch (on logic P.C.B)
2	1	AFP	1415080	Arc Force Potentiometer 10K 2w
3	1	BP	1415079	Balance Control Potentiometer 100K 2w
3a	1	R102	-	Resistor 1M ohm 1%
4	1	ROS	1415078	On/Off Switch DPST
5	1	CSS	1415076	Mode Selection Switch
5a	1	-	1415077	Switch Knob
6	1	P17	1413795	Remote Control Socket (12 Pin)
-	6	-	367972004	Control Plug Pins
-	1	-	368541003	Remote Control Plug
7	1	-	-	Terminal Cover
8	2	-	1415074	Output Terminal
9	2	-	1415072	Gas outlet 90°
9a	2	-	1415073	Gas outlet Adaptor 1/4" BSP
10	1	F1	1411873	Fuseholder 1 1/4" x 1/4"
10a	1	-	-	Fuse 5A 1 1/4" x 1/4"
11	1	PRS	1415071	Local/Remote Switch DPST
12	1	TSS	1415071	Process Selection Switch DPST
13	1	CCP	1415069	Weld Current Potentiometer 10K (on SCR P.C.B)
13a	1	-	1415070	Potentiometer Knob (Large)
14	1	SWI	1415068	Weld Current Range Switch DPST (on SCR P.C.B)
15	1	PFP	1415067	Post Flow Potentiometer (on logic P.C.B)
15a	3	-	1414954	Potentiometer Knob (Small)

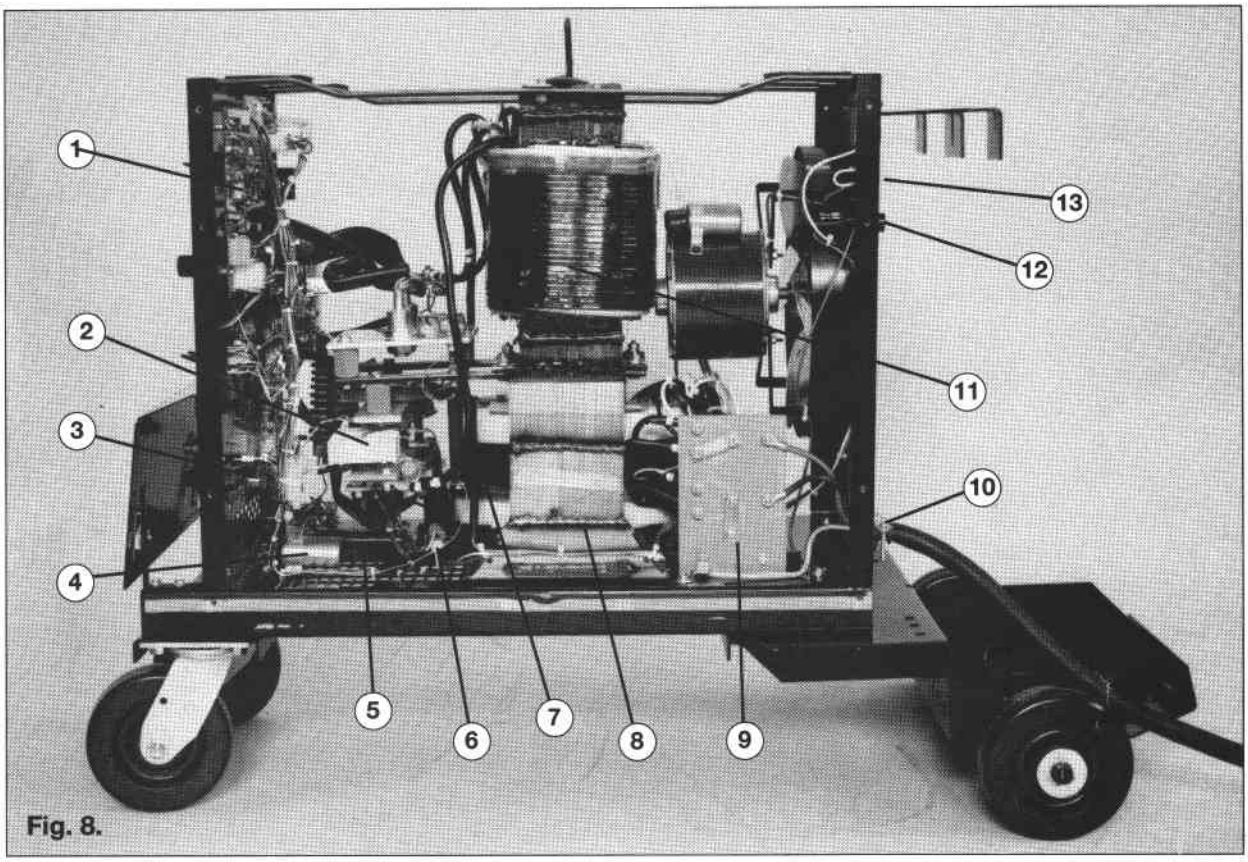


Fig. 8.

ITEM NO.	QTY	ELECTRICAL SYMBOL	PART NO.	DESCRIPTION
1	1	-	1415083	SCR Control P.C.B.
2	1	-	1415084	SCR Bridge Assy. (includes Items 2a, b, c, d)
2a	1	C1	-	Capacitor .02 mf, 1kv
2b	2	SCR-1 & 2	1414851	SCR Thyristor
2c	2	-	1415085	Filter Network
2d	1	TS3	1414888	Thermal Switch (SCR Bridge)
3	1	GSV	1414641	Solenoid valve 24v AC
-	1	R5	-	Resistor 470 ohm 2w
4	1	C8	1414637	Capacitor 10mf, 370v DC
5	1	R4	1415086	Resistor 10 ohm 50w (near side)
5a	1	R3	1415095	Resistor 150 ohm 50w (far side)
6	1	FN2	1415087	Filter Network
7	1	R6	1415093	Resistor 100 ohm 50w
8	1	MTR	1415091	Main Transformer
9	1	TB	1415092	Input Terminal Board
10	1	-	-	Input Cable Gland
11	1	HRTR	1415090	Reactor
-	2	TS1, TS2	1414610	Thermal Switch (included in item 8 and 11)
12	1	CB	1415089	Circuit Breaker 15 amp
13	1	J3	1415088	Auxiliary Power Socket (115v AC)- 1414987 Plug

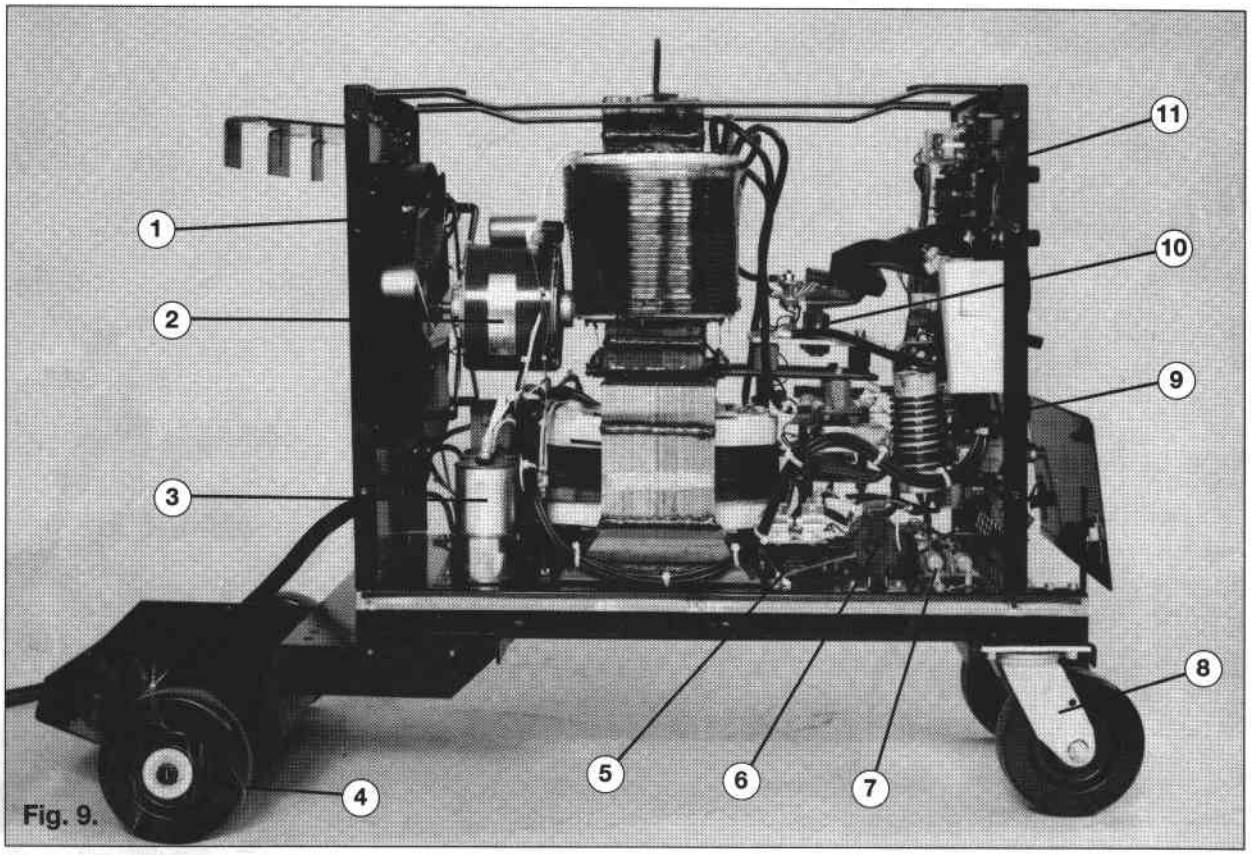


Fig. 9.

ITEM NO.	QTY	ELECTRICAL SYMBOL	PART NO.	DESCRIPTION
1	1	-	1415096	Fan Blade
2	1	FM	1414614	Fan Motor
3	3	C17, C18, C19	1415110	Capacitor 60mf, 440v
4	2	-	1415108	Rear Wheel
5	1	SG	1415101	Spark Gap Assy. (Includes Items 5a, b, c, d)
5a	1	-	1415102	Spark Gap P.C.B.
5b	2	-	-	Spark Gap Heat Sink
5c	2	-	1415104	Spark Gap Contacts
5d	1	-	1414670	Spark Gap Capacitor
6	1	HFTR	1414668	High Frequency Transformer
7	1	FN1	1415105	Filter P.C.B. Assy.
8	2	-	1415109	Front Castor Assy
9	1	ACT	1415100	Air Core Transformer
10	1	-	1415097	Diode Bridge Assy (includes Items 10a, b, c, d)
10a	2	C9, C10	-	Capacitor .02 mf, 1kv
10b	1	D1	1415098	Reverse Diode
10c	1	D2	1415099	Forward Diode
10d	2	-	-	Insulated Stand-Off
11	1	-	1415106	Logic P.C.B.
11a	1	-	1415107	HF Relay

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