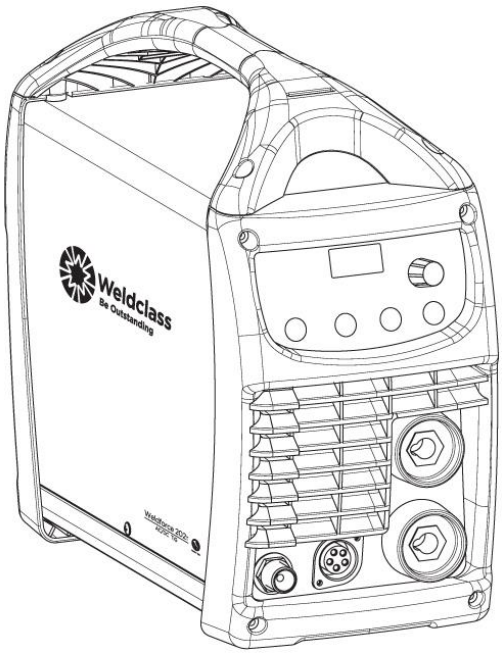
Weldforce 202T

HF Pulse AC/DC TIG



OPERATING INSTRUCTIONS

Edition 1.6

☞ IMPORTANT!

To qualify for full 24 month warranty, you must register within 30 days of purchase. See inside for details.

Read these Operating Instructions Completely before attempting to use this machine. Save this manual and keep it handy for quick reference. Pay particular attention to the safety instructions we have provided for your protection. Contact your distributor if you do not fully understand anything in this manual.

Congratulations & thank you for choosing Weldclass!

The Weldforce range from Weldclass provides market leading value, features and durability.

Register Your Warranty Now

To qualify for an extended warranty, you must register within 30 days of purchase.
Full details on warranty period and terms can be found at www.weldclass.com.au/WarrantyInfo

Please register your warranty now by going to:

www.weldclass.com.au/weldforcewarranty

You will need;

a) A copy of your purchase invoice / receipt.
b) Your machine serial number which can be found on the technical data plate on the back of the machine, or on the outside of the box that your machine came in.

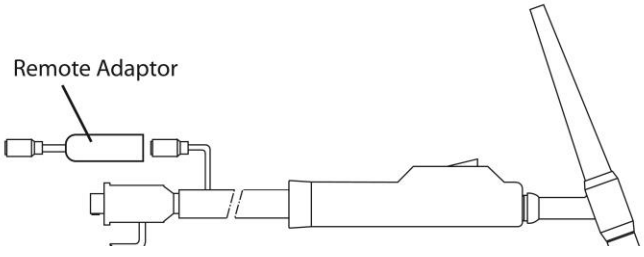
Satisfaction Guarantee

For full details on our satisfaction guarantee, refer to www.weldclass.com.au/mbg

IMPORTANT !

If using TIG Torch with Remote (Amperage) Control:

Remote Adaptor MUST be connected to TIG Torch at all times **to protect machine from HF interference damage**. Refer to section 7.2 of this manual for further information.



1 CONTENTS

2 SPECIFICATIONS

Description	WeldForce 202T AC/DC		
Part Number	WC-202T		
Dimensions	L430 x W170 x H340mm (including handle)		
Weight of Power Source	16.35kg		
Standard	AS 60974.1		
Power Supply	240V +/- 15% 50hz Single Phase		
Factory Fitted Plug Rating	10A		
Open Circuit Voltage U_0	VRD On = 15V / VRD Off = 95A		
TIG Tungsten Size	1.6 – 2.4mm		
MMA Electrode Size	1.6 – 4.0mm		
Protection Class	IP23		
TIG (GTAW) Welding	**15A Power Supply****	**10A Power Supply***	
Welding Current Output	5 – 200A	5 – 180A	
Duty Cycle	200A / 18.0V @ 24% 115A / 14.6V @ 60% 100A / 14.0V @ 100%	180A / 17.2V @ 19%* 115A / 14.6V @ 60% 100A / 14.0V @ 100%	
Effective Input Current	14A	10A*	
Maximum Input Current	33A	30A	
DC Stick (MMA) Welding	**20A Power Supply*****	**15A Power Supply****	**10A Power Supply***
Welding Current Output	5 – 160A	5 – 160A	5 – 150A
Duty Cycle	160A / 26.4V @ 30% 110A / 24.4V @ 60% 95A / 23.8V @ 100%	160A / 26.4V @ 20%** 100A / 24.4V @ 60%** 80A / 23.2V @ 100%**	150A / 26.0V @ 12%* 75A / 23.0V @ 60%* 60A / 22.4V @ 100%*
*Effective Input Current	I_{1eff} 18A	I_{1eff} 15A	I_{1eff} 10A
Maximum Input Current	I_{1max} 33A	I_{1max} 33A	I_{1max} 30A

Table 1

*This machine is factory fitted with 10A plug for commissioning purposes only. Whilst 10A plug is fitted, the operator must set to 10A (CL.2) mode and ensure that output and duty cycle limits indicated above are not exceeded.

**If using on 15A power supply, 15A plug should be installed by a qualified person (such as a licensed electrician) – and if using in MMA (stick) welding mode, the operator must ensure that output and duty cycle limits indicated above are not exceeded.

***If using on 20A power supply (to allow full output in MMA mode), 20A plug should be installed by a qualified person (such as a licensed electrician).

For full machine specifications, refer to technical data plate on base of machine.

3 KNOW YOUR MACHINE

3.1 Machine Rear

1. Mains Power Switch
2. 240V AC Mains Power Input Lead
3. Gas Inlet Connection
4. Fuse
5. Water Cooler Interface
6. Remote Control Interface

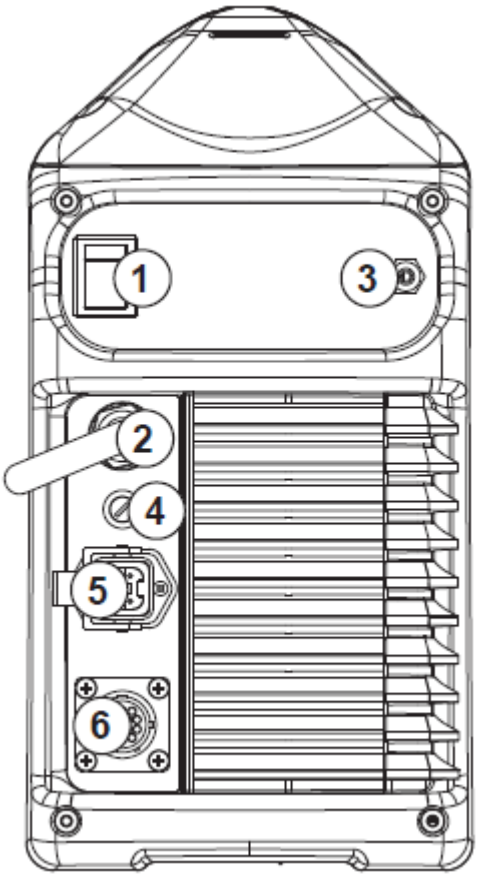


Figure 1

3.2 Machine Front

1. Positive Dinse Socket
2. Negative Dinse Socket
3. TIG torch Interface Connector
4. TIG Torch Gas Connector

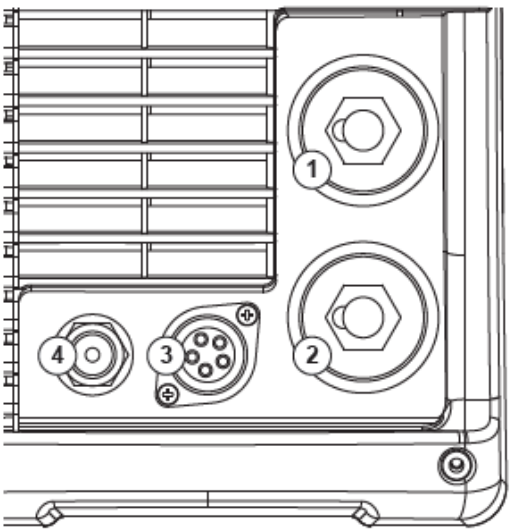


Figure 2

3.3 Control Panel

5. Control Panel
6. Welding Mode Selection Buttons
   a. Pulse Selection Button (Pulse/Easy Pulse/Bi-Level)
   b. Trigger Mode Selection Button (2T/4T/Spot)
   c. Process Selection Button (HF TIG/Lift-Arc TIG/MMA)
   d. Current Selection Button (AC/DC)
7. Welding Parameter Indicator Lights
   a. Pre-Gas (TIG) / VRD (MMA) Indicator Light ($_{[sec]}$)
   b. Start Amps (TIG) / Hot Start (MMA) Indicator Light (I_{START})
   c. Slope-Up Setting Indicator Light (t_{START})
   d. Main Amps Indicator Light (I_2)
   e. Base Amps (TIG) / Arc Force (MMA) Indicator Light ($I_{1[A]}$)
   f. Frequency Indicator Light (Hz)
   g. Balance Indicator Light (BAL)
   h. Spot Time Indicator Light (••••)
   k. Slope-Down Indicator Light (t_{END})
   l. Finish Amps Indicator Light ($I_{e[A]}$)
   m. Post-Gas Indicator Light ($_{[sec]}$)
   n. SmartStart AC ($_{[A\text{-}sec]}$)
8. Remote Control Indicator Light
9. Selection Knob
10. LCD Readout
11. Input Power Indicator Light
12. Error/Over Temperature Indicator Light

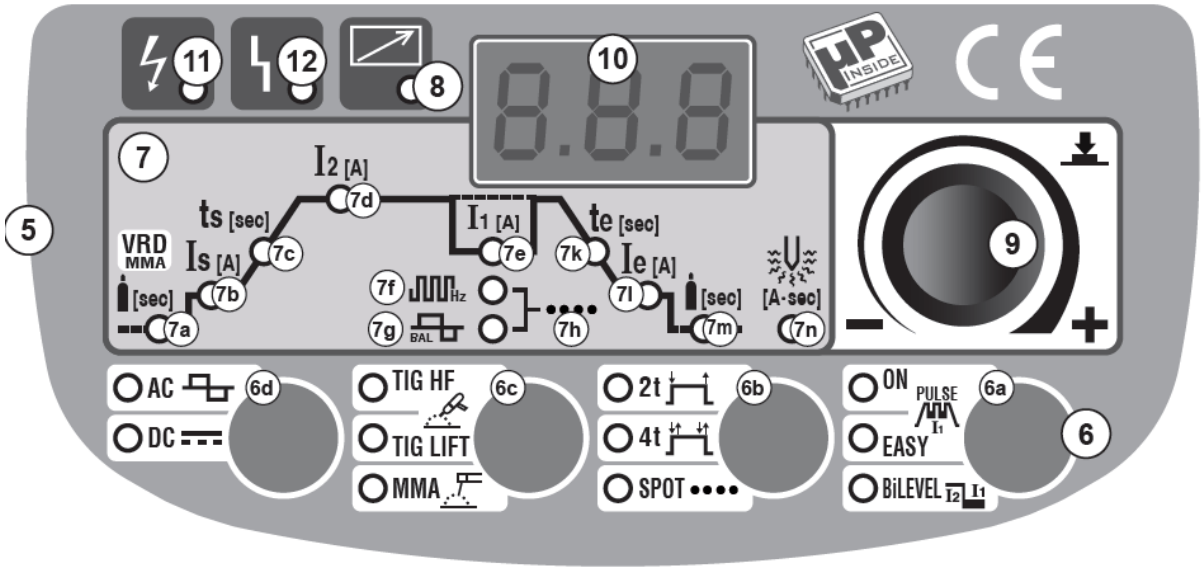


Figure 3

3.4 TIG Torch Controls

1. Torch Trigger Button
2. Remote Control Amperage Potentiometer

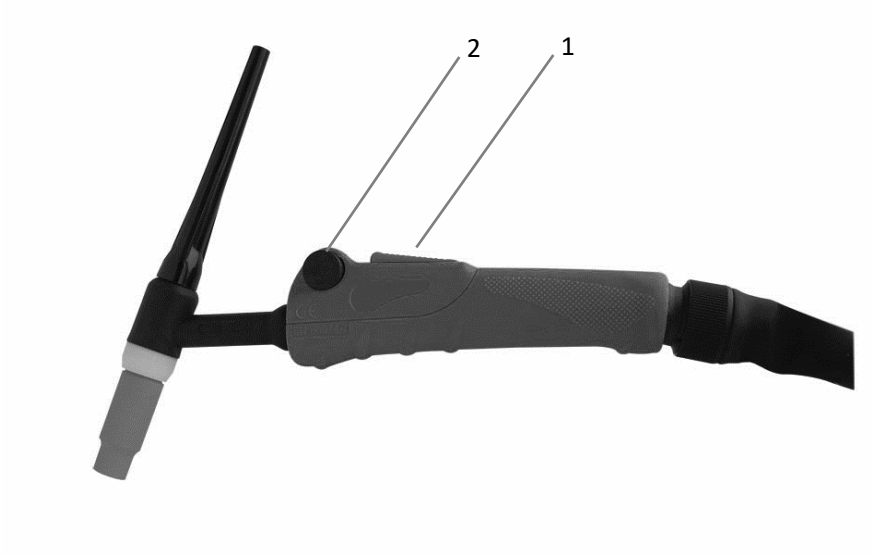


Figure 4

3.5 Symbols chart

I	Power On
O	Power Off
	Power On Indication
	Fault Indication
	Remote Control
	Caution / Hazard
	Read Instruction Manual
	Spot Weld Function
	Pulse Function
	Alternating Output Current (AC)
I2 I1	Bi-Level Trigger
	Smart Start AC
BAL	AC Arc Balance
	2T/Normal Trigger Function
	4T/Latch Trigger Function

1~	Single phase Inverter power source AC/DC
	Stick/MMA (SMAW) Function
	TIG (GTAW) Function
	Power Supply Connection
1~	Single Phase
	Alternating Input Current (AC)
	Direct Output Current (DC)
–	Negative
+	Positive
Hz	Hertz (cycles/sec)
X	Duty Cycle
A	Amperage (Current)
V	Voltage

Table 2

4 CONTROLS EXPLAINED

4.1 Weld Process Selection

1. Press ‘Current Selection Button’ until the desired Indicator Light is lit.

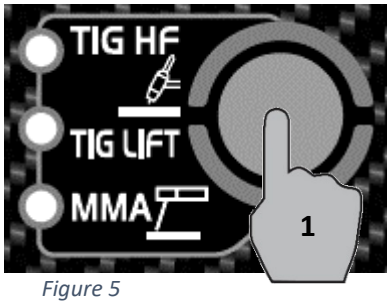


Figure 5

4.1.1 MMA

Stick/MMA welding

4.1.2 TIG HF

High Frequency Start TIG welding. This uses a high frequency arc to start the welding arc which eliminates the need for the tungsten electrode to make contact with the job. This is easier to use and prevents tungsten contamination. The disadvantage of HF ignition is that the high energy electrical pulse creates significant electrical and radio signal interference, which limits its use around sensitive electronic equipment such as some computers and CNC equipment.
See 12.2.2 for more information.

4.1.3 TIG LIFT

Lift Arc Start TIG welding. This requires the tungsten to be briefly touched on the work piece. As the tungsten electrode is lifted back off the work piece the welding arc will be initiated. This does require more skill.
See 12.2.1 for more information.

4.2 Output Current Mode Selection

1. Press Current Selection Button until the desired Welding Process Indicator Light is lit.

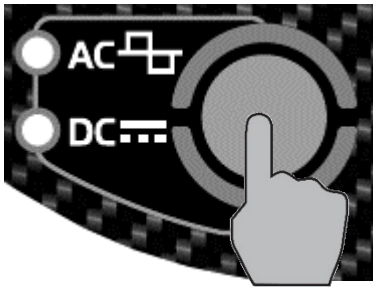


Figure 6

4.2.1 DC (Direct Current)

Direct Current. This is suitable for TIG welding ferrous (iron based) metals such as mild steel and stainless steel, copper and titanium and also suitable for most Stick/MMA welding.
See 12.3.1 for more information.

4.2.2 AC (Alternating Current)

This is required for welding reactive metals such as Aluminium, Magnesium and Zinc. When reactive metals are exposed to air they form an oxide layer that insulates the base metal and prevents welding current flowing, it also contaminates the weld pool. Reverse current flow is required to break through/ clean off this oxide layer so that welding can take place, while the current flow during the positive cycle does the majority of the heating of the weld pool area.
See 12.3.2 for more information.

4.3 Function Selection

1. Press Pulse Selection Button until the desired Indicator Light is lit. If no indicator is lit then the machine is in Standard Non-Pulse mode.

NOTE: Functions are only available in TIG modes.

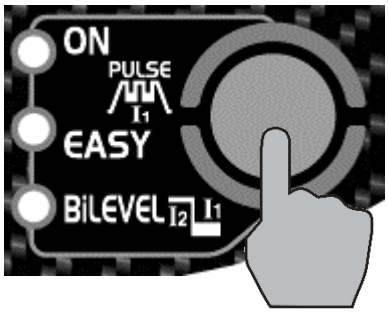


Figure 7

4.3.1 ON (Standard Pulse)

Pulse welding mode switches the welding output between a high and low current output in a cyclical manner. When used correctly this function has substantial benefits in the TIG welding process including greater weld penetration for less work heat input and greater control of the weld pool.

The basic theory for setting the base current using pulse mode is that the base current should be sufficient to maintain the existing molten weld pool, while the main current is sufficient to melt new metal in order to move/expand the molten weld pool. Increased pulse frequency will have the effect of making the arc more tightly focused which is useful for fine stainless work and similar.

Pulsing can also be used to help move the weld pool, this technique is useful for welding out of position or with materials that have higher viscosity weld pool. Higher pulse duty setting will give greater heat input, while lower pulse duty will have the opposite effect.

See 12.3.3 for more information.

4.3.2 EASY (Easy Pulse Function)

This is the same as Standard Pulse, however the advanced arc settings are automatically set based on (or in proportion to) the main current setting. This makes it much simpler for inexperienced TIG welders to set up and weld with pulse.

These settings are;
Base Current/Amps $I1_{[A]}$ = 70% of Main Current/Amps $I2_{[A]}$
Pulse Frequency = 4 Hz
Balance = 50%

These settings can be adjusted/changed if required, however they will revert to the pre-set values if/when the Pulse mode is changed and/or the machine is re-started.

4.3.1 BiLEVEL (Bi-Level Current Function)

Bi-Level Function is a non-pulse function that enables the operator to swap between 2 current levels (I_1 & I_2) whilst welding using the torch trigger. 4t Trigger Mode must be selected to enable Bi-Level selection. During welding a quick press of the trigger will toggle between I_1 current setting and I_2 current setting.

4.4 Trigger Mode Selection

1. Press Trigger Mode Selection Button until the desired indicator light is lit.

NOTE: Trigger mode selection only applies to TIG welding.

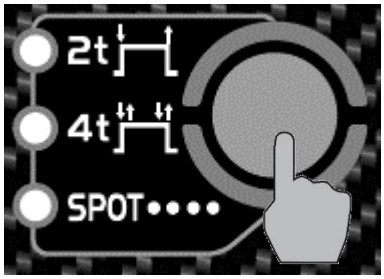


Figure 8

4.4.1 2t (Standard Trigger)

2T stands for Two Touch or 'Standard Trigger' mode. In this mode the trigger button is pressed and held on to start welding, when the trigger button is released, the welding stops.

4.4.2 4t (Latch Trigger)

4T stands for Four Touch or 'Latching' mode.
This function is useful for longer welds as the trigger is not required to be held on continuously and thus reduced operator fatigue. It also enables utilization of various advanced arc functions.

With Bi-Level Off: When the trigger button is pressed initially it will ignite the arc with an amperage level as per I_{START} Start Current setting. When the trigger is released the amperage will begin Slope-Up (as per Slope-Up ts[sec] setting) up to Main Current (I_2) amperage level. When trigger is pressed again the amperage will begin Slope-Down (as per Slope-Down te[sec] setting) to Finish Current (Ie) amperage level. When trigger is finally released again the arc will stop.

With Bi-Level On: When the trigger button is pressed initially it will ignite the arc with an amperage level as per I_{START} Start Current setting. When the trigger is released the amperage will begin Slope-Up (as per Slope-Up ts[sec] setting) up to Main Current (I_2) amperage level. Pressing the trigger and releasing quickly will toggle the amperage output between Main Current (I_2) amperage level and Base Current (I_1) amperage level. When trigger is pressed and held down again the amperage will begin Slope-Down (as per Slope-Down te[sec] setting) to Finish Current (Ie) amperage level. When trigger is finally released again the arc will stop.

4.4.1 SPOT (Spot Weld Function)

Spot Weld Time setting is adjustable from 0 – 10 seconds. This controls the length of time for the weld. When the trigger button is pressed and held down on the TIG torch, the machine will weld for the set time and then stop. This is great for producing very precise weld size or ensuring consistent weld size/length when spot welding, tacking or stitch welding.

4.5 TIG Arc Parameters/Characteristics Settings

NOTE: The following parameter settings are only available in TIG welding modes.

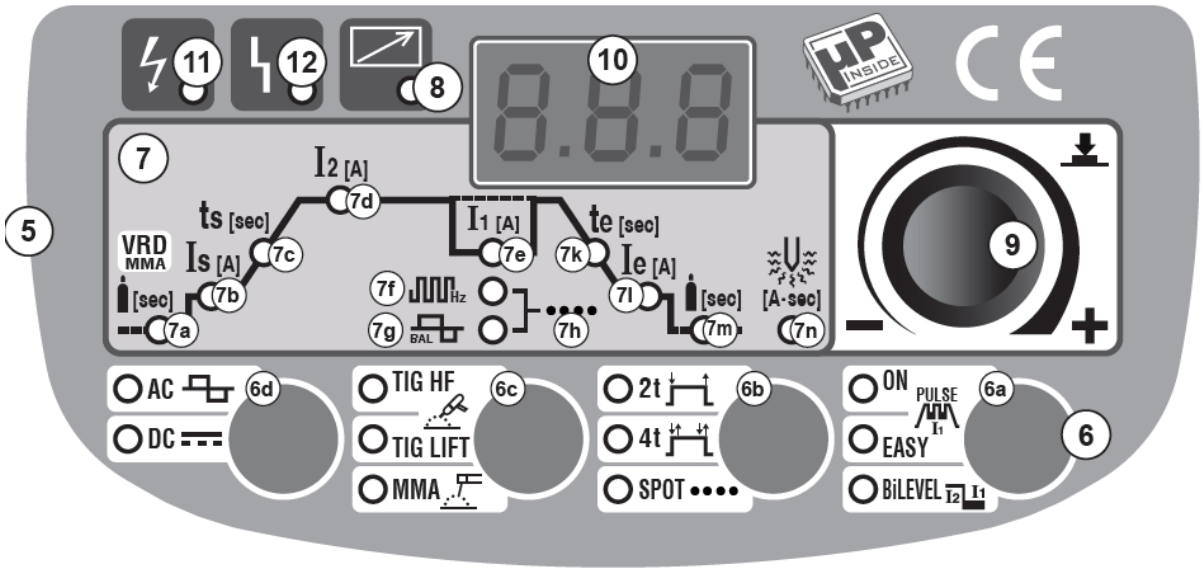


Figure 9

1. Keep Pressing 'Selection knob' (9) down until the desired Arc Parameter Setting Indicator Light is lit.
2. Rotate the 'Selection knob' (9) to adjust the Setting for this Parameter Setting.

4.5.1 Pre-Gas Time (7a)

Pre-Gas (or Pre-Flow) setting is adjustable from 0 – 10 seconds. This controls the period of time the shielding gas will flow when the torch is triggered before the arc starts. This purges the weld area from atmospheric gas which could contaminate the start of the weld.

4.5.2 Start Amps (7b)

Start Amps (or Start Current or Initial Current or I_{START}) sets the welding current activated at the beginning of the weld. Adjustable 5-200A.

In 2t & SPOT Trigger Modes: This amperage setting is maintained for a fixed time after the torch trigger is pressed at the beginning of the weld.

In 4t Modes: This amperage setting is maintained while the torch trigger is pressed down at the beginning of the weld. Once the trigger is released the Slope Up function will begin.

4.5.3 Slope Up (7c)

Slope Up (or Up Slope or Initial Slope or t_{START}) time setting is adjustable from 0 – 10 seconds. This is the time taken for the amperage to ramp up from Start Amps to Main Amps.

4.5.4 Main Amps (7d)

Main Amps (or Main Current or I_2) is the main welding current. In Pulse and Bi-Level modes it represents the Maximum current. Adjustable 5-200A.

4.5.5 Base Amps (7e)

Base Amps (or Base Current or Trough Current or I_1) is only available in Pulse or Bi-Level modes.

In Pulse & Easy Pulse mode: This is the lower amperage of the pulse wave, adjustable 1 - 100A.
See 12.3.3 for more information.

In Bi-Level mode: This is the second current setting that can be toggled to during welding, adjustable 5-198A

4.5.6 Frequency (7f)

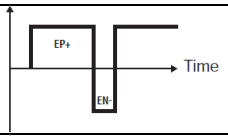
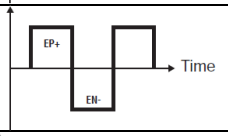
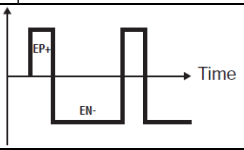
In Pulse & Easy Pulse mode: Frequency (Hz) sets the pulse frequency (the rate that the welding output alternates between the Main and Base Amp settings). Setting is measured in number of cycles per second (Hertz). Adjustable 1 - 99 Hz.
See 12.3.3 for more information.

In AC with Pulse Off: Frequency (Hz) sets the frequency of the AC welding current (the rate that the welding output alternates between forward and reverse current flow). Setting is measured in number of cycles per second (Hertz). Adjustable 10 - 200 Hz.

4.5.1 Balance (7g)

In Pulse & Easy Pulse mode: Adjusts the ratio (1-99%) between the time during which the current is at its highest level (main welding current) and the total pulse cycle period/time. This adjustment is often referred to as Pulse Width. *See 12.3.3 for more information.*

In AC with Pulse Off: Adjusts the balance (-80 to +80%) between the forward and reverse current cycles when welding in AC output mode. The reverse part of the AC cycle gives the 'cleaning' effect on the weld material, while the forward cycle melts the weld material. Neutral setting is 0.
Increased reverse cycle bias (positive settings) will give greater cleaning effect, less weld penetration and more heat in the torch tungsten. This gives the disadvantage of reducing the output current that can be used for a given tungsten size to prevent the tungsten overheating.
Increased forward cycle bias (negative settings) will give the opposite effect, less cleaning effect, greater weld penetration and less heat in the tungsten.
Ideally for maximum effectiveness, the clean width/ AC balance should be set with as much forward cycle bias as possible, while still maintaining a sufficient level of oxidisation removal for a contamination free weld pool. The cleaner the non-ferrous metal is before welding, the more effective it is to weld. This effect can also be used to reduce heat in the tungsten, allowing use of a pointed tungsten tip shape for a more defined arc. *See 12.3.4 for more information.*

Setting Value	Weld	Wave	Effects
Positive			More cleaning effect Less penetration
O (zero)			Neutral
Negative			Less cleaning effect More penetration

4.5.1 Spot Time (7h)

This only applies when set to Spot Trigger mode. This Spot Timer setting is the time adjustment for the welding duration and is adjustable from 0.01 – 10 seconds.

4.5.2 Slope Down (7k)

Slope-Down (or Down Slope or Final Slope or Ramp Down or t_{END}) time setting is adjustable from 0 – 10 seconds. This is the time taken for the amperage to ramp down from Main Amps to End Amps. This allows the operator to complete the weld without leaving a 'crater' at the end of the weld pool. *See 12.4.1 for more information.*

4.5.3 Finish Amps (7l)

Finish Amps (or Finish Current or End Current or $I_{e[A]}$) sets the welding current at the end of the weld.

In 2t Mode: This is the final setting (adjustable 5-9A) that the welding current will ramp down to after the torch trigger is released at the end of the weld. This is only applied if the Slope Down setting is greater than 0.

In 4t Mode: This amperage setting (adjustable 5-9A) is maintained while the torch trigger is held down at the end of the weld. Once the trigger is released welding arc will stop.

4.5.4 Post-Gas Time (7m)

Post Gas (or Post Flow) controls the period of time the shielding gas continues to flow for after the arc is stopped. This protects the weld area and torch tungsten from contamination while it is still hot enough to react with atmospheric gases, after the weld is finished. Adjustable 0 – 10 seconds.

4.5.1 SmartStart AC (7n)

SmartStart AC is a unique setting which can be adjusted to make weld starting easier when welding with AC current.
When welding aluminium, the material being welded and also the Tungsten electrode will have an oxide layer on them which acts as an insulator & presents an obstacle to igniting the welding arc.
SmartStart AC delivers a specific amount of positive current at a specific energy level for a specific period of time. This has the results of delivering very smooth and reliable AC arc ignition, every weld!
The setting is measured in as an 'energy' level (not time). Refer to the below chart for the recommended setting ranges for different Electrode sizes. The setting may also very depending on the Tungsten Electrode type used and specific applications.
The machine will 'beep' and flash up the Electrode diameter as the operator adjusts through the settings ranges to make it easier to set within recommended ranges.

Electrode Diameter	Recommended Setting Range	
	From	To
1.0mm	3.2	3.8
1.6mm	8.2	9.2
2.4mm	18.8	19.8
3.2mm	32.8	34.8

4.6 Remote Controls

4.6.1 Remote Control TIG Torch

The TIG torch supplied with the Weldforce 202T AC/DC machine incorporates a Remote Control Amperage Potentiometer on the handle. This can be used to change the Main Amps either before or during welding.

4.6.1 Remote Foot Control (Optional Accessory)

An optional Foot control is available for use with the Weldforce 202T AC/DC machine (part no. WC-06370).

This enables the main current to be regulated by foot to allow the operator to change the amperage whilst welding without compromising control of the torch.

Figure 10

4.7 MMA/Stick Arc Parameters/Characteristics Settings

NOTE: The following parameter settings are only available in MMA/Stick welding mode.

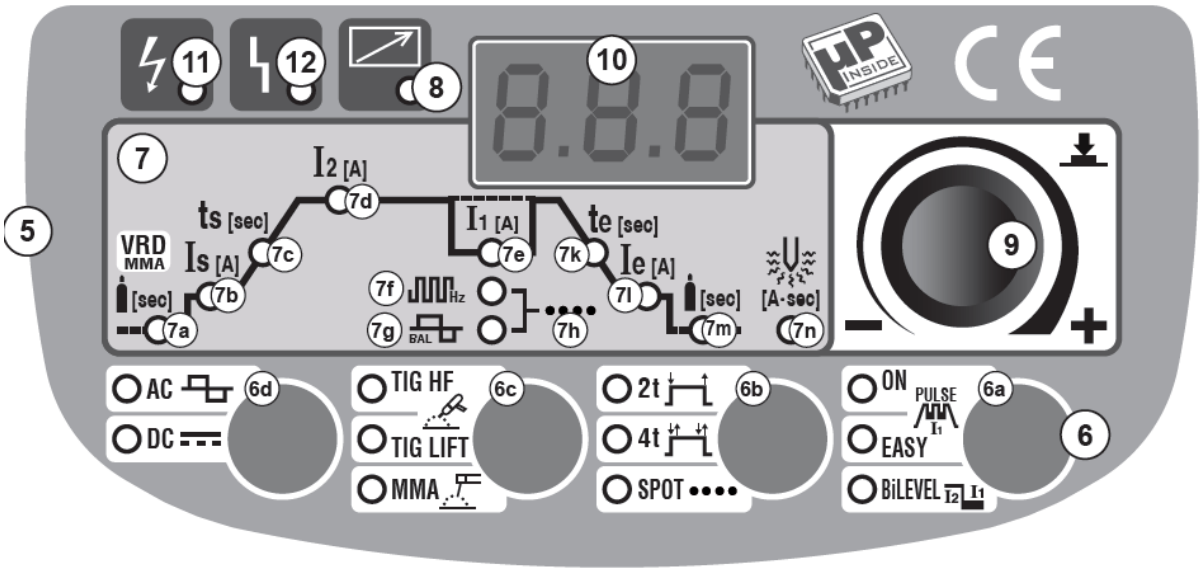


Figure 11

1. Keep Pressing 'Selection knob' (9) down until the desired Arc Parameter Setting Indicator Light is lit.
2. Rotate the 'Selection knob' (9) to adjust the Setting for this Parameter Setting.

4.7.1 Hot Start (7b)

Hot Start setting is adjustable from 0 – 100%. Hot start provides extra power when the weld starts to counteract the high resistance of the electrode and workpiece as the arc is started. It makes igniting the electrode easier and prevents it from sticking when cold.

4.7.2 Current / Amps (7d)

This is the main welding current.

4.7.3 Arc Force Adjustment (7e)

Arc Force setting is adjustable from 0 – 100%. Sometimes called 'Dig' or 'Arc Control'. A Stick welder is designed to produce constant output current (CC). This means with different types of electrode and arc length; the welding voltage varies to keep the current constant. This can cause instability in some welding conditions as Stick welding electrodes will have a minimum voltage they can operate with and still have a stable arc.

Arc Force control boosts the welding power if its senses the welding voltage is getting too low. The higher the arc force adjustment, the higher the minimum voltage that the power source will allow. This effect will also cause the welding current to increase. 0 is Arc Force off, 100 is maximum Arc Force. This is practically useful for electrode types that have a higher operating voltage requirement or joint types that require a short arc length such as out of position welds.

4.8 VRD Function (MMA / Stick)

This function only applies to Stick (MMA) mode & is not applicable to TIG welding.

VRD function reduces the welding machines' open circuit voltage (OCV, or no-load voltage) from 95V to a much safer level of approximately 15V. OCV is the voltage measured across the positive and negative terminals when welding is not in progress.

The VRD function will de-activate to allow full welding power/voltage when the operator strikes an arc and the resistance between the electrode and work piece is less than 200 Ohms (i.e. metal to metal contact).

When the VRD function is active (i.e. when in MMA mode & welding is NOT in progress), the "VRD" indicator LED on control panel will be lit. During MMA/stick welding, LED will turn off to indicate that VRD has been turned off to allow welding.

4.9 LCD Multi-Function Display

When welding is not in progress the LCD Readout (10) displays the setting selected/being adjusted using the Selection Knob (9).

During welding the LCD Readout displays the actual welding current.

Also displays error codes if the protection system (12) is activated.

4.10 Error/Over Temperature Indicator Light

Error/Over Temperature Indicator Light (12) illuminates when duty cycle is exceeded and thermal protection is activated. When thermal protection is activated, welding output will be disabled until machines cools sufficiently and overload indicator lamp goes out.

This may also activate if there are other issues or errors.

When there is an error the LCD screen will display an error code to indicate what the error is. Refer to the following table for error code explanations.

Alarm Code	Error	Solution
AL.1	The machine has exceeded its safe temperature or duty cycle.	Ensure the cooling fan is working. If not, contact supplier. Wait for machine to cool down.
AL.2	Input voltage has exceeded safe tolerance range (above or below)	Check the voltage of your power supply.
AL.9	Error in water cooling circuit.	Contact supplier.

Table 3

If you are unable to resolve the error by restarting the machine or with any of the above solutions, contact your Weldforce distributor to arrange to have the machine assessed by a technician.

5 POWER SUPPLY

5.1 Electrical Connection

The Weldforce 202T is factory-fitted with a 10A 240V plug for commissioning purposes. Whilst 10A plug is fitted, the operator must set to 10A (LC.2) mode and ensure that output and duty cycle limits indicated in Table 1 (under section 2 of this manual) are not exceeded.

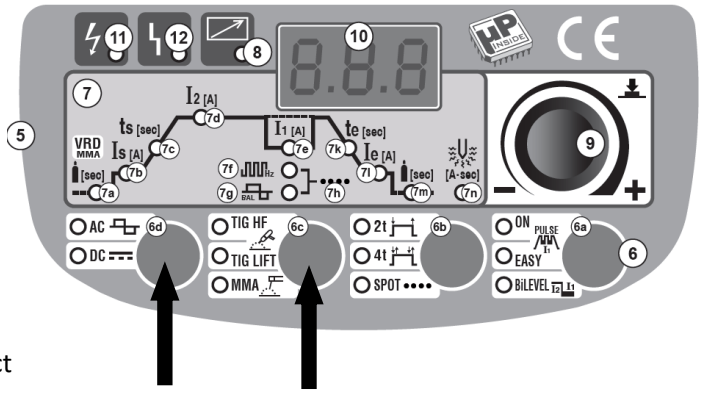
If using on 15A power supply, machine can be set to 15A (LC.1) mode to enable full output (TIG). 15A plug should be installed by a qualified person (such as a licensed electrician) – and if using in MMA (stick) welding mode, the operator must ensure that output and duty cycle limits indicated in Table 1 (under section 2 of this manual) are not exceeded.

If using on 20A power supply (to allow full output in MMA mode), 20A plug should be installed by a qualified person (such as a licensed electrician).

Follow the procedure below for setting machine to 10A or 15A Input Mode.

5.1.1.1 To change Input Power Mode

3. Switch machine OFF
4. Press left two control buttons (6d & 6c) & continue to hold
5. Switch machine ON
6. Continue to hold buttons down for approximately 10 seconds until "CL…" displays
7. Rotate adjustment dial (9) to select desired mode as per table below
8. Push adjustment dial (9) to select



Mode	Display Settings	Max Output -TIG	Max Output -MMA
10A	CL.2	180A	150A
15A	CL.1	200A	160A

5.2 Extension Leads

If an extension cord must be used, it should be minimum cable core size of 2.5mm^2.

Using extension leads of over 20m is not recommended.

5.3 Generator Use

This machine is designed with generator use in mind and incorporates wide voltage tolerance and intelligent voltage sensing technology to provide maximum protection from power fluctuations that can occur with motor generators.

5.3.1 Generator Size

Generator size should be not less than 7kva. A 7kVa generator will not provide enough power to enable full output and duty of this welder. However, it should provide sufficient power to enable TIG welding up to approximately 160A or Stick/MMA welding up to approximately 140A.
To enable full output and duty cycle of this welder, minimum recommended generator size is 10kVa.

5.3.2 Generator Quality & Warranty Limitations

Avoid using poor, low quality generators as these have the greatest risk of power spikes etc. A suitable quality generator should have a THD (total harmonic distortion) rating of no more than 6%. Most reputable generator suppliers will be able to specify the THD ratings on their product.
Any damage caused by poor quality generator power supply or incorrect use is not covered under warranty.

5.3.3 3 Golden Rules of Generator use

When running an inverter welder off a generator there are 3 **VERY IMPORTANT** Golden Rules that ***MUST*** be followed:

1. Do **NOT** plug welder into generator until **AFTER** generator has been started up and is running smoothly
2. **UNPLUG** welder from generator **BEFORE** shutting generator down/turning generator off
3. **NEVER** let your generator run out of fuel whilst the welder is plugged in.

Following these Golden Rules will significantly reduce the risk of any damage resulting from generator power supply.

6 OPERATING ENVIRONMENT

6.1 Location

The machine has electrical components and control circuit boards which may be damaged by excessive moisture, dust and dirt, so a clean and dry operating environment is important for reliable product life.

Environments hotter than 40^0C or with humidity greater than 90% should be avoided.

The enclosure design of this power source meets the requirements of IP23S as outlined in AS60529. This provides adequate protection against solid objects (greater than 12mm), and direct protection from vertical drops. Under no circumstances should the unit be operated or connected in a micro environment that will exceed the stated conditions. For further information please refer to AS 60529.

6.2 Ventilation

Adequate ventilation is required to provide proper cooling for the machine. Ensure that the machine is placed on a stable level surface where clean cool air can easily flow through the unit.

7 BASIC SETUP

7.1 Stick (MMA) Welding Setup

1. Connect the earth cable quick connector to the Negative (-) Dinse Socket
2. Connect the earth clamp to the work piece. Contact with the work piece must be firm contact with clean, bare metal, with no corrosion, paint or scale at the contact point.
3. Insert an electrode into the electrode holder and connect the electrode holder and work lead to the Positive (+) Dinse Socket.

NOTE: *This polarity connection configuration is valid for most GP (General Purpose) MMA electrodes. There are variances to this. If in doubt, check the electrode specifications or consult the electrode manufacturer.*

---

4. Connect the machine to suitable power. Switch the mains power switch to 'I' to power up the machine.
5. Set welding process selector to 'MMA'
6. Select the required output current using the Selection Knob (9). The LCD Readout (10) will display the set amperage output.
7. Adjust special Function settings if required
8. You are now ready to weld!

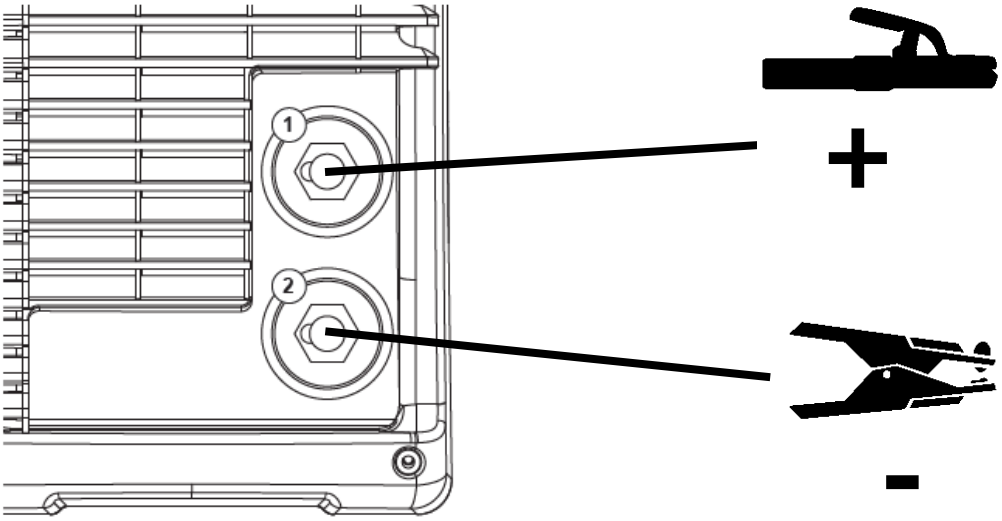


Figure 12

7.2 TIG Welding Setup

1. Connect the earth cable to the Positive (+) Dinse Socket.
2. Connect the earth clamp to the work piece. Contact with the work piece must be firm contact with clean, bare metal, with no corrosion, paint or scale at the contact point.
3. Insert TIG torch power connection into the Negative (-) Dinse Socket.
4. Connect TIG multi-pin connector of the TIG Torch to the Remote Device adapter
5. Connect the Remote Device adapter to the TIG Torch Interface socket on the front of the machine
6. Connect TIG torch gas line to the TIG Torch Gas Connection on the front of the machine. Ensure all connections are tight.
7. Assemble the female gas fitting to the gas hose securing it with the hose clamp provided.
8. Screw the female gas fitting onto the regulator outlet fitting.
9. Connect the gas regulator to a gas cylinder (not included with machine)
10. Connect the gas hose to the Gas Inlet Connection tail on the rear of the machine securing it with the hose clamp provided.
11. Ensure all connections are tight.
12. Open gas cylinder valve carefully
13. Adjust regulator. Flow should be between 5-10 l/min depending on application. Re-check regulator flow pressure with the torch triggered as static gas flow setting may drop once gas is flowing.
14. Connect the machine to suitable power. Switch the mains power switch to 'I' to power up the machine.
15. Set welding process selector to the desired TIG Process Mode
16. Select desired Output Current Mode
17. Select desired Trigger Mode
18. Select desired Pulse Function settings
19. Set the required Arc Parameters using the Selection Knob
20. You are now ready to weld!

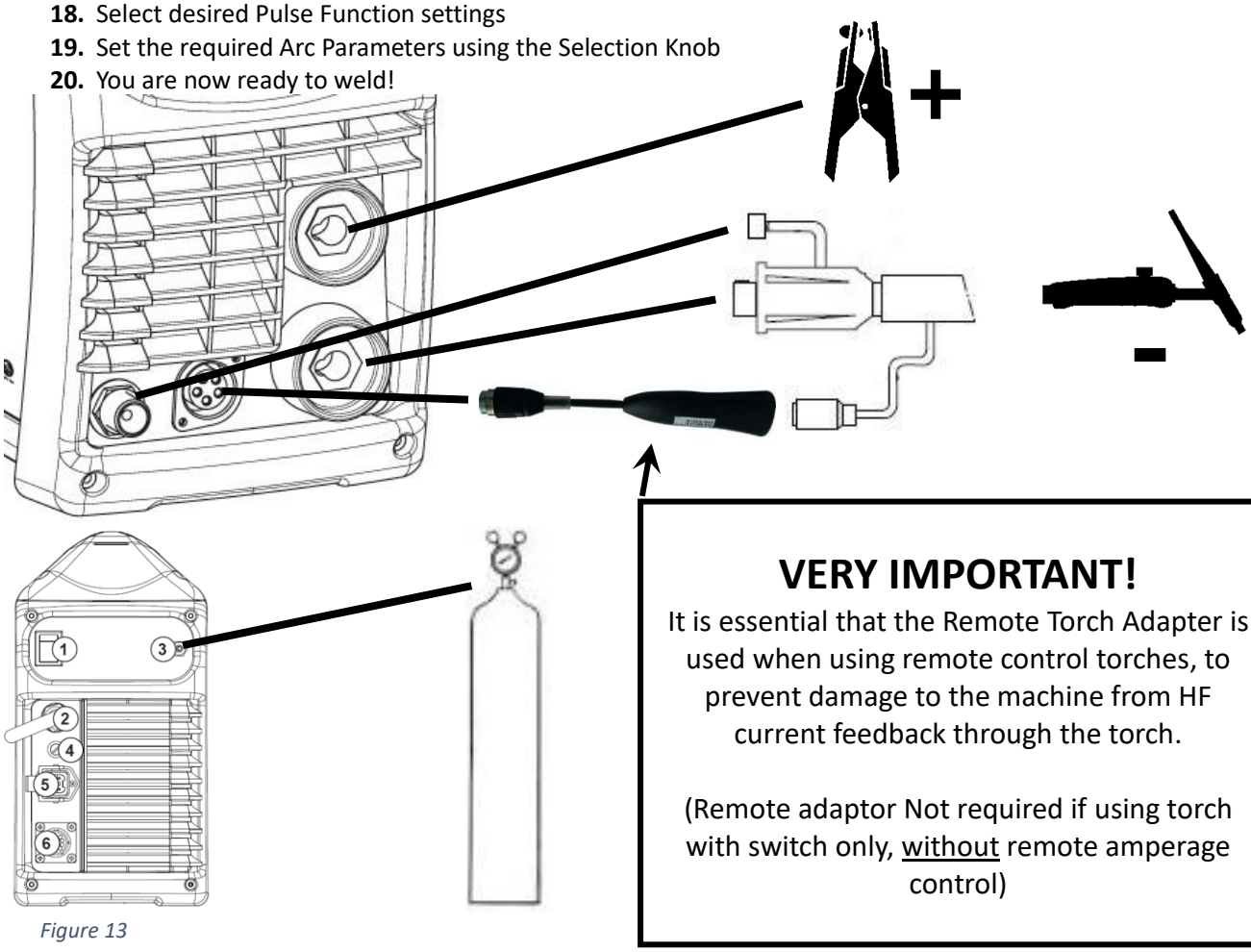


Figure 13

VERY IMPORTANT!

It is essential that the Remote Torch Adapter is used when using remote control torches, to prevent damage to the machine from HF current feedback through the torch.

(Remote adaptor Not required if using torch with switch only, without remote amperage control)

8 ACCESSORIES, SPARE PARTS & CIRCUIT DIAGRAMS

8.1 TIG Torch and Spares:

To view TIG torch and parts, go to: www.weldclass.com.au

Part No.	Description
P3-TB26	Torch Body - 17 Standard (No Valve)
P3-TB26F	Torch Body - 17F Flexible (No Valve)
WC-57Y02P	Back cap – Long Pk2
WC-57Y05P	Back cap – Medium Pk2
WC-57Y04P	Back cap – Short Pk2
P3-10N23	Collet – 1.6mm
P3-10N24	Collet – 2.4mm
P3-10N25	Collet – 3.2mm
P3-10N31	Collect Body – 1.6mm Pk2
P3-10N32	Collect Body – 2.4mm Pk2
P3-10N28	Collect Body – 3.2mm Pk2
P3-10N49	TIG Ceramic Cup - #5 7.9mm Pk2
P3-10N48	TIG Ceramic Cup - #6 9.5mm Pk2
P3-10N47	TIG Ceramic Cup - #7 11.1mm Pk2
P3-10N46	TIG Ceramic Cup - #8 12.7mm Pk2
P3-10N45	TIG Ceramic Cup - #10 15.8mm Pk2
WC-05192	TIG Tungsten RE4 – 1.6mm Pk10
WC-05193	TIG Tungsten RE4 – 2.4mm Pk10
WC-05194	TIG Tungsten RE4 – 3.2mm Pk10

Table 4

Figure 14

8.2 Optional Accessories

Optional Accessories	
Part No.	**Drive Roller**
WC-06235	Welding Trolley
WC-04676	TIG Gloves
WC-01775	Welding Gloves
WC-06370	Remote Foot Control

Table 5

8.3 Machine Spare Parts:

For machine parts, go to www.weldclass.com.au/machines or contact your Weldclass distributor.

Ref.	Description
1	IGBT Transistor
2	Gas Discharger
3	Capacitor
4	Gas Solenoid Valve
5	Power Switch
6	Potentiometer Knob
7	Fuse Holder
8	Fuse
9	Remote Control Interface (C.A.D.)
10	Water Cooler Interface (GRA)
11	TIG Torch Control Interface
12	Input Power Cable
13	Pulse Transformer Kit
14	HF Flyback Transformer
15	Front Plastic Panel
16	Back Plastic Panel
17	Carry Handle
18	Input Gas Hose Connection
19	Dinse Socket
20	TIG Torch Gas Connector Kit
21	Control Panel Keypad Card Kit
22	Bottom Panel Kit
23	Metal Cover Panel Kit
24	Power PCB Module Kit
25	Control PCB Kit
26	Front Panel PCB Card Kit
27	Support Control PCB Kit
28	HF Generator Card Kit
29	HF Transformer Kit
30	Single Phase Bridge Rectifier

Ref.	Description
31	Hall Sensor
32	IGBT Transistor
33	Mosfet Transistor
34	Resistor
35	Resistor
36	Diode
37	Diode
38	Relay
39	Diode
40	Diode
41	Resistor
42	Diode
43	Opto-Coupler
44	Resistance
45	Thermal Switch
46	Current Transformer
47	Fan
48	Inductance Filter
49	Inductor
50	Power Transformer
51	Auxilliary Flyback Transformer
52	IGBT + Diode Kit
53	Resistor

Table 6

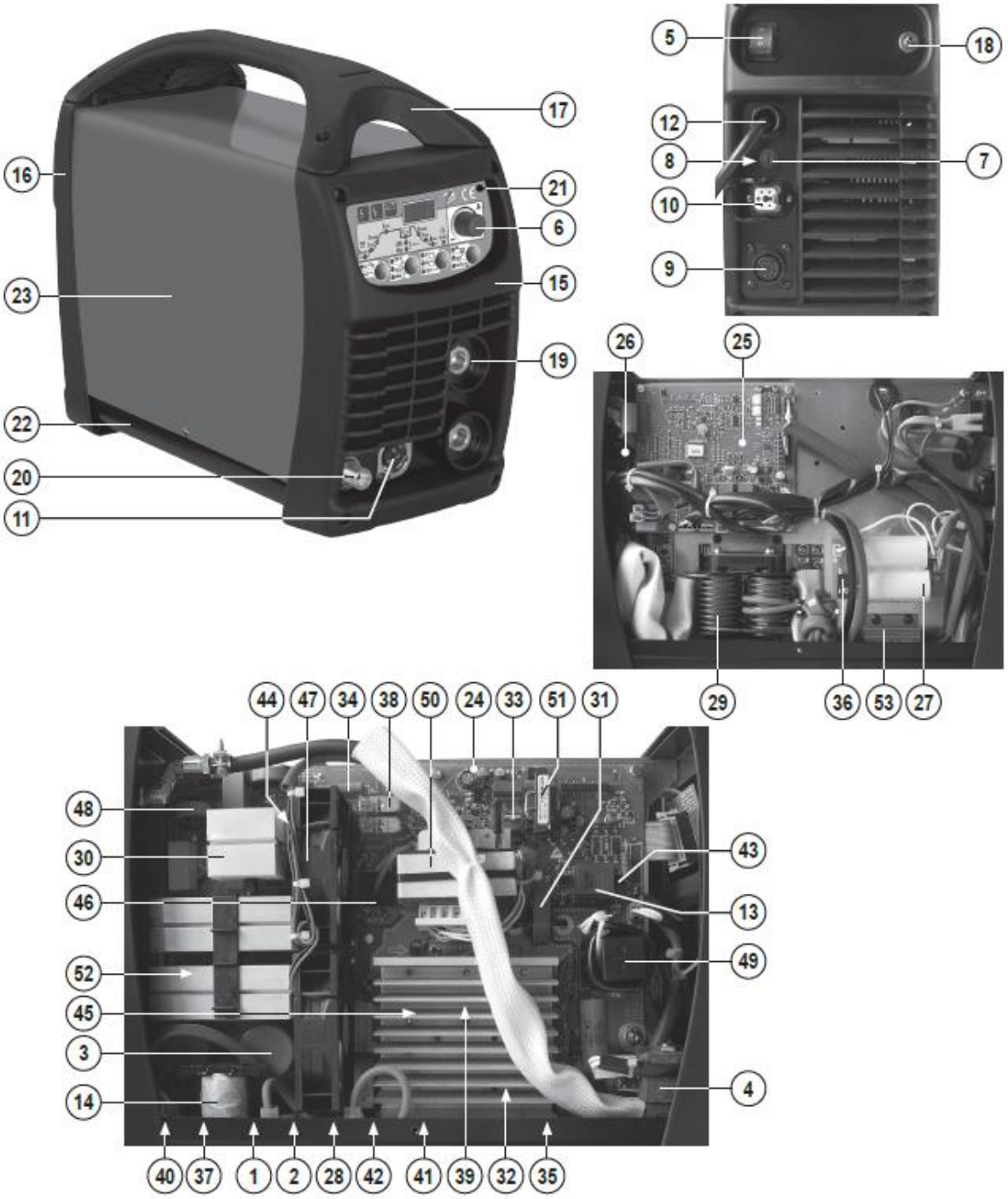


Figure 15

8.4 Primary Schematic Circuit Diagram

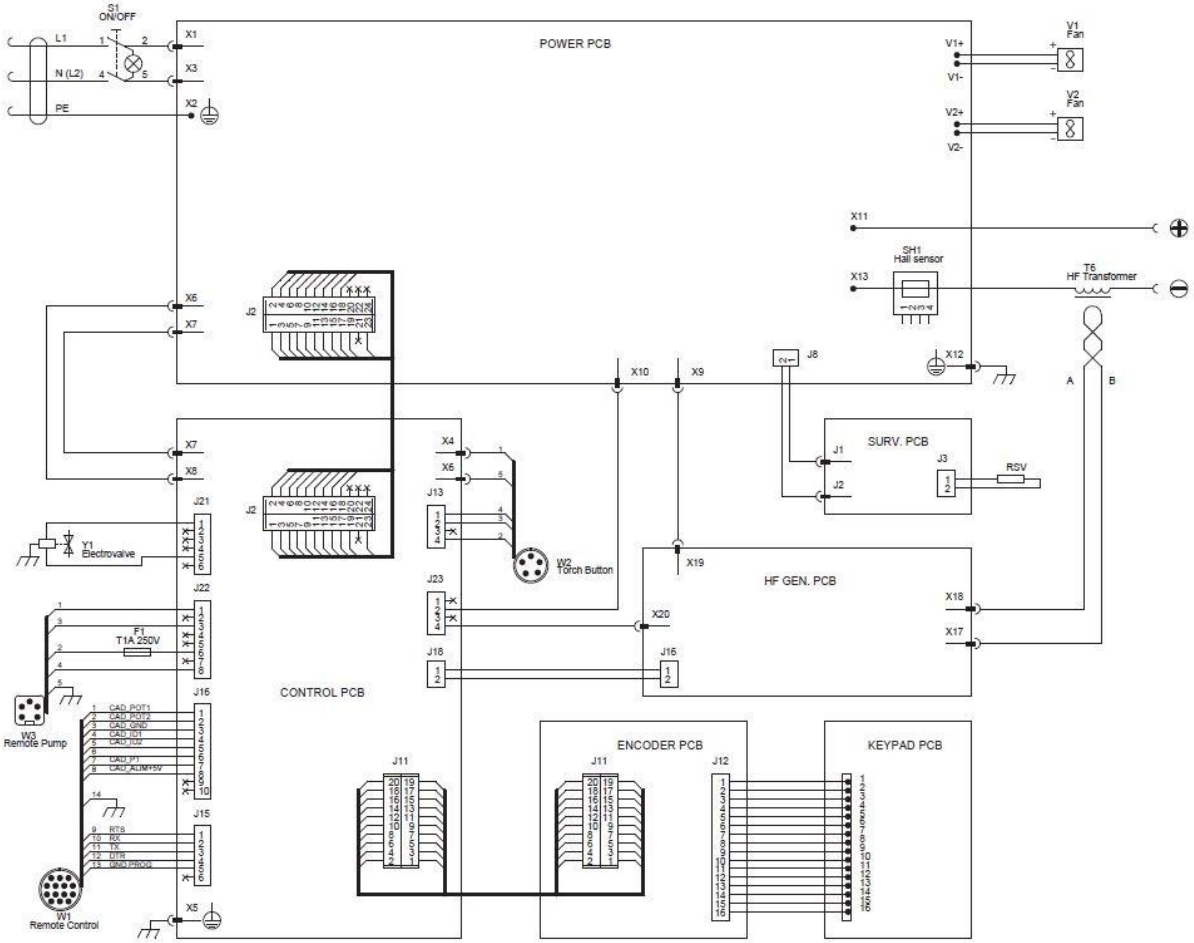


Figure 16

8.5 Torch Control Schematic Circuit Diagram

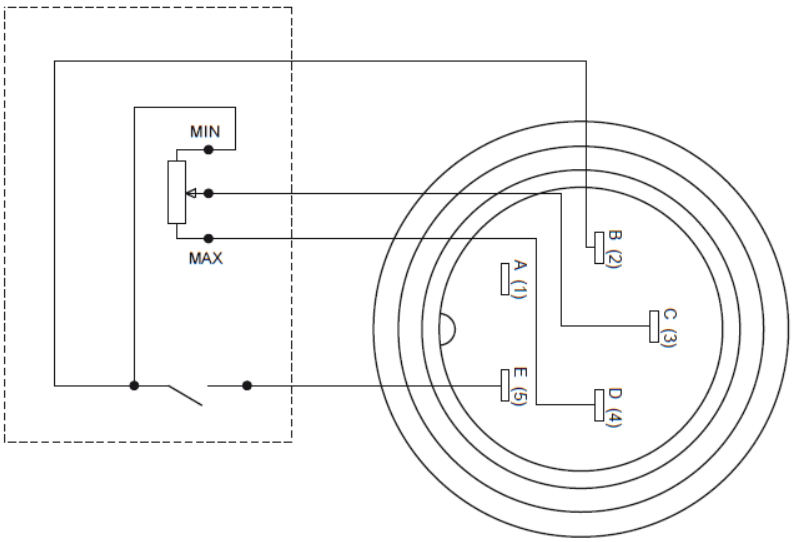


Figure 17

9 CARE & MAINTENANCE

9.1 Keep your Welding Machine in Top Condition

The Weldforce 202T AC/DC does not require any special maintenance, however the user should take care of the machine as follows:

1. Regularly clean the ventilation slots
2. Keep the casing clean
3. Check all cables before use
4. Check electrode holders, work lead/clamps and welding torches before use
5. Replace worn electrode holders and earth clamps, which do not provide a good connection
6. Replace worn torch consumable parts in a timely manner
7. Replace worn wire drive components in a timely manner
8. Use a soft cloth or brush to clean electrical components. Do not use liquid cleaning products, water or especially solvents
9. Do not use compressed air to clean electrical components as this can force dirt and dust further into components, causing electrical short circuits
10. Check for damaged parts

WARNING! *Before performing cleaning/maintenance, replacing cables/connections, make sure the welding machine is switched off and disconnected from the power supply.*

If damaged, before further use, the welder must be carefully checked by a qualified person to determine that it will operate properly. Check for breakage of parts, mountings and other conditions that may affect its operation.

Have your welder repaired by an expert. An authorised service centre should properly repair a damaged part.

This appliance is manufactured in accordance with relevant safety standards. Only experts must carry out repairing of electrical appliances, otherwise considerable danger for the user may result.
Use only genuine replacement parts. Do not use modified or non-genuine parts.

9.2 Storing the Welder

When not in use the welder should be stored in the dry, dust-free and frost-free environment.

10 GENERAL GUIDE TO WELDING

10.1 Duty Cycle Rating

Weldforce welding machines are fitted with thermal overload protection which means the machine will cut out when it reaches a certain temperature, to prevent damage to components. The machine will then re-start when it returns to a safe temperature.
Duty cycle is a measure of the percentage of time a machine will operate within a certain time period at a given amperage. For example a duty cycle of 160A @ 25% means that a machine will operate at 160A for 2 ½ minutes in a 10 minute time period. The machine will have to rest for the remaining 7 ½ minutes to enable it to cool down.
The international standard for duty cycle rating is based on an ambient air temperature of 40°C with 50% humidity, over a 10 minute period. In an environment with temperatures exceeding 40°C, the duty cycle will be less than stated. In ambient temperature less than 40°C, duty cycle performance will be higher. There are numerous other factors that can influence actual duty cycle performance.

10.2 Choosing a Welding Process – MMA/Stick or TIG?

10.2.1 The Stick (MMA) Process

10.2.1.1 Description

The acronym MMA (or MMAW) stands for Manual Metal Arc Welding. 'Manual' refers to the fact that the MMA process requires the operator to apply filler metal (in contrast to MIG 'semi-automatic' welding where the machine feeds the filler metal into the weld). 'Metal' refers to the fact that the filler metal itself (the stick electrode) is used to conduct the welding current to the job. MMA welding is commonly known as 'stick-electrode' or 'arc' welding.

10.2.1.2 Process

The MMA process involves the electrode being touched on the job to ignite the arc. The electrode is held in the electrode holder and must be continually replaced as it is consumed. The electrode consists of a metal core, which is the filler metal, covered by a flux coating which shields the weld and prevents it from oxidising. During welding the flux forms into a slag covering the weld which is chipped off after the weld has formed.

10.2.1.3 Advantages

MMA welding offers several advantages over alternative welding processes. Primarily it has a greater capacity than MIG welding, or in other words it can weld heavier materials with the same amperage output. For this reason small, portable inverter welders like the WeldForce machines, have the capacity to weld with up to 3.2mm or 4mm electrodes making it suitable for a vast range of applications without the complication of shielding gas or wire feeding. Moreover, MMA welding is typically more 'forgiving' than MIG or TIG when welding rusty or dirty materials (which makes it ideal for maintenance applications).

10.2.1.4 Limitations

Traditionally, welding thin materials whilst avoiding "blow-through" can be tricky with the MMA process. This being said, however, welding thin materials with a WeldForce machine will be noticeably easier because the arc is so stable and the output can be very finely adjusted down to very low amps.

10.2.1.5 Materials

MMA welding can be used with a wide variety of electrodes including general purpose, low hydrogen, stainless steel, iron powder, hard facing & cast iron just to name a few.

10.2.2 The TIG Process

10.2.2.1 Description

The acronym TIG stands for Tungsten Inert Gas. Tungsten refers to the type of conductor (a tungsten electrode) that is used to transfer the welding current to the job and create the arc. Inert Gas refers to the fact that the process relies on an inert gas to prevent weld oxidisation.
Also referred to as Gas Tungsten Arc Welding (GTAW).

10.2.2.2 Process

In simple terms, TIG welding is probably most similar to oxy flame welding. However, instead of a flame it uses an electrical arc to melt the job and filler metal, and instead of a preheat flame it uses inert gas to prevent weld oxidisation. Like oxy flame welding, the filler metal is fed into the weld by hand as required. Due to the fact that the current is not conducted to the job via the filler metal, (as it is in MIG and MMA welding), the arc is much more controllable.

10.2.2.3 Advantages

Very low amperages can be achieved making this process ideal for welding thin materials. Also, due to the independence of the arc and the filler metal application, TIG welding is very controllable and can therefore achieve very high quality welds with excellent appearance. Unlike MIG and MMA welding, TIG welding does not produce spatter so clean up is very minimal. It is typically used where weld appearance is critical (e.g. handrails) or where weld quality is vital (e.g. pressure vessels or pipes).

10.2.2.4 Limitations

Whilst TIG welding is very controllable, it can also be slower and more tedious than MIG or MMA welding and it will generally not operate well on dirty or rusty materials meaning that additional weld preparation is sometimes necessary. It also requires a higher level of skill and experience to achieve a quality result.

10.2.2.5 Materials

This machine incorporates AC/DC TIG function which can be used to weld a variety of materials including mild steels, stainless steels, copper and chrome moly, aluminium, titanium and zinc.

10.3 Joint Preparations

In many cases, it will be possible to weld steel sections without any special preparation. For heavier sections and for repair work on castings, etc., it will be necessary to cut or grind an angle between the pieces being joined to ensure proper penetration of the weld metal and to produce sound joints. In general, surfaces being welded should be clean and free of rust, scale, dirt, grease, etc. Slag should be removed from oxy-cut surfaces. Typical joint designs are shown in the following figures.

Open Square Butt Joint

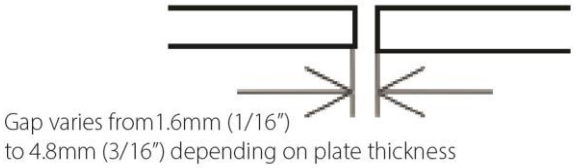


Figure 18

Single Vee Butt Joint

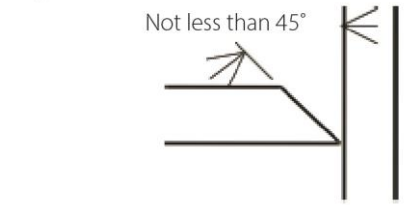


Figure 19

Single Vee Butt Joint

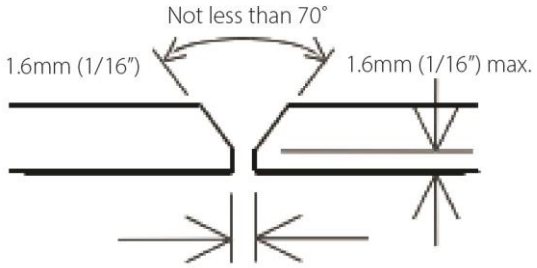


Figure 20

Double Vee Butt Joint

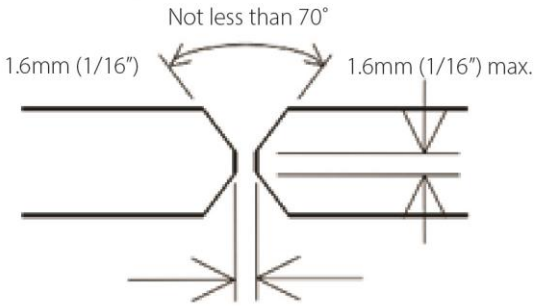


Figure 21

Lap Joint

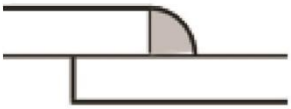


Figure 22

Fillet Joint

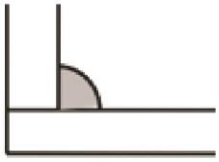


Figure 23

Tee Joints

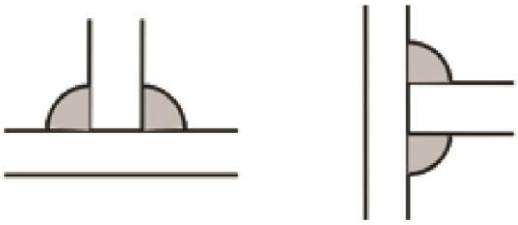


Figure 24

Edge Joint

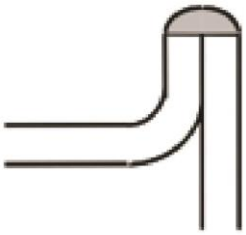


Figure 25

Corner Weld

Figure 26

Plug Welds

Figure 27

11 STICK (MMA) BASIC WELDING GUIDE

11.1 Size of Electrodes

The electrode size is determined by the thickness of metals being joined and can also be governed by the type of welding machine available. Small welding machines will only provide current (amperage) to run smaller sized electrodes. For thin sections, it is necessary to use smaller electrodes otherwise the arc may burn holes through the job. A little practice will soon establish the most suitable electrode for a given application.

11.2 Storage of Electrodes

Always store electrodes in a dry place and in their original containers. If electrodes have been exposed to moisture or moist air then they will need to be dried out using an electrode drying oven.

11.3 Electrode Polarity

Electrodes are generally connected to the electrode holder with the electrode holder connected positive polarity.
The work lead is connected to the negative polarity and is connected to the work piece. If in doubt consult the electrode data sheet.
If you are Stick welding in AC mode (which may be required with some specialty applications) then it does not matter which connections the electrode holder and earth lead are connected to.

11.4 Effects of Stick (MMA) Welding on Various Materials

11.4.1 High Tensile and Alloy Steels

The two most prominent effects of welding these steels are the formation of a hardened zone in the weld area, and, if suitable precautions are not taken, the occurrence in this zone of under-bead cracks. Hardened zone and under-bead cracks in the weld area may be reduced by using the correct electrodes, preheating, using higher current settings, using larger electrodes sizes, short runs for larger electrode deposits or tempering in a furnace.

11.4.2 Manganese Steels

The effect on manganese steel of slow cooling from high temperatures causes embrittlement. For this reason it is absolutely essential to keep manganese steel cool during welding by quenching after each weld or skip welding to distribute the heat.

11.4.3 Cast Iron

Most types of cast iron, except white iron, are weldable. White iron, because of its extreme brittleness, generally cracks when attempts are made to weld it. Trouble may also be experienced when welding white-heart malleable, due to the porosity caused by gas held in this type of iron.

11.5 Types of Electrodes

Arc Welding electrodes are classified into a number of groups depending on their applications. There are a great number of electrodes used for specialised industrial purposes which are not of particular interest for everyday general work. These include some low hydrogen types for high tensile steel, cellulose types for welding large diameter pipes, etc. The range of electrodes dealt with in this publication will cover the vast majority of applications likely to be encountered; are all easy to use.

11.5.1 Mild Steel

1. **General Purpose "GP" E6013 (Weldclass 12V):** This all-position electrode is used for maintenance and fabrication. Works well on mild steel, galvanized steel, sheet metal, steel tube and RHS. Its soft arc has minimal spatter, moderate penetration and an easy-to-clean slag. Tolerant to dirty / rusty steel & poor fit up. This is the most common type of electrode used for Stick welding.
2. **Hydrogen Controlled E7016 (Weldclass 16XT):** A "low-hydrogen" electrode commonly used for mild or high strength steel, where the joint requires higher strength than regular "GP" electrodes, such as highly restrained joints or components subject to higher load stress. Also used as a buffer layer prior to hard facing. All-Positional (except for vertical down), easy striking & smooth running, with low spatter & easy slag removal..

11.5.2 Cast Iron

1. **Cast Iron Ni-Cl (NCI):** Suitable for joining all cast irons (Suitable for mehanite, alloy and malleable cast iron) except white cast iron. Weld positions : flat, horizontal.

11.5.3 Stainless Steel

1. **Stainless Steel 316L:** Used for welding common 300 series stainless steels such as 301, 302, 304, 304L and 316L. All welding positions, excluding vertical down. Very Smooth Running and Easy to use.
2. **Universal 312:** Weld-all style electrodes for welding almost any steel or stainless-steel, including dissimilar metals. Weld metal is very crack resistant. Commonly used for repair and maintenance welding of unknown steels. All welding positions excluding vertical down.

11.6 Suggested Settings for Typical Stick (MMA) Applications

Material	Electrode Type	Electrode Size	Amperage Range
Mild Steel	General Purpose Weldclass E12V (E6013)	2.6mm	60 – 100
		3.2mm	100 – 140
		4.0mm	140 – 190
Mild Steel	Hydrogen Controlled (High Strength) Weldclass 16XT (E7016)	2.5mm	60 – 110
		3.2mm	90 – 140
		4.0mm	130 – 190
Stainless Steel	Stainless Steel 316L	2.6mm	40 – 70
		3.2mm	100 – 150
		4.0mm	135 – 180

Table 7

These settings are a guide only. Actual settings required will depend on plate thickness, operator technique, environment, etc.

11.7 MMA Welding Techniques

11.7.1 A Word for Beginners

For those who have not yet done any welding, the simplest way to commence is to run beads on a piece of scrap plate. Use mild steel plate about 6.0mm thick and a 3.2mm electrode.
Clean any paint, loose scale or grease off the plate and set it firmly on the work bench so that welding can be carried out in the down hand position. Make sure that the Work Lead/Clamp is making good electrical contact with the work, either directly or through the work table. For light gauge material, always clamp the work lead directly to the job, otherwise a poor circuit will probably result.

11.7.2 The Welder

Place yourself in a comfortable position before beginning to weld. Get a seat of suitable height and do as much work as possible sitting down. Don't hold your body tense. A taut attitude of mind and a tensed body will soon make you feel tired. Relax and you will find that the job becomes much easier. You can add much to your peace of mind by wearing a leather apron and gauntlets. You won't be worrying then about being burnt or sparks setting alight to your clothes.
Place the work so that the direction of welding is across, rather than to or from, your body. The electrode holder lead should be clear of any obstruction so that you can move your arm freely along as the electrode burns down. If the lead is slung over your shoulder, it allows greater freedom of movement and takes a lot of weight off your hand. Be sure the insulation on your cable and electrode holder is not faulty; otherwise you are risking an electric shock.

11.7.3 Striking the Arc

Practice this on a piece of scrap plate before going on to more exacting work.
You may at first experience difficulty due to the tip of the electrode "sticking" to the work piece. This is caused by making too heavy a contact with the work and failing to withdraw the electrode quickly enough. A low amperage will accentuate it. This freezing on of the tip may be overcome by scratching the electrode along the plate surface in the same way as a match is struck.
Another difficulty you may meet is the tendency, after the arc is struck, to withdraw the electrode so far that the arc is broken again. A little practice will soon remedy both of these faults.

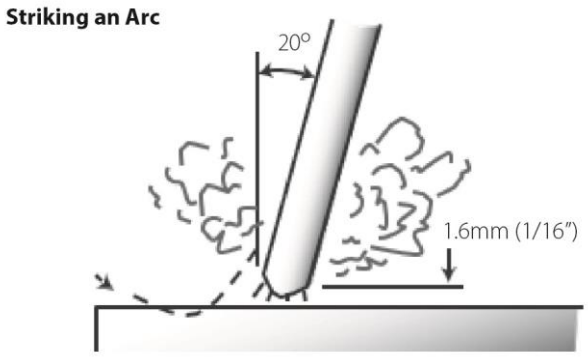


Figure 28

11.7.4 Arc Length

As soon as the arc is established, maintain a 1.6mm to 3.2mm gap between the burning electrode end and the parent metal. Draw the electrode slowly along as it melts down. The securing of an arc length necessary to produce a neat weld soon becomes almost automatic. You will find that a long arc produces more heat.
A very long arc produces a crackling or spluttering noise and the weld metal comes across in large, irregular blobs. The weld bead is flattened and spatter increases. A short arc is essential if a high quality weld is to be obtained although if it is too short there is the danger of it being blanketed by slag and the electrode tip being solidified in. If this should happen, give the electrode a quick twist back over the weld to detach it.

11.7.5 Rate of Travel

After the arc is struck, your next concern is to maintain it, and this requires moving the electrode tip towards the molten pool at the same rate as it is melting away. At the same time, the electrode has to move along the plate to form a bead.
The electrode is directed at the weld pool at about 20º from the vertical. The rate of travel has to be adjusted so that a well-formed bead is produced.
If the travel is too fast, the bead will be narrow and strung out and may even be broken up into individual globules. If the travel is too slow, the weld metal piles up and the bead will be too large.

11.8 Making Welded Joints

Having attained some skill in the handling of an electrode, you will be ready to go on to make up welded joints.

11.8.1 Butt Welds

Set up two plates with their edges parallel, as shown in Figure 29, allowing 1.6mm to 2.4mm gap between them and tack weld at both ends. This is to prevent contraction stresses from the cooling weld metal pulling the plates out of alignment.
Plates thicker than 6.0mm should have their mating edges beveled to form a 70º to 90º included angle. This allows full penetration of the weld metal to the root. Using a 3.2mm Weldclass 12V Stick electrode at 100 amps, deposit a run of weld metal on the bottom of the joint.
Do not weave the electrode, but maintain a steady rate of travel along the joint sufficient to produce a well-formed bead. At first you may notice a tendency for undercut to form, but keeping the arc length short, the angle of the electrode at about 20º from vertical, and the rate of travel not too fast, will help eliminate this.
The electrode needs to be moved along fast enough to prevent the slag pool from getting ahead of the arc. To complete the joint in thin plate, turn the job over, clean the slag out of the back and deposit a similar weld.
Heavy plate will require several runs to complete the joint. After completing the first run, chip the slag out and clean the weld with a wire brush. It is important to do this to prevent slag being trapped by the second run. Subsequent runs are then deposited using either a weave technique or single beads laid down in the sequence shown in Figure 30. The width of weave should not be more than three times the core wire diameter of the electrode.
When the joint is completely filled, the back is either machined, ground or gouged out to remove slag which may be trapped in the root, and to prepare a suitable joint for depositing the backing run. If a backing bar is used, it is not usually necessary to remove this, since it serves a similar purpose to the backing run in securing proper fusion at the root of the weld.

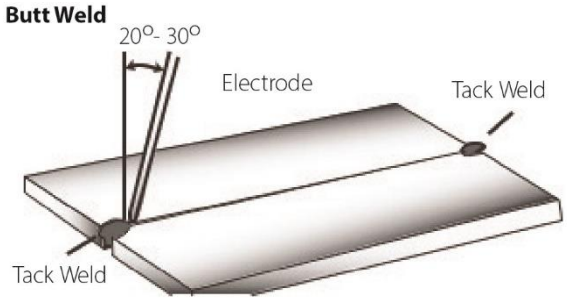


Figure 29

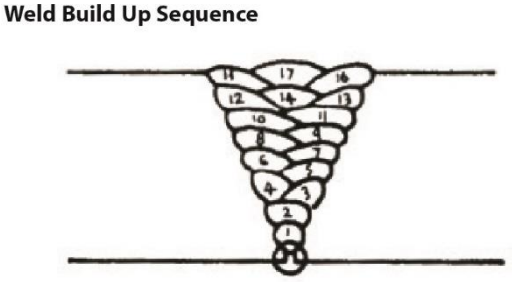


Figure 30

11.8.2 Fillet Welds

These are welds of approximately triangular cross-section made by depositing metal in the corner of two faces meeting at right angles. Refer Figure 31 and Figure 32.
A piece of angle iron is a suitable specimen with which to begin, or two lengths of strip steel may be tacked together at right angles. Using a 3.2mm Weldclass 12V Stick electrode at 100 amps, position angle iron with one leg horizontal and the other vertical. This is known as a horizontal-vertical (HV) fillet. Strike the arc and immediately bring the electrode to a position perpendicular to the line of the fillet and about 45º from the vertical. Some electrodes require being sloped about 20º away from the perpendicular position to prevent slag from running ahead of the weld. Refer to Figure 31.
Do not attempt to build up much larger than 6.4mm width with a 3.2mm electrode, otherwise the weld metal tends to sag towards the base, and undercut forms on the vertical leg. Multi-runs can be made as shown in Figure below. Weaving in HV fillet welds is undesirable.

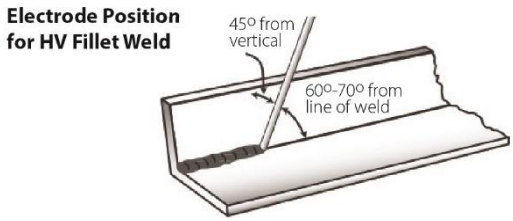


Figure 31

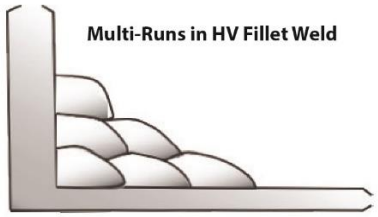


Figure 32

11.8.3 Vertical Welds

11.8.3.1 Vertical Up

Tack weld a three feet length of angle iron to your work bench in an upright position. Use a 3.2mm Weldclass 12V Stick electrode and set the current at 100 amps. Make yourself comfortable on a seat in front of the job and strike the arc in the corner of the fillet. The electrode needs to be about 10º from the horizontal to enable a good bead to be deposited.
Refer Figure 33.

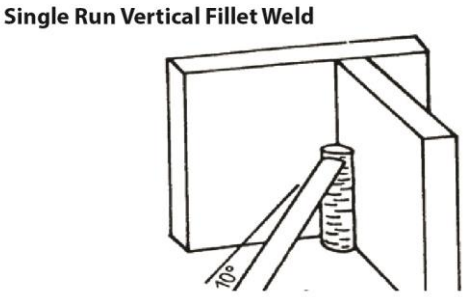


Figure 33

Use a short arc, and do not attempt to weave on the first run. When the first run has been completed deslag the weld deposit and begin the second run at the bottom. This time a slight weaving motion is necessary to cover the first run and obtain good fusion at the edges.
At the completion of each side motion, pause for a moment to allow weld metal to build up at the edges, otherwise undercut will form and too much metal will accumulate in the centre of the weld. Figure 34 illustrates multi-run technique and Figure 35 shows the effects of pausing at the edge of weave and of weaving too rapidly.

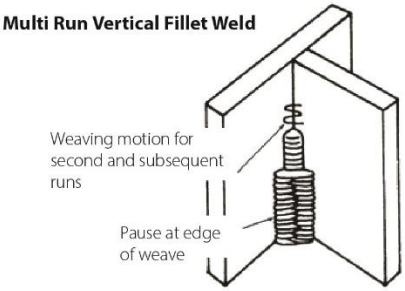


Figure 34

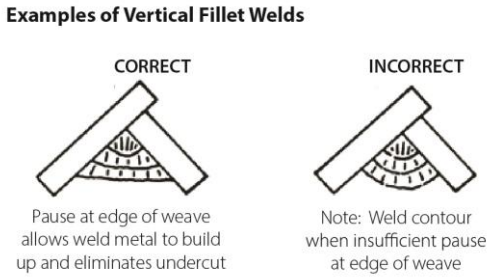


Figure 35

11.8.3.2 Vertical Down

The Weldclass 12V Stick electrode makes welding in this position particularly easy. Use a 3.2mm electrode at 100 amps. The tip of the electrode is held in light contact with the work and the speed of downward travel is regulated so that the tip of the electrode just keeps ahead of the slag. The electrode should point upwards at an angle of about 45º.

11.8.4 Overhead Welds

Apart from the rather awkward position necessary, overhead welding is not much more difficult that down hand welding. Set up a specimen for overhead welding by first tacking a length of angle iron at right angles to another piece of waste pipe. Then tack this to the work bench or hold in a vice so that the specimen is positioned in the overhead position as shown in the sketch.
The electrode is held at 45º to the horizontal and tilted 10º in the line of travel (Figure 36). The tip of the electrode may be touched lightly on the metal, which helps to give a steady run. A weave technique is not advisable for overhead fillet welds.
Use a 3.2mm Weldclass 12V Stick electrode at 100 amps, and deposit the first run by simply drawing the electrode along at a steady rate. You will notice that the weld deposit is rather convex, due to the effect of gravity before the metal freezes.

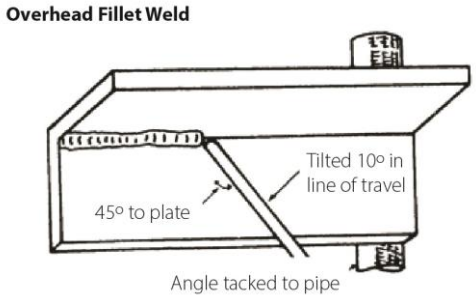
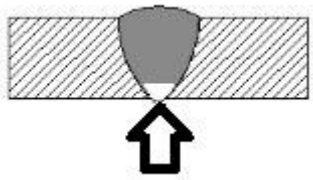
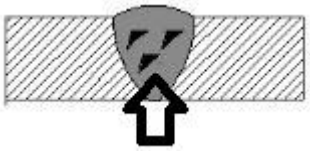
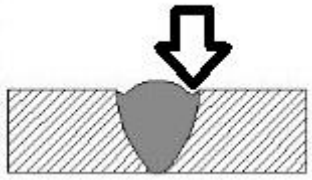


Figure 36

11.9 MMA (Stick) Troubleshooting

Fault	Cause	Remedy
A gap is left by failure of the weld metal to fill the root of the weld.  *Figure 37*	Welding current too low.	Increase welding current.
	Electrode too large for joint.	Use smaller diameter electrode.
	Insufficient gap.	Allow wider gap.
Non-metallic particles are trapped in the weld metal.  *Figure 38*	Non-metallic particles may be trapped in undercut from previous run.	If a bad undercut is present clean slag bout and cover with a run from a smaller gauge electrode.
	Joint preparation too restricted.	Allow for adequate penetration and room for cleaning out the slag.
	Irregular deposits allow slag to be trapped.	If very bad, chip or grind out irregularities.
	Lack of penetrations with slag trapped beneath weld bead.	Use smaller electrode with sufficient current to give adequate penetrations. Use suitable tools to remove all slag from comers.
	Rust or mill scale or preventing full fusion.	Clean joint before welding.
	Wrong electrode for position in which welding is done.	Use electrodes designed for position in which welding is done, otherwise proper control of slag is difficult.
A groove has been formed in the base metal adjacent to the top of a weld and has not been filled by the weld metal (undercut).  *Figure 39*	Welding current is too high.	Reduce welding current.
	Welding arc is too long.	Reduce the length of the welding arc.
	Angle of the electrode is incorrect.	Electrode should not be inclined less than 45° to the vertical face.
	Joint preparation does not allow correct electrode angle.	Allow more room for joint for manipulation of the electrode.
	Electrode too large for joint.	Use smaller gauge electrode.
	Insufficient deposit time at edge of weave.	Pause for a moment at edge of weave to allow weld metal build-up.
	Power source is set for MIG (GMAW) welding.	Set power source to STICK (MMA) mode.

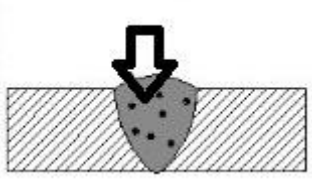
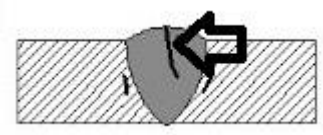
Fault	Cause	Remedy
Portions of the weld run do not fuse to the surface of the metal or edge of the joint.  *Figure 40*	Small electrodes used on heavy cold plate.	Use larger electrodes and preheat the plate.
	Welding current is too low.	Increase welding current.
	Wrong electrode angle.	Adjust angle so the welding arc is directed more into the base metal.
	Travel speed of electrode is too high.	Reduce travel speed of electrode.
	Scale or dirt on joint surface.	Clean surface before welding.
Gas pockets or voids in weld metal (porosity)  *Figure 41*	High levels of Sulphur in steel.	Use an electrode that is designed for high Sulphur steels.
	Electrodes are damp.	Dry electrodes before use.
	Welding current is too high.	Reduce welding current.
	Surface impurities such as oil, grease, paint, etc.	Clean joint before welding.
	Welding in a windy environment.	Shield the weld area from the wind.
	Electrode damaged i.e. flux coating incomplete.	Discard damaged electrodes and only use electrodes with a complete flux coating.
Crack occurring in weld metal soon after solidification commences  *Figure 42*	Rigidity of joint.	Redesign to relieve weld joint of severe or use crack resistance electrodes.
	Insufficient throat thickness.	Travel slightly slower to allow greater build up in throat.
	Weld current is too high.	Decrease welding current.

Table 8

12 TIG BASIC WELDING GUIDE

TIG Welding is a fusion procedure that uses an electric ARC created between an infusible tungsten electrode and base material to be welded. For TIG welding an inert gas must be used (Argon) which protects the welding bead. If filling material is used, it is made up of rods suitable to the material to be welded (steel, stainless steel, copper etc.).

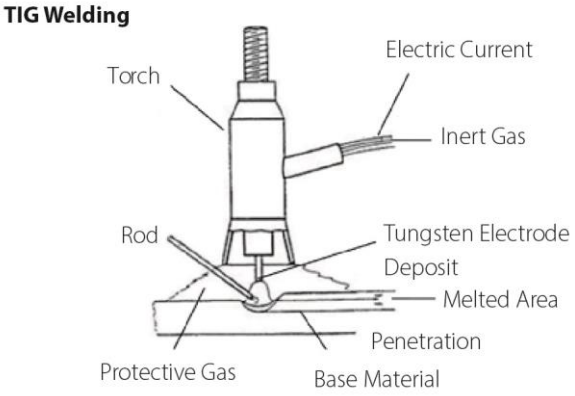


Figure 43

In TIG mode, welding is possible in all positions: flat, angle, on the edge, vertical and overhead. Furthermore, with respect to other types of welding, the welding joint has greater mechanical resistance, greater corrosion resistance and limited heating in the welded area which limits distortion. Welding can be done even without weld material, guaranteeing a smooth, shiny weld with no impurities or slag.

12.1 TIG Electrode Selection and Preparation

12.1.1 Tungsten Electrode Selection & Polarity

Connect the TIG torch to the negative (-) torch terminal and the work lead to the positive (+) work terminal for direct current straight polarity. Direct current straight polarity is the most widely used polarity for DC TIG welding. It allows limited wear of the electrode since 70% of the heat is concentrated at the work piece.

Tungsten Electrode Types			
Electrode Type	**Application**	**Features**	**Colour Code**
Rare-Earth (Weldclass RE4)	All metals*	High-Performance, suitable for both DC (Steel, Stainless steel etc.) and AC (Aluminium) TIG welding. Maintains tip shape, reliable arc striking, low burn off rate, long service life and smooth/stable arc.	Purple

Table 9

Tungsten Electrode Current Ranges	
Electrode Diameter	**DC Current (Amps)**
1.6mm (1/16”)	60 – 115
2.4mm (3/32”)	100 – 165
3.2mm (1/8”)	135 – 200

Table 10

Guide For Selecting Filler Wire Diameter	
Filler Electrode Diameter	**DC Current (Amps)**
1.6mm (1/16”)	20 – 90
2.4mm (3/32”)	65 – 115
3.2mm (1/8”)	100 – 165

Table 11

12.1.2 Preparing Tungsten

The electrode should be pointed (tapered) according to the welding current.
Grind end of tungsten on fine grit, hard abrasive wheel before welding. Do not use wheel for other jobs or tungsten can become contaminated causing lower weld quality.
Rule of thumb is that the taper section should be 2.5 times the Electrode Diameter.

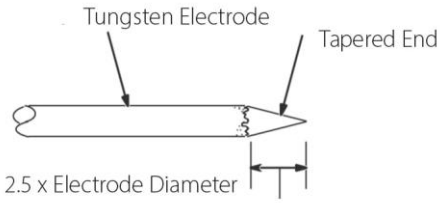


Figure 44

Ideal Tungsten Preparation = Stable ARC
Diameter of the flat left on the end of the Electrode determines amperage capacity.

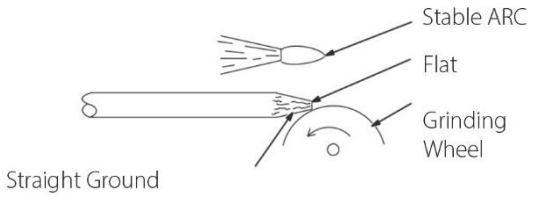


Figure 45

Wrong Tungsten Preparation = Wandering ARC

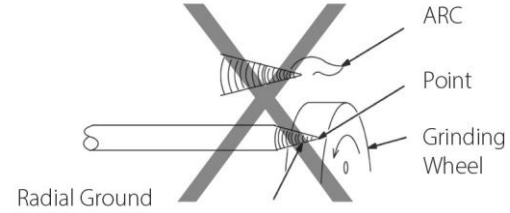


Figure 46

Pointing the Tungsten Electrode
The electrode should be pointed according to the welding current.

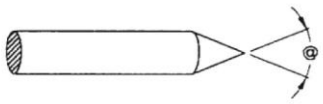


Figure 47

Electrode Angles	
Angle @	**Range of Current (Amps)**
30°	0 – 30
60-90°	30 -120
90-120°	120 - 250
120°	≥250

Table 12

Note that when welding in AC Mode the tungsten should automatically form a ‘ball’ shape on the end. This is perfectly normal and this is what is required for AC TIG welding.

12.1.3 Shielding Gas for TIG Welding

Shielding Gas Selection	
Alloy	**Shielding Gas**
Carbon Steel	100% Argon
Stainless Steel	
Nickel Alloy	
Copper	
Titanium	
Aluminium	

Table 13

12.1.4 Typical TIG Welding Settings

TIG Welding Settings For DC						
Metal Thickness	**DC Current (Amps)**		**Tungsten Electrode Diameter**	**Filler Rod Diameter (if required)**	**Argon Gas Flow Rate L/min**	**Joint Type**
	Mild Steel	**Stainless Steel**				
1.2mm (0.045”)	45-55	30-45	1.0mm (0.040”)	1.6mm (1/16”)	5 - 10	Butt/ Corner
	50-60	35-50				Lap / Fillet
1.6mm (1/16”)	60-70	40-60	1.6mm (1/16”)	1.6mm (1/16”)	10 - 15	Butt/ Corner
	70-90	50-70				Lap / Fillet
3.2mm (1/8”)	80-100	65-85	1.6mm (1/16”)	2.4mm (3/32”)	10 - 15	Butt/ Corner
	90-115	90-110				Lap / Fillet

Table 14

TIG Welding Settings For AC			
Tungsten Electrode Diameter	**AC Current (Amps)**		**Argon Gas Flow Rate L/min**
	Unbalanced Wave	**Balanced Wave**	
1.0mm (0.040”)	15-80	20-60	5 - 10
1.6mm (1/16”)	70-150	60-120	10 - 15
2.4mm (3/32”)	140-235	100-180	10 - 15

Table 15

12.2 Starting the Weld

12.2.1 Lift-Arc Ignition

Lift-Arc Ignition Function means that to start the arc the tungsten is touched on the job and lifted off. The ignition current is very low and therefore the tungsten barely sticks to the job and the sharpened point is not damaged. The tungsten is then easily lifted off the job. The machine senses that the contact is broken and begins the weld.

1. Press the Torch Trigger Button down and hold
2. Pre-Gas will start
3. Touch the Tungsten Electrode onto the Workpiece very briefly
4. Lift the Tungsten Electrode up slowly off the Workpiece
5. If set to 4T Trigger mode the Start Current will be maintained until you release the Torch Trigger Button and will then proceed to the Slope-Up process. If Set to 2T Trigger mode machine will begin with Start Current briefly then proceed to the Slope-Up process.

12.2.2 HF Ignition

High-Frequency (HF) Ignition Function uses a high frequency arc to jump from the tungsten electrode to the workpiece to start the welding arc (eliminating the need for the tungsten electrode to make contact with the job).

1. Hold the Tungsten Electrode close to the workpiece (1-3mm). It is usually easiest to lie the torch over and rest the edge of the shield cup on the workpiece.
2. Press the Torch Trigger Button down
3. The machine will begin the ‘Pre-Gas’ time and then ignite the arc.
4. If set to 4T Trigger mode the Start Current will be maintained until you release the Torch Trigger Button and will then proceed to the Slope-Up process. If Set to 2T Trigger mode machine will begin with Start Current briefly then proceed to the Slope-Up process.

12.3 Main Weld Current

12.3.1 DC Current

DC or Direct Current is where the welding current flows in only one direction. With a DC circuit 70% of the energy or heat is always on the positive side.

DC is used for welding the following materials:

- Mild Steel
- Stainless Steel
- Copper
- Titanium

12.3.2 AC Current

AC or Alternating Current is where the welding current flow oscillates back and forth in both directions. When reactive metals are exposed to air they form an oxide layer that insulates the base metal and prevents welding current flowing. It also contaminates the weld pool. Reverse current flow is required to break through/ clean off this oxide layer so that welding can take place, while the current flow during the positive cycle does the majority of the heating of the weld pool area.

AC is used for welding the following materials:

- Aluminium
- Aluminium Alloys
- Magnesium
- Zinc

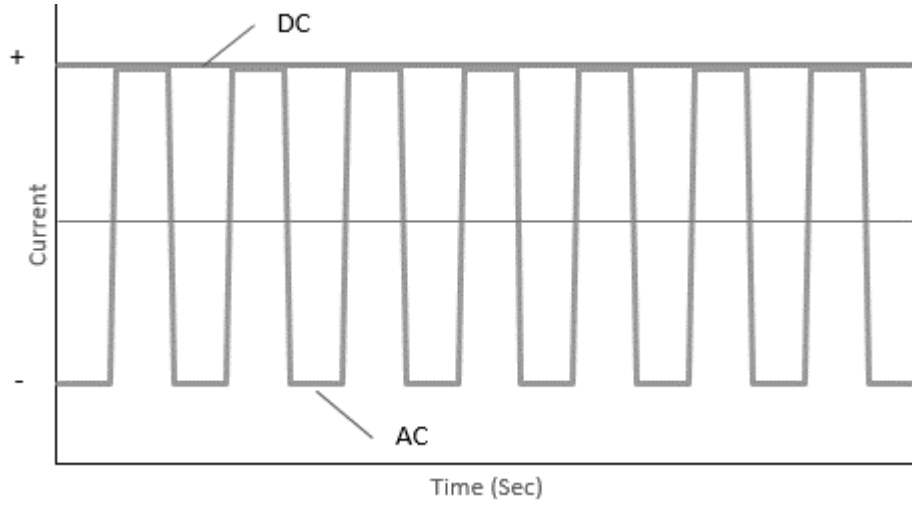


Figure 48

12.3.3 Pulse Welding

Pulse welding is where the Arc oscillates between high and low current/amperage.

It should not be confused with AC Current. AC refers to a change in the *direction* of the current flow whereas Pulse refers to a change the *amount* or Amperage of the current.

In Pulse mode the actual welding is done at the Peak of the Pulse. During the Trough of the Pulse the weld is allowed to cool which reduces the overall heat input into the workpiece.

There are several variables that can be adjusted in Pulse welding which allows for much better control of various aspects of the weld including:

- Heat input
- Penetration
- Operator Control
- Finished Weld Appearance

Pulse welding enables the operator to weld faster with better control and reduced heat which in turn minimises distortion of the work piece and gives a much better looking weld appearance.

The variables are explained further as follows:

Main Amps: this is the main welding current/amperage and which is used to melt the work piece and/or filler metal.
Base Amps: this is the lower current that allows the weld & work piece to cool. Generally this is set such that the weld pool is approximately half the size of the main weld pool during Main Current.
Pulse Frequency: this controls how quickly the pulse oscillates (cycles per second) between Main & Base currents. The setting of this is predominately based on how the operator wants the finished weld bead to appear.
Pulse Balance: this controls how much time is spent at the Main Current vs the Base Current. Increasing the Pulse Width percentage increase the time that is spent at the Main Current which in turn increases the heat input into the job. Inversely reducing the Pulse Width percentage means more time is spent at the Base Current which reduces heat input.

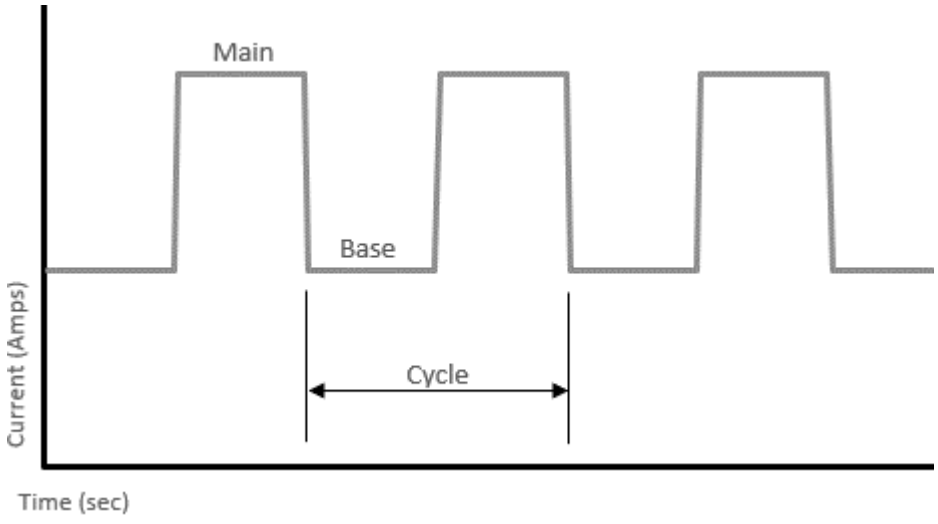


Figure 49

12.3.4 AC Balance

AC Balance is used to vary the proportion of time that the weld current flows in each direction.

The reverse part of the AC cycle is what breaks the oxide layer and 'cleans' the weld material.
The forward cycle is what actually melts the weld material.

A neutral AC Balance setting is 0 which means that the currently is flowing forwards for 50% of the time and in reverse for 50% of the time.

More Positive AC Balance will mean will give greater cleaning effect, less weld penetration and more heat in the Tungsten Electrode.
This gives the disadvantage of reducing the output current that can be used for a given tungsten size to prevent the tungsten overheating.

More Negative AC Balance will give the opposite effect, less cleaning effect, greater weld penetration and less heat in the tungsten.

Ideally for maximum effectiveness, AC balance should be set with as much Negative AC Balance as possible, while still maintaining a sufficient level of oxidisation removal for a contamination free weld pool.
The cleaner the non-ferrous metal is before welding, the more effective it is to weld.

This effect can also be used to reduce heat in the tungsten, allowing use of a pointed tungsten tip shape for a more defined arc.

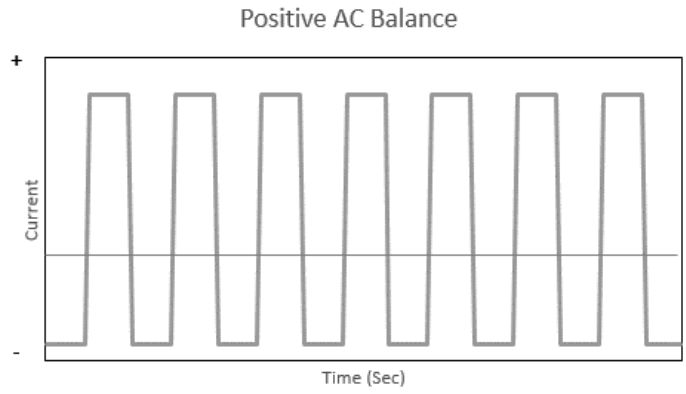


Figure 50

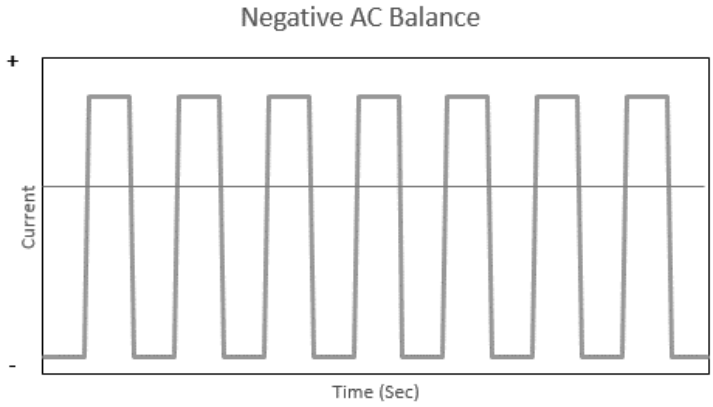


Figure 51

12.4 Finishing the Weld

In 2t Trigger Mode

1. Release the Torch Trigger Button
2. The welding currently will complete the Down-Slope process to reduce amperage from Main Amps down to Finish Amps
3. The Post-Gas time will then complete

In 4T Trigger Mode

1. Press and Hold the Torch Trigger Button down
2. The welding current will complete the Down-Slope process to reduce amperage from Main Amps down to Finish Amps
3. Release the Torch Trigger Button when you want the Finish Amps to stop
4. The Post-Gas time will then complete

12.4.1 Down-Slope

This gradually reduces the weld current over the time selected down to Finish Amps. This allows the operator to complete the weld without leaving a 'crater' at the end of the weld pool.

12.4.2 Post Gas Flow

This controls the period of time the shielding gas continues to flow for after the arc stops. This protects the weld area and torch tungsten from contamination while it is still hot enough to react with atmospheric gases.

12.4.3 Finish Amps

This gives a selected small amount of current which the operator can use to neatly complete the end of the weld.

12.5 TIG Welding Troubleshooting

Troubleshooting – TIG Weld quality		
Fault	**Cause**	**Remedy**
Excessive bead build up or poor penetration or poor fusion at edges of weld	Welding current is too low.	Increase weld current and/or faulty joint preparation
Weld bead too wide and flat or undercut at edges of weld or excessive burn through	Welding current is too high.	Decrease weld current.
Weld bead too small or insufficient penetration or ripples in bead are widely spaced apart.	Travel speed too fast.	Decrease weld current.
Weld bead too wide or excessive bead build up or excessive penetration in butt joint.	Travel speed too fast.	Increase travel speed.
Uneven leg length in fillet joint	Wrong placement of filler rod.	Re-position filler rod.
Electrode melts or oxidises when an arc in struck	Torch lead connected to positive welding terminal.	Connect torch lead to negative welding terminal.
	No gas flowing to welding region.	Check the gas lines for kinks or breaks and gas cylinder contents.
	Torch is clogged with dust or dirt.	Clean torch.
	Gas hose is cut.	Replace gas hose.
	Gas passage contains impurities.	Disconnect gas hose from the rear of Power Source then raise gas pressure and blow out impurities.
	Gas regulator turned off.	Turn on.
	Torch electrode is too small for the welding current.	Increase electrode diameter or reduce the welding current.
Dirty weld pool	Electrode contaminated by contact with work piece or filler rod material.	Clean the electrode by grinding off any contaminates.
	Work piece surface has foreign material on it.	Clean surface.
	Gas contaminated with air.	Check gas lines for cuts and loose fitting or change gas cylinder.
Poor weld pool	Inadequate shielding gas.	Increase gas flow or check gas line for gas flow problems.
Arc start is not smooth.	Tungsten electrode is too large for the welding current.	Select the right size electrode.
	The wrong electrode is being used for the welding job.	Select the right electrode type.
	Gas flow rate is too high.	Select the right rate for the welding job.
	Incorrect shielding gas is being used.	Select the right shielding gas.
	Poor Work Lead/Clamp connection to work piece.	Improve connection to work piece.
Arc flutters during TIG welding.	Tungsten electrode is too large for the welding current.	Select the right size electrode.

Table 16

13 KNOWLEDGE & RESOURCES

Please refer to Weldclass website www.weldclass.com.au for more information.

14 SAFETY

14.1 Store and Retain this Manual

Retain this manual for the safety warnings and precautions, assembly, operating, inspection, maintenance and cleaning procedures. Write the product's serial number into the NOTES section at the rear and keep this manual and the receipt in a safe and dry place for future reference.

14.2 Important Safety Information

Failure to follow the warnings and instructions may result in electric shock, fire, serious injury and/ or death. Save all warnings and instructions for future reference.
This is the safety alert symbol to alert you to potential personal injury hazards:

Obey all safety messages that follow this symbol to avoid possible injury or death.

 **DANGER!** indicates a hazardous situation which, if not avoided, will result in death or serious injury.

 **WARNING!** indicates a hazardous situation which, if not avoided, could result in death or serious injury.

 **CAUTION**, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTE, used to address practices not related to personal injury.

CAUTION, without the safety alert symbol, is used to address practices not related to personal injury.

14.3 Welding Operation

1. **Maintain labels and nameplates on the welder.** These carry important information. If unreadable or missing, contact Weldclass for a replacement.
2. **Avoid unintentional starting.** Make sure the welder is setup correctly and you are prepared to begin work before turning on the welder.
3. **Unplug before performing maintenance.** Always unplug the welder from its electrical outlet before performing any inspection, maintenance, or cleaning procedures.

4. **Never leave the welder unattended while energised.** Turn power off before leaving the welder unattended.
5. **Do not touch live electrical parts.** Wear dry, insulating gloves. Do not touch the electrode or the conductor tong with bare hands. Do not wear wet or damaged gloves.
6. **Protect yourself from electric shock.** Do not use the welder outdoors. Insulate yourself from the work piece and the ground. Use non-flammable, dry insulating material if possible, or use dry rubber mats, dry wood or plywood, or other dry insulating material large enough to cover the area of contact with the work or the ground.
7. **Avoid inhaling fume.** Some fume created by welding contain chemicals known to cause cancer, birth defects or other harm. Your risk from these exposures varies, depending on how often you do this type of work. To reduce your exposure to these chemicals, work in a well-ventilated area, and work with approved safety equipment, such as dust masks that are specially designed to filter out microscopic particles.
8. **People with pacemakers should consult their physician(s) before using this machine.**

WARNING! *Electromagnetic fields in close proximity to a heart pacemaker could cause interference, or failure of the pacemaker. The use of a Welder is NOT RECOMMENDED for pacemaker wearers. Consult your doctor.*

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9. **Ensure that the unit is placed on a stable location before use.**

WARNING! *If this unit falls while plugged in, severe injury, electric shock, or fire may result.*

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10. **Transportation Methods.** Lift unit with the handles provided, or use a handcart or similar device of adequate capacity. If using a fork lift vehicle, secure the unit to a skid before transporting.

CAUTION! *Disconnect input power conductors from de-energized supply line before moving the welding power source.*

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11. **Exercise good work practices.** The warnings, precautions, and instructions discussed in this instruction manual cannot cover all possible conditions and situations that may occur. It must be understood by the operator that common sense and caution are factors which cannot be built into this product, but must be considered by the operator.
12. **Do not use this machine for pipe thawing.** This machine was not designed for pipe thawing and will be a significant electrical & heat hazard if attempt is made to use for thawing pipe.

14.4 Welding Safety Instructions & Warnings

WARNING! *Protect yourself and others from possible serious injury or death. Keep children away. Read the operating/Instruction manual before installing, operating or servicing this equipment. Have all installation, operation, maintenance, and repair work performed by qualified people.*

If an operator does not strictly observe all safety rules and take precautionary actions, welding products and welding processes can cause serious injury or death, or damage to other equipment or property.

Safe practices have developed from past experience in the use of welding and cutting. These practices must be learned through study and training before using this equipment. Some of these practices apply to equipment connected to power lines; other practices apply to engine driven equipment. Anyone not having extensive training in welding and cutting practices should not attempt to weld.

Safe practices are outlined in the Australian Standard AS 1674.2 entitled: Safety in Welding and European Standard EN60974-1 entitled: Safety in welding and allied processes.

WARNING! *Only use safety equipment that has been approved by an appropriate standards agency. Unapproved safety equipment may not provide adequate protection. Eye and breathing protection must be AS/NZS compliant for the specific hazards in the work area.*

DANGER! *Always wear AS/NZS compliant safety glasses and full face shield fitted with appropriate filter shade number. (Refer Filter Table on page 17.)*

CAUTION! *Heavy-duty work gloves, non-skid safety shoes and hearing protection used for appropriate conditions will reduce personal injuries.*

CAUTION! *Have the equipment serviced by a qualified repair person using identical replacement parts. This will ensure that the safety of the power tool is maintained.*

14.4.1 Personal Safety

CAUTION! *Keep the work area well lit. Make sure there is adequate space surrounding the work area. Always keep the work area free of obstructions, grease,*

oil, trash, and other debris. Do not use equipment in areas near flammable chemicals, dust, and vapours. Do not use this product in a damp or wet location.

1. **Stay alert, watch what you are doing and use common sense when operating equipment.** Do not use a tool while you are tired or under the influence of drugs, alcohol or medication. A moment of distraction when operating equipment may result in serious personal injury.

2. **Do not overreach.** Keep proper footing and balance at all times. This enables better control of the power tool in unexpected situations.

14.4.2 Arc Rays can Burn Eyes and Skin

CAUTION! *Arc rays from the welding process produce intense heat and strong ultraviolet rays that can burn eyes and skin.*

1. Use a Welding Helmet or Welding Face Shield fitted with a proper shade filter (refer AS 60974-1, AS/NZS 1337.1 and AS/NZS 1338.1 Safety Standards) to protect your face and eyes when welding or watching. (See Filter Table on Page17).

2. Wear approved safety glasses. Side shields are recommended.

3. Use protective screens or barriers to protect others from flash and glare; warn others not to watch the arc.

4. Wear protective clothing made from durable, flame-resistant material (wool and leather) and foot safety protection.

5. Never wear contact lenses while welding.

14.4.3 Noise Can Damage Hearing

CAUTION! *Noise from some processes can damage hearing. Use AS/NZS compliant ear plugs or ear muffs if the noise level is high.*

14.4.4 Work Environment Safety

DANGER! *Remove any combustible material from the work area.*

1. When possible, move the work to a location well away from combustible materials. If relocation is not possible, protect the combustibles with a cover made of fire resistant material.

2. Remove or make safe all combustible materials for a radius of 10 metres around the work area. Use a fire resistant material to cover or block all doorways, windows, cracks, and other openings.
3. Enclose the work area with portable fire resistant screens. Protect combustible walls, ceilings, floors, etc., from sparks and heat with fire resistant covers.
4. If working on a metal wall, ceiling, etc., prevent ignition of combustibles on the other side by moving the combustibles to a safe location. If relocation of combustibles is not possible, designate someone to serve as a fire watch, equipped with a fire extinguisher, during the welding process and well after the welding is completed.
5. Do not weld or cut on materials having a combustible coating or combustible internal structure, as in walls or ceilings, without an approved method for eliminating the hazard.
6. After welding, make a thorough examination for evidence of fire. Be aware that visible smoke or flame may not be present for some time after the fire has started. Do not weld or cut in atmospheres containing dangerously reactive or flammable gases, vapours, liquids, and dust. Provide adequate ventilation in work areas to prevent accumulation of flammable gases, vapours, and dust.
7. Do not apply heat to a container that has held an unknown substance or a combustible material whose contents, when heated, can produce flammable or explosive vapours. Clean and purge containers before applying heat. Vent closed containers, including castings, before preheating, welding, or cutting.

14.4.5 Electricity Can Kill

⚠ ***DANGER!*** *Touching live electrical parts can cause fatal shocks or severe burns. The electrode and work circuit is electrically live whenever the output is on.*

The input power circuit and machine internal circuits are also live when power is on. In semiautomatic or automatic wire welding, the wire, wire reel, drive roll housing, and all metal parts touching the welding wire are electrically live. Incorrectly installed or improperly grounded equipment is a hazard.

1. Do not touch live electrical parts.
2. Wear dry, hole-free insulating gloves and body protection.
3. Insulate yourself from the work and the ground using dry insulating mats or covers.
4. Disconnect input power before installing or servicing this equipment. Lock input power, disconnect switch open, or remove line fuses so power cannot be turned on accidentally.
5. Properly install and ground this equipment according to national, state, and local codes.
6. Turn off all equipment when not in use. Disconnect power to equipment if it will be left unattended or out of service.
7. Use fully insulated electrode holders. Never dip the holder in water to cool it or lay it down on the ground or the work surface. Do not touch holders connected to two welding machines at the same time or touch other people with the holder or electrode.
8. Do not use worn, damaged, undersized, or poorly spliced cables.
9. Do not wrap cables around your body.
10. Connect work piece to a good electrical ground.
11. Do not touch the electrode while in contact with the work (ground) circuit.
12. Use only well-maintained equipment. Repair or replace damaged parts as soon as practical.
13. In confined spaces or damp locations, do not use a welder with AC output unless equipped with a voltage reducer.

Arc rays from the welding process produce intense heat and strong ultraviolet rays that can burn eyes and skin. Use the following table to select the appropriate shade number for a Welding Helmet or Welding Face

Shield.

Recommended Protection Fillers For Electric Welding		
Welding Process / Application	**Approximate Range of Welding Current in Amps**	**Minimum Shade Number of Filter Lens**
Stick (MMA)	Up to 100	8
	100 to 200	10
TIG	Up to 100	10
	100 to 200	11

Table 17

14.4.6 Fumes And Gases

WARNING! *Welding produces fumes and gases. Breathing these fumes and gases can be hazardous to your health.*

1. Keep your head out of the fumes. Do not breathe the fumes.
2. If inside, ventilate the area and/or use an exhaust at the arc to remove welding fumes and gases.
3. If ventilation is poor, use an approved supplied-air respirator (PAPR).
4. Read the Safety Data Sheets (SDS) and the manufacturer's instruction for the metals, consumables, coatings, and cleaners.
5. Work in a confined space only if it is well ventilated, or while wearing an air-supplied respirator. Shielding gases used for welding can displace air causing injury or death. Be sure the breathing air is safe.
6. Do not weld in locations near degreasing, cleaning, or spraying operations. The heat and rays of the arc can react with vapours to form highly toxic and irritating gases.
7. Do not weld on coated metals, such as galvanized, lead, or cadmium plated steel, unless the coating is removed from the weld area, the area is well ventilated, and if necessary, while wearing an air- supplied respirator. The coatings and any metals containing these elements can give off toxic fumes if welded.

14.4.7 Fire & Explosive Risks

WARNING! *Sparks and spatter fly off from the welding arc. The flying sparks and hot metal, weld spatter, work piece, and hot equipment can cause fires and burns.*

Accidental contact of electrode or welding wire to metal objects can cause sparks, overheating, or fire.

1. Protect yourself and others from flying sparks and hot metal.
2. Do not weld where flying sparks can strike flammable material.
3. Remove all flammables within 10m of the welding site.
4. Be alert that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas.
5. Watch for fire, and keep a fire extinguisher nearby.
6. Be aware that welding on a ceiling, floor, bulkhead, or partition can cause fire on the hidden side.
7. Do not weld on closed containers such as tanks or drums.

8. Connect the work lead/clamp to the job as close to the welding area as practical to prevent welding current from traveling long, possibly unknown paths and causing electric shock and fire hazards.
9. Do not use a welder to thaw frozen pipes.
10. Remove the stick electrode from the holder or cut off the welding wire at the contact tip when not in use.

14.4.8 Sparks & Hot Metal

WARNING! *Chipping and grinding causes flying metal, and as welds cool they can throw off slag.*

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1. Wear an AS/NZS approved face shield or safety goggles. Side shields are recommended.
2. Wear appropriate safety equipment to protect the skin and body.]

14.4.9 Gas Cylinders

WARNING! *Gas cylinders contain gas under high pressure. If damaged, a cylinder can explode. Since gas cylinders are normally part of the welding process, be sure to treat them carefully.*

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1. Protect compressed gas cylinders from excessive heat, mechanical shocks, and arcs.
2. Install and secure cylinders in an upright position by chaining them to a stationary support or equipment cylinder rack to prevent falling or tipping.
3. Keep cylinders away from any welding or other electrical circuits.
4. Never allow a welding electrode to touch any cylinder.
5. Use appropriate shielding gas, regulators, hoses, and fittings designed for the specific application; maintain them and their associated parts in good condition.
6. Turn your face away from the valve outlet when opening the cylinder valve.

15 WARRANTY

15.1 Warranty Information

For full details on warranty period and terms and conditions, go to
www.weldclass.com.au/WarrantyInfo