

GMAW

Operating Principles

Gas - Uses an inert gas shield to protect the weld pool from oxygen in the atmosphere.

Metal - A variety of metals can be joined with the GMAW process including; steels, aluminium and stainless steels.

Arc - GMAW uses an electric arc of approx 6000°Celsius.

Welding - GMAW is a fusion welding process where the parent metal and filler metal are melted together to create a weld.

Operating Principles

On completion of this topic you will be able to:

Identify the **Uses of GMAW** in Industry.

Name the basic components of **GMAW plant**.

Describe the role of the: **Inert Gas Supply**

Wire Feed Unit

Hand Piece

Power Source

Understand the **O.H.S.** (occupational health and safety) issues of GMAW.

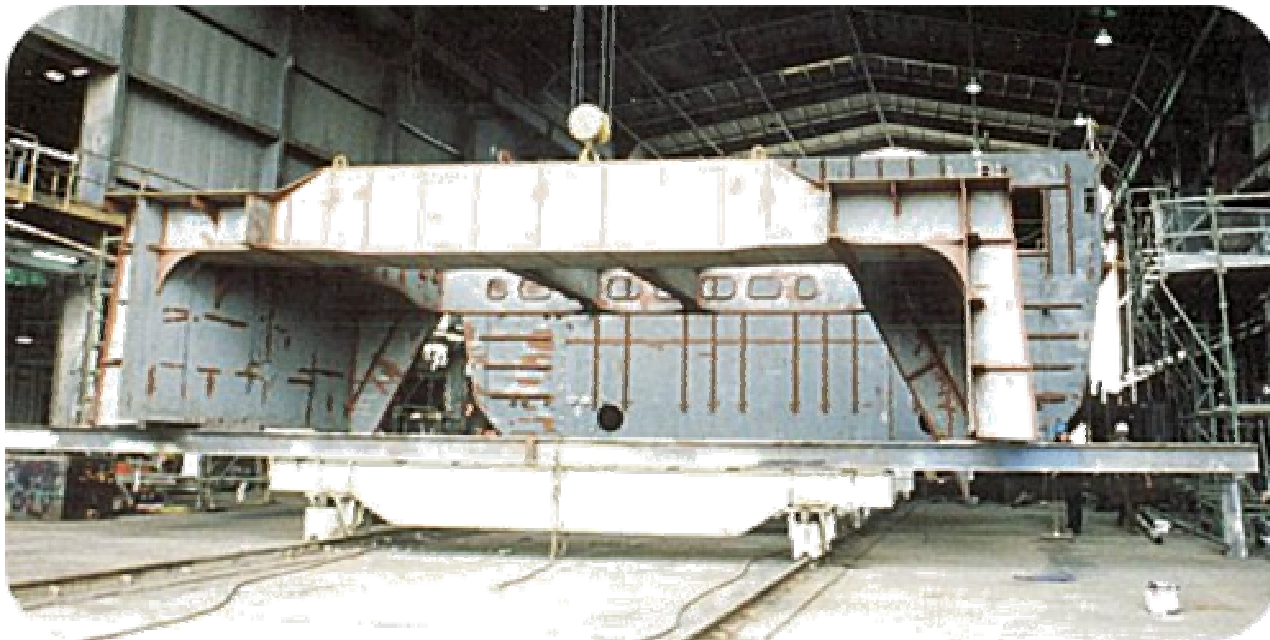
Uses of GMAW

Uses of GMAW



Light fabrication

Heavy fabrication



Construction

Uses of GMAW

The GMAW is the most common welding process in fabrication workshops today.

The advantages of GMAW :

- No flux coated electrodes (no slag removal).
- Continuous wire electrodes allow for longer welds and less stop/starts.
- High deposition (metal input) rates.
- Low level of fumes generated.
- Open arc (no slag coverage) allows for better vision of the arc
- Good control of the weld deposit
- Produces low hydrogen welds of x-ray quality (pressure welding applications).
- Can be used on a number of metal types and thickness.
- Excellent for light material and filling of gaps.
- Quality weld finish.

Uses of GMAW

There are some limitations of the GMAW process :

- GMAW does require some operator expertise.
- Welding over unprepared materials can easily cause weld defects.
- Operator needs trouble shooting knowledge / skills to correct problems with GMAW plant.
- Power source and wire feed unit can be difficult to move in some areas.
- Inert gas shield can be affected by drafty conditions.

Operating Principles

GMAW plant

GMAW plant

Inert gas supply



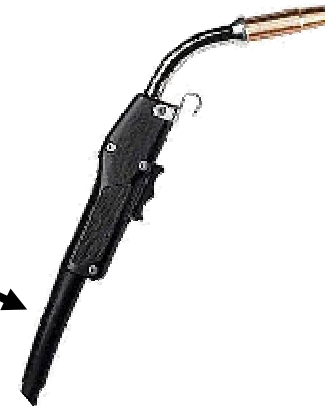
Power source



Wire feed unit



Hand piece



Inert Gas Supply

Inert gas supply

An inert gas is a gas that does not react with the molten weld pool.

Inert gas displaces and protects the weld pool from the surrounding atmosphere which contains oxygen.

Inert gas is stored under high pressure in bottles.



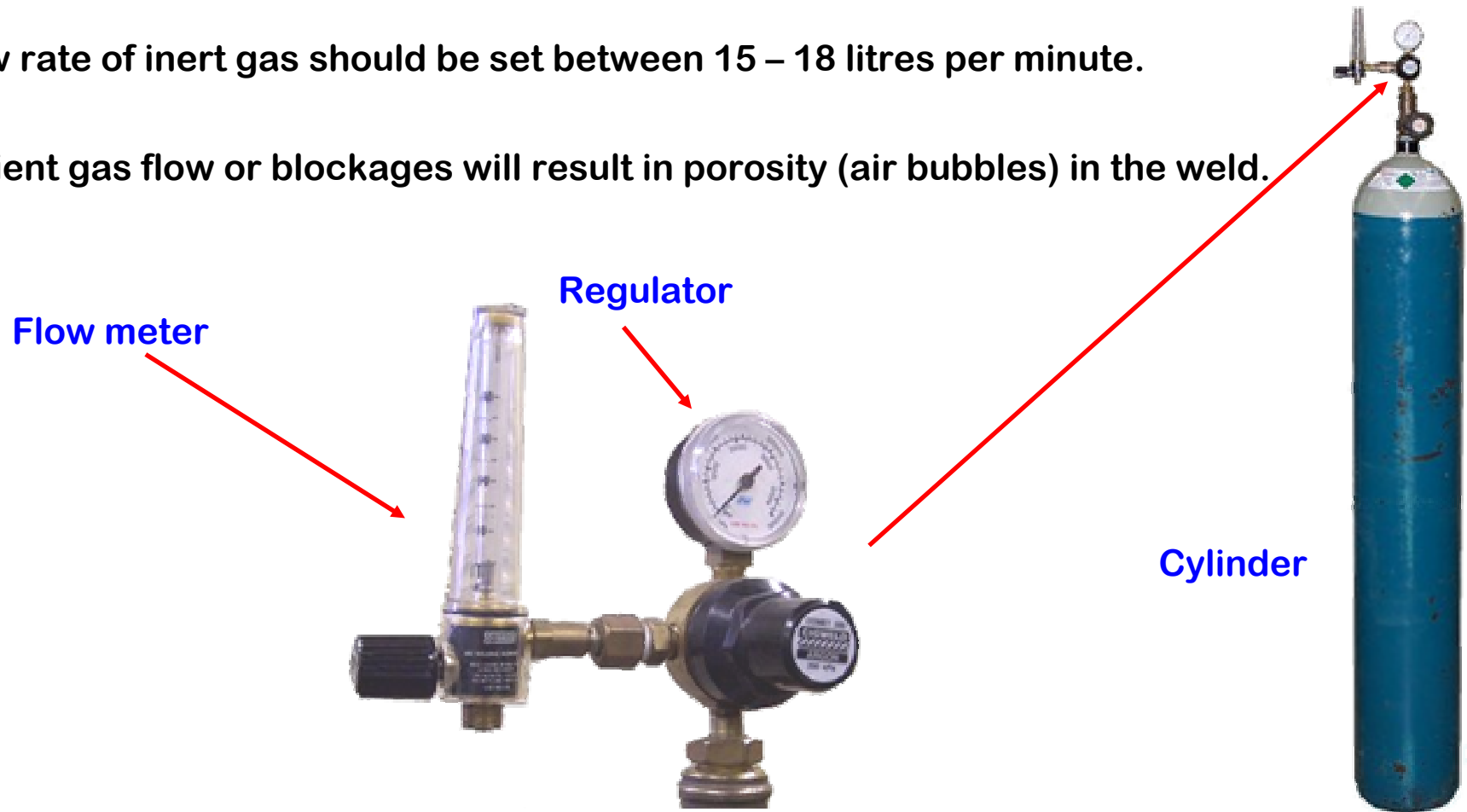
Inert gas supply

The inert gas leaves the cylinder through a regulator which reduces the gas pressure.

A flow meter then allows adjustment of a low pressure flow to the handpiece.

The flow rate of inert gas should be set between 15 – 18 litres per minute.

Insufficient gas flow or blockages will result in porosity (air bubbles) in the weld.



Wire Feed Unit

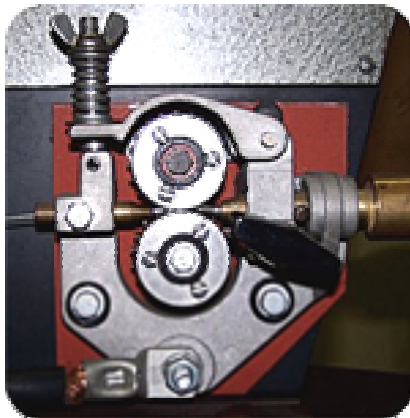
Wire feed unit



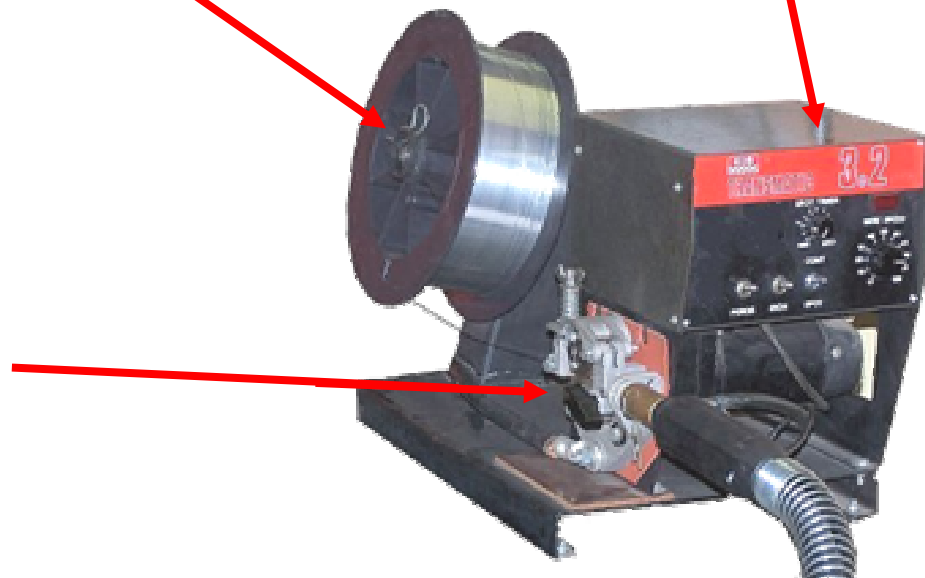
Electrode wire



Control panel



Feed rolls



Wire feed unit

Wire electrodes are manufactured from a variety of metal and drawn into wires of various sizes.

Wire size can vary from 0.6mm – 1.6 mm.

The most common sizes being 0.9mm and 1.2mm in diameter.

Quality welds are produced by mixing deoxidizers such as, silicon, manganese and aluminium into the wires when manufactured. This is known as double deoxidizing.

Steel wires have a copper coating to aid the pick up of electrical current and prevent rust.

It is important that the wire type be selected is suitable for the material being welded e.g. aluminum wire for aluminium.



Wire feed unit

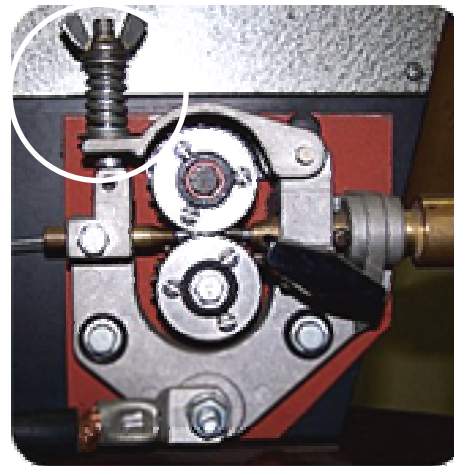
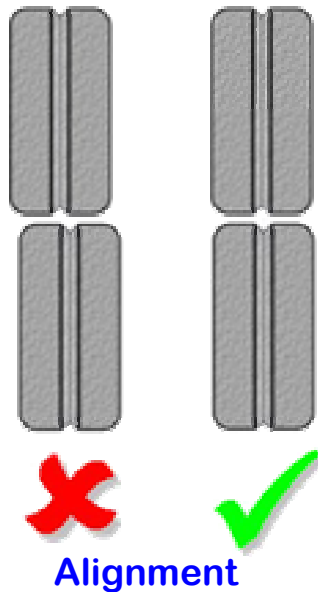
Most wire rolls consists of two rollers.

It is important to have correct:

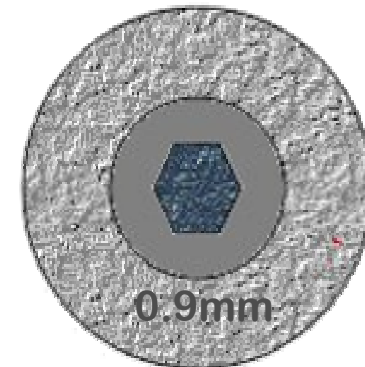
Alignment - misalignment can cause entanglement.

Pressure - insufficient, results in poor feed and too much pressure causes tangles.

Size – incorrect size can cause slippage on the wire and jerky feeding.



Pressure adjustment



Roller size

Wire feed unit

Inch - allows wire feed without gas flow and welding power.

Wire speed - adjusts the speed at which the wire enters the weld pool and the amperage. If the weld voltage is changed, the wire speed must also be changed to suit.



Purge - allows gas flow to be set without wire feed and welding power.

Cont / Spot - the wire feeder can be set for continuous welding or timed spot welding.

Hand Piece

Hand piece



Insulator – isolates the shroud from the welding current. Replace if worn.



Shroud – guides the inert gas over the weld area. Keep clean with spatter gel.

Cable liner – guides the wire up to and through the hand piece. Do not kink or bend.



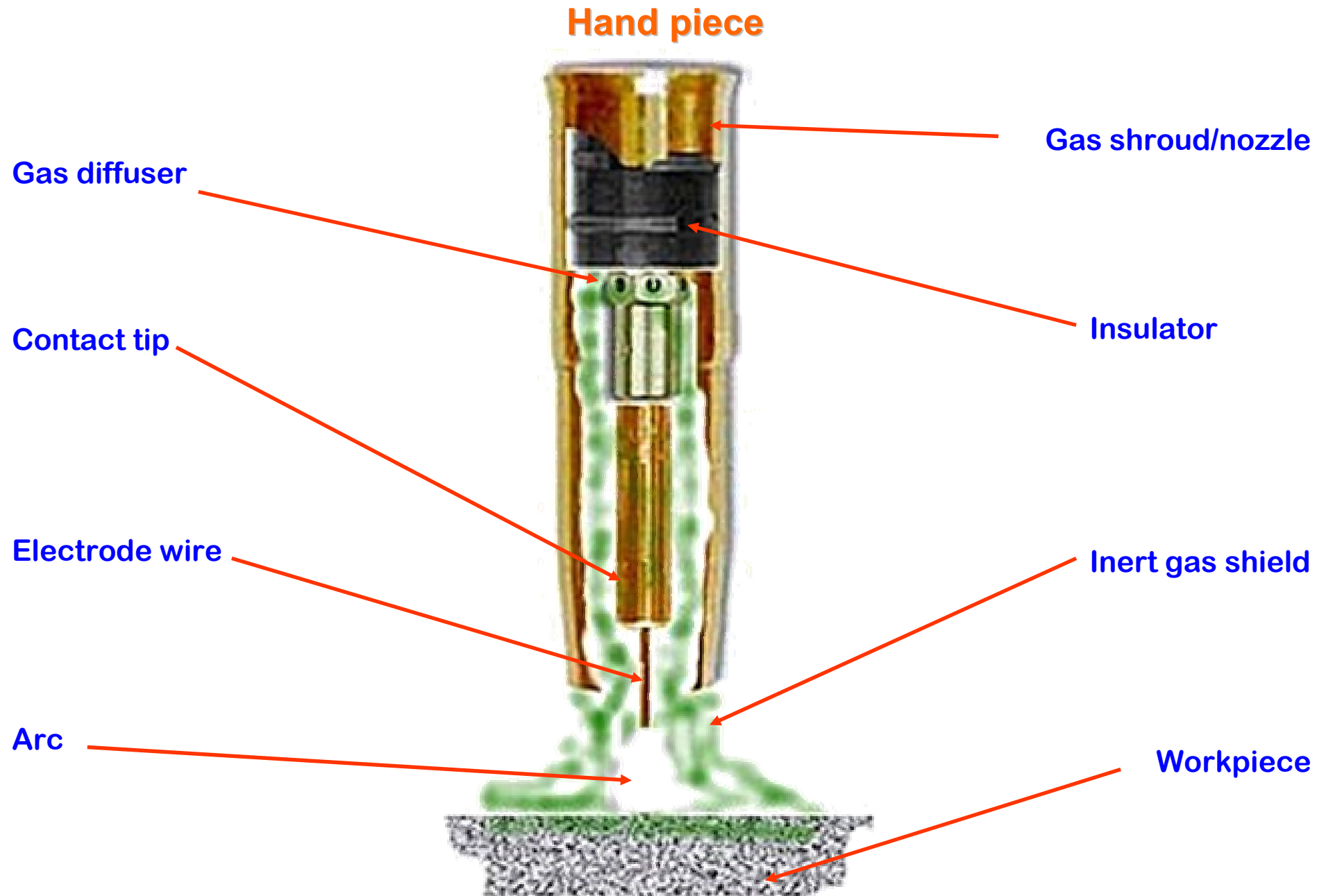
Gas diffuser – evenly distribute the inert gas in the shroud. Check for blockages.



Contact tip – passes the welding current onto the electrode wire and guides the wire into the weld pool. Must use correct size.



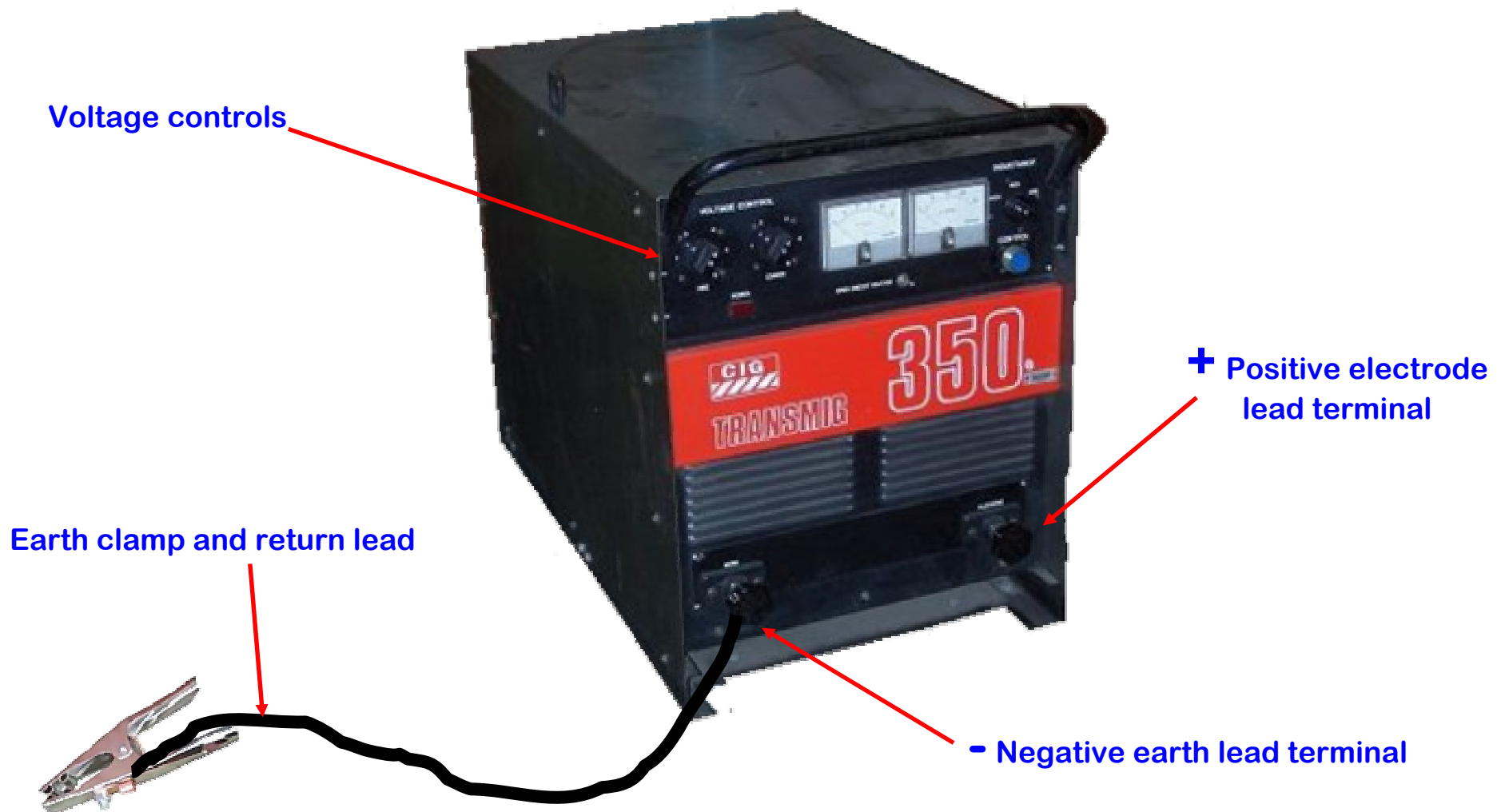
Anti spatter gel – should be used to protect the shroud and contact tip from weld spatter.



Power Source

Power source

The GMAW power source converts AC (alternating current) mains current into a suitable and adjustable DC (direct current) welding current.



Power source

The welding current produced by the power source has a flat voltage /amperage nature, resulting in a stable arc suitable for GMAW.

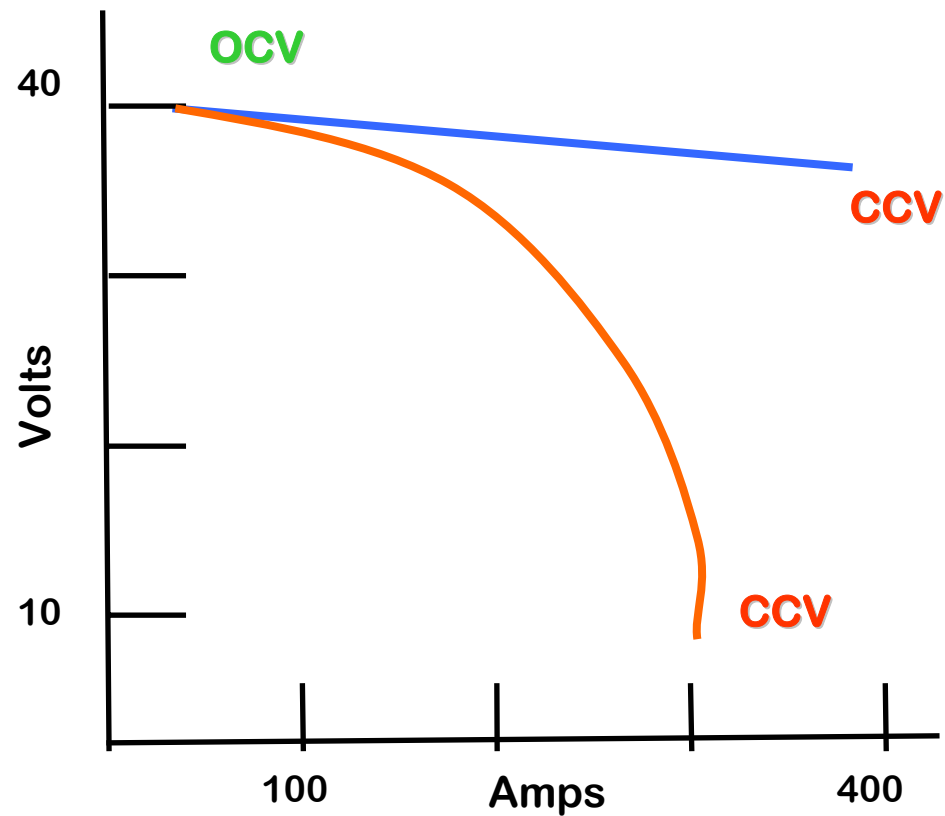
This is known as a constant voltage power supply.

OCV = Open circuit voltage
(not welding)

CCV = Closed circuit voltage
(welding)

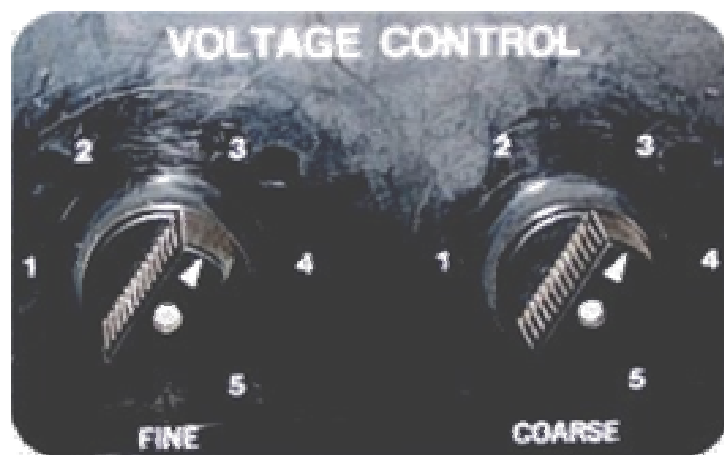
— = MMAW

— = GMAW



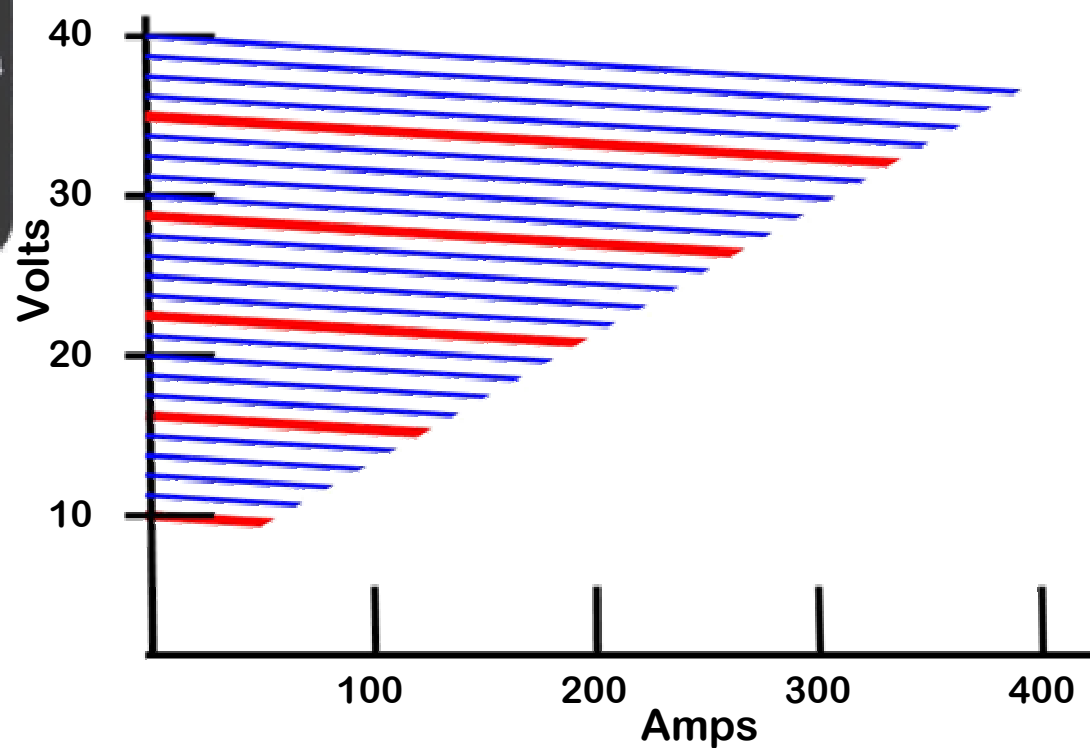
Power source

On the power source there is coarse and fine voltage controls.



 = coarse voltage steps

 = fine voltage steps



Power source

To comply with Australian standards all welding power sources must have a name plate stating the equipments class and the rated electrical output at given **duty cycles**.

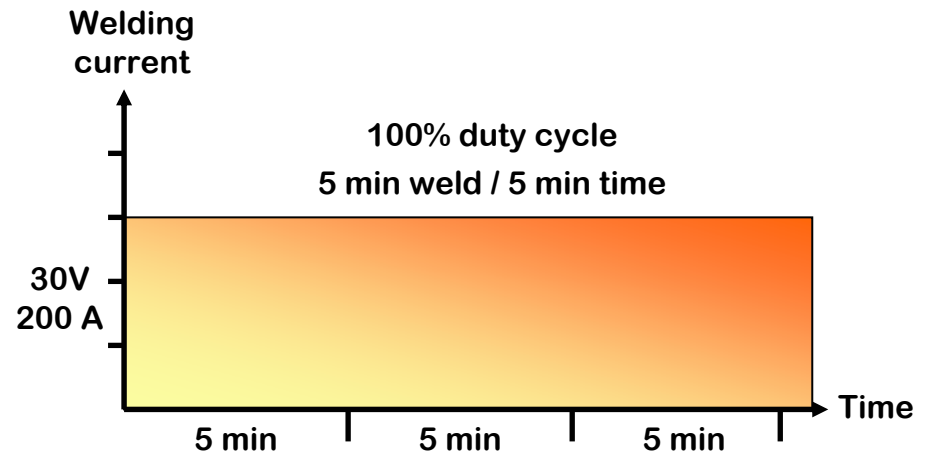
A duty cycle is a percentage rating (%) of the amount of work time a power source can complete in a given 5 minute time cycle.

Power sources are classified as:

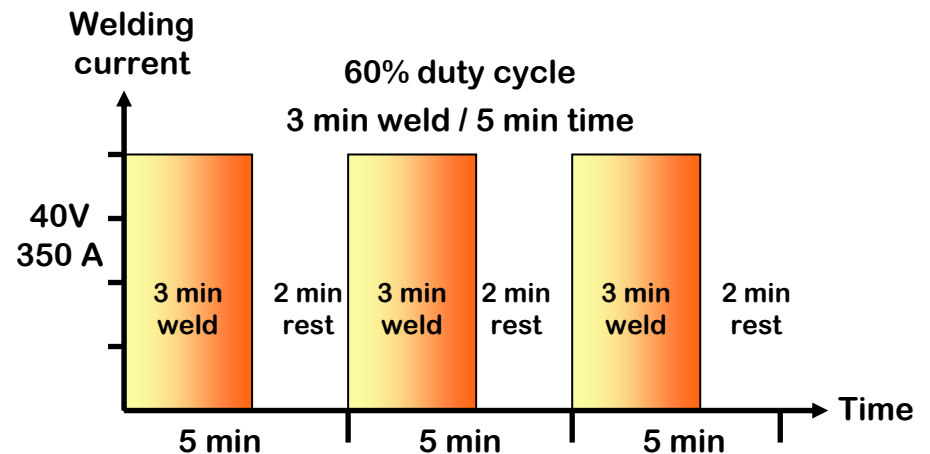
- Limited output duty
- Light industrial duty
- Heavy duty
- Continuous duty

Name plate

Model 300		
Material	0.9mm – 12mm	6mm – 25mm
Wire Size	0.9 mm – 1.2mm	0.9mm – 1.6mm
Output current	30V / 200A	40V / 350A
Duty cycle	100%	60%



Duty cycle



Operating Principles

O.H.S.

O.H.S.

GMAW can be a hazardous activity.

By identifying the hazards and taking the precautions GMAW can be carried in safety.

Hazard	Effects	Precautions
Electricity	Electrocution Death	Do not work in wet conditions or clothing. Check all cables for damage. Keep gloves dry.
Fumes	Asphyxiation Poisoning Lung disorders	Work in well ventilated areas. Use forced or exhaust fans. Clean parent metals of coatings, paint, grease, gal-coat etc. Use a respirator.
Infra-red rays Ultra-violet rays Bright light	Arc eye Skin burns	Wear clear safety glasses Use correct shade welding lens. Apply UV skin cream. Wear full length clothing. Use shield around work to protect others.
Hot / molten metal	Burns to skin	Cool metals where possible. Wear gloves and use tongs. Wear 100% cotton clothing, leathers and leather steel capped boots.

O.H.S.

GMAW requires the use of personal protective equipment (P.P.E).

