# MUREX

# MIG Metal Inert Gas Welding

## Features

**Suitable for a wide range of material thicknesses –**
- The high productivity of the process enables heavy sections to be welded economically.

**High deposition rates –**
- Up to 12kg/hr achievable with cored wires.

**No de-slagging required –**
- No slag cover is formed with bare filler wires.

**Low Hydrogen –**
- Low hydrogen process with bare wire; basic low hydrogen cored wires are also available.

**Good control of process –**
- Process can be adjusted to give optimum control of welding (e.g. dip transfer for thin section work).

**Approved for high strength and toughness joints –**
- e.g. Consumables available to meet Crack Opening Displacement (C.O.D.) requirements of oil and gas industry.

**Safety –**
- Low d.c. open circuit voltages are normally used.

**Continuous operation –**
- Minimum 'downtime' and wastage of consumables.

**Absence of slag inclusions –**
- No slag to form inclusions with bare wire.

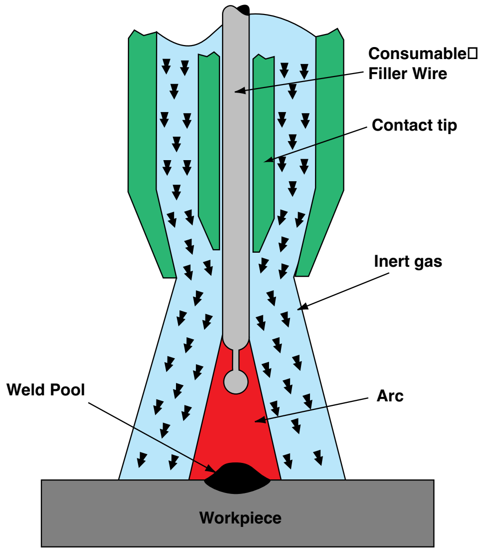
**Mechanisation –**
- The process can easily be mechanised or fully automated.

**Wide operational range for one electrode size –**
- e.g. using a 1.2mm diameter filler wire it is possible to weld sheet metal or heavy plate at a variety of deposition rates.

**Positional capability –**
- 'All position' welding rutile cored wires or by with solid wires.

## Typical Applications

- Car and coach body manufacture and repair.
- Exhaust system manufacture.
- Commercial vehicle manufacture and repair.
- Trailer and caravan manufacture.
- Container and storage tank manufacture.
- Earth moving equipment manufacture and repair.
- Construction industry, structural steelwork.
- Ship building.
- Elevator and conveyor engineering.
- Ducting, heating and ventilation engineering.
- Fan and blower manufacture.
- Pipework and plumbing.
- Garden equipment.
- Leisure equipment and toy manufacture.
- Metal furniture manufacture.
- Sheet metal product producers.
- Domestic appliance manufacture.
- Training establishments.




**WARNING: Adequate safety precautions must be taken to offset the effect of heat, glare and fumes SEE 'ACCESSORIES'**

## Process Description

In the MIG process the heat generated by an arc, formed between the end of a consumable filler wire and the workpiece, is used to fuse the joint area.

The filler wire is fed continuously, through a contact tube or tip (from which it picks up welding current), into the arc area.

The arc is formed in an inert gas which prevents oxidation of the weld, assists in cleaning, determines the heating characteristics of the arc and the mode of transfer.

### Notes

1. The only truly inert gases used in welding are argon and helium but for many applications gases containing chemically active constituents are used, in these cases the process is referred to as M.A.G. (Metal Active Gas). In the USA the process is sometimes referred to as Gas Metal Arc Welding or G.M.A.W.
2. Constant current type power sources can be used with voltage control wire feed units.
3. Murex publications are available giving guidance on consumable selection, process data, equipment choice and operating procedures. Contact your local Murex distributor.

## Equipment

The basic equipment required comprises a power source, wire feed unit, gas supply and a torch. The power sources commonly used have constant voltage static characteristics (see note 2) and controls are provided for voltage and inductance adjustment. This type of power source is used in conjunction with a wire feed unit which takes the wire from a spool and feeds it through a torch to the arc. A control on the wire feeder enables the speed of the wire to be set to a constant level which will in turn determine the arc current.

## Filler Wires

Filler wires are available for joining most ferrous and non ferrous metals in a range of diameters between 0.6mm to 2.4mm.

The composition of solid filler wires is usually chosen to match the parent plate. In some cases dissimilar fillers are used, eg. to produce a hard surface or a bearing surface layer or to produce adequate Mechanical properties where a matching consumable would be unsuitable.

Cored wires, consisting of a metal sheath containing a flux or metal powder, can be used to increase deposition rates, enhance weld metal properties or produce wear-resistant hard surface layers.

In some cases special alloy additions to the wire are made to prevent specific defects. (e.g. niobium to stainless steel to prevent weld decay).

## Shielding Gas

The type of gas used determines the heat input, arc stability and mode of transfer as well as providing protection for the solidifying weld metal. Argon or argon/helium mixtures are normally used for aluminium and its alloys, copper and nickel. Carbon dioxide ($CO_2$) can be used for dip transfer of structural steels but argon/$CO_2$ mixtures give improved transfer and weld finish. Argoshield 5 can be used for some stainless steels but argon/oxygen mixtures are used if carbon pick up is undesirable.

## Accessories

To provide a safe and comfortable working environment whilst MIG welding and to make the welding jobs easier, a wide range of Accessories are available:

- Helmets & Lenses
- Goggles & Lenses
- General Eye & Face
- Welding screens & curtains
- Cables, Connectors & Lugs
- Antispatter & Paint
- Respiratory protection
- Clothing & Gloves
- Wire brushes
- Work return clamps
- Safety spectacles
- Hand tools
- Torches

## Metal Transfer Mode

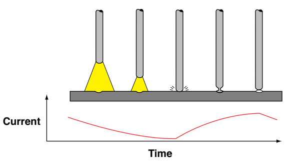
### Dip

In the dip mode the arc is periodically extinguished.

### Free Flight

In Free Flight transfer, a continuous arc is maintained between the electrode and the workpiece and the metal is transferred to the weld pool as droplets.

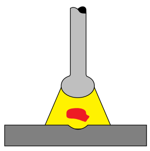
## Dip Transfer




The wire is fed at a rate which is just greater than the burn-off rate for the particular arc voltage being used, as a result the wire touches the weld pool and short circuits the power supply. The filler wire then acts as a fuse and when it ruptures a free burning arc is created. This phenomenon is repeated regularly up to 200 times every second.

The net effect is a continuous welding condition with a low heat input and 'small weld pool'.

## Globular Transfer

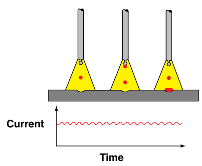


At currents above those which produce dip transfer, but below the current level required for spray transfer globular transfer occurs.

The droplet size is large relative to the wire diameter and transfer is irregular.

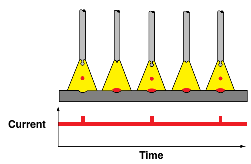
This mode of transfer occurs with steel wires at high currents in $CO_2$ but is generally regarded as unusable unless high spatter levels can be tolerated. The use of cored wires gives a controlled form of globular transfer which is acceptable.

## Spray Transfer




This mode of transfer consists of a 'spray' of very small molten metal droplets which are projected towards the workpiece by electrical forces within the arc. This mode of transfer is particularly suited to 'downhand' welding, but can be used by positional welding with aluminium and its alloys.

## Pulse Transfer




In pulse transfer, the droplets are transferred by a high current which is periodically applied to the arc. Typical operating frequencies are 50 to 100 droplets per second. A background current is maintained between pulses to sustain the arc but avoid metal 'downtransfer'. Ideally, one drop is transferred with each pulse and is 'fired' across the arc by the pulse. This may be achieved with 'synergic' power units. Solid state electronics greatly improves the ease of operation and single knob control is possible over a wide range of pulsed parameters.

**A good weld –** under the correct operating conditions, excellent weld quality, surface finish and absence from defects can be obtained with MIG.

Certain defects can be produced by poor welding procedure. The most common problems and their remedies are shown for reference

**Lack of fusion –** this is caused by cold (low current) welding conditions or incorrect manipulation of the torch. To correct this defect, raise the welding current and/or the level of secondary inductance and ensure that the correct weave pattern is being used.

**Porosity –** the most common cause of this defect is the presence of Nitrogen in steel or nickel, and Hydrogen in aluminium.

Hydrogen commonly arises from surface contaminants or moisture and can be avoided by cleaning the work, ensuring that the wire is protected from contamination during storage and using gas hoses which do not absorb moisture.

**Poor bead appearance –** can be caused by the use of incorrect current setting, excessive voltage or poor operating technique.

Overfilled or 'peaky' welds result from low heat input

**Spatter –** results from explosive rupture of the short-circuited filler in dip transfer or to a lesser extent ejection of fine metal droplets in spray transfer. Spatter can be controlled by adding inductance (to limit the peak short circuit current), reducing the current and employing an Argon/$CO_2$ shielding gas instead of $CO_2$.