

# TELWIN®



## QUICK GUIDE TO MMA ELECTRODE WELDING



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## > WHAT IS WELDING

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Welding is a process that allows two or more metals to melt one into the other in a permanent way. Protagonists in this process are: Steel, Stainless Steel, Aluminum, Copper, Bronze, Titanium, metal alloys and galvanized surfaces.

Welding is anywhere it is necessary to guarantee the highest performance, even in the most extreme environmental and use conditions, but it is also an ally capable of adapting to our simplest but no less important needs - as in the world of do-it-yourself - as well as to be flexible to all plant engineering and maintenance needs in all civil and professional fields.

There are various welding processes: the most common and simplest one is Arc Welding with coated electrodes (the so-called MMA - Manual Metal Arc – welding process), to follow is the Continuous Wire Arc Welding process either with gas (GMAW - Gas Metal Arc Welding) or without gas protection (FLUX or Self Shielded Wire) and the Inert Gas Arc Welding with infusible Tungsten electrode (TIG - Tungsten Inert Gas).

Wherever welding is required, Telwin is there, with a range of products which, for extent and typology fears no comparison on the market. Technological products that are functional, reliable and safe, the quality of which is certified/ acknowledged by the most important international certifying bodies in the sector. To any request, Telwin guarantees the best response.

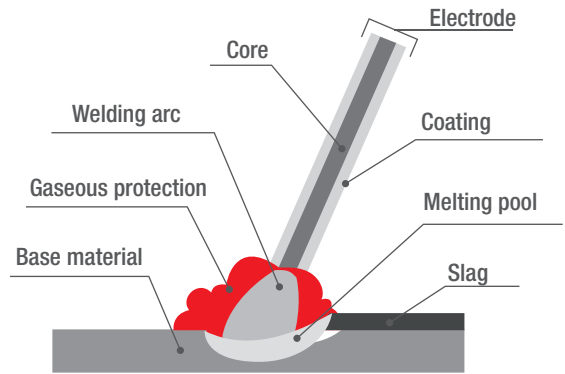


## > THE MMA WELDING PROCESS

Arc welding with coated electrodes is a manual process in which the heat generated by an electric arc between a coated electrode and the piece to be welded leads to the fusion of these two elements.

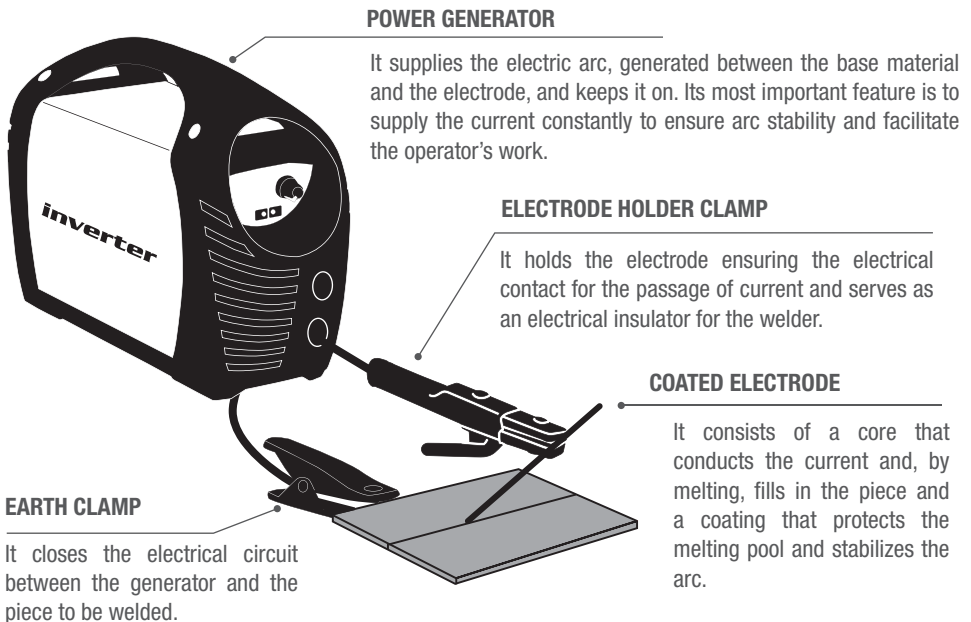
The protection of the molten metal is ensured by the electrode coating which by evaporating, creates a protective atmosphere.

The part of the coating that melts becomes protective slag for the melting pool and is to be removed later on.



## > WHAT YOU NEED TO WELD IN MMA

Electrode Welding is a process easy to perform: just a few elements are enough to start welding.



## ELECTRODES



### Types of electrodes

There are 3 types of electrodes: **rutile, basic and cellulosic**.

**Rutile electrodes**, the most common ones, are suitable for horizontal, vertical and angled/corner welding for small thicknesses. They are easy to strike and guarantee a stable arc. They are easy to store and are cheap.



**Basic electrodes** allow welding in all positions even on large thicknesses; however, they are difficult to strike and store and can be used on DC welding machines only.

**Cellulosic electrodes** are those with greater penetration and allow welding in all positions, thanks also to a low production of slag. They are used to weld pipes, exclusively on dedicated DC welding machines.



### Choice of the electrode

The diameter of the electrode must be chosen according to the thickness of the material to be welded and how it has been prepared.

Electrode diameter Ø (mm)	AVERAGE VALUES OF WELDING CURRENT (A)						
	1,6 mm	2 mm	2,5 mm	3,25 mm	4 mm	5 mm	6 mm
<b>RUTILE</b>	30-55 A	40-70 A	50-100 A	80-130 A	120-170 A	150-250 A	220-370 A
<b>BASIC</b>	50-75 A	60-100 A	70-120A	110-150 A	140-200 A	190-260 A	250-320 A
<b>CELLULOSIC</b>	20-45 A	30-60 A	40-80 A	70-120 A	100-150 A	140-230 A	200-300 A

## PPE (PERSONAL PROTECTIVE EQUIPMENT)

### Welding helmets

The mask is one of the PPE which is essential to protect the eyes and face from smoke, splashes, ultraviolet and infrared rays emitted by the welding arc. The helmet type provides the best protection even in case of small maintenance or DIY works. There are several types of masks:



#### “TRADITIONAL” MASKS WITH PASSIVE GLASS

They are equipped with a window containing an inactinic glass that always remains dark, ensuring constant protection. Cheap and easy, however, they have the disadvantage for the operator of having to raise the mask or the window every time he has to look at the welding result and the joint.

#### AUTOMATIC DARKENING MASKS

They are equipped with a filter that automatically darkens the viewing area when the welding arc strikes on and quickly returns to the transparent state when it is switched off. Automatic masks can have fixed or variable dimming. Those with variable dimming allow dimming adjustment to better adapt to the welding process (MMA, MIG-MAG, TIG).

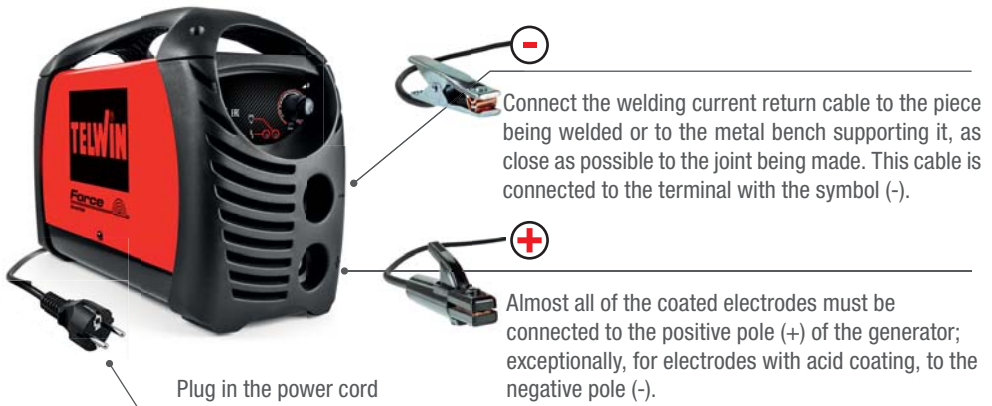


### Welding gloves



Essential to protect your hands from the heat generated by welding and from sparks or splashes, welding gloves are generally made of fire-retardant leather and are longer than common safety gloves, so as to cover also the part of the forearm.

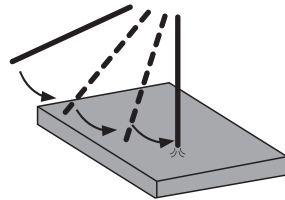
## > HOW TO WELD



### HOW TO PROCEED / TO START

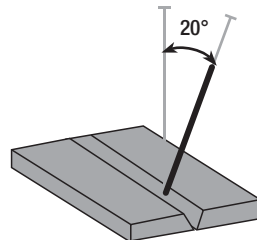
■ Rub the tip of the electrode on the piece to be welded by performing a movement as if you were lighting a match.

**⚠ WARNING:** DO NOT TAP the electrode on the piece; you risk damaging the coating and make it difficult to strike the arc.



■ Once the arc is triggered, keep a distance from the piece equivalent to the diameter of the electrode used, keeping it as constant as possible.

**⚠ WARNING:** the inclination of the electrode in the direction of advancement must be about 20° - 30°.





■ At the end of the weld bead, bring the end of the electrode slightly behind the direction of advancement. Quickly lift the electrode from the melt pool to get the arc extinguished.

The most modern welders are equipped with 3 devices that allow for optimal and safe use.

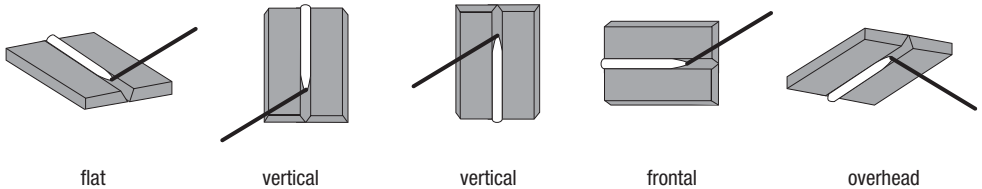
**ARC FORCE:** it eases the transfer of drops of melted material from the electrode to the base material, preventing the arc from extinguishing when the drops cause contact (i.e. a short circuit) between the electrode and the weld pool.

**HOT START:** it facilitates the striking of the electric arc, by supplying an overcurrent every time welding restarts.

**ANTI-STICK:** it automatically switches the power source off if the electrode sticks to the base material, thus allowing it to be removed manually without ruining the electrode holder clamp.

## THE WELDING POSITIONS

The EN ISO 6947:2011 standard classifies the following welding positions:



## REMOVAL OF SLAG

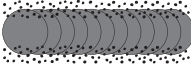



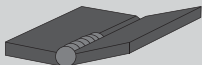
Once the weld seam has cooled, it is necessary to clean the workpiece from the slag.



Use a hammer to chisel the electrode coating deposited on the piece and a brush to finish the cleaning.

## > WHAT DOES THE SHAPE OF THE WELDING SEAM TELLS YOU

The shape of the bead can indicate any execution errors:

PROBLEM	CAUSE	POSSIBLE SOLUTION
<b>Excessive spatter</b> 	Too high amperage for the electrode.	→ Reduce amperage or select a larger electrode.
	Too long arc length or too high voltage.	→ Reduce either arc length or voltage.
<b>Incomplete fusion/ Lack of penetration</b>  	Insufficient heat input.	→ Increase the amperage. Select a larger electrode and increase the amperage.
	Improper welding technique.	→ Try to keep the weld bead centered over where the seam is to be created. Change the welding angle or increase the crimping of the piece in order to penetrate the weld on the base of the piece.
	Dirty piece.	→ Remove grease, oil, moisture, rust, paint or coatings from the work surface.
	Wrong joint preparation.	→ Too thick material. The preparation and design of the joints must allow access to the bottom of the groove.
	Insufficient heat output.	→ Increase the amperage. Select a larger electrode and increase the amperage. Reduce welding speed.
<b>Excessive penetration/holes</b> 	Excessive heat input.	→ Select lower amperage and/or use a smaller electrode. Increase and/or maintain a suitable and constant welding speed.
<b>Distortion</b> 	Excessive heat input.	→ Use the clamp to hold the base metal in place. Spot welds along the joint before starting the welding operation. Select an amperage suitable for the thickness and the electrode. Increase the speed. Weld in small segments and allow cooling between welds.



## > TIPS & TRICKS

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### WELDING MACHINE

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- Use the shortest welding cables possible. If the power source is far away, it is better to lengthen the power cables than the welding ones (max up to 3 meters).
- Unwind the extensions if they are in roll and remember to increase the section of the extension every 15 meters or so, so as not to overheat the extension or drop in voltage.
- Always make sure that the welding cables are well fixed, so as not to lose voltage or trigger overheating or flames between the connectors with their rapid deterioration and loss of efficiency.

### ELECTRODES

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- Start with the easiest electrodes (Rutile E6013); always check the manufacturer's instructions on the package.
- Always store the electrodes in closed boxes and possibly in low humidity conditions.
- If the electrode remains stuck, move the electrode slightly left and right: in this way it will easily detach from the piece and you can start welding again.
- Check the polarity of the electrodes before welding. Usually the Rutile electrodes are connected to the negative pole and the Basic ones to the positive. The electrode box will provide you with this indication.

### TIPS FOR THE USE

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- Before welding, prepare the pieces by cleaning them well (there should be no paint or rust).
- Always check for your PPE to be in good condition (mask and gloves). Choose a helmet mask for greater protection from smoke and brightness.
- While welding, keep the electrode almost in contact with the metal: this will allow you to be more precise and make the weld flow better.
- If you weld vertically, weld from top to bottom to perform the work more easily.
- Make a zigzag movement (up & down electrode) to make a thicker joint (wider bead).
- If you weld particularly large thicknesses, you can make two or more welding turns. At the end of the first, remember to remove the slags before proceeding with the second.
- Avoid using metal structures that are not part of the workpiece to replace the welding current return cable; this can be dangerous for safety and give unsatisfactory welding results.

## > THE FORCE RANGE

Force is the 100% Made in Italy range of direct current (DC) MMA electrode welding machines, which has established itself on the market as a standard of Telwin's quality and reliability. Thanks to the inverter technology, which guarantees exceptional stability of the welding current, and thanks to the arc force, hot start and anti-stick devices, it is possible to weld on Steel, Stainless Steel and Cast Iron with extreme simplicity and quality, any simple maintenance or artistic work.



- Complete with accessories for electrode welding (electrode holder and earth clamp, complete with welding cables).
- Made in Italy by Telwin. Safety and Quality certified by TÜV SUD
- Lightweight and compact with 230V power supply (can be used with 3kW domestic meters)
- Thermostatic, overvoltage, undervoltage, overcurrent protections. Compatible for use with motor generators (230V ± 15%).

		Force 125	Force 145	Force 165	Force 195	Force 168 MPGE
 Current range (min-max)		10-80A	10-130A	10-150A	15-170A	10-150A
 MMA Electrode Diameter (min-max)		1,6-2,5mm	1,6-3,2mm	1,6-4mm	1,6-4mm	1,6-4mm
 Duty Cycle at 20°C		80A @ 50%	125A @ 60%	150A @ 60%	170A @ 40%	150A @ 60%
 Mains Fuse		10A	16A	16A	16A	16A

## > Are you sure you haven't forgotten anything? \_\_\_



With Telwin you have everything you need, from welding masks to gloves, as well as other accessories such as magnetic positioners and electrodes. Visit [telwin.com](http://telwin.com) to discover the whole offer!

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