Wire feed system

Objective: At the end of this lesson you shall be able to
- **state the functions of wire feeder and different types of drive rollers.**

Wire feeder (Fig 1)

The wire feeder is the part of the MIG/MAG welding set up that:

i) Controls the speed of the wire electrode and pushes this wire from the feeder through the welding torch to the workpiece.

ii) Provides the path for welding current to be passed from the welding power source through the interconnecting lead to the feeder and then to the welding torch.

iii) Provides gas flow control through a solenoid valve. The gas is fed down from the gas regulator to the weld area via the feeder and then the MIG welding torch.

Wire feeders come in many different shapes and sizes, but they all do the same basic job roles. Feeders can be separated from the power source or built into the power source itself. Feeders are made up of different parts, each having a different job role.

Wire spool holder. This is designed to hold the spool of the correct wire size in place on the feeder to ensure the wire electrode is on the correct input angle for the drive roller to be able to do its job properly.

Drive motor MIG/MAG welding relies on smooth and constant wire feed. The wire drive motor has the job of turning the drive rollers (this can be one or more sets of rollers). Undersize drive motors can result in poor feeding of the wire electrode down the MIG welding torch . This will have the effect of making the overall performance of the MIG machine sub-standard as compared to a machine with a quality drive system.

Drive rollers: The drive rollers grasp the wire electrode and continuously feed the wire down the MIG torch into the welding arc (Fig 2 & 3). The rollers need to be selected by :

i) the wire size

ii) the type of wire to be fed. Each type of wire may need a different style of roller groove – eg

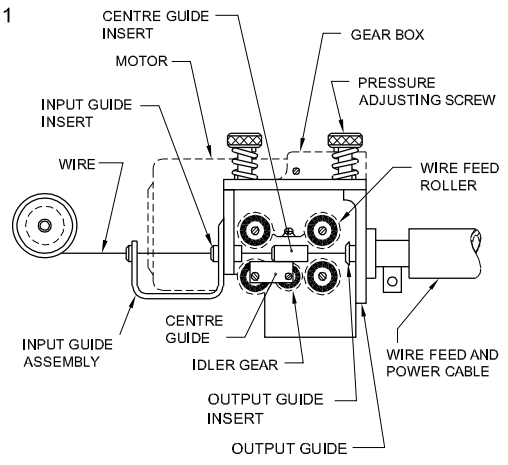
V rollers for steel and other hard wires

V-Knurled for Fluxcored wire

U-Grooved for aluminium and other soft wires

The idea of using the correct roller is to have a good wire drive without crushing the wire. The pressure roller is also used to set the wire tension. This must be set with enough pressure to feed the wire electrode, but not too much tension as to crush the wire.

Fig 1



A SIMPLIFIED WIRE FEED MECHANISM FOR GMAW

Fig 2

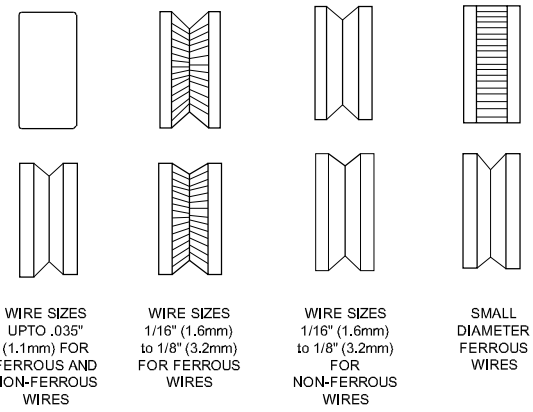
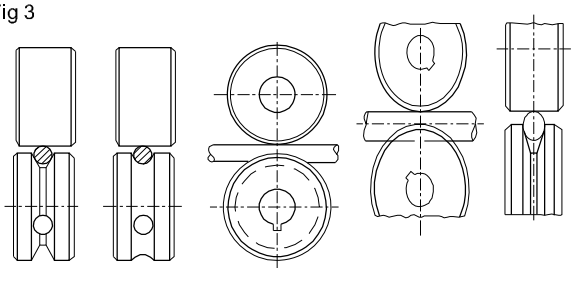


Fig 3



iii) all guides must be as close as possible to the drive roller to prevent the possibility of the wire bunching up.

Wire feed controls

The wire feeder will have its own built-in control system. The number of controls that will be built into the feeder will depend on the type of feeder but the most common are

i) Wire speed - this control is the adjustment for how fast the drive rollers will turn and as stated earlier, the faster the wire speed for each wire size the more amperage the power source will produce. The wire speed controls can be labelled as wire speed, eg ipm (inches per minute) or mpm(metre per minute), or as a percentage from the slowest speed being zero to the highest speed being 100%. Usually mpm will be the range of 1 m/min to 25 m/min.

The amperage being set by the wire speed setting will also have an effect on the speed of travel and the deposition rate of the wire (how fast the weld metal is being put onto the weldpiece); with the advantage of, the higher the amperage the thicker the material that can be welded.

ii) Purge switch - Some feeders have a purge switch. This is to allow the gas flow setting to be set on the gas regulator without turning of the wire feed roller or without any welding power being turned on.

iii) Burnback - Burnback is the setting of the degree that the wire electrode will melt back towards the contact tip at the completion of the weld. If there is too much burnback the wire electrode will melt back onto the contact tip, possibly damaging it. If there is not enough burnback set, the wire electrode will not melt away from the weldpool and can be left stuck to the weld metal.

iv) Spot timers or stitch modes are to be found on some feeders. These controls normally control the time the drive roller will turn for after the trigger contactor has been activated.

Welding wires used for GMAW, standard diameter and codification as per AWS

Objective: At the end of this lesson you shall be able to
- **state the chemical composition of different electrode wires.**

Electrode wire - consumable wire for GMAW: Performance & metal transfer characteristics are largely governed by the diameter of the wire and the machine settings such as arc voltage and amperage and chemical properties of the filler wire employed.

Machine settings: Diameter of the wire and ampere/ current employed for welding decide the type of metal transfer. The various recommended diameter, voltage and current ranges are tabulated in tables below for welding mild steel, low alloy steel and stainless steel.

Approx. machine settings for short circuit metal transfer on mild and low alloy steel

Electrode diameter(mm)	Arc voltage	Amperage range
0.8	16-22	80-190
1.2	17-22	100-225

Approx. machine settings for spray arc transfer on mild and low alloy steel

Electrode diameter(mm)	Arc voltage	Amperage range
0.8	24-28	150-265
1.2	24-30	200-315
1.6	24-32	275-500

Approx. machine settings for short circuit transfer on series 300 stainless steel

Electrode diameter(mm)	Arc voltage	Amperage range
0.8	17-22	50-180
1.2	17-22	100-210

Approx. machine settings for spray transfer on series 300 stainless steel

Electrode diameter(mm)	Arc voltage	Amperage range
0.8	24-28	160-210
1.2	24-30	200-300
1.6	24-32	215-325

Chemical properties: Chemical compositions of the filler wire play a very important role. The main composition, apart from the major elements, in the case of mild steel welding, will contain deoxidisers like Si, Mn to take of care of porosity due to oxidation of carbon in the steel. Typical composition of mild steel filler wires are listed in the table. We are using ER70S-6 for most of our carbon steel fabrication.

Specification of electrode wires

The GMAW electrode specification as per AWS is as given below.

Eg: E 70S-2 or ER70S-2 or E70T-2

E — Electrode

ER — Electrode can also be used as a filled Rod in GTAW.

70 — 70 x 1000 PSI — Tensile strength of the weld metal in pounds per square inch.

S — Solid wire / Rod

T — Tubular wire used in FCAW.

2 — Chemical composition of the wire.

Chemical composition, Weight percent

AWS classification	c	Mn	Si	P	S	Cu	Ti	Zr	Al
70S-2	0.07	0.90 to 1.40	0.40 to 1.40	0.025	0.035	0.5	0.05 to 0.15	0.02 to 0.12	0.05 to 0.15
70S-3	0.06 to 0.15	0.90 to 1.4	0.45 to 0.7						
70S-6	0.07 to 0.15	1.4 to 1.85	0.8 to 1.15						

Wire electrodes selection

The selection of the wire electrode to be used in the MIG/ MAG process is a decision that will depend on

1 the process being used (eg, solid wire or fluxcore wire)

2 the composition of the metal being welded

3 welding indoors or outdoors

4 joint design

5 cost

6 mechanical properties of the weld material and those that are a match for the base material.