WA Technology

Saving MIG (& TIG) Shielding Gas

(While Improving Weld Start Quality)

THE PROBLEM:

The typical user of MIG welding consumes from 3 to 6 times the amount of shielding gas needed. Two published reports discuss reasons for this waste.

An article in the Fabricator Magazine entitled "Shielding Gas Consumption Efficiency," states the average fabricator uses from 18 to 30 cubic feet of shielding gas per pound of wire consumed. This is 3 to 5 times the amount that is needed. They also define that the gas flow surge at the weld start is a significant cause of the waste (See Reference 1.) We have also found the excess gas surge at each weld start wastes more gas than the often-blamed gas leaks!

Another article published in Trailer Body Builders magazine quotes a representative from a leading manufacturer of shielding gases, Praxair, indicating their findings from fabricating shop surveys show the average MIG welder consumes 30 cubic feet of gas per pound of wire indicating that was up to 5 to 6 times what is needed (See Reference 2).

Depending on the price paid for shielding gas, the amount of arc time, the gas delivery hose length and the frequency of MIG gun trigger pulls; this gas waste can be ***over $1000 per year per welder.***

MEASURING GAS WASTE

Estimating shielding gas waste is straightforward. For example, if 0.035 diameter solid wire is being used welding at 200 amps; 6 lb/hr of wire is being deposited for every hour of arc time. A shielding gas flow rate of 30 CFH would be more than adequate. Therefore, for every pound of wire 30 CFH/6 lbs/hr or 6 CF of shielding gas is being consumed. Check past purchases of wire and shielding gas and don't be surprised if the ratio is 3 plus times what it should be!

The accompanying table provides deposition rates for some typical wire types, sizes and amperages.

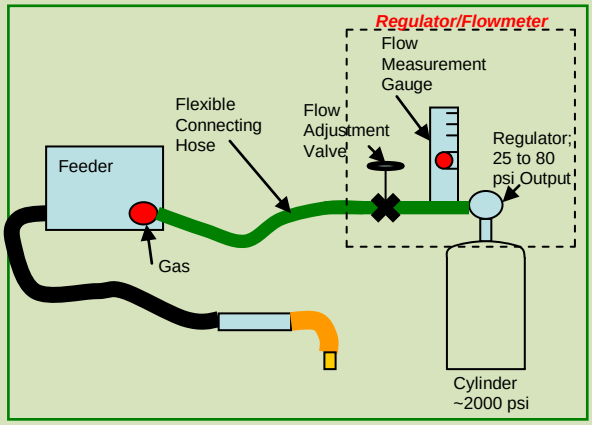
Type	Size	Amps	Lbs/hr
Solid	.035	150	4.1
Solid	.035	200	6.0
Solid	.045	200	5.5
Solid	.045	250	7.6
Cored	.045	250	8.0
Cored	.045	300	11.6
Cored	1/16	300	8.6
Cored	1/16	350	11.9

More complete deposition rate data with various wire types is available; email: TechSupport@NetWelding.com

A MAJOR CAUSE OF GAS WASTE

The accompanying figure schematically shows a typical MIG welding system. The regulator/ flowmeter reduces pressure from the cylinder or gas pipeline to that

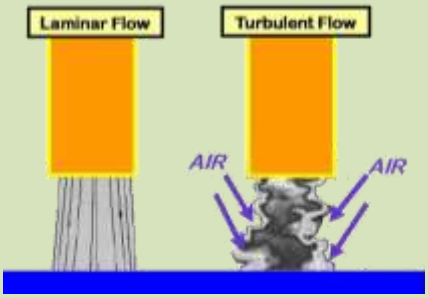
needed to deliver the required rate of shielding gas to the MIG gun.



A restriction orifice or a valve is used to control the gas flow. Typical regulator outlet pressures range from 25 to 80 psi. For CO_2 shielding 80 psi is often used to help prevent ice formation. A minimum of 25 psi is needed to provide "automatic flow compensation" for the inevitable flow restriction variations occurring while welding. Lower pressure eliminates this very important function (See Reference 3 for details.)

However, the pressure needed at the feeder to flow the shielding gas though the solenoid, fittings and MIG gun can be 3 to 8 psi. When welding stops, gas continues to flow through the orifice or needle valve flow control and the pressure rapidly increases in the gas delivery hose to that of the output of the regulator or pipeline. This increase in pressure causes up to 7 times the physical hose volume of gas to be stored every time welding stops. When welding is started or the wire inched to cut off the end, the pressure drops rapidly to the 3 to 8 psi needed to provide the desired flow. The excess gas, that built-up in the hose, is expelled in a very short time. In fact, the gas flow surge can exceed 250 CFH. The amount of gas expelled and wasted is proportional to the hose volume and the pressure build-up when welding stopped. At higher regulator or typical pipeline pressures the excess gas expelled on each MIG/TIG gun/torch pull can be 7 times the physical hose volume.

In addition to wasting shielding gas, the high gas surge at the weld start causes very turbulent flow with any size gas nozzle. This causes air to be pulled into the center of the shielding gas stream, creating poor weld starts. This turbulent flow takes a short time to stabilize into a quality, laminar shielding gas stream even when flow returns to the normal desired level. The flow rates required to maintain flow in the desirable non-turbulent range are not much higher than those commonly used in MIG welding (See Reference 4.)



PAST ATTEMPTS TO SOLVE SURGE

Restriction Orifices (left pic) placed at the wire feeder gas inlet set the steady state flow rate and eliminate the starting gas flow surge. ***However*** then insufficient extra gas is available at the start to purge the gun nozzle and weld start area of moisture-laden air! Stauffer clearly defined the problem in Reference 5. It's essentially starting in air. Welders often see the inferior weld starts and will increase flow in attempt to compensate, ***causing gas waste!*** In fact any device, including flow control regulators (right pic,) placed at the wire feeder ***cause this lack of needed "starting gas purge."***

Low Pressure Devices at first appear to be a possible solution. However, quality shielding gas delivery systems have used a minimum pressure of 25 psi since the introduction of TIG and MIG in the 1950's for very good reason. That is the minimum pressure needed to provide automatic compensation for MIG gun flow restrictions that inevitably occur in production! We have measured changes in flow of up to 65% in tests of a low pressure "gas guard" device (pic left) without any change in flow adjustments (Reference 3 describes the problems with low pressure devices.)

PATENTED GAS SAVER SYSTEM

Our ***patented WA Technology Gas Saver System*** (***GSS*** ™) significantly reduces shielding gas waste due to excess gas flow surge while maintaining system pressure and automatic flow compensation. Simply replace the existing gas delivery hose with the ***GSS.***

The system employs a shielding gas delivery hose with a much smaller internal diameter. At the low flow rates used for MIG welding, this creates only a small, acceptable pressure drop. Secondly, it incorporates a start flow restriction orifice on the wire feeder end of the gas hose. The surge-restricting orifice has the significant benefit of improving weld starts by minimizing turbulence of the shielding gas stream - reducing spatter. The orifice also helps reduce gas waste. The ***GSS*** hose has a large OD with fiber-reinforced construction to provide a robust product, which will not kink or flatten when stepped on. The flow restrictor size is selected to reduce the surge flow rate avoiding excess turbulence but allows the operator to have full control of the welding flow rate. A controlled amount of extra gas is available to purge air from the weld start area and gun nozzle. Gas surge waste reduction with the **GSS** over a conventional 1/4-inch ID hose will range from 80 to 85% depending on hose length.

SELECTION OPTIONS AND INSTALLATION

To gain the benefits of this patented system simply replace the existing gas delivery hose from gas supply to feeder or welder with the WA Technology ***GSS***. For industrial MIG systems, hose end fittings are supplied with custom CGA 032, 5/8 inch-18 male threaded connectors ("B" size, left in photo).

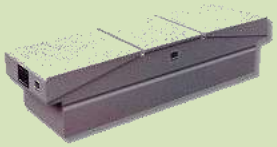
For some feeders or regulators where a CGA fitting is not used, such as when a hose barb is on the feeder, the ***GSS*** can be ordered with simple hose splice connectors (photo right.) This allows the existing hose to be cut and the ***GSS*** assembly added by splicing to a 1/4 or 3/16 inch ID hose. Both systems incorporate a flow restriction orifice on the hose end, which is connected to the welder or wire feeder, and perform equally.

GSS components or prefitted hose may be ordered in 3, 4, 6, 12, 25 or 50-foot lengths. These lengths are satisfactory with most commercial regulators or gas pipeline pressures. It is possible to use longer lengths however, it's suggested you contact us before ordering.

When using cylinder gases, there is also reduced time spent changing and moving cylinders.

PRODUCTION RESULTS

A number of fabricators have performed total gas usage measurements comparing the ***GSS*** with a conventional delivery hose. They reported average savings in gas usage of from 30 to 60%. Many also report welders are very impressed with the improved starts from the significant reduction in the "gas blast" at each weld start.



A fabricator of truck boxes reports their test results with the ***GSS***. They selected a repetitive application, welding doors. Using a full cylinder with their standard gas delivery hose, they were able to fabricate 236 doors. With no other changes than replacing the gas delivery hose with our ***GSS,*** they welded 632 doors with a full cylinder of gas. That is a 63% shielding gas savings! Stated another way, they would have required 2.7 cylinders of gas with their standard gas delivery hose to weld 632 doors versus the one with the ***GSS!*** They immediately purchased 25 systems for all their welders. About a year later, they added 10 more MIG welding machines. They called, and asked for 10 more of the "Magic Hose!" Although some folks find it difficult to fully understand how this simple patented ***GSS*** saves gas - it is much more than ***"Magic!"***

MORE INFORMATION

Current product information is available at www.netwelding.com. Detailed information of how the system operates is also presented.

A detailed explanation of why a minimum of 25-psi gas delivery pressure is needed to create "critical orifice flow" and have automatic flow compensation is also covered. Of interest this system was used when MIG and TIG were first introduced in the 1950's as the engineers designing those flow control systems understood the inevitable flow restrictions that occur when welding and knew large flow variations could occur.

Welders Setting High Flows?

If welders are setting very high gas flow rates, wasting even more gas, they are also causing air to be pulled into the gas stream, effecting weld quality! We have measured flows from standard flowmeters in excess of 150 CFH when the needle valve is fully open. The ***GSS*** will limit the maximum flow that can be set to the rate established by the built in starting peak flow orifice. This will create minimum turbulence flow and reduce flow to about half these maximum flow levels.

Have gas delivery hose lines longer than 50 to 100 feet? We have patented designs that work with "***any***" length hose. Define the details of your system and email: TechSupport@NetWelding.com

We also have a number of video's that discuss shielding gas flow: See: http://www.netwelding.com/Small_Video_1_Meg.htm for links to these YouTube Video's.

BOTTOM LINE

The WA Technology *GSS* has no moving parts to wear, repair or leak; no pressures to set or knobs to adjust. Its unique, patented design maintains the gas pressure in the delivery hose. This allows a small amount of extra gas flow at the weld start to quickly purge air from the weld start area and MIG gun nozzle during each weld stop.

Maintaining the higher pressure also retains the systems ability to automatically compensate for varying pressure drops that occur in production. Flow restrictions are due to flow restrictions created by spatter accumulation in the gun nozzle and gas diffuser ports. Restrictions also occur in the gun cable gas passage as the cable is bent. The gas passage often doubles as the hose holding the spiral wire liner and can be restricted by copper flakes and wire drawing lubricant debris. That is the main reason quality flow control systems have been designed to operate at pressures above 25 psi since the introduction of MIG welding in the 1950's!

The *GSS* hose is made with a heavy wall thickness and fiber reinforced construction and provides a robust product for shop environments. It will continue to flow even when stepped on. The heavy wall thickness makes the hose resistant to leaks caused by abrasion.

For most applications, the *GSS* will pay for itself in gas waste reduction alone in a matter of weeks. The improved weld starts, weld start quality and the reduced cylinder handling are added benefits.

Welders appreciate the benefits and are not frustrated as often occurs with other devices attempting to control gas waste that create more problems than they solve!

Need to lock in your flow control setting? We have a patented Flow Rate Locking device that fits most flowmeters. Check our web site for details (See photo below.)

Flow Rate Limiter
US Patent 7,462,799

References:

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US Patent Numbers 6,610,957; 7,015,412; 7,019,248. Canadian patent 2,455,644
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