WA Technology

Saving MIG Shielding Gas

(While Improving Weld Start Quality)

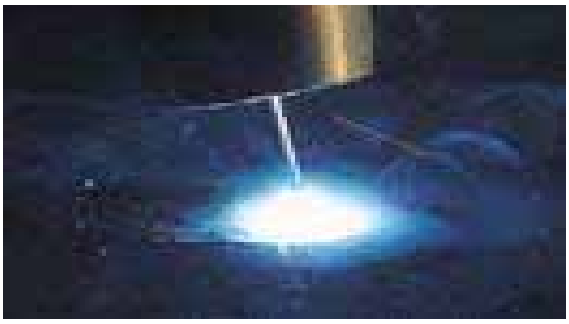
THE PROBLEM:

The typical user of MIG welding consumes from 2.5 to 5 times the amount of shielding gas needed. Two published reports quantify these estimates.

An article in the June 2000 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 2.5 to 5 times the amount that is needed. They also define the gas flow surge at the weld start as a significant cause of the waste (See Reference 1.)

Another article published in the January 2003 issue of Trailer Body Builders magazine quotes a representative from a leading manufacturer of shielding gases, Praxair, indicating their site surveys show the average fabricator consumes 30 cubic feet of gas per pound of wire indicating that was up to 6 times what is needed (See Reference 2).

Our findings of the amount of gas waste in MIG welding support these two reports. Depending on the price paid for shielding gas, the amount of arc time, and several other variables; this gas waste can be ***over $1000 per year per welder.***



MEASURING GAS WASTE

Estimating shielding gas waste is straight forward. For example, if 0.045 diameter solid wire is being used welding at 225 amps- 6.8 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/6.8 lb/hr or 4.4 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 to 4 times what it theoretically should be!

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

Type	Size	Amps	Lbs/hr
Solid	.035	175	5.5
Solid	.045	225	6.8
Cored	.045	250	8.5
Cored	1/16	300	10.2

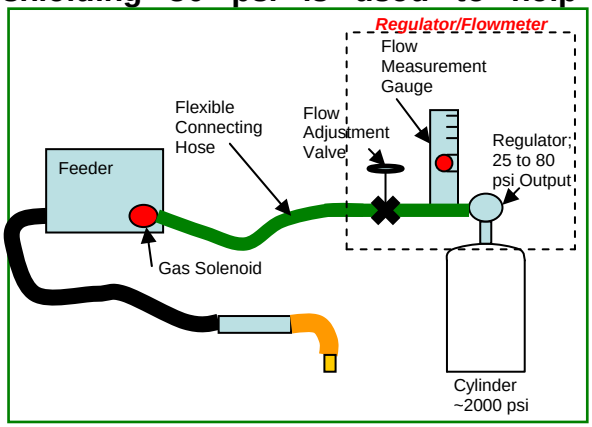
More complete deposition rate data with various wire types is available from a WA Technology.

A MAJOR CAUSE OF GAS WASTE

The accompanying figure schematically shows a typical MIG welding system. The regulator/ flowmeter drops the pressure from the cylinder or gas pipeline to that needed to deliver the required amount of shielding gas to the torch.

A small restriction orifice or a valve is used to control the gas flow. Typical regulator outlet pressures

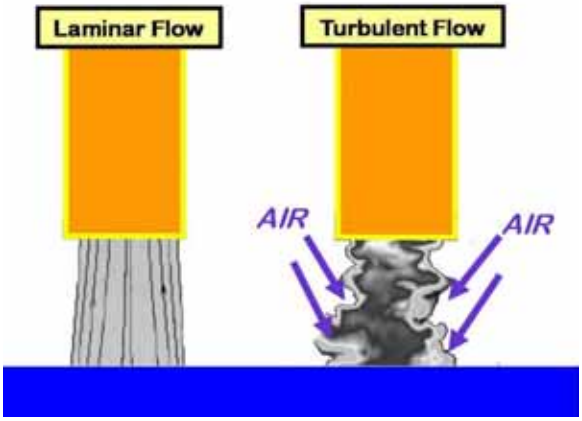
are from 25 to 80 psi. For CO_2 shielding 80 psi is used to help



prevent ice formation. These higher pressures are designed to provide automatic flow compensation for restrictions occurring during use. Anything lower will eliminate this critical function (See Reference 3.)

However the pressure needed at the feeder to flow the shielding gas though the solenoid, fittings and torch can be 3 to 8 psi. When welding is stopped, gas continues to flow through the orifice or needle valve flow control until the pressure increases in the gas delivery hose to that of the output of the regulator or pipeline. This increase in pressure causes significantly more gas to be stored (measured at standard temperature and pressure) in the hose than the physical volume. 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 torch pull can be 6 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 torch gas nozzle. This causes air to be pulled into the center of the shielding gas stream creating poor weld starts.



In an industrial trade magazine, Kevin Lyttle, Manager Welding R&D for Praxair states; ***"In many instances, production site surveys determine that shielding gas flow rates typically are set in excess of 50 CFH. This can contribute to poor weld quality as atmospheric gases are drawn into the arc zone because of excessive gas turbulence. Optimized flow enhances quality and reduces shielding gas usage."*** (See reference 4.)

SOME EXTRA GAS IS NEEDED AT THE WELD START TO AVOID WASTE

Just as the high gas surge causes wasted gas; if gas flow control is attempted at the wire feeder with an orifice, flowmeter or needle valve then the surge is eliminated but now little or no extra gas is available at the weld start to purge the torch nozzle and weld start area of gas. We have found in these instances welders raise the steady state gas flow in attempt to compensate so they are not starting in air! This is described fully in reference 5. Excess steady state flow settings create considerable gas waste!

PAST ATTEMPTS TO SOLVE SURGE PROBLEM AND WASTE

Restriction Orifices have been used to minimize the gas flow surge at the weld start. However, they may save little gas if just used to control peak surge. Gas is still stored in the delivery hose. Instead of the gas surge taking about a second to occur it takes longer at a lower flow rate. Significant gas waste occurs but over a longer time!

If the restrictor is used to control the steady state flow then insufficient extra gas is available at the start to purge the torch nozzle and weld start area of moisture laden air. This causes similar problems to those caused by the high surge flow! Welders then set steady state flow rates higher in attempt to compensate.

Low Pressure Devices appear at first to be a possible solution. However delivery systems have used pressures of a minimum of 25 psi since the introduction of TIG and MIG for very good reason. That is the minimum pressure needed to provide automatic compensation of hose and torch flow restrictions that occur in production! We have measured changes in flow of 35% up to 65% in tests with low pressure systems without any change in flow settings (Reference 3 describes this feature.)

Higher pressure also helps to quickly delivery some extra gas at the weld start to purge the torch nozzle and weld start area of moisture laden air.

PATENTED GAS SAVER SYSTEM

Our *patented WA Technology Gas Saver System* (*GSS* ™) significantly reduces shielding gas waste due to 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 a significant benefit of improving weld starts by minimizing turbulence of the shielding gas stream at the weld start.

The *GSS* hose has a large OD with fiber reinforced construction to provide a robust product which will not kink or flattened when stepped on. The flow restrictor size is selected to reduce the surge at the start but allow the operator to have full control of the welding flow rate. It is also sized to allow a small amount of extra gas flow to assist in quickly purging air that diffuses into the torch gas line during the stoppage. The gas waste reduction with the *GSS* over a conventional ¼ inch ID hose will range from 80 to 85% depending on 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 preceding 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 a hose splice connector (right in previous photo). 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 perform equally and incorporate a flow restriction orifice on the hose end which is connected to the feeder.

GSS components or prefitted hose may be ordered in 3, 6, 15, 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.

PRODUCTION RESULTS

A number of fabricators have performed usage measurements comparing the ***GSS*** with a conventional delivery hose. They reported savings in gas usage of from 30 to 63%. Many also report welders are very impressed with the improved starts from the significant reduction in initial gas flow peak surge. The following discuses three:

Ken Ard, President of Double A Body Builders found a 50% reduction in gas use in his tests of the ***GSS*** and purchased 23 units for all his MIG welders. After over a year of use they added 20 more MIG welders and equipped each with a ***GSS***.

A fabricator of truck boxes reported his test results with the ***GSS***. They

selected a repetitive application, welding doors. Using one full cylinder with their standard gas delivery hose they were able to fabricate 236 doors. With no other changes other 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! They immediately purchased 25 systems for all their welders. Two years latter they added 10 more MIG welders and called and asked for 10 more "Magic Hose!"

The need for some extra gas at the weld start is supported with the following example. Welders at a Bar Joist fabricator wanted more gas flow than the 45 CFH that was set with the orifices they were using at their wire feeders. A ***GSS*** was installed and provided a controlled amount of extra gas at the weld start. By providing extra gas only at the start, the ***GSS*** was able to improve starts and the steady state flow could be reduced to 35 CFH or less and the welders still saw a significant improvement! Overall gas savings were documented at about 30% and most important the welders were pleased with the improved weld performance.

MORE INFORMATION

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

BOTTOM LINE

The WA Technology *GSS* has no moving parts to wear, repair or leak. It has no pressures to set or knobs to adjust. It uses a unique, patented design that maintains the gas pressure in the delivery hose. This provides a small amount of extra gas flow at the weld start to rapidly purge air from the weld areas and torch nozzle. Higher pressure is retained to assure the system's ability to automatically compensate for varying pressure drops in the delivery hose and compensates for flow restrictions caused by spatter accumulation in the torch nozzle and gas diffuser ports.

The *GSS* hose is made with a heavy wall thickness and fiber reinforced construction to provide a robust product. 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 they often are with other devices attempting to control gas waste which often create more problems than they solve!

Other Needs

Have gas delivery hose lines longer than 50 feet? We have new patented designs that work with "*any*" length hose. Email us at TechSupport @NetWelding.com for details.

Need to lock in your flow control settings? We have a patented Flow Rate Locking device that fits most flowmeters. Check our web site for details or email for information.

Flow Rate Limiter

References:

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4. Lyttle, K. and Stapon, G. Simplifying Shielding Gas Selection, Practical Welding Today, February 2005
5. Stauffer, H. R. Application and Method for Reducing the Waste of Shielding Gas. US Patent number 4,341,237, July 27, 1982

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Patent Pending in other countries
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