WA Technology

Saving MIG 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 quantify these estimates.

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 6 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.)

Another article published in Trailer Body Builders magazine quotes a representative from a leading manufacturer of shielding gases, Praxair, indicating their findings from shop 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).

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

MEASURING GAS WASTE

Estimating shielding gas waste is straight forward. For example, if 0.035 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.

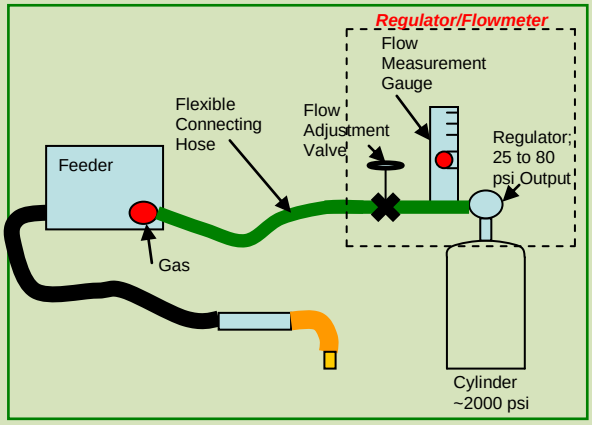
Type	Size	Amps	Lbs/hr
Solid	.035	150	4.1
Solid	.035	200	6.0
Solid	.045	200	5.5
Solid	.045	250	7.6
Cored	.045	250	8.0
Cored	.045	300	11.6
Cored	1/16	300	8.6
Cored	1/16	350	11.9

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

A MAJOR CAUSE OF GAS WASTE

The accompanying figure schematically shows a typical MIG welding system. The regulator/ flowmeter drops the pressure from

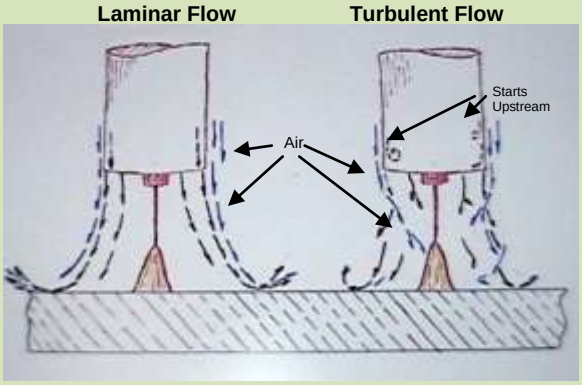
the cylinder or gas pipeline to that needed to deliver the required amount of shielding gas to the torch.



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 often used to help prevent ice formation. These higher pressures needed to provide automatic flow compensation for restrictions occurring during use. Anything lower will eliminate this important 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 up to 7 times the physical hose volume of gas to be stored evry 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 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 cup. 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 more laminar, quality 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 have been occasionally used to minimize the gas flow surge at the weld start. However, assuming flow is still controlled at a regulator/flowgauge or flowmeter, significant gas waste still exists! If a pressure gauge is put in the shielding gas hose line the gas pressure changes observed are at similar levels as if the restrictor was not present. 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! See reference 5 for a discussion for the need for this extra gas and a special gas storage device defined by Stauffer in his 1982 patented system.

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 up to 65% in tests with low pressure "surge reduceing" devices without any change in flow adjustments (Reference 3 also describes this issue.)

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. This has the benefit of reducing gas waste for very short time torch trigger actuation such as when inching the wire to cut of the end. The surge restricting orifice has a significant benefit of improving weld starts by minimizing turbulence of the shielding gas stream.

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 79 to 82% 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 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 (right in 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 incorporate a flow restriction orifice on the hose end which is connected to the feeder and perform equally.

GSS components or prefitted hose may be ordered in 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.

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

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 31 to 63%. Many also report welders are very impressed with the improved starts from the significant reduction in initial gas flow peak surge.

A fabricator of truck boxes reports his 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 to replace 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!"

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.

A Lean Welding Manufacturing Learning Program entitled *"Optimizing Shielding Gas Use and Eliminating Waste"* that covers controlling leaks and other gas savings recommendations is also available. A condensed version, useful for welders, is available for purchase as a PDF download. These training aids define shielding gas flow rates that create turbulence and why increasing gas flow can cause poor shielding. It quantifies how much wind or draft can be tolerated and when a wind break is needed. It is an excellent tool for understanding shielding gas control and to use for operator and supervisor training.

Have gas delivery hose lines longer than 50 feet? We have new patented designs that work with "***any***" length hose. Contact us from our web site for details or email: TechSupport@NetWelding.com

BOTTOM LINE

The WA Technology *GSS* has no moving parts to wear, repair or leak; no pressures to set or knobs to adjust. It's 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 that diffuses into the torch gas line during weld stoppage. Maintaining the higher pressure also retains the systems 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. That is a key reason regulator flow systems have been designed to operate at pressures above 25 psi since the invention of TIG and MIG welding in the 1950's!

The *GSS* hose is made with a heavy wall thickness and fiber reinforced construction to provide a robust product for shop enviroments. 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 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 following photo.)

Flow Rate Limiter
US Patent 7,462,799

References:

1. Standifer, L. R. Shielding Gas Consumption Efficiency. The Fabricator, Volume 30, Number 6, June 2000.
2. Weber, R. How to Save 20% on Welding Costs. Trailer/Body Builders, Volume 44, Number 3, January 2003
3. Uttrachi, G.D. GMAW Shielding Gas Flow Control Devices, American Welding Society Welding Journal, April 2007
4. Wilkinson, M. E. Direct Gas Shield Analysis to Determine Shielding Efficiency. Report of The Welding Institute, Cambridge, England, December 1974
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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