

# Welding on the Farm: Selecting a Welding Unit for the Farm or Ranch

Farms encounter a wide variety of welding repairs and projects – having the right welder depends on a lot of factors. Do you have to bring the welder to the work or can you take the work to the welder? Which process (MIG, Stick, or TIG) fits your needs? This article examines all these issues and more.

The weather finally cleared, and Wisconsin dairy farmer Al Hoffmann has 385 acres of haylage to cut and store when the chopper blower band for the silo snaps in half. Part of the 3/16 in. steel band has worn paper thin and snapped, and on this Saturday, the nearest replacement band is two days away. Using a 200 amp Milleromatic® wire welder, Al saves the band by tack welding it together and then welding on a back-up strip of steel. The repaired chopper blower moves more than 800 tons of haylage in the next few days...

...It's evening milking time. Al is half done with his 185 cows when a hinge breaks on the air gate in the milking parlor. Al resumes milking a few minutes later, after he repairs the gate with a portable Milleromatic wire welder that runs off his 115 V household current.

"This farm has a lot of old iron, but welders keep my machinery running," Al says. In addition to the two wire welders, Al also uses a 175 amp Stick (shielded metal arc) welder, primarily for hardfacing the bucket on his skid loader or repairing his manure spreader.

Does every farm or ranch need two or three different types of welders? While Al wouldn't trade in any of his machines, he "can't imagine not having a wire welder. It's easy to use, makes heavy welds, yet still allows me to work on thin sheet metal. I wouldn't have even attempted to repair the chopper blower band with a Stick welder because it was so thin. It would have burned right through."

To help determine the right welder for your operation, first consider how you could use it.

Typical farm/ranch applications include:

- Welding the steel frames (tubes) in place for a milking parlor
- 1) Patching the sheet metal on combines and other equipment
- 2) Repairing aluminum irrigation pipes
- 3) Mending wagons, seeders, spreaders and other machines that can break down in the field
- 4) Repairing the lighting on augers
- 5) Welding together the self-locking panels in the feeding alley of a free stall barn, or the slats for a hog's holding pen
- 6) Constructing fences
- 7) Hardfacing skid loader buckets and tillage equipment
- 8) Reattaching an A-frame hitch on a cattle trailer
- 9) Repairing stainless steel sprayer tanks
- 10) Fixing aluminum engine manifolds

Because different applications sometimes call for different welding processes, selecting the right welder for your operation is important.

The most common welding processes used for fabricating metals are Shielded Metal Arc Welding (SMAW or Stick electrode), Gas Metal Arc Welding (GMAW or MIG, a wire welding process), Flux Cored Arc Welding (FCAW, also a wire welding process), and Gas Tungsten Arc Welding (GTAW or TIG). Note that MIG and flux cored welding can be performed by the same machine, and that TIG machines can usually Stick weld, too.

Unfortunately, there is no single welding process suitable for all welding situations. For this reason, it is necessary to weigh the advantages and disadvantages of each welding process (see Chart 1).



Process	MIG	Flux Cored	Stick	TIG
<b>Type of metal it can weld</b>	Steel, stainless, aluminum	Steel, stainless	Steel, stainless	All weldable metals
<b>Metal thickness</b>	24 gauge and up	1/8" and up	1/8" and up	22 gauge and up
<b>Welding speed</b>	Very fast	Very fast	Slow	Very slow
<b>Skill required</b>	Some skill	Some skill	More skill	Most skill
<b>Purchase cost</b>	Moderate	Moderate	Low	High
<b>Operating cost</b>	Low	Low	High	High

*Chart 1. A brief comparison of the welding processes.*

### What Size Welder Should You Buy?

One way of classifying the "size" of welding power sources is by how much amperage they can generate at a given "duty cycle." Duty cycle is the number of minutes out of a 10-minute cycle a welder can operate. For example, the Millermatic 210 MIG unit can deliver 160 amps of power at a 60 percent duty cycle. It can weld continuously at 160 amps for six minutes, and then must cool down during the remaining four minutes to prevent overheating.

Next, consider that thin metals require less amperage and thicker metals require more amperage. For example, to MIG weld 18 gauge steel in a single pass takes roughly 70 amps, where welding 1/4 in. steel in a single pass requires roughly 180 amps.

The phrase in a single pass is the key, because multiple passes can be made to weld thicker material. However, this takes more time, so you may exceed the machine's duty cycle and spend more time waiting than welding.

For light repair work on steel, stainless steel and aluminum – from sheet metal to material 3/16 in. thick – a 130 to 150 amp MIG unit with a 30 percent duty cycle can perform many of the welding jobs a farm or ranch requires. For heavier repair or fabrication jobs – trailer hitches, axles, hardfacing – consider a 200 to 250 amp MIG unit with a 40 to 60 percent duty cycle, or consider a 175 to 250 amp Stick machine.

Remember, you need to have sufficient amperage to ensure proper penetration on the root (first) pass, and that you cannot make up for a poor root pass with subsequent passes. To determine the size of welder that is right for you, consult chart 2.

Approximate welding amperage used for various thicknesses of mild steel. Actual amperage used depends on the type of weld (butt, lap, fillet, corner), welding position (flat, vertical down, vertical up, overhead), diameter of electrode, type of shielding gas, and other factors. Remember, thicker material can be welded by making multiple passes.

Mild steel	1/16"	3/32"	1/8"	1/4"	1/2"
Stick, E6013	20-45	40-90	80-130	250-350	300+
MIG	100-120	125-145	140-150	180-190	300+
Flux cored	N/A	110-125	140-155	170-190	430-470
TIG	55-90	90-120	95-130	245-330	330-440

Chart 2: Finding the right-sized welder

## Portability

Can you bring the work to the welder, or does the welder need to go to the work? And if you bring the welder to the work, is power available? Small welders, like the Millermatic 135 MIG unit, weigh about 67 lb. and operate off 115 V household current.

Al Hoffmann runs .030 in. flux cored wire in his unit, which eliminates the need for a shielding gas bottle and makes it even more portable. Small Stick welders are also portable. Al demonstrated the value of a lightweight welder when he needed to fix a silo unloader frame – at the top of his silo.

"I ran an extension cord out of the milking parlor, tied a rope to that little wire welder, and just pulled it up to the top of the silo," he says. "I made the repair on the spot in about an hour. If I would have had to bring the frame into my shop, it would have taken me five or six hours." Al also notes that the repair, which has held for more than two years, was made while the temperature was about -18° F.

Portability also was important during the construction of the equal potential grounding grid in the free stall barn. This job required making hundreds of tack welds to connect the steel reinforcing bars together. With a small MIG welder, moving from joint to joint was much easier than trying to move his larger MIG welder, which weighs about 200 lb. and has a 4 ft. gas bottle. Also, these large MIG welders typically require 220 V power, which isn't always available.

When breakdowns occur far away from an electrical outlet, the farmer or rancher should consider purchasing an engine-driven welding generator, such as Miller's Blue Star® 6000 or Bobcat™ 225 NT. Not only do these machines provide their own welding power, they also provide auxiliary power to run tools and lights. Many people keep the generator in the bed of a pick-up truck, enabling them to drive to wherever repairs are needed.

While "basic" engine drive units like the Blue Star can only Stick weld, the larger engine drive units are often multiprocess machines capable of Stick, MIG and TIG welding by adding the right accessories.

## Buy Quality

As with everything else, you get what you pay for when you invest in a welder. A good welder from one of the major manufacturers can run dependably for decades. Designed to withstand rough use,

these machines use high quality components and are tested for durability. Most of the major brands are also made in America by American-owned companies.

"I don't necessarily take good care of my welders, but they keep running," says Hoffmann. "Every welder I've ever had from Miller Electric has been good quality."

Also, consider purchasing your welder from a welding supply store. This gives you access to their knowledge and experience, plus after-sale service and support. If they have a demo room, ask if you can use a welder before purchasing one. And if you've never used a MIG welder, you owe it to yourself to try one.

By properly considering the factors of your application, and examining the advantages that each welding process offers, selecting the right welding power source can be an easy and profitable decision.

A brief comparison of the welding processes.

## Stick

"Should I buy a Stick, MIG or TIG welder?" Traditionally, most farms and ranches have a small AC Stick welder, primarily because they cost a few hundred dollars. While Stick welders are great for general repairs on steel or for hardfacing, they do have drawbacks:

1) Welding thin materials may be difficult or impossible. Even skilled welders would hesitate before attempting to Stick weld sheet metal (18 ga. steel). 2) Marginal for welding aluminum (and takes a lot of skill). 3) You must clean the slag off the weld, a messy and time-consuming job. 4) Stick is a slower process than MIG.

Stick does have its advantages (besides low cost). Because the electrodes are self-shielding, they are better-suited for windy, outdoor conditions than MIG or TIG. Stick is also more forgiving than MIG when welding on dirty or rusty metal. (Still, it is always advisable to scrape or grind off paint, rust, and other debris; welding on the cleanest material possible produces a stronger weld.)

If you plan to purchase a Stick welder, try to buy an AC/DC welder. For most applications, DC reverse polarity welding offers advantages over AC, including: easier starts; fewer arc outages and sticking; less spatter (better looking welds); easier out-of-position welding; easier to learn "how to weld"; smoother arc; and welds thinner metals better.

## MIG

Farmers like Al Hoffmann wouldn't give up their MIG welders for anything. While an old Stick welding pro may disagree, learning to MIG weld is easier. With a little practice, even a first-time MIG user can achieve a good-looking weld. This means that anyone can use it.

For the farm or ranch, a MIG welder probably offers more advantages than any other welding process. The advantages of MIG welding are:

1) Easiest welding process to learn. 2) Welds light gauge material or thick plates. 3) Welds all common metals – carbon steel, stainless steel and aluminum. 4) High welding speeds can be obtained – up to four times faster than Stick welding – reducing repair or construction time. 5) Increased efficiency – 50 lb. of MIG welding wire yields 49 lb. of metal deposition, where 50 lb. of Stick electrode rods yields approximately 30 lb. of deposition.

A further advantage is that the same equipment used for MIG welding also performs flux cored welding. Rather than running a solid wire coupled with a shielding gas, flux cored welding uses self-shielded wire with flux inside.

The advantages of flux cored welding are:

1) Less affected by drafts, so better suited for outdoor work. 2) Works as well as Stick on rusty or dirty material. 3) Continuous wire feed, which minimizes starts and stops. 4) Deep penetration for welding thick sections. 5) Increased metal deposition (two or three times that of Stick welding), which is beneficial for hardfacing. 6) Can eliminate need for a shielding gas bottle, which increases portability.

Between its MIG and flux cored capabilities, a wire welder can perform any task a Stick welder can, and do it more efficiently. While a good quality wire welder costs \$450 to \$2,000 (depending on its size), the costs for wire and gas are much less than that for Stick welding rods. Coupled with the ability to weld aluminum and sheet metal, a wire welder can pay for itself very quickly.

## TIG

This welding process uses a non-consumable tungsten electrode and a shielding gas which protects the welding area from contamination. The concentrated heat and precise control of the TIG arc allows thin material (.010 in.) to be welded. The advantages of TIG welding are:

1) Precise welding on thin materials is easily accomplished, plus there is less distortion overall. 2) Provides the highest quality work, as well as highly aesthetic weld beads. 3) Allows the welder to adjust heat input while welding by using a foot or hand amperage control. 4) Welds steel, aluminum and other metals with just a single gas, argon.

Although TIG welding is a relatively slow process, it provides high quality welds. Typical applications are for aluminum irrigation pipes, stainless steel sprayer tanks and aluminum engine parts.

Another factor to consider is that TIG machines also have Stick welding capabilities (they are often referred to as TIG/Stick welders). While costing more than MIG or Stick-only welders, a single TIG/Stick machine gives the user greater flexibility. Miller's Econotig® TIG/Stick welder provides this flexibility and offers features found on industrial-class equipment, but with a price tag geared for the do-it-yourself welder.