HTP America Inc.

Inverarc 200 TLP
Owner's Manual

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Manufacturer's Warranty

It is expressly agreed that there are no warranties, expressed or implied, made by either the Salesman, Dealer, or HTP America, Inc. on products or parts furnished hereunder, except the Manufacturer's Warranty against defective materials or workmanship as follows:

HTP America, Inc. warrants each new welding machine to be free from defects in material and workmanship under normal use and service for three (3) years after delivery to the original purchaser. HTP America, Inc. will repair or replace, at its factory, any part or parts thereof. Products should be returned to HTP America, Inc., with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been thus defective. This warranty being in lieu of all other warranties, expressed or implied, and all other obligations or liabilities on its part and it neither assumes nor authorizes any other person to assume for it any other liability in connection with the sale of its machines.

This warranty shall not apply to any welding machine which has been repaired or altered by unauthorized service departments in any way so as in the judgment of HTP America, Inc. to affect its stability and reliability, nor which has been subjected to misuse, negligence, or accident.

HTP America, Inc. shall not be liable in any event, unless HTP America, Inc. receives notice of alleged breach of warranty, specifying the claimed defect, within not more than thirty (30) days after the discovery.

HTP America, Inc. has reserved the right to make changes in design and/or add any improvements to its products at any time without incurring any obligation to install same on equipment.

This warranty is void unless warranty card is sent to HTP America, Inc. within fifteen (15) days from the date of purchase.

Exclusions to Warranty:

The electrode holder and the optional TIG welding torch are warranted for a period of ninety (90) days against defects in material and workmanship.

NOTE: This warranty is to the original purchaser only. The warranty can be transferred to another owner, with HTP's approval, for a warranty transfer fee. HTP America, Inc. must be notified within fourteen (**14**) days of the sale and must be provided with the contact information of the original owner, the contact information of the new owner, and the serial number of the machine.

Safety Suggestions

People with PACEMAKERS should not use or come near the Inverarc 200 TLP when in use.

Electric arc welding produces ultra-violet rays which are harmful to skin and eyes. Ultra-violet radiation can penetrate lightweight clothing, reflect from light colored surfaces, and burn the skin and eyes.

- Wear non-oily/non-greasy flameproof welding gloves; the oil or grease on the gloves may ignite.
- Wear a heavy, pocketless, long-sleeved shirt, cuffless trousers, and high-topped work shoes.
- Wear a full-faced welding helmet with a number ten (10) or darker lens and a cap.

Electric arc welding produces flying sparks and hot material, which can cause fire.

- To avoid fire, do not weld on wood, plastic tile, or carpeted floors. Concrete or masonry floors are safest.
- Do not weld on pressurized containers.
- Do not weld on drums, barrels, tanks, or other containers until they have been cleared and cleaned as described in AWS Standard A6.01.

- Do not weld near flammable materials.
- Avoid having any type of fuel, such as cigarette lighters or matches, on your person as your weld.
- Ensure that there is a fire extinguisher in the welding area.

Electric arc welding produces toxic fumes.

- Provide adequate ventilation in the welding area at all times.
- Do not weld on galvanized zinc, cadmium, or lead beryllium materials unless you are POSITIVE that sufficient ventilation is provided. These materials produce toxic fumes.
- Do not weld in areas close to degreasing or spraying operations. Chlorinated hydrocarbon vapors may react with the ultra-violet rays and form highly toxic phosphine gas.
- If you develop momentary eye, nose, or throat irritation during welding, stop welding immediately. This is an indication that ventilation is not adequate. Do not continue to weld until ventilation is provided.

Noise can damage your hearing. Protect yourself to avoid hearing damage.

The welding arc can cause burns. Keep the tip of the welding gun, torch, or arc welding clamp far from your body and from other persons.

ELECTRIC SHOCK CAN KILL.

Exposed, electrically hot conductors, other bare metal in the welding circuit, or ungrounded, electrically hot equipment can fatally shock a person whose body becomes a conductor. Do not stand, sit, lie, lean on, or touch a wet surface when welding.

- Disconnect the power supply before working on the welding machine.
- Do not work with deteriorated or damaged cables
- Frequently inspect cables for wear, cracks, and damage. Replace cables with excessively worn insulation to avoid possible lethal shock from bared wire.
- Do not touch bare electrical parts.
- Ensure that all the panels covering the welding machine are firmly secured in place when the machine is connected to the power supply.
- Insulate yourself from the workbench and from the floor (ground); use insulating footwear and gloves.
- Keep gloves, footwear, clothes, the work area, and the welding equipment clean and dry.
- Check the machine power cable frequently; the power cable must be free from damage to the insulation. BARE CABLES ARE DANGEROUS. Do not use the machine if the power cable is damaged; it must be replaced immediately.
- If it is necessary to open the machine, first disconnect the power supply. Wait five (5) minutes to allow the capacitors to discharge. Failure to take this precaution may expose the operator to the dangerous risk of electric shock.

For more information, refer to the following standards and comply as applicable.

1) ANSI Standard Z49.1 SAFETY IN WELDING AND CUTTING, obtainable from the American Welding Society, 2051 NW 7th St., Miami, FL 33125.
2) ANSI Standard Z87.1 SAFE PRACTICE FOR OCCUPATIONAL AND EDUCATIONAL EYE AND FACE PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018.
3) America Welding Society Standard A6.0 WELDING AND CUTTING CONTAINERS WHICH HAVE HELD COMBUSTIBLES, obtainable from same as item 1.
4) NFPA STANDARD 51. OXYGEN-FUEL GAS SYSTEMS FOR WELDING AND CUTTING, obtainable from the National Fire Protection Assoc., 470 Atlantic Avenue, Boston, MA 02210.
5) NFPA Standard 51B. CUTTING AND WELDING PROCESSES, obtainable from same as item 4.
6) CGA PAMPHLET P-1. SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS, obtainable from the Compressed Gas Association, 500 Fifth Avenue, New York, NY 10036.
7) OSHA Standard 29 CFR, Part 1910, Subpart Q WELDING, CUTTING AND BRAZING.

Fig. 1

Specifications

Input Voltage	230 V (208 – 240 V), Single-Phase, 50/60 Hz
Input Amperage	43 A @ 200 Amps SMAW
Output Amperage	4 – 200 A
Duty Cycle (Stick & TIG)	10% @ 200 Amps 60% @ 130 Amps 100% @ 115 Amps
No Load Voltage	100 V
No Load Voltage with VRD On	Less than 25 V
Arc Voltage (Stick)	20.2 – 28 V
Arc Voltage (TIG)	10.2 – 18 V
Arc Force (Stick Only)	ARC Welding Mode 0 – 200% CEL Welding Mode 0 – 500%
Hot Start (Stick Only)	3 – 40%
Pulse Frequency (Stick)	0.4 – 5 Hz
Pulse Frequency (TIG)	0.4 – 999 Hz
Slope Down (TIG Only)	.1 – 10 Sec
Dimensions	13-5/8” L x 5-1/2” W x 11” H
Weight	15 Lbs.

Electrical Connection

Your Inverarc 200 TLP operates on single-phase, 230 Volt power (208-240 Volt). It comes with a NEMA 6-50P plug installed on the machine. Connect the welder to a properly wired 6-50R receptacle. The maximum current draw will be 43 amps when stick welding at an output of 200 amps. If the machine is operated on a generator, it needs to be a clean power generator with a continuous rating of 10,000.

General Characteristics

Our new, pulsed process welding machine, which features electronic adjustments controlled through a microprocessor, allows the operator to achieve excellent welding quality thanks to the advanced technologies applied. The microprocessor circuit controls optimize the transfer arc, regardless of the load variation and the impedance of the welding cables. The full bridge inverter technology, combined with the DSP (Digital Signal Processor), ensures excellent performance and arc dynamic.

Advantages of Pulse Welding

Pulse welding includes ALL of the following advantages, but **not all at the same time**. At a later point in the manual, we cover, in more detail, suggested settings regarding how, when, and where certain situations apply.

- Visually spatter free (MIG & TIG only, though still reduced spatter when stick welding)
- Higher travel speeds
- Deeper penetration
- Less heat input, which equals less material distortion
- Ability to weld thinner material than you could without pulse
- Superior control of the weld puddle, especially when welding out of position
- Easily join materials of differing thicknesses
- Better gap bridging when welding materials with a poor fit up
- Ability to make leak-tight welds
- Improved bead appearance
- Ability to use one size bigger welding rod than normal
- Weld on thinner material without burning through
- Easier for beginner welders

Disadvantages of Pulse Welding

- Pulse welding can interfere with sensitive electronics like pacemakers and automatic welding hoods
- Low pulse frequencies (less than 1.5 Hz) can be perceived as unpleasant by the operator (TIG and Stick only)

SMAW (Shielded Metal Arc Welding) or Stick Welding Basics

Experienced stick welders may proceed **directly to page 9**.

With the growing popularity of welding processes such as MIG welding, TIG welding, plasma welding, and laser welding, many people often find the stick welding process outdated with little or no use in the world of welding. However, stick welding is one of the oldest and most reliable welding methods in the world, and, even today, still has a solid market share—mainly in the repair field, but also in the manufacturing and

construction fields. Today, in 2017, cross country pipelines in the U.S. and all over the world are being built using the stick welding process, as well as ships, mining equipment, and farming equipment.

Stick welding is extremely versatile. You can stick weld many different materials including mild steel, stainless steel, brass, cast iron, and even aluminum, amongst others, and you can stick weld almost any material thickness. However, material thicknesses under 1/16" are not really practical to weld via the stick welding process, and very thick material may require multiple pass welds. Stick welding is an all position process, though this all depends on the rods you use, and the stick welding process is suitable for producing strong, leak-tight welds and even x-ray quality welds.

With the addition of cutting or chamfering rods, the stick welder also functions as a cutting or metal removal tool.

Besides welding, the stick process is also popular for hard-facing or hard-surfacing of metal surfaces. By the nature of the process, stick can be an excellent choice. Although, deposition rates (the amount of metal put down in a certain time frame) is typically only about 1/3 of that compared to flux cored wire. But stick rods have the huge advantage that the amount of flux and alloy that can be put on them is much greater than the amount that fits inside a tubular flux cored wire. For example, good flux cored hard-surfacing wires contain as much as 13% alloy, which makes for a good wear resistant surface. On the other hand, stick welding rods, in most cases, have over 20% alloy on them (in the coating that is around the metal rod), and there is a new generation of tubular hard-surfacing stick rods that can carry flux and alloy inside the tube and on the outside of the tube—these rods carry as much as 37% alloy. So while stick rods deposit less material (lbs./hr.) than flux cored wire, the quality of the deposits is much higher, generally speaking.

What makes stick welding so different than all other welding processes?

The short answer—stick welding is simple.

All you really need is a welder with an electrode holder, a ground cable, and a box of welding rods. 1, 2, 3 and you are ready to go. No shielding gas and no consumables (other than the welding rods) required. Also, operating the machine is quite a bit simpler. Instead of having to select wire speed, voltage, polarity, drive roll pressure, gas flow, gas type, wire diameter, etc., you simply choose your welding rod (based on what you want the machine to do) then select your polarity and amperage. As far as polarity goes, the majority of welding rod runs on DCEP (Direct Current Electrode Positive). To determine amperage required, reading the welding rod box is a good rule of thumb to follow. Typically, the welding rod box shows an amperage range the rod is designed to run in (for example, the box may display a range between 70 and 110 amps). A good start value would be to select a mid range amperage and figure out what works best for you. If you experience the rod sticking, dial up the amperage until the rod runs smooth. On the other hand, if you experience a large amount of spatter, dial down the amperage until you achieve a smoother arc.

What about stick welding outdoors?

Stick welding works excellent outdoors and is probably the most forgiving welding process for windy weather or dirty material, i.e., material that has not been cleaned and is not rust or paint free. Stick welding is a spray arc process with excellent penetration. The gasses created by the flux coating of the rods when burned shields the welding arc. The slag that is created by the burning of the flux also shields the molten puddle and fresh weld so that it cools down slower and is protected from the atmosphere, which leads to welds with better elongation and ductility than bare MIG wire welds.

Evolution of Stick Welding

Back in the early 1900s, welders would make their own stick electrodes by dipping metal rods in different chemical solutions to create something similar to the flux coating used on today's electrodes. The processes used to make stick electrodes were time consuming and welding with the electrodes often produced undesirable results. However, the process was refined during the 1940s and 1950s, and welders could purchase store bought electrodes similar to what we buy and use today. The refined process for creating stick welding electrodes made a huge difference in the consistency and quality of the rods and the welds produced using the rods.

The machines used for stick welding also looked and performed differently than they do today. In the beginning, welders used transformers and generators to produce the welding current. There are two major kinds of welding current—AC (alternating current) and DC (direct current). Many older welding machines utilize AC current because welding machines utilizing AC current were easier and cheaper to make. Today, most stick welding machines utilize DC current because rods are typically designed to run on DC, and there are certain advantages to DC welding that prompted much of the industry go that route. Not much changed about stick welding equipment from the early 1900s to the 1980s—even companies who have been in business for 100+ years build the same model engine driven welding machines over and over with minimal changes.

In the last couple of decades, however, stick welding technology has undergone some major advancements. New inverters were introduced to the market, and 200 amp welding machines now weigh less than 55 lbs. instead of 800+ lbs. The required input for these machines also went down from around 100 amps to 20 or 30 amps. These are some of the more obvious changes—the real evolution of stick welding technology is hidden from the operator.

The real evolution came about as inverter technology advanced, making options and adjustments such as arc force and hot start available at the touch of a dial, and these additions and advancements changed the volt amp curves. In 2005, an Italian manufacturer even added a pulse feature to a stick welder for the first time ever.

Setting Up and Operating the Inverarc 200 TLP

The Inverarc 200 TLP is capable of the following processes: SMAW (stick), SMAW-P (pulsed stick), GTAW (TIG), and GTAW-P (pulsed TIG).

The Inverarc 200 TLP offers two different stick welding options:

1) ARC—The standard welding mode for most welding rod.
2) CEL—The welding mode with enhanced arc characteristics designed especially for electrodes with cellulosic flux coatings.

The Inverarc 200 TLP also features a DC lift arc TIG mode, which includes a slope down function. The minimum requirement to TIG weld with the Inverarc 200 TLP is a TIG torch with a gas valve. The Inverarc can also be operated with a wired remote control, e.g., a foot control or hand control, but a remote control is not required to TIG weld.

Fig. 2

1. Negative Welding Current Terminal
2. Select Mode Button
3. TIG Weld Mode Indicator LED
4. Cellulose Electrode Weld Mode Indicator LED
5. Arc Weld Mode Indicator LED
6. Power Indicator LED
7. Over Temp Indicator LED
8. Multifunction/Amperage Display
9. Encoder
10. Arc Force Indicator LED
11. Slope Down Function Indicator LED
12. Pulse Function Indicator LED
13. Function Button
14. Positive Welding Current Terminal
15. Remote Control Connection

DESCRIPTION OF THE WELDING FUNCTIONS

When you switch the welder on, all of the indicator LEDs will illuminate for approximately two seconds, and then the multifunction/amperage display (Fig. 2, #8) and the reference LED showing the welding mode selected (Fig. 2, # 3, #4, or #5) will both blink. Approximately two seconds later, the multifunction/ amperage display (Fig. 2, #8) will show the welding current, which you can adjust as necessary with the encoder (Fig. 2, #9). The power indicator LED (Fig. 2, #6) remains illuminated while the welder is switched on.

DESCRIPTIONS OF THE REGULATIONS IN THE VARIOUS WELDING MODES

STICK WELDING (ARC)

1) Press the Select Mode button (Fig. 2, #2) to switch on the Arc Weld Mode LED (Fig. 2, #5).
2) The display (Fig. 2, #8) will blink **ARC** for approximately two seconds.
3) The Arc Force Indicator LED (Fig. 2, #10) will illuminate.
4) Use the encoder (Fig. 2, #9) to regulate the welding current shown on the display (Fig. 2, #8).
5) You can adjust the Hot Start value by pressing and holding the Function button (Fig. 2, #13) for several seconds until the display (Fig. 2, #8) shows **HS**. Once you see **HS**, let go of the Function button; the **HS** should be replaced by a number between 003 and 040. The number displayed refers to the hot start value as a percentage. For example, if you weld at 100 amps and set the **HS** to 003, for a short period of time after you strike an arc, the welding output is raised to 103 amps. Likewise, if you weld at 100 amps and set the **HS** to 040, for a short period of time after you strike an arc, the welding output is raised to 140 amps.
6) Pressing the Function button (Fig. 2, #13) once allows you to select the Arc Force value. The display (Fig. 2, #8) will blink **AF**, and then you can select the value with the encoder (Fig. 2, #9). The Arc Force can be varied from 0% to 200% based on the set welding current value.
7) Pressing the Function button (Fig. 2, #13) again activates the pulse frequency mode. The Pulse Function Indicator LED (Fig. 2, #12) will blink and the display will read **P Fr**. By turning the encoder (Fig. 2, #9), you can vary the frequency value from 0.4Hz to 5Hz. The factory set the base current at 50% of the welding current value with 50% pulse on time. To exit out of the pulse frequency mode, hold down the Function button (Fig. 2, #13) for approximately 2 seconds until the flashing **P Fr** disappears.

CELLULOSE ELECTRODE WELDING, 6010 (CEL)

1) Press the Select Mode button (Fig. 2, #2) to switch on the Cellulose Electrode Mode LED (Fig. 2, #4).
2) The display (Fig. 2, #8) will blink **CEL** for approximately two seconds.
3) The Arc Force Indicator LED (Fig. 2, #10) will illuminate.
4) Use the encoder (Fig. 2, #9) to regulate the welding current shown on the display (Fig. 2, #8).
5) You can adjust the Hot Start value by pressing and holding the Function button (Fig. 2, #13) for several seconds until the display (Fig. 2, #8) shows **HS**. Once you see **HS**, let go of the Function button; the **HS** should be replaced by a number between 003 and 040. The number displayed refers to the hot start value as a percentage. For example, if you weld at 100 amps and set the **HS** to 003, for a short period of time after you strike an arc, the welding output is raised to 103 amps. Likewise, if you weld at 100 amps and set the **HS** to 040, for a short period of time after you strike an arc, the welding output is raised to 140 amps.
6) Pressing the Function button (Fig. 2, #13) once allows you to select the Arc Force value. The display (Fig. 2, #8) will blink **AF**, and then you can select the value with the encoder (Fig. 2, #9). The Arc Force can be varied from 0% to 500% based on the set welding current value.
7) Pressing the Function button (Fig. 2, #13) again activates the pulse frequency mode. The Pulse Function Indicator LED (Fig. 2, #12) will blink and the display will read **P Fr**. By turning the encoder (Fig. 2, #9), you can vary the frequency value from 0.4Hz to 5Hz. The factory set the base current at 50% of the welding current value with 50% pulse on time. To exit out of the pulse frequency mode, hold down the Function button (Fig. 2, #13) for approximately 2 seconds until the flashing **P Fr** disappears.

TIG WELDING

1) Press the Select Mode button (Fig. 2, #2) to switch on the TIG Weld Mode LED (Fig. 2, #3).
2) The display (Fig. 2, #8) will blink TIG for approximately two seconds.
3) The Slope Down Function Indicator LED (Fig. 2, #11) will illuminate.
4) Use the encoder (Fig. 2, #9) to regulate the welding current shown on the display (Fig. 2, #8).
5) You can select the slope down time by pressing the Function button (Fig. 2, #13) until the display (Fig. 2, #8) blinks **SLo**. Use the encoder (Fig. 2, #9) to select the slope down time desired. The slope down regulation varies from 0.1 to 10 seconds. You can also turn off slope down by reducing the slope down regulation to a minimum. Simply turn the encoder until the display reads **OFF**.
6) Pressing the Function button (Fig. 2, #13) again activates the pulse frequency mode. The Pulse Function Indicator LED (Fig. 2, #12) will blink and the display will read **P Fr**. By turning the encoder (Fig. 2, #9), you can vary the frequency value from 0.4Hz to 999Hz. The factory set the base current at 25% of the welding current value. To exit out of the pulse frequency mode, hold down the Function button (Fig. 2, #13) for approximately 2 seconds until the flashing **P Fr** disappears.

Procedure for TIG Welding with LIFT Start

Start Welding:

1) Bring the tip of the electrode (tungsten) into contact with the work piece.
2) Lift the torch from the side so as to move slightly away from the work piece and start the welding process.

End Welding:

1) In TIG welding mode with the slope down function on, you can end your weld by regulating the distance between the arc and the work piece.
2) With the slope down function turned off, the you must pull the arc away from the work piece to end the welding process.

Fig. 3 below shows how you can lift the torch from the work piece to start the slope down process and end welding.

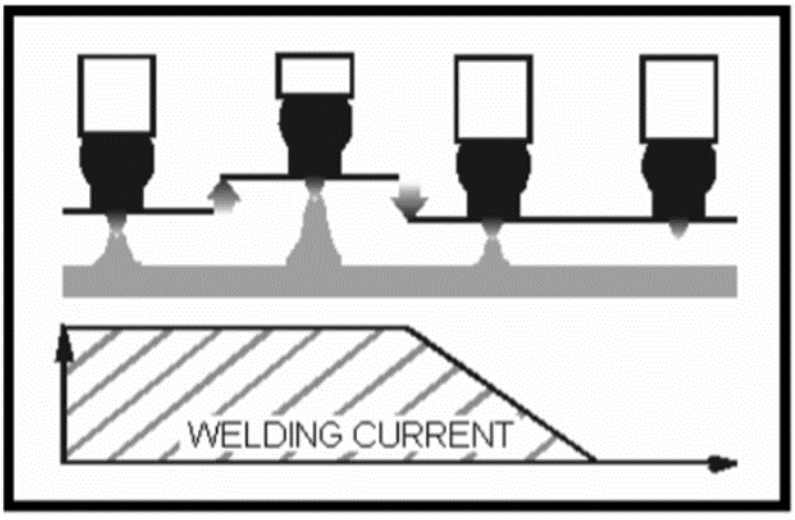

Fig. 3

Welding with a Remote Control (Foot Pedal or Hand Control)

When welding with a wired remote control, such as a foot pedal or hand control, you set the max amperage on the Inverarc 200 TLP using the encoder (Fig. 2, #9). When you connect the remote control via the remote control connection (Fig. 2, #15), the machine automatically recognizes the remote control. At this point, you can use the remote control to vary the amperage from 4 amps to the max amperage you previously set on the machine.

GENERAL INFORMATION ABOUT STICK WELDING

Whether welding, hard surfacing, or cutting, you can choose from a plethora of stick welding electrodes, in a multitude of material types, with even a variety of rods available in a single material type (for example, mild steel). Varieties include fast freeze rods, high elongation rods, high tensile strength rods, low tensile strength rods, easy slag removal rods, in-position rods, out-of-position rods, high deposition rate rods, etc. All of these rod types and varieties work on Direct Current (although, some may also work on Alternating Current).

If you purchase rods from name brand manufacturers, the box typically provides the specifications for the rod. For example, the specifications include the amperage range the rod is designed to run in. As previously stated, start welding in the middle of the provided amperage range. If you experience the rod sticking, increase the amperage until the arc runs smooth. On the other hand, if you experience a large amount of spatter, reduce the amperage until the arc runs smooth.

The specifications will also state the required polarity. If the specifications show DCEP (Direct Current Electrode Positive), the electrode holder and cable must be connected to the positive weld current terminal (Fig. 2, #14), and the ground clamp and cable assembly must be connected to the negative weld current terminal (Fig. 2, #1). This is commonly referred to as reverse polarity. If the specifications show DCEN (Direct Current Electrode Negative), the electrode holder and cable must be connected to the negative weld current terminal, and the ground cable and clamp assembly must be connected to the positive weld current terminal. This is commonly referred to as straight polarity.

Lastly, the specifications will often state the tensile strength, elongation, and which welding positions you can use the rod for. For example, the specifications will state All Position, All Position Except Vertical Down, Flat and Horizontal Only, and so on. In some cases, smaller diameters such as 3/32”, 1/8”, and 5/32” will be labeled All Position and bigger rods such as 3/16” and 1/4” will be labeled flat only—but this is not always the case. When in doubt about acceptable welding positions, simply check the rod box. The specifications chart on the box should tell you everything, or close to everything, you need to know about the rod.

Common Stick Welding Electrode Types & Descriptions

6010—Rod with a cellulosic coating, fast freeze puddle, deep penetration, slag can be hard to remove, less elongation of welds, not the most attractive welds, may present some hydrogen cracking. However, rod runs all position including vertical up and down. Also forgiving for some contamination of the parent metal. An excellent choice for root passes.

7018—Rod with a low hydrogen coating that flows nicely. Probably the most popular rod in today’s market. Builds a thick, easy to remove slag layer on top of the weld, medium penetration, excellent bead appearance, puddle stays wet and fluid much longer than 6010, higher tensile strength than 6010. Good choice for the maintenance welder and even to do x-ray quality structural welds.

6013—Rod with a cellulosic coating that runs on old and simple AC (alternating current) stick welders. Typically referred to as the farmer’s rod.

7014—Rod with properties similar to 7018, but also designed to run on older, simpler stick welders.

The rods listed above represent the most common types of rods available today. However, an almost endless selection of various stick rods exist. We simply cannot cover all rod types in the manual.

Since 7018 is probably the most popular welding rod available today, please find a few pointers below.

How to find the right amperage when you lose the box?

The general rule of thumb with 7018: For every 0.001" of welding rod diameter, you need about 1 amp

What does this mean?

Rod Diameter Fraction	Rod Diameter Decimal	Required Amperage
3/32"	0.09375" rounded to 0.094"	94 amps
1/8"	0.125"	125 amps
5/32"	0.15625" rounded to 0.156"	156 amps
3/16"	0.1875" rounded to 0.188"	188 amps

Fig. 4

Will these numbers be a perfect fit for every rod manufacturer and every position you will weld 7018 rod in? No, but the numbers get you really close.

Now Let's Talk Pulse

How does pulse work? How do I set up the Inverarc 200 TLP to pulse weld?

For manufacturing or critical code repairs, welding procedures are typically specified. These welding procedures spell out everything including, but not limited to, pre-heat of the part, alloy of the part, alloy of the filler rod, amperage setting, travel speed, bead size, multi-pass weld number of passes (if applicable), inter-pass temperature, post-heat, and so on. No variable stays undefined, and there is no room for creative freedom.

In the repair field, however, things look a little bit different. In Europe, procedures that spec pulse welding exist. The pulse welding process is relatively new in the U.S., so no written procedures that spec pulse welding currently exist. For example, a 1/8" 7018 rod typically has an operating range between 90-160 amps. But many people like to run them between 120 and 130 amps.

To pulse weld, the operator first sets the welding current, and then chooses a pulse frequency. The machine automatically sets the background current and a pulse on time of 50%. So what does that mean when you weld? Let's say, for example, you dialed the machine in to 130 amps. 50% of the time the arc is lit, the welding current is 130 amps. The other 50% of the time the arc is lit, the welding current is 65 amps. You may notice that 65 amps is outside of the manufacturer's recommended amperage range. While the background current is on, the amperage is high enough to maintain an arc but low enough to where there is no metal transfer happening.

The benefit of this is especially apparent at very low frequencies (1-1.5 Hz). The out of range background current allows the puddle to cool down and also allows the weld to partially solidify around the edges. This makes out-of-position gap bridging on poor fit up much easier than it is with a classic stick welder. You will

not sacrifice any penetration because during the 50% on time at 130 amps, the rod burns as hot and deep as it normally would on a classic stick welder at 130 amps.

This may prompt you to ask: If the amperage range of the rod is 80 or 90 to 160, why not set the welding current at 160 amps so the Inverarc sets the background current to 80 amps? The amperage ratings, essentially, would be well within the specs then. This is absolutely possible and a good setting. However, this setting is very hot and metal transfer occurs the entire time. This, paired with a 3-4 Hz pulse frequency makes for a very high travel speed in the horizontal or flat position. Plus, the heat input into the work piece is enormous.

Knowing what we know now, let's go back to the beginning and look more closely at the advantages of pulse welding.

Pulse welding includes ALL of the following advantages, but **not all at the same time**.

- Visually spatter free (MIG & TIG only, though still reduced spatter when stick welding)
- Higher travel speeds—*As just covered, with the right settings, the travel speed can be greatly increased.*
- Deeper penetration—*If you choose the same or similar settings to the ones for a higher travel speed, the overall heat input and penetration increases also.*
- Less heat input, which equals less material distortion—*More like the first example about setting the welding current to 130 amps.*
- Ability to weld thinner material than you could without pulse—*To achieve this, you would reduce the max amperage even more. For example, 110 amps or 120 amps with a 55 amp background current, which makes for an average heat input of (110 + 55)/2 = 82.5 amps. With this setting, you can weld materials with a 1/8" rod when you would normally need to weld with a 3/32" rod.*
- Superior control of the weld puddle, especially when welding out of position—*You have better control on lower pulse frequencies because the puddle has time to partially solidify.*
- Easily join materials of differing thicknesses—*More like the first example about setting the welding current to 130 amps.*
- Better gap bridging when welding materials with a poor fit up—*More like the first example about setting the welding current to 130 amps.*
- Ability to make leak-tight welds—*Spray arc or stick welding arc, in general, works better at making leak tight welds that short arc MIG, for example.*
- Improved bead appearance—*Pulse welds, especially lower frequency pulse welds (2 Hz or less) make really nice and defined ripples on the top of the weld bead; welds like this are generally thought to be aesthetically appealing.*
- Ability to use one size bigger welding rod than normal—*To achieve this, you would reduce the max amperage even more. For example, 110 amps or 120 amps with a 55 amp background current, which makes for an average heat input of (110 + 55)/2 = 82.5 amps. With this setting, you can weld materials with a 1/8" rod when you would normally need to weld with a 3/32" rod.*
- Weld on thinner material without burning through—*More like the first example about setting the welding current to 130 amps.*
- Easier for beginner welders—*The pulsed stick process is extremely forgiving.*