

SIMPLICITY

SERIES 9160



**UNITROL ELECTRONICS INC.
NORTHBROOK, ILLINOIS 60062
847-480-0115**

WARRANTY

Unitrol Electronics provides a 5-year limited warranty to cover all of this SIMPLICITY control. The warranty periods are determined using the date the control was shipped from Unitrol Electronics to the first customer. All warranty coverage is FOB Northbrook, Illinois.

This warranty, except for exclusions shown herein covers the following items:

DURING YEAR #1:

1. All parts (exclusive of fuses) that fail due to manufacturing defects.
2. Necessary labor to repair control that has failed due to manufacturing defects.

DURING YEAR #2:

1. 80% cost of all parts (exclusive of SCR, Circuit Breaker, fuses, pressure transducer, printer, infrared thermometer, and load cells.
2. 80% cost of necessary labor to repair control that has failed due to manufacturing defects.

DURING YEAR #3:

1. 60% cost of all parts (exclusive of SCR, Circuit Breaker, fuses, pressure transducer, printer, infrared thermometer, and load cells.
2. 60% cost of necessary labor to repair control that has failed due to manufacturing defects.

DURING YEAR #4:

1. 40% cost of all parts (exclusive of SCR, Circuit Breaker, fuses, pressure transducer, printer, infrared thermometer, and load cells.
2. 40% cost of necessary labor to repair control that has failed due to manufacturing defects.

DURING YEAR #5:

1. 20% cost of all parts (exclusive of SCR, Circuit Breaker, fuses, pressure transducer, printer, infrared thermometer, and load cells.
2. 20% cost of necessary labor to repair control that has failed due to manufacturing defects.

EXCLUSIONS TO WARRANTY

1. Any expense involved with repair of control by other than Unitrol Electronics personnel that has not been authorized in advance and in writing by an officer of Unitrol Electronics.
2. All costs for freight, to and from Unitrol Electronics, are excluded from this warranty
3. All field service labor, travel expense, and field living expenses associated with field service are excluded from this warranty.
4. No coverage, parts or labor, is offered for components that have failed on control **not** being used as specified in Unitrol Electronics published literature, technical sheets, and this direction book.
5. No warranty coverage will be made on controls that are being used contrary to specifications, that are sized incorrectly compared to the published Unitrol Electronics sizing charts on current Unitrol Electronics price lists, that were mechanically or electronically altered by customer, or that were physically damaged after shipment from Unitrol Electronics.
6. Damages to a control by lightning, flood, or mechanical damage are excluded from this warranty.
7. Unitrol Electronics assumes no liability for damage to other equipment or injury to personnel due to a failure in the Unitrol Electronics control.
8. Unitrol Electronics shall not be responsible for any consequential damages of whatever kind.
9. Any expense involving alteration or installation of a Unitrol Electronics control where the control was manufactured to the specifications of the customer, or where a control is altered by the customer prior, during, or after installation will be covered under this warranty.

NO OTHER UNITROL ELECTRONICS INC. WARRANTY, WRITTEN OR IMPLIED, COVERS THIS CONTROL UNLESS IN WRITING AND SIGNED BY AN OFFICER OF UNITROL ELECTRONICS, INC. PRIOR TO SHIPMENT OF PRODUCT.

Address all warranty questions to:

Unitrol Electronics, Inc.
702 Landwehr Road
Phone: 847-480-0115
FAX: 847-480-0932
techsupport@unitrol-electronics.com

UNITROL ELECTRONICS SIMPLICITY CONTROL

For series 9160D, 9160M, 9160L

SCOPE: This microcomputer control system uses the latest in microelectronics to create an almost unlimited choice of operation. The simplicity in design means years of trouble free operation. The control comes in four cabinet styles:

This **SIMPLICITY** welding control is designed and produced in the USA.

FINAL INSPECTION BY: _____

MODEL NUMBER:

SYSTEM SERIAL NUMBER:

DATE OF MANUFACTURE:

SOFTWARE VERSION: SA

PRINTED CIRCUIT BOARD SERIAL NUMBER: SYM0609537

PRINTED CIRCUIT BOARD VERSION: 9160M-2

OPTIONS IN SYSTEM IF CHECKED BELOW

√

9161-01 UPSLOPE

9161-02 DOWNSLOPE

9161-03 PULSATION

9161-05 DUAL TIME / DUAL HEAT

9161-06 DUAL TIME/DUAL HEAT

9161-07 SEAM WELD

9161-11 QUENCH & TEMPER

9181-01 FOOT PEDAL WITH CABLE

9161-34 SOFT TOUCH

UNITROL ELECTRONICS INC

702 LANDWEHR ROAD

NORTHBROOK, IL

847-480-0114

techsupport@unitrol-electronics.com

SIMPLICITY WELDING CONTROL 9160M, 9160D, 9160L

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INSTALLATION

SIMPLICITY WELDING CONTROL

9160M, 9160D, 9160L

INSTALLATION

1. Carefully unpack system and inspect for damage. Report any problems to the factory at once. If damage is obvious from outside of carton, report to carrier immediately.
2. Select location for cabinet being sure that the control face is clear of the worst anticipated location of parts to be welded and is not in the direct path of weld flash. It is usually an advantage to locate this cabinet as close to eye level as possible for easy use and servicing.
3. Install the SIDE MOUNT BRACKET set provided with this control by removing screws holding side panel to that side of the control and install the mounting brackets using the same screws through the side panel. Note that the center screws to the cabinet are not used with this bracket.
4. Drill welder to match the four mounting holes in the bracket. Install cabinet.
5. If installing a 9160M cabinet on a tabletop or on top of the welder and permanent location is desired, carefully drill holes in center of each boss on bottom of cabinet.
6. Drill or punch power cable hole either through the back, side or bottom of the cabinet. Drill or punch a second hole to handle the return cable to the welder transformer

CAUTION: IT IS IMPORTANT THAT NO METAL CHIPS ENTER ANY OF THE ELECTRONIC COMPONENTS IN THE CABINET! PROTECT CIRCUIT BOARDS AND SCR CONTACTOR DURING DRILLING AND INSTALLATION OPERATIONS. WHEN COMPLETE, REMOVE ALL CHIPS FROM THIS CABINET BEFORE APPLYING POWER.

Note: During wiring, remove four outer screws on the control's front panel and rotate the white faceplate forward for easy wiring. This panel has a built-in bracket to hold the circuit board in a horizontal position.

7. Drill or punch an access hole to handle the foot pedal or palm buttons at a convenient location in the cabinet. **OBSERVE THE CAUTIONS IN THE STEP ABOVE.** After cleaning interior of all chips, install liquid tight or rigid conduit at all locations.
8. Connect heavy power wires as shown in the WIRING HOOK-UP DIAGRAM on page 4 of this book. Be sure that an 18ga wire from L2 of the incoming power is connected to the terminal marked L2 on the bottom of the enclosure. Check that all connections are cleaned prior to insertion, and that all connectors are fully tightened. Loose connections will cause heating problems in the control, and eventually create intermittent welds.

SIMPLICITY WELDING CONTROL

9160M, 9160D, 9160L

INSTALLATION

9. CONNECTING INITIATION SWITCHES

Connect foot pedal, palm buttons, or machine contacts per WIRING HOOK-UP DIAGRAM page

4. Note that this system will support:

One or two single or double level foot switches

Or

Two double palm switches for anti-tiedown operation

NOTE 1: Use double level foot switch initiation for welders where the operator **cannot** place fingers or other body parts between the opened electrodes (typically less than 1/4" opening between electrodes).

NOTE 2: If using double palm switch anti-tiedown initiation, both switches **must** have two normally open switch contacts. These have to be wired as shown for anti-tiedown. **If any other wiring is done, the control will not function in the anti-tiedown mode and will not be safe to use for applications where space between the electrodes is large enough to allow operator's finger to enter this area.**

If two normally open switch contacts are not available, use a Unitrol Electronics #9161-56 ANTI-TIEDOWN INTERFACE board. This interface board can be used for either dry contact switches or solid-state switches.

10. If limit switch, pressure switch, and/or transformer thermostat is used, connect per WIRING HOOKUP DIAGRAM. If any of these are not being used, install jumpers as shown (usually supplied factory installed).

NOTE: The transformer overtemperature terminals (#1 - #4) allow for either normally open or normally closed contact configurations. If the thermostat contacts **OPEN** on TEMPERATURE RISE (typical), connect thermostat wires to points #3 and #4. If the thermostat contacts **CLOSE** on TEMPERATURE RISE (unusual), connect thermostat wires to terminals #1 and #2

11. If system uses a water-cooled SCR contactor, connect water hoses to 1/4" NPT fittings at the front or rear of the cabinet. In/out direction of water is not important unless the system has been supplied with the #9181-28 water flow switch.

CAUTION: BE SURE PIPE FITTINGS THAT THREAD INTO THE ALUMINUM HEAT SINK PLATE ARE NON-METALLIC (PVC, NYLON, ETC.). DO NOT INSTALL BRASS, GALVANIZED, OR ANY OTHER METALLIC PIPE FITTINGS DIRECTLY INTO THE ALUMINUM HEAT SINK. OVER TIME, METALLIC FITTINGS TOUCHING THE ALUMINUM WILL CAUSE A HOLE TO FORM AT THE END OF THE THREADED HOLE AND WATER WILL FLOOD THE INSIDE OF THE CABINET.

SIMPLICITY WELDING CONTROL

9160M, 9160D, 9160L

INSTALLATION

12. Secure all wires inside power supply cabinet and check to be sure that connections are made correctly and that no loose strands of wire are at any terminal point.
13. Locate wire at lower right of circuit board marked COM., and connect to voltage terminal that most closely matches your supply.
14. Take a moment to try pulling all connected wires back from their terminal connections. Be sure that all connections are secure. If in doubt, unscrew the terminal, reinsert the wire, and tighten again. This can save much frustration later when the control is in use and becomes intermittent due to a loose connection. **Trust us on this!**

WARNING: SINCE HIGH VOLTAGE IS PRESENT, EXTREME CAUTION SHOULD BE TAKEN AT ALL TIMES POWER IS ON INSIDE CONTROL AND CABINET DOOR IS OPEN!

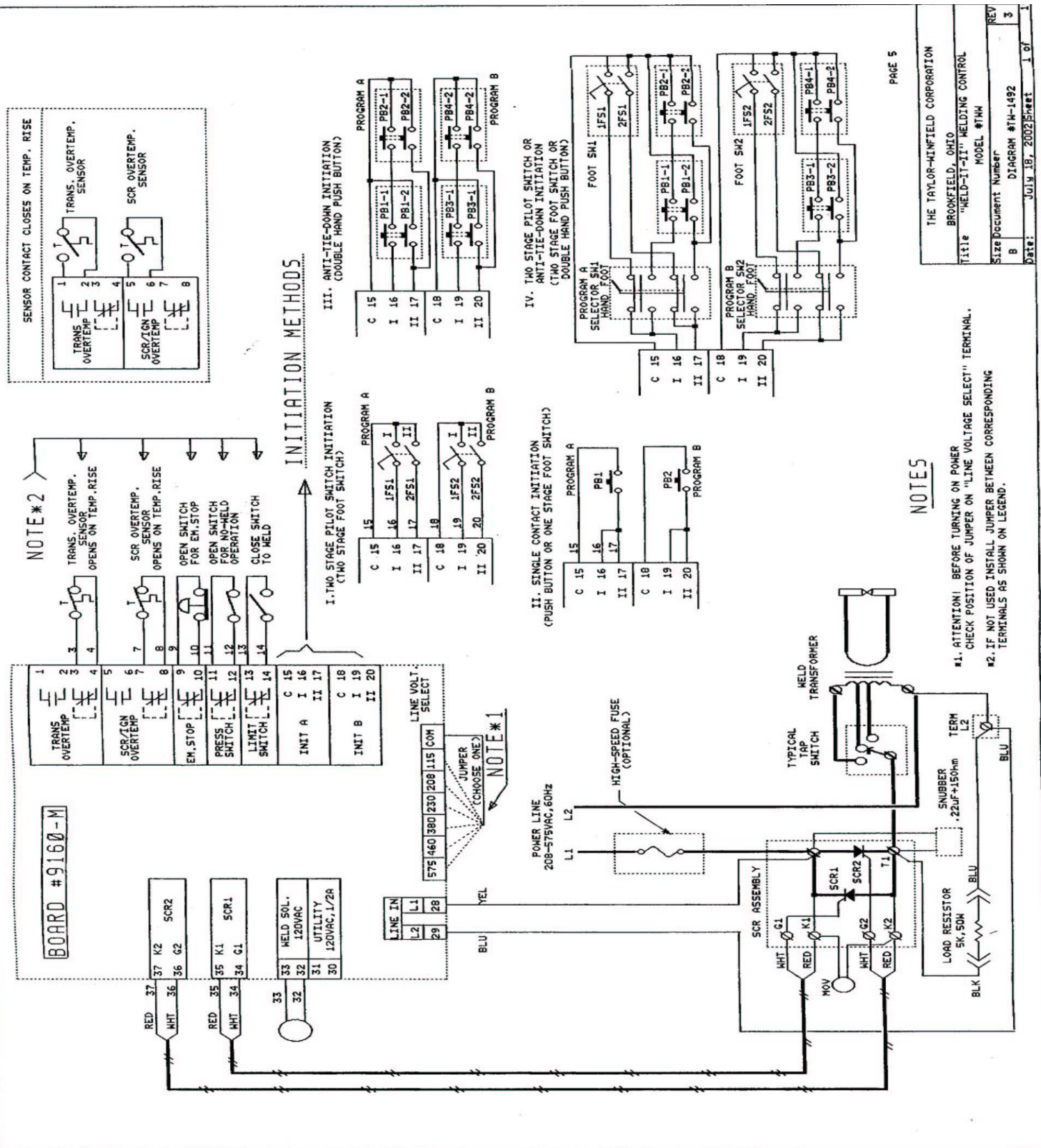
15. **LINE FREQUENCY SETTING:** This SIMPLICITY control can operate on 50Hz or 60Hz power. Unless specified in the order for this control, it has been set to 60Hz. **Before operating, check the slide switch located on the upper left corner of the circuit board. Be sure that it is in the position that matches your line frequency. 60Hz is standard for the U.S., Canada, Mexico, and most of South America. 50Hz is standard for most European, Asian, and Middle East countries.**
16. Turn power on and check that the green Power LED indicator on the front of the control is on. If not, check to be sure incoming power is on by carefully testing voltage across the two power lines.
17. System should now be ready for operation.

Contact the Unitrol Electronics service department at 847-480-0114 or Email us at techsupport@unitrol-electronics.com if installation assistance is needed.

SIMPLICITY WELDING CONTROL

9160M, 9160D, 9160L

INSTALLATION



SIMPLICITY WELDING CONTROL

9160M, 9160D, 9160L

DIRECTIONS FOR USE

DOUBLE HAND PUSHBUTTON ANTI-TIEDOWN INITIATION

USING SINGLE POLE SWITCHES.

REQUIRES OPTIONAL BOARD #9280-AT01.

WARNING!

LIKE MOST SOLID-STATE DEVICES NON-MECHANICAL TOUCH BUTTONS ARE AS EQUALLY LIKELY TO FAIL IN THE CONDUCTING ("ON") STATE AS IN THE NON-CONDUCTING ("OFF") STATE. IF NON-MECHANICAL TOUCH BUTTONS ARE USED TO INITIATE (OR WELDER WHERE A FALSE OPERATION COULD BE DANGEROUS, POINT-TO-OPERATION GUARDING DEVICES OR RELATED SAFETY CONTROLS MUST BE INSTALLED AND MAINTAINED TO MEET ALL APPROPRIATE OSHA AND ANSI B11 MACHINE SAFETY STANDARDS.

SIMPLICITY

BOARD #9160-M

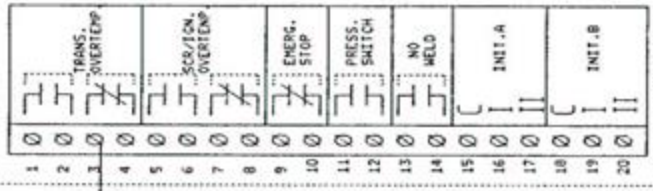
TEST POINTS
GND

TP10 DP2

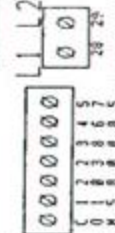
TP30 DP4

TP50 DP6

TP70 DP8



K2	37
SCR2	36
K1	35
SCR1	34
SN	33
WELD	32
UTILITY	31
120VAC	30
1/2IN	



APPROVED:

* SOLDER WIRE "GND" TO TEST POINT "GND"

THE TAYLOR-WINFIELD CORPORATION
BROOKFIELD, OH

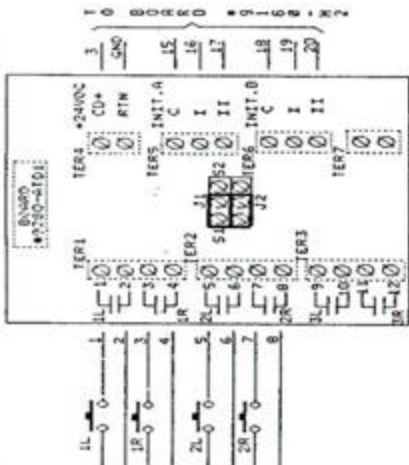
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ANTI-TIEDOWN INITIATION

Size: Document Number
8 #10-1537-INT2-2
REV 3

Date: 05/04/87 23, 2003 Sheet 1 of 1

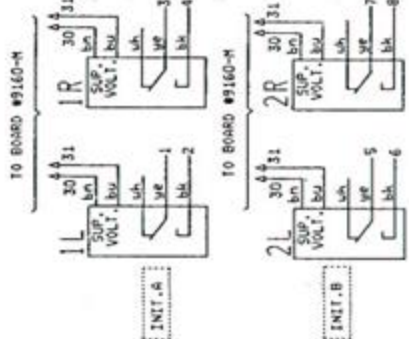
MECHANICAL PUSHBUTTONS

TYPE OF
PUSHBUTTONS
1L, 1R & 2L, 2R:
MECHANICAL
MOMENTARY ACTION,
N. O. CONTACT.

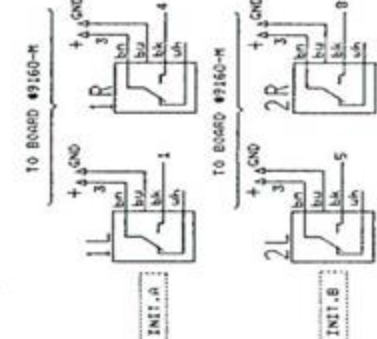


NON-MECHANICAL TOUCH BUTTONS

TYPE OF
TOUCH BUTTONS
1L, 1R & 2L, 2R:
"OPTO-TOUCH"
PHOTOELECTRIC SWITCHES
WITH ELECTROMECHANICAL
RELAY OUTPUT (N.O.),
MOMENTARY ACTION,
("BANNER" Mod. 07B5
OR EQUIVALENT)
Supply Voltage 120VAC.



TYPE OF
TOUCH BUTTONS
1L, 1R & 2L, 2R:
"OPTO-TOUCH"
PHOTOELECTRIC SWITCHES
WITH SOLID STATE OUTPUT
PNP (SOURCING),
MOMENTARY ACTION,
("BANNER" Mod. 01V8
OR EQUIVALENT)
Supply Voltage 10-30VDC.



SIMPLICITY WELDING CONTROL

9160M, 9160D, 9160L

DIRECTIONS FOR USE

FOR USE WITH **SEAM WELD** CONTROLS (option #9161-07), skip to page 8.

TO TRY **SPOT WELD** CONTROL FOR THE FIRST TIME:

1. Turn power ON. The green **POWER** LED on the control front should be on.
2. Rotate the mode selector knob to **NO WELD**, and set the thumbwheels as follows:

SQUEEZE = 30 cycles

WELD TIME = 10 cycles

WELD PERCENT = 45

HOLD TIME = 03 cycles

REPEAT OFF TIME = 00 cycles

UPSLOPE, DOWN SLOPE, IMPULSATION (options) =

NOTE: All timing functions in this control are in CYCLES.

For a 60Hz power line, 1 cycle = 1/60th second (16.666 ms).

For a 50Hz power line, 1 cycle = 1/50th second (20 ms)

3. Set air pressure so that the tip force is great enough for this schedule.
On welders smaller than 30 **KVA**, a tip force of 400 pounds is usually satisfactory. On welders 30 to 100 **KVA**, a force of 700 pounds is a reasonable setting for the first test firing.
4. Turn cooling water on (if any).
5. Initiate control to first foot switch level.
6. The yellow **SOLENOID** LED should glow, and the welder head should advance to close the copper tips. If a single initiation switch is being used, skip this step.

NOTE 1: If you are using **double palm button anti-tiedown initiation**, both switches must be closed **within ½ second** for the system to operate. At that time, the yellow **SOLENOID** LED will glow, and the control will go through the full weld sequence.

NOTE 2: If only **one** of the palm switches is closed without the other, **no** solenoid closure will occur and the welder will **not** go through the full weld sequence. This palm switch must be opened and then re-closed with the second palm switch (within ½ second) for the system to operate.

SIMPLICITY WELDING CONTROL

9160M, 9160D, 9160L

DIRECTIONS FOR USE

7. Press the foot switch further to the second level. After approximately 3/4 second, the yellow **SOLENOID** LED should go off and the welding tips will open. No welding will occur.

8. **CAUTION: BEFORE PROCEEDING, BE SURE THAT**
9. **PROTECTION, SUCH AS SAFETY GLASSES AND PROPER**
CLOTHING, ARE BEING WORN BY ALL PERSONNEL IN THE
WELDING AREA

- a. If single level initiation or double palm switch anti-tiedown initiation is being used, a short transformer hum should be heard. Skip to step 11.
10. Press the foot switch further until a short transformer hum is heard.
11. Tips should now release automatically even though the foot switch is still being pressed.
12. If all operates correctly, set control to desired welding schedule.
13. Test system on metal. If any of the above steps do not function properly, turn system off and carefully check all connections prior to contacting factory. Our service department will be happy to assist you on the phone should you experience difficulties. The number is 847-480-0114.

HALF CYCLE TIMING OPERATION

The SIMPLICITY II control is capable of operation in either **FULL CYCLE** or **HALF CYCLE** timing. **Setting the slide switch on the back of the circuit board to FULL CYCLE or HALF CYCLE makes this selection.**

In **FULL CYCLE** timing, each number selected on the WELD TIME thumb-wheels represents a full line cycle (or 1/60th of a second for 60Hz power, and 1/50th second for 50Hz power). **FULL CYCLE** timing is the normal position for typical welding and **SEAM WELDING** (9161-07 option).

In **HALF CYCLE** timing, each number selected on the WELD TIME thumb-wheels represents 1/2 line cycle. **BI-POLAR OPERATION:** Each time a weld is made the control will start in a polarity opposite of the last 1/2 cycle of the previous weld.

HALF CYCLE timing is normally used for joining of the very small parts that require only 1/2 cycle of weld. **HALF CYCLE** timing can also be used for critical welding where, for example, 9 cycles is too long and 8 cycles is too short. By putting the control into **HALF CYCLE** timing, a choice of 17 (17 **half** cycles) will allow the control to operate between these two settings. This increases the precision of the timing system by a factor of 2.

SIMPLICITY WELDING CONTROL

9160M, 9160D, 9160L

DIRECTIONS FOR USE

OPERATING MODES

SINGLE MODE

This mode runs the welder through the complete weld cycle and then releases the welding solenoid (opens tips) even though the foot pedal (or initiation switch) is still closed. To make another weld, release the initiation switch and close again. This **ANTI-REPEAT** feature assures full operator control and the maximum speed of welder operation.

REPEAT MODE

This mode operates as above, except that after the tips are released, if the initiation switch is still closed, a time will elapse as chosen on the **REPEAT OFF TIME** thumbwheels, then the tips will close and welding sequence starting from SQUEEZE TIME will repeat. This function will continue until the initiation switch has been opened. At that time, the system will complete the current weld sequence and then open the electrodes. Note that this **REPEAT OFF TIME** is in line cycles.

Use of the **REPEAT** mode allows “automatic” operation of the welder without the need to open and close the initiation switch.

TO USE REPEAT set the desired dwell time between welds on the **REPEAT OFF TIME** thumbwheels and rotate the mode switch to **REPEAT**.

SIMPLICITY WELDING CONTROL

9160M, 9160D, 9160L

DIRECTIONS FOR USE

OPTIONS

UPSLOPE #9161-01

This function provides a controlled initial ramp of heat in each weld. Upslope is useful in various types of welding.

For joining of **galvanized** or other coated steels, UPSLOPE allows a controlled liquefying of the coating at the start prior to the final weld heat. In this way, the actual weld is done on virtually uncoated areas to eliminate expulsion of the coating and minimize coating of the electrodes. A recommended weld schedule is provided at the end of this book to illustrate this function.

Another application of UPSLOPE is in welding of parts that have **projections** such as weld nuts and component with stamped projections. In this application, a few cycles of UPSLOPE will allow the projections (especially multiple) to forge into the mating part in a controlled manner without excessive expulsion.

DOWNSLOPE #9161-02

This function provides a controlled lowering of the heat **after** the end of the last **WELD** cycle. It is useful in welding of materials that are subject to stress cracks when cooled rapidly such as **aluminum**. Typically the use of DOWNSLOPE cycles about ½ the number of **WELD** cycles and going to a **FINAL % HEAT** of about ½ the **WELD HEAT** works well.

PULSATION #9161-03

This option repeats the **WELD** sequence the number of times chosen by the QTY. thumbwheels (0-9) with a non welding time between the pulses as determined by the OFF thumbwheels (0-9 cycles). This function is useful in welding **near the edge of a part** as well as an alternate method of welding **galvanized** steel.

UPSLOPE/DOWNSLOPE #9161-05

This option combines the operations of **UPSLOPE (#9161-01)** and **DOWNSLOPE (#9161-02)**.

SIMPLICITY WELDING CONTROL

9160M, 9160D, 9160L

DIRECTIONS FOR USE

DUAL HEAT/DUAL COUNT #9161-06

This option allows the use of two independent time and heat settings to be used on the welder. The option includes a **4** thumbwheel set for **WELD 2 TIME** and **WELD 2 PERCENT**. To use this set of thumbwheels on a weld, it is necessary to have a second initiation switch (foot, hand, or machine contact) connected to the control. This switch is connected as shown on the HOOK-UP diagram. The SQUEEZE TIME, HOLD TIME, and REPEAT TIME on the upper row of thumbwheels will be used for this WELD 2 sequence. To weld with the WELD 2 time and heat, close a switch connected to the PROGRAM B terminals.

SEAM WELD OPTION #9161-07

This optional function will supply either continuous or intermittent weld heat for use on seam welding. This control does not operate the seam wheel. The seam wheel can be turning continuously, or the 115V coil of a relay can be wired in parallel to the solenoid valve output and contacts of the relay used to operate a seam motor

This optional function will supply either continuous or intermittent weld heat for use on seam welding.

CONTINUOUS SEAM WELD HEAT: With the **COOL TIME** set to **00**, the control will weld with continuous heat (no **COOL TIME** between weld pulses) after going through **SQUEEZE TIME** or **WELD CURRENT DELAY** time. While during continuous seam heat welding the computer does **not** respond to the **WELD TIME** thumbwheel settings, it will not weld with **WELD TIME** set to **0**. As a matter of practice, set the **WELD TIME** thumbwheels to **01**. The sequence of operation after the second level initiation switch has been closed is:

1. Turn Solenoid Valve power on and go through **WELD CURRENT DELAY** time
2. Go through **UPSLOPE** (if option #9161-01 is in system)
3. Start weld cycles and continue until initiation is opened (see INITIATION options below)
4. Go through **DOWNSLOPE** (IF #9161-02 option is in system)
5. Go through **HOLD TIME**
6. Release solenoid valve power

INTERMITTENT SEAM WELD HEAT: With the **COOL TIME** set to a number **higher** than **00**, the control will operate as follows after the second level initiation switch has been closed:

1. Turn Solenoid Valve power on and go through **SQUEEZE TIME** or
2. **WELD CURRENT DELAY** time
3. Go through **UPSLOPE** (if option #9161-01 is in system)

SIMPLICITY WELDING CONTROL

9160M, 9160D, 9160L

DIRECTIONS FOR USE

4. Conduct the chosen number of **WELD TIME** cycles
5. Stop current flow for the selected number of **COOL TIME** cycles
6. Continue to sequence between 4 and 5 until initiation is opened (see INITIATION options below)
7. Go through **DOWNSLOPE** (if #9161-02 option is in system)
8. Go through **HOLD TIME**
9. Release solenoid valve power

INITIATION OPTIONS FOR SEAM WELD

SINGLE SEAM MODE

With the mode switch set to **SINGLE**, the control operates the welding transformer for as long as the initiation switch remains closed. Once the pedal (or initiation switch) has been released, the control finishes the last weld cycle, (and DOWNSLOPE if in system) then **HOLD TIME** and release the solenoid line.

REPEAT SEAM MODE

This mode of operation is useful when making seams on a very long part.

With the mode switch set to **REPEAT / RUN**, the control will

- A. Start the welding operation when the second level initiation has been closed.
- B. After weld heat starts, **release** the initiation switch, and the seam operation will continue.
- C. At the end of the seam close the initiation switch **again**. The welding operation will finish the last weld cycle, (and **DOWNSLOPE** if in system) then **HOLD TIME**, and then release the solenoid valve.

SIMPLICITY WELDING CONTROL

9160M, 9160D, 9160L

DIRECTIONS FOR USE

TO TRY THE SEAM WELD SYSTEM FOR THE FIRST TIME:

CAUTION: BEFORE PROCEEDING, BE SURE THAT PROTECTION, SUCH AS SAFETY GLASSES AND PROPER CLOTHING, ARE BEING WORN BY ALL PERSONNEL IN THE WELDING AREA

1. Turn power ON. The green **POWER** LED on the control front should be **ON**.
2. Set the control mode switch to **NO WELD** and the other controls as follows (note: switch on back of control board should be set to FULL CYCLE).
SQUEEZE = **25** cycles
WELD TIME = **02** cycles
WELD PERCENT = **65%**
HOLD TIME = **10** cycles
If options are installed on this control, set all other thumbwheels to 00
3. Set air pressure so that the tip force is great enough for this schedule. On welders smaller than 30 **KVA**, a tip force of 400 pounds is usually satisfactory. On welders 30 to 100 **KVA**, a force of 700 pounds is a reasonable setting.
4. Turn cooling water on (if any). Initiate control to the first foot switch level. The yellow **SOLENOID** LED should glow, and the welder head should advance to close the copper wheels. If a single initiation switch is being used, skip this step. At this same time, the seam motor should be rotating.
5. Press the foot switch further to the second level. The yellow **SOLENOID** LED should stay on until the imitation switch has been opened.
6. Set the mode knob to **SINGLE**.
7. With metal between the electrode wheels, press the foot switch to the first level. Wheels should close as the yellow **SOLENOID** LED glows, and the seam weld motor should be running (part moving).
8. Press the foot switch to the second level and welding heat should flow in smooth pulses.
9. Release the foot switch and the control should complete the last weld sequence, go through a short HOLD time and then open the wheels.

SIMPLICITY WELDING CONTROL

9160M, 9160D, 9160L

DIRECTIONS FOR USE

10. If all operates correctly, reset control to the desired welding schedule and test system on metal. If any of the above steps do not function properly, turn system off and carefully check all connections prior to contacting factory. Our service department will be happy to assist you on the phone should you experience difficulties. The number is 847-480-0114.

QUENCH & TEMPER OPTION #9161-11

This option adds the ability to stop heating after the weld has been completed for a selected time (QUENCH TIME), and then reheat the weld nugget at a low heat level (TEMPER TIME, TEMPER HEAT %). This function is used to anneal the weld zone nugget and increase ductility when welding high carbon content metal.

SERVICE

Note that all pilot lights mentioned below (green, yellow, and red) are located on the face of the control panel.

TROUBLE SHOOTING CHART

PROBLEM	[Grab your reader's attention with a great quote from the document or use this space to emphasize a key point. To place this text box anywhere on the page, just drag it.] PROBABLE REASON
No lights on front of the control. No operation of any kind.	1. No incoming power at terminals 28 and 29 2. Fuses F1 or F2 are blown. Check voltage selection jumper for correct position to match incoming voltage. 3. Circuit breaker or high-speed fuse open. On circuit breaker, check to be sure setting of rotary knob is correct per installation directions.
Green light is ON at the front of the control. Yellow light does not come on when the initiation switch is closed, and welding tips do not close.	1. EMERGENCY STOP switch connected to terminals 9 & 10 is open. If no ES switch is installed, be sure that a jumper is installed between terminals 9 & 10. 2. No initiation signal at terminals 15 & 16. Test by touching one wire of a wire jumper to 15 and other to 16. If the yellow light comes on and the solenoid valve closes, welder's initiation switch is not operating correctly. 3. TRANSF. OVERTEMP THERMOSTAT (if used) at terminals 3 and 4, or SCR OVERTEMP input to control is open. Check by temporarily jumping these two input terminal sets. If jumping 7 and 8 allows the control to operate, check and replace defective SCR OVERTEMP switch mounted on SCR contactor
Welding head goes down and stays down when control is initiated, but no welding occurs. Welding head releases when initiation switch is opened.	1. No LEVEL-2 initiation is put into terminal 20. Check foot or hand switches. 2. PRESSURE SWITCH connected to terminals 11 & 12 is open, or jumper missing between these terminals.

TROUBLE SHOOTING CHART (continued)

PROBLEM	PROBABLE REASON
Welding head goes down when control is initiated, but immediately goes up and no welding occurs even though the initiation switch remains closed.	1. Welding transformer primary windings are open. Check for bad transformer tap switch, open transformer winding, or disconnected wire at input to transformer. 2. SCR contactor is shorted. Turn power off, unwire wiring going to one large terminal on the SCR contactor, and check to see if there is a short between the two large terminals on the SCR contactor.
Welding head goes down when control is initiated, goes through SQUEEZE, WELD, & HOLD time, but red WELD light on panel does not come on and no weld occurs.	1. Selector switch in NO WELD position. Put in SINGLE or REPEAT position. 2. Check chips U8, Q1, and relay K2 3. Bad 3-position SINGLE – NO WELD – REPEAT switch.
Welding head goes down when control is initiated, goes through SQUEEZE TIME, WELD, & HOLD, red light comes on briefly, but no weld occurs.	1. Blown SCR gate fuses F3 or F4 2. Bad connection on welder secondary, dirt between electrodes, electrodes not touching metal under force 3. Bad SCR contactor (unlikely)

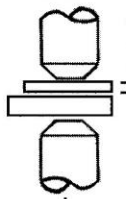
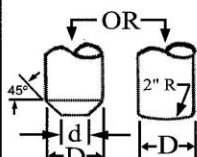
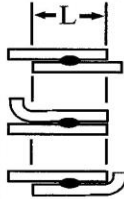
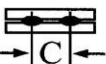
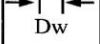
WELDING SCHEDULES

SIMPLICITY CONTROL

9160M, 9160D, 9160L

WELDING SCHEDULES

RECOMMENDED PRACTICES FOR SINGLE-PULSE SPOT WELDS IN LOW CARBON STEEL

Thickness of Thinnest Outside Piece		Electrode Major Diameter and Shape		Net Electrode Force	Weld Time (Single pulse)	Welding Current*	Minimum Contacting Overlap	Minimum Weld Spacing	Diameter of Fused Zone	Minimum Tensile-Shear Strength
										
MEG GAUGE	THICKNESS Inch (mm)	D. MIN. Inch	d. MAX. Inch	POUNDS	CYCLES (60 HZ)	AMPERES (approx.)	INCH	INCH	INCH (approx.)	POUNDS
32	.010 (0.25)	1/2	1/8	200	4	4,000	3/8	1/4	.13	235
25	.021 (0.53)	1/2	3/16	300	6	6,100	7/16	3/8	.17	530
22	.030 (0.76)	1/2	1/4	400	8	8,000	7/16	1/2	.21	980
20	.036 (0.91)	1/2	1/4	500	10	9,200	1/2	3/4	.23	1,350
18	.048 (1.22)	1/2	1/4	650	12	10,300	9/16	7/8	.25	1,820
16	.060 (1.52)	5/8	5/16	800	14	11,600	5/8	1-1/16	.27	2,350
14	.075 (1.91)	5/8	5/16	1,100	21	13,300	11/16	1-3/8	.31	3,225
13	.090 (2.29)	5/8	3/8	1,300	25	14,700	3/4	1-5/8	.34	4,100
12	.105 (2.67)	5/8	3/8	1,600	29	16,100	13/16	1-13/16	.37	5,300
11	.120 (3.05)	5/8	7/16	1,800	30	17,500	7/8	2	.40	6,900

* Starting values shown are based on industry experience. Adjust these values as needed to reach required weld quality.

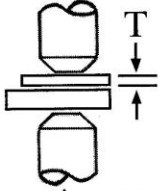
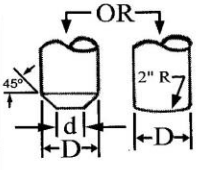
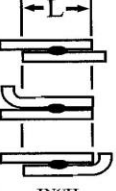
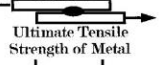
- Type of steel: **SAE 1008-1010**
- Table is for a 3:1 maximum ratio of thickest to thinnest piece, and a maximum stackup thickness of 4"T"
- Material should be free from scale oxides, paint, grease, and heavy oil
- Electrode material: **RWMA CLASS 2**

SIMPLICITY CONTROL

9160M, 9160D, 9160L

WELDING SCHEDULES

RECOMMENDED PRACTICES FOR SINGLE-PULSE SPOT WELDS IN STAINLESS STEEL

Thickness of Thinnest Outside Piece		Electrode Major Diameter and Shape		Net Electrode Force	Weld Time (Single pulse)	Welding Current*		Minimum Contacting Overlap	Minimum Weld Spacing ¹	Diameter of Fused Zone	Minimum Tensile-Shear Strength		
						FOR MATERIAL WITH TENSILE STRENGTH							
MFG. GAUGE	THICKNESS Inch (mm)	D. MIN. Inch	d. MAX. Inch	POUNDS	CYCLES (60 HZ)	Below (150 kpsi) AMPS (approx.)	Above (150 kpsi) AMPS (approx.)	INCH	INCH	INCH (approx.)	From 70 to 90 kpsi LBS	From 90 to 150 kpsi LBS	150 kpsi & up LBS
38 34	.006 (0.15) .008 (0.20)	3/16 3/16	3/32 3/32	180 200	2 3	2,000 2,000	2,000 2,000	3/16 3/16	3/16 3/16	.045 .055	60 100	70 130	85 145
33 30	.009 (0.23) .012 (.030)	3/16 1/2	1/8 1/8	230 260	3 3	2,000 2,100	2,000 2,000	3/16 1/4	3/16 1/4	.065 .076	150 185	170 210	210 250
29 28	.013 (0.33) .015 (0.39)	1/2 1/2	1/8 1/8	300 330	4 4	2,500 3,000	2,200 2,500	1/4 1/4	1/4 5/16	.082 .088	240 280	250 300	320 380
26 25	.018 (0.46) .021 (0.53)	1/2 1/2	1/8 5/32	380 400	4 4	3,500 4,000	2,800 3,200	1/4 5/16	5/16 5/16	.093 .100	320 370	360 470	470 500
24 22	.024 (0.60) .030 (0.76)	1/2 1/2	5/32 3/16	520 650	5 5	5,000 6,000	4,100 4,800	3/8 3/8	7/16 1/2	.120 .130	500 680	600 800	680 930
21 20	.033 (0.84) .036 (0.91)	1/2 1/2	3/16 3/16	750 900	6 6	7,000 7,800	5,500 6,300	7/16 7/16	9/16 5/8	.150 .160	800 1,000	920 1,270	1,100 1,400
19 18	.042 (1.07) .048 (1.22)	1/2 1/2	3/16 1/4	1,000 1,200	8 8	8,700 9,500	7,000 7,500	7/16 1/2	11/16 3/4	.180 .190	1,200 1,450	1,450 1,700	1,700 2,000
17 16	.054 (1.37) .060 (1.52)	1/2 1/2	1/4 1/4	1,350 1,500	10 10	10,300 11,000	8,300 9,000	9/16 5/8	7/8 1	.210 .220	1,700 1,950	2,000 2,400	2,450 2,900
15 14	.067 (1.70) .075 (1.91)	5/8 5/8	1/4 5/16	1,700 1,900	12 14	12,300 14,000	10,000 11,000	5/8 11/16	1-1/8 1-1/4	.250 .275	2,400 2,700	2,800 3,400	3,550 4,000
13 12	.090 (2.29) .105 (2.67)	5/8 3/4	5/16 3/8	2,400 2,800	16 18	15,700 17,700	12,700 14,000	3/4 13/16	1-3/8 1-1/2	.285 .290	3,550 4,200	4,200 5,000	5,300 6,400
11	.120 (3.05)	3/4	3/8	3,300	20	18,000	15,500	7/8	2	.300	5,000	6,000	7,600

* Starting values shown are based on industry experience. Adjust this value as needed to reach required weld quality.

1. Minimum spacing shown is for the welding of two pieces. Increase spacing by 30% when welding three pieces. Smaller minimum spacing requires higher current. Electrode material: **RWMA CLASS 2 or CLASS 3**

• Type of steel: **AISI 301, 302, 303, 304, 308, 316, 317, 321, 349**

• Material should be free from scale oxides, paint, grease, and heavy oil

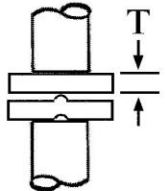
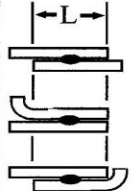
• Table is for a 3:1 maximum ratio of thickest to thinnest piece, and a maximum stackup thickness of 4" T"

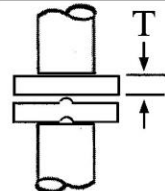
SIMPLICITY CONTROL

9160M, 9160D, 9160L

WELDING SCHEDULES

RECOMMENDED PRACTICES FOR PROJECTION WELDS IN LOW CARBON STEEL

DATA COMMON TO ALL CLASSES OF PROJECTION WELDS						WELDING SCHEDULE A FOR A SINGLE PROJECTION			
Thickness		Projection Size		Minimum Weld Spacing	Minimum Contacting Overlap	Weld Time	Net Electrode Force	Welding Current*	Minimum Tensile-Shear Strength
									
MFG. GAUGE	THICKNESS Inch (mm)	Diameter. Inch	Height. Inch	INCH	INCH	CYCLES (60 HZ)	POUNDS	AMPERES (approx.)	POUNDS
25	.021 (0.53)	.090	.025	0.38	0.25	3	150	4,400	370
23	.027 (0.69)	.090	.025	0.38	0.25	3	195	5,500	500
21	.033 (0.84)	.110	.035	0.50	0.38	3	240	6,600	700
19	.042 (1.07)	.110	.035	0.50	0.38	5	330	8,000	1,060
18	.048 (1.22)	.140	.038	0.75	0.50	8	400	8,800	1,300
16	.060 (1.52)	.150	.042	0.75	0.50	10	550	10,300	1,800
14	.075 (1.91)	.180	.048	0.88	0.50	14	800	1,800	2,425
13	.090 (2.29)	.210	.050	1.06	0.62	16	1,020	13,150	3,250
12	.105 (2.67)	.240	.055	1.25	0.75	19	1,250	14,100	3,850
11	.120 (3.04)	.270	.058	1.50	0.81	22	1,500	14,800	4,800
10	.135 (3.43)	.300	.062	1.63	0.88	24	1,650	15,300	5,500

WELDING SCHEDULE B FOR 2 - 3 PROJECTIONS						WELDING SCHEDULE C FOR 4 OR MORE PROJECTIONS			
Thickness		Total Weld Time	Net Electrode Force	Welding Current*	Min. Tensile- Shear	Total Weld Time	Net Electrode Force	Welding Current*	Min. Tensile- Shear
		Do <u>not</u> mult. Per projection	per each projection	per each projection	per each projection	Do <u>not</u> mult. Per projection	per each projection	per each projection	per each projection
MFG GAUGE	THICKNESS Inch (mm)	CYCLES (60 HZ)	POUNDS	AMPERES (approx.)	POUNDS	CYCLES (60 HZ)	POUNDS	AMPERES (approx.)	POUNDS
25	.021 (0.53)	6	150	3,850	325	6	80	2,900	290
23	.027 (0.69)	6	150	4,450	425	8	100	3,300	340
21	.033 (0.84)	6	150	5,100	525	11	125	3,800	425
19	.042 (1.07)	10	210	6,000	875	15	160	4,300	720
18	.048 (1.22)	16	270	6,500	1,100	19	220	4,400	875
16	.060 (1.52)	20	365	7,650	1,575	25	330	5,400	1,225
14	.075 (1.91)	28	530	8,850	2,150	34	470	6,400	1,750
13	.090 (2.29)	32	680	9,750	2,800	42	610	7,200	2,325
12	.105 (2.67)	38	830	10,600	3,450	50	740	8,300	2,900
11	.120 (3.04)	45	1,000	11,300	4,200	60	900	9,200	3,600
10	.135 (3.43)	48	1,100	11,850	4,850	66	1,000	9,900	4,250

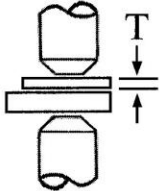
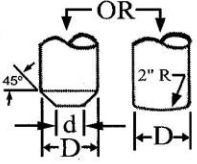
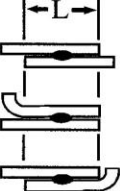
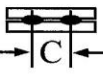
- * Starting values shown are based on industry experience. Adjust these values as needed to reach required weld quality.
- Material should be free from scale oxides, paint, grease and heavy oil
- Electrode Material: **RWMA CLASS 3 or 11**

SIMPLICITY CONTROL

9160M, 9160D, 9160L

WELDING SCHEDULES

RECOMMENDED PRACTICES FOR SPOT WELDS IN HIGH STRENGTH LOW ALLOY (HSLA) STEEL

Thickness of Thinnest Outside Piece ¹		Electrode Major Diameter and Shape ²		Net Electrode Force	Weld Time (Single pulse)	Welding Current*	Minimum Contacting Overlap	Minimum Weld Spacing	Diameter of Fused Zone	Minimum Tensile-Shear Strength
										
MFG GAUGE	THICKNESS Inch (mm)	D. MIN. Inch	d. MAX. Inch	POUNDS	CYCLES (60 HZ)	AMPERES (approx.)	INCH	INCH	INCH (approx.)	POUNDS
32	.010 (0.25)	1/2	1/8	250	4	4,000	3/8	1/4	.14	680
25	.021 (0.53)	1/2	3/16	490	6	6,100	7/16	3/8	.18	690
22	.030 (0.76)	1/2	1/4	560	8	6,700	7/16	1/2	.18	1,270
20	.036 (0.91)	1/2	1/4	720	10	8,000	1/2	3/4	.25	1,750
18	.048 (1.22)	1/2	1/4	910	12	9,700	9/16	7/8	.25	2,360
16	.060 (1.52)	5/8	5/16	1,200	17	12,000	5/8	1-1/16	.25	3,050
14	.075 (1.91)	5/8	5/16	1,550	21	12,500	11/16	1-3/8	.31	4,190
13	.090 (2.29)	5/8	3/8	1,730	27	13,200	3/4	1-5/8	.31	5,330
12	.105 (2.67)	5/8	3/8	1,900	32	13,900	13/16	1-13/16	.35	6,890
11	.120 (3.04)	5/8	7/16	2,300	42	15,100	7/8	2	.35	8,970

* Starting values shown are based on experience of member companies. Adjust this value as needed to reach required weld quality. When using radiussed electrodes, increase welding current approximately 10% over values shown.

¹ Table is for a 3:1 maximum ratio of thickest to thinnest piece, and a maximum stackup thickness of 4" T"

² Electrode material: **RWMA CLASS 2**

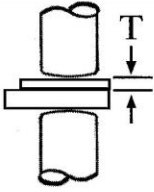
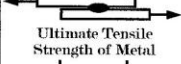
• Material should be pickled or otherwise cleaned to obtain a surface contact resistance not exceeding 200 microhms

SIMPLICITY CONTROL

9160M, 9160D, 9160L

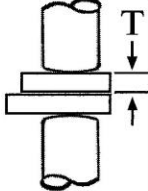
WELDING SCHEDULES

RECOMMENDED PRACTICES FOR SPOT WELDING ALUMINUM ALLOYS ON SINGLE PHASE MACHINES

Thickness of Thinnest Outside Piece	Electrode Major Diameter and Shape		Net Electrode Force	Weld Time (Single pulse)	Welding Current*	Diameter of Fused Zone	Minimum Tensile- Shear Strength		
							 Ultimate Tensile Strength of Metal		
THICKNESS Inch (mm)	D. MIN. Inch	R. MAX. Inch	POUNDS	CYCLES (60 HZ)	AMPS (approx.)	INCH (approx.)	From 19.5 to 28 kpsi	From 28 to 56 kpsi	56 kpsi & up
.016 (0.40)	5/8	1-Flat	320	4	15,000	.110	95	130	145
.020 (0.51)	5/8	1-Flat	340	5	18,000	.125	135	175	190
.025 (0.64)	5/8	2-Flat	390	6	21,800	.140	195	235	250
.032 (0.81)	5/8	2-Flat	500	6	26,000	.160	280	315	350
.040 (1.02)	5/8	3-Flat	600	8	30,700	.180	400	415	460
.050 (1.27)	5/8	3-Flat	660	8	33,000	.210	550	590	640
.063 (1.60)	5/8	3-Flat	750	10	35,900	.250	755	835	920
.071 (1.80)	5/8	4-4	800	10	38,000	.275	875	980	1,130
.080 (2.03)	7/8	4-4	860	10	41,800	.300	1,035	1,155	1,400
.090 (2.29)	7/8	6-6	950	12	46,000	.330	1,175	1,355	1,700
.100 (2.54)	7/8	6-6	1,050	15	56,000	.360	1,270	1,600	2,050
.125 (3.18)	7/8	6-6	1,300	15	76,000	.425	1,400	2,170	2,830

- * **Starting values** shown are based on industry experience. Adjust this value as needed to reach required weld quality.
- This table is for commercial welding. See table below for single phase welding to meet more rigid requirements.
 - Table is for alloys: **2014-T3-T4-T6, 2024-T3-T4, and 7075-T6**. Somewhat lower values can be used for alloys such as **5053, 6061, 6009, 6010, 5182, and 2036**
 - Electrode material: **RWMA CLASS 1**

RECOMMENDED PRACTICES FOR SPOT WELDING ALUMINUM ALLOYS ON SINGLE PHASE MACHINES WITH SLOPE

Thickness of Thinnest Outside Piece	Electrode Major Diameter and Shape		Net Electrode Force		Heat Time			Current*			Minimum Tensile Shear Strength	Diameter of Fused Zone
			WELD	FORGE	UPSLOPE	WELD HEAT	DOWN SLOPE	INITIAL	WELD	FINAL		
THICKNESS Inch (mm)	D. MIN. Inch	R. MAX. Inch	POUNDS	POUNDS	CYCLES (60 HZ)	CYCLES (60 HZ)	CYCLES (60 HZ)	AMPS (approx.)	AMPS (approx.)	AMPS (approx.)	POUNDS	POUNDS
.016 (0.40)	7/8	3	500	1,200	1	0	1	5,500	17,700	0	167	.134
.020 (0.51)	7/8	3	500	1,200	1	1	2	8,500	19,800	11,300	228	.143
.040 (1.02)	7/8	3	700	1,600	1	2	5	10,800	28,300	10,600	578	.156
.063 (1.60)	7/8	6	1,180	2,750	3	5	11	16,850	34,500	18,700	1,126	.281
.090 (2.29)	7/8	6	1,700	4,300	4	8	17	17,700	46,500	33,200	2,039	.334

- * **Starting values** shown are based on industry experience. Adjust this value as needed to reach required weld quality.
- Table is for alloys: **2014-T3-T4-T6, 2024-T3-T4, and 7075-T6**. Somewhat lower values can be used for alloys such as **5053, 6061, 6009, 6010, 5182, and 2036**
 - Electrode material: **RWMA CLASS 1**
 - This table is for more rigid welding requirements. See table above for single phase welding to meet less rigid commercial requirements.

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