

Arc Welding and Cutting — OSHA Standard 1910.254¹

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The Impact of Safety on Florida Agriculture

Florida agriculture, including forestry and fishing, made an annual economic impact of \$98 billion in 2004. More than 390,000 workers are directly employed in these industries in Florida, and another 380,000 people are employed in activities related to agriculture (Hodges 2006). The state's agricultural enterprises range from large citrus, vegetable and cattle operations to small family-operated farms.

In spite of the popular images of agriculture, it is a highly mechanized, industrial profession with one of the highest injury and death rates among U.S. industries. The last study of death rates in Florida agriculture (Liller 2000) found 240 deaths from 1989 to 1998. In 2005, the Bureau of Labor Statistics (BLS 2005a) reported that death due to injury in agriculture was 31.4 deaths per 100,000 full-time workers, which was the highest rate among all major occupational groups and an increase of 14% over 2004. Also in 2005, the Bureau of Labor Statistics reported 6,100 injuries per 100,000 full-time workers (BLS 2005b).

Safety in Florida agriculture is challenging because:

- the state's agricultural enterprises are diverse,
- safety knowledge among workers varies,
- manual labor is used extensively,
- the climate creates year-round heat stress.

Therefore, it is vital to assist the public in learning about OSHA documents related to agriculture. More information about the OSHA Standards and agricultural safety is available at the following Web sites:

- Florida AgSafe: <http://www.flagsafe.ufl.edu>
- OSHA Regulations:
<http://www.osha.gov/comp-links.html>
- National Agricultural Safety Database:
<http://www.cdc.gov/nasd>

Overview

This document, a condensation of Section 1910.254 of the Occupational Safety and Health Act (29 CFR), is not intended to be totally inclusive but rather to

1. This document is ABE280, one of a series of the Agricultural and Biological Engineering Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. First published January 2001. Revised September 2007. Please visit the EDIS Web site at <http://edis.ifas.ufl.edu>.

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highlight the information and requirements in the complete OSHA standard that owners and managers of agricultural businesses should understand. Refer to the OSHA Web site given above for the complete standard and for court interpretations of the standard.

Note: "Subpart S of this part" is referred to throughout this standard. It refers to Subpart S of Standard 1910 which covers general electrical standards. This statement implies that non-electrical standards which involve electricity in some way must also conform to OSHA Electrical Standards.

Subpart S standards are numbered 1910.301–1910.399. The majority of these numbers are still reserved for future standards. Current standards in Subpart S are (titles followed by asterisks are available on the Web through EDIS at <http://edis.ifas.ufl.edu>):

- 1910.301 — Introduction
- 1910.302 — Electric utilization systems
- 1910.303 — General requirements**
- 1910.304 — Wiring design and protection**
- 1910.305 — Wiring methods, components, and equipment for general use**
- 1910.306 — Specific purpose equipment and installations**
- 1910.307 — Hazardous (classified) locations**
- 1910.308 — Special systems**
- 1910.331 — Scope**
- 1910.332 — Training**
- 1910.333 — Selection and use of work practices**
- 1910.334 — Use of equipment**
- 1910.335 — Safeguards for personnel protection**

- 1910.399 — Definitions applicable to this subpart
- 1910 Subpart S — Authority for 1910 Subpart S
- 1910 Subpart S App A — Reference Documents
- 1910 Subpart S App B — Explanatory Data [Reserved]
- 1910 Subpart S App C — Tables, Notes, and Charts [Reserved]

Contents of OSHA Standard 1910.254

- Section 1910.254(a) — General
- Section 1910.254(b) — Application of Arc Welding Equipment
- Section 1910.254(c) — Installation of Arc Welding Equipment
- Section 1910.254(d) — Operation and Maintenance

Note: Some sections of OSHA standards are labeled "Reserved." This label implies either that information has been deleted from the previous version of the standard or that additions to the standard are anticipated. Because standards often reference other standards, it is important that paragraph numbers remain consistent.

Section 1910.254(a) — General

1910.254(a)(1) — Equipment Selection. Welding equipment shall be chosen for safe application to the work to be done as specified in paragraph (b) of this section.

1910.254(a)(2) — Installation. Welding equipment shall be installed safely as specified by paragraph (c) of this section.

1910.254(a)(3) — Instruction. Workers designated to operate arc welding equipment shall have been properly instructed and qualified to operate such equipment as specified in paragraph (d) of this section.

Section 1910.254(b) — Application of Arc Welding Equipment

1910.254(b)(1) — General. Assurance of consideration of safety in design is obtainable by choosing apparatus complying with the *Requirements for Electric Arc-Welding Apparatus* (NEMA EW-1-1962, National Electrical Manufacturers Association) or the *Safety Standard for Transformer-Type Arc-Welding Machines* (ANSI C33.2-1956, Underwriters' Laboratories), both of which are incorporated by reference as specified in Sec. 1910.6.

1910.254(b)(2) — Environmental Conditions

(i) — Standard machines for arc welding service shall be designed and constructed to carry their rated load with rated temperature rises where the temperature of the cooling air does not exceed 40 °C. (104 °F.) and where the altitude does not exceed 3,300 feet (1,005.8 m), and shall be suitable for operation in atmospheres containing gases, dust, and light rays produced by the welding arc.

(ii) — Unusual service conditions may exist, and in such circumstances machines shall be especially designed to safely meet the requirements of the service. Chief among these conditions are:

- (A) Exposure to unusually corrosive fumes.
- (B) Exposure to steam or excessive humidity.
- (C) Exposure to excessive oil vapor.
- (D) Exposure to flammable gases.
- (E) Exposure to abnormal vibration or shock.
- (F) Exposure to excessive dust.
- (G) Exposure to weather.
- (H) Exposure to unusual seacoast or shipboard conditions.

1910.254(b)(3) — Voltage. The following limits shall not be exceeded:

(i) — Alternating-current machines

- (A) Manual arc welding and cutting - 80 volts.
- (B) Automatic (machine or mechanized) arc welding and cutting - 100 volts.

(ii) — Direct-current machines

- (A) Manual arc welding and cutting - 100 volts.
- (B) Automatic (machine or mechanized) arc welding and cutting - 100 volts.

(iii) — When special welding and cutting processes require values of open circuit voltages higher than the above, means shall be provided to prevent the operator from making accidental contact with the high voltage by adequate insulation or other means.

(iv) — For AC (alternating current welding under wet conditions or warm surroundings where perspiration is a factor, the use of reliable automatic controls for reducing no-load voltage is recommended to reduce the shock hazard.

1910.254(b)(4) — Design

(i) — A controller integrally mounted in an electric motor driven welder shall have capacity for carrying rated motor current, shall be capable of making and interrupting stalled rotor current of the motor, and may serve as the running overcurrent device if provided with the number of overcurrent units as specified by Subpart S of this part.

(ii) — On all types of arc welding machines, control apparatus shall be enclosed except for the operating wheels, levers, or handles.

(iii) — Input power terminals, tap change devices and live metal parts connected to input circuits shall be completely enclosed and accessible only by means of tools.

(iv) — Terminals for welding leads should be protected from accidental electrical contact by personnel or by metal objects, i.e., vehicles, crane hooks, etc. Protection may be obtained by use of dead-front receptacles for plug connections recessed openings with nonremovable hinged covers or heavy insulating sleeving or taping or other equivalent electrical and mechanical protection. If a welding lead terminal which is intended to be used exclusively for connection to the work is connected to the grounded enclosure, it must be done by a

conductor at least two AWG (American Wire Gauge) sizes smaller than the grounding conductor and the terminal shall be marked to indicate that it is grounded.

(v) — No connections for portable control devices such as remote push buttons to be carried by the operator shall be connected to an AC circuit of higher than 120 volts. Exposed metal parts of portable control devices operating on circuits above 50 volts shall be grounded by a grounding conductor in the control cable.

(vi) — Auto transformers or a.c. reactors shall not be used to draw welding current directly from any AC power source having a voltage exceeding 80 volts.

Section 1910.254(c) — Installation of Arc Welding Equipment

1910.254(c)(1) — General. Installation, including power supply, shall be in accordance with the requirements of Subpart S of this part.

1910.254(c)(2) — Grounding

(i) — The frame or case of the welding machine (except engine-driven machines) shall be grounded under the conditions and according to the methods prescribed in Subpart S of this part.

(ii) — Conduits containing electrical conductors shall not be used for completing a work-lead circuit. Pipelines shall not be used as a permanent part of a work-lead circuit, but may be used during construction, extension, or repair, providing current is not carried through threaded joints, flanged bolted joints, or caulked joints and that special precautions are used to avoid sparking at connection of the work-lead cable.

(iii) — Chains, wire ropes, cranes, hoists, and elevators shall not be used to carry welding current.

(iv) — Where a structure, conveyor, or fixture is regularly employed as a welding current return circuit, joints shall be bonded or provided with adequate current collecting devices.

(v) — All ground connections shall be checked to determine that they are mechanically strong and electrically adequate for the required current.

1910.254(c)(3) — Supply Connections and Conductors

(i) — A disconnecting switch or controller shall be provided at or near each welding machine which is not equipped with such a switch or controller mounted as an integral part of the machine. The switch shall be in accordance with Subpart S of this part. Overcurrent protection shall be provided as specified in Subpart S of this part. A disconnect switch with overload protection or equivalent disconnect and protection means, permitted by Subpart S of this part, shall be provided for each outlet intended for connection to a portable welding machine.

(ii) — For individual welding machines, the rated current-carrying capacity of the supply conductors shall be not less than the rated primary current of the welding machines.

(iii) — For groups of welding machines, the rated current-carrying capacity of conductors may be less than the sum of the rated primary currents of the welding machines supplied. The conductor rating shall be determined in each case according to the machine loading based on the use to be made of each welding machine and the allowance permissible in the event that all the welding machines supplied by the conductors will not be in use at the same time.

(iv) — In operations involving several welders on one structure, DC welding process requirements may require the use of both polarities; or supply circuit limitations for AC welding may require distribution of machines among the phases of the supply circuit. In such cases no-load voltages between electrode holders will be 2 times normal in DC or 1, 1.41, 1.73, or 2 times normal on AC machines. Similar voltage differences will exist if both AC and DC welding are done on the same structure.

(A) All DC machines shall be connected with the same polarity.

(B) All AC machines shall be connected to the same phase of the supply circuit and with the same instantaneous polarity.

Section 1910.254(d) — Operation and Maintenance

1910.254(d)(1) — General. Workers assigned to operate or maintain arc welding equipment shall be acquainted with the requirements of Sections 1910.254 and 1910.252 (a), (b), and (c) of this part.

1910.254(d)(2) — Machine Hook-Up. Before starting operations all connections to the machine shall be checked to make certain they are properly made. The work lead shall be firmly attached to the work; magnetic work clamps shall be freed from adherent metal particles of spatter on contact surfaces. Coiled welding cable shall be spread out before use to avoid serious overheating and damage to insulation.

1910.254(d)(3) — Grounding. Grounding of the welding machine frame shall be checked. Special attention shall be given to safety ground connections of portable machines.

1910.254(d)(4) — Leaks. There shall be no leaks of cooling water, shielding gas or engine fuel.

1910.254(d)(5) — Switches. It shall be determined that proper switching equipment for shutting down the machine is provided.

1910.254(d)(6) — Manufacturers' Instructions. Printed rules and instructions covering operation of equipment supplied by the manufacturers shall be strictly followed.

1910.254(d)(7) — Electrode Holders. Electrode holders when not in use shall be so placed that they cannot make electrical contact with persons, conducting objects, fuel or compressed gas tanks.

1910.254(d)(8) — Electric shock. Cables with splices within 10 feet (3 m) of the holder shall not be used. The welder should not coil or loop welding electrode cable around parts of his or her body.

1910.254(d)(9) — Maintenance

(i) — The operator should report any equipment defect or safety hazard to his supervisor and the use of the equipment shall be discontinued until its safety has

been assured. Repairs shall be made only by qualified personnel.

(ii) — Machines which have become wet shall be thoroughly dried and tested before being used.

(iii) — Cables with damaged insulation or exposed bare conductors shall be replaced. Joining lengths of work and electrode cables shall be done by the use of connecting means specifically intended for the purpose. The connecting means shall have insulation adequate for the service conditions.

Changes to This Standard

"September 2005 — A reference to Recommended Safe Practices for Gas-Shielded Arc Welding," A6.1-1966, from the American Welding Society, was deleted from paragraph (d)(1) because the information in that reference was both generally outdated and covered by other OSHA standards. Documented in 70 FR 53929, September 13, 2005.

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