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cable shall be spread out before use to avoid serious overheating and damage to insulation.

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

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

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

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

(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.

(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 body.

(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.

[55 FR 13696, Apr. 11, 1990, as amended at 61 FR 9241, Mar. 7, 1996; 70 FR 53929, Sept. 13, 2005]

§ 1910.255 Resistance welding.

(a) *General*—(1) *Installation.* All equipment shall be installed by a qualified electrician in conformance with subpart S of this part. There shall be a safety-type disconnecting switch or a circuit breaker or circuit interrupter to open each power circuit to the machine, conveniently located at or near the machine, so that the power can be shut off when the machine or its controls are to be serviced.

(2) *Thermal protection.* Ignitron tubes used in resistance welding equipment shall be equipped with a thermal protection switch.

(3) *Personnel.* Workmen designated to operate resistance welding equipment shall have been properly instructed and judged competent to operate such equipment.

(4) *Guarding.* Controls of all automatic or air and hydraulic clamps shall be arranged or guarded to prevent the operator from accidentally activating them.

(b) *Spot and seam welding machines (nonportable)*—(1) *Voltage.* All external weld initiating control circuits shall operate on low voltage, not over 120 volts, for the safety of the operators.

(2) *Capacitor welding.* Stored energy or capacitor discharge type of resistance welding equipment and control panels involving high voltage (over 550 volts) shall be suitably insulated and protected by complete enclosures, all doors of which shall be provided with suitable interlocks and contacts wired into the control circuit (similar to elevator interlocks). Such interlocks or contacts shall be so designed as to effectively interrupt power and short circuit all capacitors when the door or panel is open. A manually operated switch or suitable positive device shall be installed, in addition to the mechanical interlocks or contacts, as an added safety measure assuring absolute discharge of all capacitors.

(3) *Interlocks.* All doors and access panels of all resistance welding machines and control panels shall be kept locked and interlocked to prevent access, by unauthorized persons, to live portions of the equipment.

(4) *Guarding.* All press welding machine operations, where there is a possibility of the operator's fingers being under the point of operation, shall be effectively guarded by the use of a device such as an electronic eye safety circuit, two hand controls or protection similar to that prescribed for punch press operation, §1910.217 of this part. All chains, gears, operating bus linkage, and belts shall be protected by

adequate guards, in accordance with §1910.219 of this part.

(5) *Shields.* The hazard of flying sparks shall be, wherever practical, eliminated by installing a shield guard of safety glass or suitable fire-resistant plastic at the point of operation. Additional shields or curtains shall be installed as necessary to protect passing persons from flying sparks. (See §1910.252(b)(2)(i)(C) of this part.)

(6) *Foot switches.* All foot switches shall be guarded to prevent accidental operation of the machine.

(7) *Stop buttons.* Two or more safety emergency stop buttons shall be provided on all special multispot welding machines, including 2-post and 4-post weld presses.

(8) *Safety pins.* On large machines, four safety pins with plugs and receptacles (one in each corner) shall be provided so that when safety pins are removed and inserted in the ram or platen, the press becomes inoperative.

(9) *Grounding.* Where technically practical, the secondary of all welding transformers used in multispot, projection and seam welding machines shall be grounded. This may be done by permanently grounding one side of the welding secondary current circuit. Where not technically practical, a center tapped grounding reactor connected across the secondary or the use of a safety disconnect switch in conjunction with the welding control are acceptable alternates. Safety disconnect shall be arranged to open both sides of the line when welding current is not present.

(c) *Portable welding machines*—(1) *Counterbalance.* All portable welding guns shall have suitable counterbalanced devices for supporting the guns, including cables, unless the design of the gun or fixture makes counterbalancing impractical or unnecessary.

(2) *Safety chains.* All portable welding guns, transformers and related equipment that is suspended from overhead structures, eye beams, trolleys, etc., shall be equipped with safety chains or cables. Safety chains or cables shall be capable of supporting the total shock load in the event of failure of any component of the supporting system.

(3) *Clevis.* Each clevis shall be capable of supporting the total shock load of the suspended equipment in the event of trolley failure.

(4) *Switch guards.* All initiating switches, including retraction and dual schedule switches, located on the portable welding gun shall be equipped with suitable guards capable of preventing accidental initiation through contact with fixturing, operator's clothing, etc. Initiating switch voltage shall not exceed 24 volts.

(5) *Moving holder.* The movable holder, where it enters the gun frame, shall have sufficient clearance to prevent the shearing of fingers carelessly placed on the operating movable holder.

(6) *Grounding.* The secondary and case of all portable welding transformers shall be grounded. Secondary grounding may be by center tapped secondary or by a center tapped grounding reactor connected across the secondary.

(d) *Flash welding equipment*—(1) *Ventilation and flash guard.* Flash welding machines shall be equipped with a hood to control flying flash. In cases of high production, where materials may contain a film of oil and where toxic elements and metal fumes are given off, ventilation shall be provided in accordance with §1910.252(c) of this part.

(2) *Fire curtains.* For the protection of the operators of nearby equipment, fire-resistant curtains or suitable shields shall be set up around the machine and in such a manner that the operators movements are not hampered.

(e) *Maintenance.* Periodic inspection shall be made by qualified maintenance personnel, and a certification record maintained. The certification record shall include the date of inspection, the signature of the person who performed the inspection and the serial number, or other identifier, for the equipment inspected. The operator shall be instructed to report any equipment defects to his supervisor and the use of the equipment shall be discontinued until safety repairs have been completed.

Subpart R—Special Industries

AUTHORITY: Sections 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29