

SECTION 9: ARC FLASH SAFETY & PPE

California carries its own flame and electric-arc duties, and they sit in two different places with two different conditions. This section states both, and does not present a consensus standard as though it were California law.

9.1 The apparel duty for energised work under the Low-Voltage Electrical Safety Orders

The eighth condition for energised work is an apparel duty: each employee who is exposed to the hazards of flames or electric arcs wears apparel that, when exposed to flames or electric arcs, does not increase the extent of injury that would be sustained by the employee; and that condition prohibits clothing made from acetate, nylon, polyester and rayon, either alone or in blends, unless the employer can demonstrate that the fabric has been treated with flame retardant (8 CCR Sec. 2320.2). Title 8 requirement

> "(8) Each employee who is exposed to the hazards of flames or electric arcs wears apparel that, when exposed to flames or electric arcs, does not increase the extent of injury that would be sustained by the employee. This subsection prohibits clothing made from the following types of fabrics, either alone or in blends, unless the employer can demonstrate that the fabric has been treated with flame retardant: acetate, nylon, polyester, and rayon." (8 CCR Sec. 2320.2)

That condition applies wherever work is to be performed on exposed energised parts of equipment or systems, because it is one of the conditions the energised-equipment section states for such work (8 CCR Sec. 2320.2). The subsection names no fabric that must be used and no arc rating; it states an outcome and a prohibition. Demo Company LLC's route to the outcome is to issue arc-rated work shirts and trousers as the standard uniform for energised work, and to prohibit on that work any garment, including base layers, shirts, jackets, rainwear, liners, hoods and high-visibility vests, made wholly or partly of acetate, nylon, polyester or rayon, unless Demo Company LLC can demonstrate that the fabric has been treated with flame retardant (8 CCR Sec. 2320.2(a)(8)); an arc rating alone is not treated as that demonstration. compliance method - chosen by Demo Company LLC

The apparel condition carries its own note, which points to Section 2320.11 for protection from flames and electric arcs that apply to power generation, transmission and distribution (8 CCR Sec. 2320.2). That section is stated in SECTION 9.2, on its own condition. Title 8 requirement

Section 2320.2 is part of the Low-Voltage Electrical Safety Orders. For energised work on systems above 600 volts, see the High-Voltage Electrical Safety Orders' apparel subsection stated in SECTION 9.4 (8 CCR Sec. 2940.6(k)) and, for power generation, transmission and distribution work, Section 2940.11 of those Orders.

9.2 The flame and electric-arc section, and the condition it states for itself

Read the scope clause first. The section on protection from flames and electric arcs covers the construction, operation, and maintenance of electric power generation, control, transformation, transmission, and distribution lines and equipment, including related equipment for the purpose of communication or metering that are accessible only to qualified employees (8 CCR Sec. 2320.11). Title 8 requirement

> "Scope: This section covers the construction, operation, and maintenance of electric power generation, control, transformation, transmission, and distribution lines and equipment. This includes related equipment for the purpose of communication or metering that are accessible only to qualified employees." (8 CCR Sec. 2320.11)

That is an installation-and-activity test, not an employer test and not a test about the label put on a job. The scope clause contains no exclusion of its own (8 CCR Sec. 2320.11). Title 8 requirement

Where a job of Demo Company LLC's on systems of 600 volts or less falls inside the scope clause quoted above, every duty in SECTIONS 9.3 to 9.7 is owed on that job (8 CCR Sec. 2320.11). Where a job falls

outside the clause, SECTION 9.1 is the apparel duty at 600 volts or less (8 CCR Sec. 2320.2(a)(8)), and the apparel subsection stated in SECTION 9.4 applies above 600 volts (8 CCR Sec. 2940.6(k)). Title 8 requirement

On work within the clause above 600 volts, the corresponding duties are those of Section 2940.11(a)-(f), which cover the same topics as SECTIONS 9.3 to 9.7, and Section 2940.11 adds a fourth condition for a flame-resistant outer layer: the employee is exposed to contact with energized circuit parts operating at more than 600 volts (8 CCR Sec. 2940.11(a)-(f), (b)(1)(A)). Title 8 requirement

Company policy. Demo Company LLC's default is to de-energise, and to decline work the customer will not allow an outage for where no safe energised method exists; that decision is Daniel Ortiz's. company rule - beyond Title 8

9.3 Hazard assessment and the incident-energy estimate

Where the scope clause in SECTION 9.2 is met, the employer assesses the workplace in accordance with the Injury and Illness Prevention Program standard to identify employees exposed to hazards from flames or from electric arcs; and for each employee exposed to hazards from electric arcs, the employer makes a reasonable estimate of the incident heat energy to which the employee would be exposed (8 CCR Sec. 2320.11). Title 8 requirement

> "(2) For each employee exposed to hazards from electric arcs, the employer shall make a reasonable estimate of the incident heat energy to which the employee would be exposed." (8 CCR Sec. 2320.11)

The workplace assessment that duty is anchored to is the Injury and Illness Prevention Program's procedure for identifying and evaluating work place hazards, including scheduled periodic inspections to identify unsafe conditions and work practices, which SECTION 2 states (8 CCR Sec. 3203). Title 8 requirement

The section leaves the calculation method open, and says so. Its first note records that Appendix D of the High-Voltage Electrical Safety Orders provides guidance on estimating available heat energy, that the Division of Occupational Safety and Health will deem employers following that guidance to be in compliance with the estimate duty, and that an employer may choose a method of calculating incident heat energy not included in that appendix if the chosen method reasonably predicts the incident energy to which the employee would be exposed (8 CCR Sec. 2320.11). Title 8 requirement

And it does not require a per-task estimate. Its second note records that the subsection does not require the employer to estimate the incident heat energy exposure for every job task performed by each employee, that the employer may make broad estimates covering multiple system areas provided the employer uses reasonable assumptions about the energy-exposure distribution throughout the system and provided the estimates represent the maximum employee exposure for those areas, and it gives the example of estimating the heat energy just outside a substation feeding a radial distribution system and using that estimate for all jobs performed on that radial system (8 CCR Sec. 2320.11). Title 8 requirement

Because the section names a safe-harbour method and expressly permits another, the choice of method is the employer's. On work this section reaches, a qualified person at Demo Company LLC makes the estimate before the work starts and records, with the job file, the method used, the inputs relied on - nominal voltage, the available fault current and its source, and the upstream protective device and its clearing time - the working distance assumed, the resulting estimate, and the arc-rated apparel and face and hand protection selected against it; where any of those inputs cannot be established for the specific equipment, the work is not performed energised (8 CCR Sec. 2320.11). compliance method - chosen by Demo Company LLC

9.4 Selection and prohibited clothing

The employer selects the apparel based on the incident-energy estimate and ensures that each employee who is exposed to hazards from flames or electric arcs is provided suitable apparel in accordance with the requirements of Section 2940.6(k) of the High-Voltage Electrical Safety Orders; and the employer does not select apparel that could melt onto the employee's skin or that could ignite and continue to burn when exposed to flames or the heat energy estimated under the incident-energy estimate in SECTION 9.3 (8 CCR Sec. 2320.11(a)(2), (b)). Title 8 requirement

Flame-resistant clothing. The employer ensures that the outer layer of clothing worn by an employee, except for clothing not required to be arc rated under the body-coverage exceptions in SECTION 9.5, is flame resistant under any of three conditions: an electric arc could ignite flammable material in the work area that, in turn, could ignite the employee's clothing; molten metal or electric arcs from faulted conductors in the work area could ignite the employee's clothing; or the incident heat energy estimated under the assessment subsection exceeds 2.0 cal/cm² (8 CCR Sec. 2320.11). Title 8 requirement

The second of those three conditions does not apply to conductors that are capable of carrying, without failure, the maximum available fault current for the time the circuit protective devices take to interrupt the fault (8 CCR Sec. 2320.11). Title 8 requirement

The apparel subsection the flame and electric-arc section points to. It is part of the High-Voltage Electrical Safety Orders and reaches the work SECTION 9.2 covers through the incorporation stated above. Its condition is an employee exposed to the hazards of flames or electric arcs, and it reads (8 CCR Sec. 2940.6(k)): Title 8 requirement

> "(k) Apparel. The employer shall ensure that each employee who is exposed to the hazards of flames or electric arcs does not wear clothing that, when exposed to flames or electric arcs, could increase the extent of injury that would be sustained by the employee. This subsection prohibits clothing made from the following types of fabrics: acetate, nylon, polyester, polypropylene, and rayon, either alone or in blends, unless the employer can demonstrate that the fabric has been treated with flame retardant." (8 CCR Sec. 2940.6)

The subsection's note states: NOTE: For apparel requirements for the power generation, transmission, and distribution industry, see Section 2940.11 for the protection from flames and electric arcs. (8 CCR Sec. 2940.6).

9.5 Arc rating, and the five body-coverage exceptions

The employer ensures that each employee exposed to hazards from electric arcs wears protective clothing and other protective equipment with an arc rating greater than or equal to the heat energy estimated under the assessment subsection whenever that estimate exceeds 2.0 cal/cm², and that protective equipment covers the employee's entire body, subject to five exceptions (8 CCR Sec. 2320.11). Title 8 requirement

1. Arc-rated protection is not necessary for the employee's hands when the employee is wearing rubber insulating gloves with protectors or, if the estimated incident energy is no more than 14 cal/cm², heavy-duty leather work gloves with a weight of at least 407 gm/m² (12 oz/yd²) (8 CCR Sec. 2320.11).
2. Arc-rated protection is not necessary for the employee's feet when the employee is wearing heavy-duty work shoes or boots (8 CCR Sec. 2320.11).
3. Arc-rated protection is not necessary for the employee's head when the employee is wearing head protection meeting Section 3381 if the estimated incident energy is less than 9 cal/cm² for exposures involving single-phase arcs in open air or 5 cal/cm² for other exposures (8 CCR Sec. 2320.11).
4. The protection for the employee's head may consist of head protection meeting Section 3381 and a faceshield with a minimum arc rating of 8 cal/cm² if the estimated incident-energy exposure is less than 13 cal/cm² for exposures involving single-phase arcs in open air or 9 cal/cm² for other exposures (8 CCR Sec. 2320.11).

5. For exposures involving single phase arcs in open air, the arc rating for the employee's head and face protection may be 4 cal/cm² less than the estimated incident energy (8 CCR Sec. 2320.11).

The dates the section states. The requirement to make reasonable estimates of incident energy commenced October 1, 2018; the requirement to ensure that the outer layer of clothing worn by an employee is flame-resistant when the estimated incident heat energy exceeds 2.0 cal/cm² commenced October 1, 2018; and the requirement to ensure that each employee exposed to hazards from electric arcs wears the required arc-rated protective equipment commenced October 1, 2018 (8 CCR Sec. 2320.11). All three are in force. Title 8 requirement

Company policy. Demo Company LLC does not use exceptions 3, 4 or 5 to reduce head and face protection below a full arc-rated hood on work this section reaches. company rule - beyond Title 8

9.6 Fuse handling

When an employee must install or remove fuses with one or both terminals energized at more than 300 volts, or with exposed parts energized at more than 50 volts, the employer ensures that the employee uses tools or gloves rated for the voltage (8 CCR Sec. 2320.11). Title 8 requirement

When an employee installs or removes expulsion-type fuses with one or both terminals energized at more than 300 volts, the employer ensures that the employee wears eye protection meeting the requirements of Section 3382, uses a tool rated for the voltage, and is clear of the exhaust path of the fuse barrel (8 CCR Sec. 2320.11). Title 8 requirement

9.7 Covered conductors, metal parts and switching under load

The requirements of the flame and electric-arc section that pertain to the hazards of exposed live parts also apply when an employee performs work in proximity to energized covered (noninsulated) wires (8 CCR Sec. 2320.11). Title 8 requirement

Non-current-carrying metal parts of equipment or devices, such as transformer cases and circuit-breaker housings, are treated as energized at the highest voltage to which these parts are exposed, unless the employer inspects the installation and determines that these parts are grounded before employees begin performing the work (8 CCR Sec. 2320.11). Title 8 requirement

The employer ensures that devices used by employees to open circuits under load conditions are designed to interrupt the current involved and that the devices used by employees to close circuits under load conditions are designed to safely carry the current involved (8 CCR Sec. 2320.11). Title 8 requirement

9.8 The protective-equipment programme behind the shock and arc equipment

Which personal-protective-equipment programme applies turns on whether the operation is regulated by the Construction Safety Orders (8 CCR Sec. 3380(f); 8 CCR Sec. 1514). This program states both, so that whichever kind of operation a job is, the programme that governs it is set out here. Title 8 requirement

On construction operations. The employer requires employees to use the required personal protective equipment; personal protective equipment required by those orders is approved for its intended use as provided in Section 1505 and distinctly marked so as to facilitate identification of the manufacturer, except for employer manufactured shields, barriers, etc.; it is used in accordance with the manufacturer's instructions; the employer assures that all required safety devices and safeguards, whether employer or employee provided, including personal protective equipment for the eyes, face, head, hand, foot, and extremities (limbs), protective clothing, respiratory protection, protective shields and barriers, comply with the applicable Title 8 standards and are maintained in a safe, sanitary condition; protectors are of such design, fit and durability as to provide adequate protection against the hazards for which they are designed, and are of safe design, construction, reasonably comfortable and do not unduly encumber the employee's movements necessary to perform their work; and all personal protective equipment is selected to ensure that it properly fits each affected employee (8 CCR Sec. 1514). This subsection is where the construction personal-protective-device section is stated in full, including its design, fit, durability, comfort and freedom-of-movement requirement and its individual-fit requirement; SECTION 6 is the company's general personal-protective-equipment programme and the two are read together on construction operations. Title 8 requirement

On general-industry operations. The employer assures that the employee is instructed and uses protective equipment in accordance with the manufacturer's instructions; that all required safety devices and safeguards, whether employer or employee provided, including personal protective equipment for the eyes, face, head, hand, foot, and extremities (limbs), protective clothing, respiratory protection, protective shields and barriers, comply with the applicable Title 8 standards and are maintained in a safe, sanitary condition; and that protectors are of such design, fit and durability as to provide adequate protection against the hazards for which they are designed, are reasonably comfortable and do not unduly encumber the employee's movements necessary to perform his or her work. Protective equipment is distinctly marked so as to facilitate identification of the manufacturer, except for employer manufactured shields, barriers, etc., and personal protective equipment is approved for its intended use as provided in Section 3206 of those Orders (8 CCR Sec. 3380). In that article the terms "protection" and "protective", where modified by the words head, eye, body, hand, foot and as used in the subsection on required safety devices, mean the safeguarding obtained by safety devices and safeguards of the proper type for the exposure and of such design, strength and quality as to eliminate, preclude or mitigate the hazard (8 CCR Sec. 3380). Title 8 requirement

The hazard-assessment, selection, training and certification subsection, and the limits it states on itself. The employer assesses the workplace to determine if hazards are present, or are likely to be present, which necessitate the use of personal protective equipment; if such hazards are present or likely to be present, the employer selects, and has each affected employee use, the types of equipment that will protect the affected employee from the hazards identified in the hazard assessment, communicates selection decisions to each affected employee, and selects equipment that properly fits each affected employee; the employer verifies that the required workplace hazard assessment has been performed through a written certification that identifies the workplace evaluated, the person certifying that the evaluation has been performed, the dates of the hazard assessment, and which identifies the document as a certification of hazard assessment; defective or damaged personal protective equipment is not used; the employer provides training to each employee who is required by that section to use personal protective equipment, and each such employee is trained to know at least the following: when it is necessary, what is necessary, how to properly don, doff, adjust and wear it, its limitations, and the proper care, maintenance, useful life and disposal of it; each affected employee demonstrates an understanding of that training and the ability to use the equipment properly before being allowed to perform work requiring its use; the employer retrain any employee it has reason to believe lacks that understanding and skill, including where changes in the workplace or in the types of equipment render previous training

obsolete or where inadequacies in an employee's knowledge or use of assigned equipment indicate the employee has not retained the requisite understanding or skill; and the employer verifies that each affected employee has received and understood the required training through a written certification that contains the name of each employee trained, the dates of training, and that identifies the subject of the certification (8 CCR Sec. 3380). Title 8 requirement

Those duties do not reach everywhere, and the section says where they stop. Subsections (f)(1) and (2) and (f)(4) through (7) of that section apply only to Sections 3381, 3382, 3384 and 3385 of those Orders, and do not apply to Section 5144 of those Orders or to Section 2940.6 of the High Voltage Electrical Safety Orders; and subsection (f) as a whole does not apply to workplace operations regulated by the Construction Safety Orders or the Mine Safety Orders (8 CCR Sec. 3380). On this company's construction work, therefore, the construction personal-protective-device section stated above is the one that applies, not this subsection; and respiratory protection is governed by the company's written respiratory protection program in SECTION 34. Title 8 requirement

On general-industry operations, Demo Company LLC completes the written hazard-assessment certification (8 CCR Sec. 3380(f)(2)) and the written training certification (8 CCR Sec. 3380(f)(7)). Title 8 requirement The section states what each must contain and states no retention period for either; this program states none. Rachel Kim keeps both with the training records SECTION 4 describes. compliance method - chosen by Demo Company LLC