

## Chapter 21

## HAZARDOUS ENERGY CONTROL

**21.1. Scope.** This chapter establishes DAF-specific hazardous energy control program requirements in addition to the OSHA requirements found in 29 CFR § 1910.147, *The Control of Hazardous Energy (Lockout/Tagout)*, 29 CFR § 1910.331, *Scope*, 29 CFR § 1910.332, *Training*, 29 CFR § 1910.333, *Selection and Use of Work Practice*, 29 CFR § 1910.334, *Use of Equipment*, 29 CFR § 1910.335, *Safeguards for Personnel Protection*. When conducting servicing and maintenance of machinery/equipment, hazardous energy control procedures will be developed to protect against the various sources of hazardous energy. **(T-0)** Refer to **Table 21.1** for a list of common hazardous energy sources. Exceptions to the hazardous energy control program can be found in accordance with 29 CFR § 1910.147(a)(2).

**Table 21.1. Common Hazardous Energy Categories and Corresponding Sources.**

Category	Hazardous Energy Sources
Electrical	Power Transmission Lines Generators Machine Power Cords Conductors Motors Capacitors Solenoids Batteries
Mechanical	Blades Materials in supply lines of bins or silos Springs Actuators Counterweights Raised Loads Top or movable part of a press or lifting device Augers Reciprocating Motions Pinch Points
Pressurized Liquids and Gases	Supply Lines Storage Tanks and Vessels
Hydraulic	Presses Rams Cylinders Hammers Shears Punches Drives Hose and Line Failure
Pneumatic	Air Lines

Category	Hazardous Energy Sources
	Pressure Reservoirs Accumulators Air Surge Tanks Rams Cylinders Tools
<b>Note:</b> This table is not all-inclusive and only represents common examples. Wind, gravity and kinetic energy need to be considered when controlling hazardous energy. Hand-operated machinery/equipment may store hazardous energy or pose hazards to employees if broken or defective and require the use of this program. <b>(T-0)</b>	

**21.2. Hazardous Energy Control Program.** Work center/shop supervisors shall:

21.2.1. Establish a hazardous energy control program. **(T-0)** When required, develop procedures for tagout only processes. **Note:** The employer shall demonstrate that the tagout program will provide a level of safety equivalent to that obtained by using a lockout program. **(T-0)**

21.2.2. Perform and document an annual hazardous energy control program self-inspection. **(T-1)** Refer to paragraphs [21.4.1](#) and [21.4.2](#) for additional guidance.

**21.3. Training.**

21.3.1. Authorized and affected employees as defined by OSHA will receive training in accordance with 29 CFR § 1910.147(c)(7). **(T-0)** Supervisors shall verify training for authorized and affected employees is accomplished. **(T-0)**

21.3.2. Retraining. Authorized employees and affected employees shall be retrained, e.g., change in their job assignments, a change in machinery, equipment or processes that present a new hazard, when there is a change in the energy control procedures or other conditions as specified in 29 CFR § 1910.147(c)(7)(iii). **(T-0)**

21.3.3. Documentation. All related training shall be documented in accordance with AFI 91-202. **(T-1)**

**21.4. Program Self-Inspections.**

21.4.1. Shop hazardous energy control program periodic inspections shall be conducted by authorized employees, one acting as an inspector and one performing the maintenance/servicing activity, at least annually, to ensure compliance with all program elements. **(T-0)** Periodic inspections shall be designed to identify and correct any deviations or inadequacies observed. **(T-0)** The inspection shall be documented to include the date of the inspection and the unit representative conducting the inspection. **(T-0)** The organization shall certify that the periodic inspections have been performed. **(T-0)** The certification shall identify the machine or equipment on which the energy control procedures was being utilized, the date of the inspection, the employees included in the inspection, and the person performing the inspection. **(T-0)** An authorized employee other than the one(s) utilizing the energy control procedure shall conduct periodic inspections of the energy control procedure in accordance with 29 CFR 1910.147(c)(6)(i)(A). **(T-0)** The inspection shall include, as a minimum:

21.4.1.1. Identification of equipment and machinery for which the hazardous energy control program applies. **(T-0)**

21.4.1.2. A review of each employee's responsibilities under the program. **(T-0)**

21.4.1.3. Verification that training has been conducted is current and properly documented. **(T-0)**

21.4.1.4. A review of hazardous energy control procedures with authorized employees to include demonstration by the employee of the required practices. **(T-0)**

21.4.1.5. An out-brief to the shop or unit supervisor, as appropriate, and documented in the written report. **(T-0)**

21.4.2. A qualified occupational safety inspector shall review the annual self-inspection hazardous energy control report during the organization's safety assessment to ensure compliance. **(T-1)**

**21.5. Authorized Lockout and Tagout Devices.** Authorized lockout and tagout devices shall be used in accordance with 29 CFR § 1910.147(c)(5), 29 CFR § 1910.333(b)(2)(iii)(D), and in the paragraphs below. **(T-0)** **Note:** When using tags, a tag is required to be supplemented with at least one additional safety measure that provides a level of safety equipment to that obtained by the use of a lock.

21.5.1. Be singularly keyed with only authorized employees retaining the key(s) to the lock(s) when in use. **(T-0)**

21.5.2. AF Form 983, *Danger – Equipment Lockout Tag*, or DoD tag or commercial equivalent tags, shall be used in conjunction with energy-isolating devices. **(T-1)** The functional manager or supervisor shall ensure an adequate supply of energy-isolating devices are available. **(T-1)**

**21.6. Hazardous Energy Control Procedures.** Develop and document specific procedures for each piece of equipment identified in the hazardous energy control program unless exempted in 29 CFR § 1910.147(a)(2). **(T-0)** Procedures will include all steps from **Figure 21.1** and **Figure 21.2**. **(T-0)** Additional information for procedure development can be found in 29 CFR § 1910.147(c)(4). **Note:** NFPA 70E, Article 120.2, defines the two (2) forms of hazardous electrical energy controls permitted as simple lockout/tagout and complex lockout/tagout. For the simple lockout/tagout, the authorized person shall be in charge. For the complex lockout/tagout, the person in charge shall have overall responsibility. **Exception:** The employer need not document the required procedure for a particular machine or equipment, when all elements identified in 29 CFR § 1910.147(c)(4)(i) exist.

**Figure 21.1. Eight-Step Hazardous Energy Control Procedure Checklist.**

The authorized employee shall:	
<b>1. Preparation</b>	Determine if written hazardous energy control procedures for the machinery/equipment are applicable to the task. <b>(T-0)</b> If so, the authorized employee shall review hazardous energy control procedures and ensure they are followed correctly. <b>(T-0)</b>
	Prior to shutting down machinery/equipment, the authorized employee must have knowledge of and assess the type (e.g.,

The authorized employee shall:	
	electrical, mechanical, hydraulic), magnitude (e.g., 120 volts, 60 psi) and hazards of the energy to be controlled, including hidden energy sources such as springs, capacitors, elevated parts, etc. <b>(T-0) Warning:</b> Machinery/equipment may contain more than one type of energy.
	Determine in accordance with written procedures, appropriate methods for controlling the hazardous energy. <b>(T-0)</b> Methods for energy-isolation may include, but are not limited to, circuit breakers, disconnect switches or valves.
<b>2. Notification</b>	Notify all affected employees of the impending shutdown and that they shall not touch hazardous energy control devices or attempt to restart the machinery/equipment until informed it is safe to resume normal operations. <b>(T-0)</b>
<b>3. Shutdown</b>	Verify it is safe to shut down the machinery/equipment. <b>(T-0)</b>
	The machinery/equipment shall be turned off or shut down using normal stopping and shutdown procedures (depress stop button, open toggle switch, close shut off valve, etc.). <b>(T-0)</b>
<b>4. Isolation</b>	Isolate all energy sources by operating (switch off, valve off, etc.) energy-isolating device(s). <b>(T-0)</b>
	All energy isolating devices that are needed to control the energy to the machine or equipment shall be physically located and operated in such a manner as to isolate the machine or equipment from the energy source(s). <b>(T-0)</b>
<b>5. Authorized LOTO Device Application</b>	Affix lockout device to hold energy-isolating devices in an “off” or “safe” position that physically prohibits normal operation of the device. <b>(T-0)</b> If possible, both locks and tags shall be installed. <b>(T-1)</b>
	Tags shall indicate date, time, reason and name of the authorized employee installing device. <b>(T-0)</b>
	To prevent inadvertent or accidental detachment, tags shall be securely attached with a self-locking and non-releasable attachment (e.g., a nylon or plastic cable tie-off strap) with a minimum unlocking strength of 50 pounds. <b>(T-0)</b>
	For group hazardous energy control procedures, conduct in accordance with <b>paragraph 21.6.1.</b>
<b>6. Verification</b>	Once the system is locked/tagged out, all potentially hazardous stored or residual energy shall be relieved, disconnected, restrained or otherwise rendered safe. <b>(T-0)</b> Insert physical restraints (blocks, chocks) for moving or raised parts, blind flanges for pressurized piping, disconnect springs (if safe to do so), etc., to ensure moving parts are physically restrained or disconnected. <b>(T-0)</b> Machinery/equipment shall be in a zero energy state. <b>(T-0)</b>
	When the equipment to be worked on does not have normal controls, e.g., energy-isolating device, on/off switch, use the

The authorized employee shall:	
	following procedure for isolation confirmation. Test potential energy sources using appropriately rated and calibrated instruments or testers. <b>(T-0)</b> Instruments used to test voltage, pressure or temperature shall be checked for proper operation both before and after use. <b>(T-0)</b> If the authorized employee is not qualified to test the energy being isolated, he or she shall ensure the energy is tested by a qualified person. <b>(T-0)</b>
	Physically attempt to operate energy-isolating devices and attempt to restart the equipment or machinery using normal controls. <b>(T-0)</b> <b>Caution:</b> Return energy-isolating devices to “safe” or “off” position after the test.
<b>7. Keep Authorized Hazardous Energy Control Devices in Place</b>	The LOTO device shall remain in place until work on the machinery/equipment is complete. <b>(T-0)</b>
	When circumstances require testing, adjustment or repositioning of machinery/equipment, it may be necessary to temporarily remove LOTO devices before work is complete in order to verify functionality. The following sequence of actions shall be used when LOTO devices must be temporarily removed from the energy-isolating device:
	1. Notify all affected employees and supervisors. <b>(T-0)</b>
	2. Clear machinery/equipment of tools and materials. <b>(T-0)</b>
	3. Remove all employees from machinery/equipment area and ensure required tools are safely and properly positioned. <b>(T-0)</b>
	4. Remove all repositioning and blocking devices and return all vents and valves to normal operating positions. <b>(T-0)</b>
	5. Remove all grounding/shorting conductors, hooks or wands.
	6. Don any required PPE. <b>(T-0)</b>
	7. Energize and proceed with testing or positioning. <b>(T-0)</b>
	8. De-energize all systems; reapply hazardous energy control measures; notify all affected employees and supervisors; and continue servicing, maintenance or modification of equipment or machinery. <b>(T-0)</b>
<b>8. Before Restoring Machinery/Equipment to Service</b>	The authorized employee will ensure the steps in <b>Figure 21.2</b> are followed in order. <b>(T-0)</b> <b>Note:</b> When the authorized employee is unavailable, follow 29 CFR § 1910.147(e)(3). <b>(T-0)</b>

**Figure 21.2. Three-Step Release from Hazardous Energy Control Procedure Checklist.**

<b>1. Preparation and Notification</b>	Before removing LOTO devices and reenergizing machinery/equipment, the authorized employee shall:
	1. Notify all affected employees the system is ready for return to service. <b>(T-0)</b> Ensure all personnel are clear of the equipment point of operation and other hazard zones. <b>(T-0)</b>

	2. Inspect the work area and ensure all tools, debris and non-essential personnel are removed or are a safe distance from the machinery/equipment. <b>(T-0)</b>
	3. Replace safety guards, inspect machinery/equipment and ensure guards are operational. <b>(T-0)</b>
<b>2. Removal of Additional Devices</b>	Remove any additional devices applied in accordance with hazardous energy control application. <b>(Figure 21.1). (T-0)</b>
	Remove all safety grounding devices. <b>(T-0)</b>
	Verify the work for which hazardous energy control was applied is complete and it's safe to reenergize the machinery/equipment.
<b>3. Removal of all LOTO Devices</b>	Each LOTO device shall be removed only by the authorized employee who applied it. <b>(T-0)</b> When the authorized employee who applied the device is not available to remove it, their supervisor may remove the device in accordance with <b>paragraph 21.6.3. (T-0)</b> This is considered an emergency procedure, undertaken only in extreme circumstances, e.g., use of machinery/equipment is required immediately.
	Authorized employees shall remove all LOTO devices and restore the energy-isolating device to the "ON" position. <b>(T-0)</b>
	Notify all employees the hazardous energy control condition has been cleared (LOTO devices removed) and machinery/equipment is ready for service. <b>(T-0)</b>
	Energize the machinery/equipment and restore to normal operating condition. <b>(T-0)</b>

21.6.1. Group lockout/tagout will be in accordance with 29 CFR § 1910.147(f)(3) and its subordinate paragraphs. **(T-0)**

21.6.2. Group Hazardous Energy Control Verification Procedure. Group hazardous energy control procedures will be developed to ensure authorized employees walk through the affected work area to verify isolation at each LOTO device. **(T-0)** After verification, each authorized employee participating in the group LOTO shall affix their personal LOTO devices to the group LOTO box prior to performing servicing/maintenance. **(T-0)** If there is a potential for the release or re-accumulation of hazardous energy, verification of isolation must be continued. **(T-0) Note:** All group LOTO authorized employees must be informed of their right to verify the effectiveness of the hazardous energy control procedure and verify that hazardous energy sources have been effectively isolated. **(T-0)**

21.6.3. Authorized Employee Requirements. No employee may attach or remove another person's LOTO device, including signing on or signing off for another person, unless the provisions of the exception to 29 CFR § 1910.147(e)(3) are met. **(T-0)** Individual employee device removal indicates that employees are no longer exposed to the hazards from the servicing or maintenance operation.

21.6.4. Shift Changes. Specific, written procedures shall be developed and used during shift or personnel changes to ensure continuity of hazardous energy control protection. **(T-0)** This includes provision for orderly transfer of authorized LOTO devices between off-going and on-coming supervisors and authorized employees to minimize exposure to hazards from

unexpected energization, start-up or release of stored energy from machinery/equipment. Refer to 29 CFR § 1910.147(f)(4) for more information.

**21.7. Hazardous Energy Control Procedures When Establishing An Electrically Safe Work Condition.** When establishing an electrically safe work condition in accordance with NFPA 70E, *Electrical Safety in the Workplace*, Article 120, hazardous energy control program shall meet the requirements of this chapter and procedures listed below.

21.7.1. Simple Lockout/Tagout Procedure. All lockout/tagout procedures that involve only an authorized person(s) de-energizing one set of conductors or circuit part source for the sole purpose of safeguarding employees from exposure to electrical hazards shall be considered to be a simple lockout/tagout. **(T-0)** Simple lockout/tagout procedures shall not be required to be written for each application. Each authorized employee shall be responsible for their own lockout/tagout. **(T-0)**

21.7.2. Complex Lockout/Tagout.

21.7.2.1. A complex lockout/tagout procedure shall be required where one or more of the following exists:

21.7.2.1.1. Multiple energy sources, e.g., electrical and other sources. **(T-0)**

21.7.2.1.2. Multiple crews. **(T-0)**

21.7.2.1.3. Multiple crafts. **(T-0)**

21.7.2.1.4. Multiple locations. **(T-0)**

21.7.2.1.5. Multiple employers. **(T-0)**

21.7.2.1.6. Multiple disconnecting means. **(T-0)**

21.7.2.1.7. Particular sequences. **(T-0)**

21.7.2.1.8. Job or task that continues for more than one work period. **(T-0)**

21.7.2.2. The complex lockout/tagout procedures shall require a written plan of execution in accordance with 29 CFR § 1910.147 and identifies the person(s) in charge. **(T-0)**

21.7.2.3. The complex lockout/tagout procedure shall vest primary responsibility in an authorized employee for employees working under the protection of a group lockout or tagout device, such as an operation lock or lockbox. **(T-0)** The person(s) in charge shall be held accountable for safe execution of the complex lockout/tagout. **(T-0)**

21.7.2.4. Each authorized employee shall affix a personal lockout or tagout device to the group lockout device, group lockbox or comparable mechanism when he or she begins work and shall remove those devices when he or she stops working on the machine or equipment being serviced or maintained. **(T-0)**

21.7.2.5. All complex lockout/tagout plans shall identify the method to account for all persons who might be exposed to electrical hazards in the course of the lockout/tagout. **(T-0)**

**21.8. Contractors.** Interaction with contractors will be in accordance with DoDI 6055.01, AFI 91-202 and 29 CFR § 1910.147(f)(2). **(T-0)** These details will be specified in the contract. **(T-0)**