

## **ATTACHMENT III**

**Pruning, Trimming, Repairing, Maintaining,  
and Removing Trees, and Cutting Brush-  
Safety Requirements**

**ANSI Z133.1-2006**

ANSI Z133.1-2006

# American National Standard

for Arboricultural Operations—  
Safety Requirements

ANSI Z133.1-2006



**ANSI®**  
**Z133.1-2006**  
Revision of  
**ANSI Z133.1-2000**

**American National Standard  
for Arboricultural Operations—  
Safety Requirements**

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## 1 GENERAL

### 1.1 Scope

This standard contains **arboriculture** safety requirements for pruning, repairing, maintaining, and removing trees; cutting brush; and for using equipment in such operations. (Note: Terms specific to the safe practice of arboriculture appear in boldface type at first use and are defined in Annex A, the glossary.)

### 1.2 Purpose

The purpose of this standard is to provide safety criteria for **arborists** and other workers engaged in arboricultural operations. It is intended as a guide to federal, state, and local authorities in drafting their regulations and may be adopted in whole or in part.

### 1.3 Application

This standard is intended to apply to all employers engaged in the business, trade, or performance of arboriculture, including employers engaged in tree pruning, repairing, maintaining; removing trees; cutting brush; or performing pest or soil management who hire one or more persons to perform such work. This standard serves as a reference for safety requirements for those engaged in tree pruning, repairing, maintaining; removing trees; cutting brush; or performing pest or soil management.

This standard may require situational modifications in response to personnel emergencies and is not intended to limit the options available to emergency responders.

### 1.4 Responsibilities of the Employee

Each person (employee or otherwise) shall be responsible for his or her own safety while on the jobsite and shall comply with the appropriate federal or state occupational safety and health standards and all rules, regulations, and orders that are applicable to his or her own actions and conduct.

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## 2 NORMATIVE REFERENCES

This standard contains references to other American national standards and federal regulations, which, through reference in this text, constitute provisions of this American national standard. See Annex D for a list of these and other applicable informative references. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this American national standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex D.

Because of the many specialized procedures utilized during arboricultural operations, it must be emphasized that exceptions to provisions of this standard may be acceptable and that flexibility and/or a decision as to the applicability of these standards to professional operations may be required.

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### **3 GENERAL SAFETY REQUIREMENTS**

#### **3.1 General**

- 3.1.1 Tools and equipment shall conform to the requirements of this standard.
- 3.1.2 Employers shall instruct their employees in the proper use, inspection, and maintenance of tools and equipment, including ropes and lines, and shall require that appropriate working practices be followed.
- 3.1.3 A **qualified arborist** should determine whether **direct supervision** is needed on a jobsite.
- 3.1.4 A **job briefing** shall be performed by the qualified arborist in charge before the start of each job. The briefing shall be communicated to all affected workers. An employee working alone need not conduct a job briefing. However, the employer shall ensure that the tasks are being performed as if a briefing were required.

#### **3.2 Traffic Control Around the Jobsite**

- 3.2.1 High-visibility safety apparel and headgear, when required, shall conform to ANSI-ISEA 107-2004 and the U.S. Department of Transportation (DOT) Manual on Uniform Traffic Control Devices (MUTCD), when required.
- 3.2.2 Effective means for controlling pedestrian and vehicular traffic shall be instituted on every jobsite where necessary, in accordance with the U.S. Department of Transportation (DOT) Manual on Uniform Traffic Control Devices (MUTCD) or applicable state and local laws and regulations.
- 3.2.3 Temporary traffic-control devices used in arboricultural operations shall conform to the U.S. Department of Transportation (DOT) Manual on Uniform Traffic Control Devices (MUTCD) and applicable federal and state regulations.

#### **3.3 Emergency Procedures and Readiness**

- 3.3.1 Emergency phone numbers shall be available when and where arboricultural operations are being carried out. Arborists and other workers shall be instructed as to the specific location of such information.
- 3.3.2 A first-aid kit, adequately stocked and maintained, shall be provided by the employer, when and where arboricultural operations are being carried out. Arborists and other workers shall be instructed in its use and specific location.
- 3.3.3 Instruction shall be provided in the identification, preventive measures, and first-aid treatment of common poisonous plants (poison ivy, poison oak, and poison sumac), stinging and biting insects, and other pests indigenous to the area in which work is to be performed.

- 3.3.4 Employees who may be faced with a rescue decision shall receive training in emergency response and rescue procedures appropriate and applicable to the work to be performed, as well as training to recognize the hazards inherent in rescue efforts (Annex F).
- 3.3.5 Cardiopulmonary resuscitation (CPR) and first-aid training shall be provided in the absence of an infirmary, clinic, or hospital near the worksite.

### **3.4 Personal Protective Equipment (PPE)**

- 3.4.1 Personal protective equipment (PPE), as outlined in this section, shall be required when there is a reasonable probability of injury or illness that can be prevented by such protection. Training shall be provided in the use, care, maintenance, fit, and life of personal protective equipment.
- 3.4.2 Workers engaged in arboricultural operations shall wear head protection (helmets) that conforms to ANSI Z89.1. Class E helmets shall be worn when working in proximity to electrical conductors, in accordance with ANSI Z89.1. Workers shall not place reliance on the dielectric capabilities of such helmets.
- 3.4.3 Face protection shall comply with applicable federal regulations as well as with ANSI Z87.1.
- 3.4.4 Clothing and footwear appropriate to the known job hazards shall be approved by the employer and worn by the employee.
- 3.4.5 Respiratory protection shall comply with applicable federal regulations as well as with ANSI Z88.2.
- 3.4.6 Hearing protection provided by the employer shall be worn when it is not practical to decrease or isolate noise levels that exceed acceptable standards.
- 3.4.7 Eye protection shall comply with ANSI Z87.1 and shall be worn when engaged in arboricultural operations.
- 3.4.8 Chain-saw-resistant leg protection shall be worn while operating a chain saw during ground operations.

### **3.5 Fire Protection**

- 3.5.1 Equipment shall be refueled only after the engine has stopped. Spilled fuel shall be removed from equipment before restarting.
- 3.5.2 Equipment shall not be operated within 10 feet (3.05 m) of refueling operations or areas in which refueling has recently taken place.
- 3.5.3 Flammable liquids shall be stored, handled, and dispensed from approved containers.

- 3.5.4 Smoking shall be prohibited when handling or working around flammable liquids.
- 3.5.5 Clothing contaminated by flammable liquid shall be changed as soon as possible.
- 3.5.6 Open flame and other sources of ignition shall be avoided.

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## 4 ELECTRICAL HAZARDS

### 4.1 General

- 4.1.1 All overhead and underground electrical conductors and all communication wires and cables shall be considered energized with potentially fatal voltages.
- 4.1.2 The employer shall certify that each employee has been trained to recognize and is appropriately qualified to work within proximity to electrical hazards that are applicable to the employee's assignment.
- 4.1.3 Arborists and other workers shall be instructed that
  - (a) electrical shock will occur when a person, by either **direct contact** or **indirect contact** with an energized electrical conductor, energized tree limb, tool, equipment, or other object, provides a path for the flow of electricity to a grounded object or to the ground itself. Simultaneous contact with two energized conductors **phase to phase** will also cause electric shock that may result in serious or fatal injury.
  - (b) electrical shock may occur as a result of **ground fault** when a person stands near a grounded object (for example, if an uninsulated aerial device comes into contact with a conductor with outriggers down).
  - (c) in the event of a downed energized electrical conductor or energized grounded object, there exists the hazard of **step potential**.
- 4.1.4 If the **minimum approach distance** for a **qualified line-clearance arborist** (shown in Table 1) or for a **qualified arborist** (shown in Table 2) cannot be maintained during arboricultural operations, the **electrical system owner/operator** shall be advised and an electrical hazard abatement plan implemented before any work is performed in proximity to energized electrical conductors.

### 4.2 Working in Proximity to Electrical Hazards

- 4.2.1 The items contained in section 4.1 shall always be included in the review of this section.
- 4.2.2 An inspection shall be made by a qualified arborist to determine whether an **electrical hazard** exists before climbing, otherwise entering, or performing work in or on a tree.

**Table 1. Minimum approach distances from energized conductors for qualified line-clearance arborists and qualified line-clearance arborist trainees.**

Nominal voltage in kilovolts (kV) phase to phase	Includes 1910.269 elevation factor, sea level to 5,000 ft*		Includes 1910.269 elevation factor, 5,000–10,000 ft*		Includes 1910.269 elevation factor, 10,001–14,000*	
	ft-in	m	ft-in	m	ft-in	m
0.051 to 0.3	<i>Avoid contact</i>		<i>Avoid contact</i>		<i>Avoid contact</i>	
0.301 to 0.75	1-01	0.33	1-03	0.38	1-04	0.41
0.751 to 15.0	2-05	0.70	2-09	0.81	3-00	0.88
15.1 to 36.0	3-00	0.91	3-05	1.04	3-09	1.00
36.1 to 46.0	3-04	1.01	3-10	1.16	4-02	1.09
46.1 to 72.5	4-02	1.26	4-09	1.44	5-02	1.30
72.6 to 121.0	4-06	1.36	5-02	1.55	5-07	1.68
138.0 to 145.0	5-02	1.58	5-11	1.80	6-05	1.96
161.0 to 169.0	6-00	1.80	6-10	2.06	7-05	2.23
230.0 to 242.0	7-11	2.39	9-00	2.73	9-09	2.95
345.0 to 362.0	13-02	3.99	15-00	4.56	15-03	4.94
500.0 to 550.0	19-00	5.78	21-09	6.60	23-07	7.16
765.0 to 800.0	27-04	8.31	31-03	9.50	33-10	10.29

\*Exceeds phase to ground; elevation factor per 29 CFR 1910.269.

Note: At time of publication, the minimum approach distances in this table for voltages between 301 and 1,000 volts exceed those specified by 29 CFR 1910.269, in anticipation of OSHA adopting these distances during the life of ANSI Z133.1-2006.

- 4.2.3 Only qualified line-clearance arborists or qualified line-clearance arborist trainees shall be assigned to work where an electrical hazard exists. Qualified line-clearance arborist trainees shall be under the direct supervision of qualified line-clearance arborists.
- 4.2.4 A second qualified line-clearance arborist or line-clearance arborist trainee shall be within visual or voice communication during line-clearing operations aloft when an arborist must approach closer than 10 feet (3.05 m) to any energized electrical conductor in excess of 750 volts (primary conductor) or when
- branches or limbs are being removed, which cannot first be cut (with a nonconductive pole pruner/pole saw) to sufficiently clear electrical conductors, so as to avoid contact; and/or
  - roping is required to remove branches or limbs from such electrical conductors.

**Table 2. Minimum approach distances to energized conductors for persons other than qualified line-clearance arborists and qualified line-clearance arborist trainees.**

Nominal voltage in kilovolts (kV) phase to phase*	Distance	
	ft-in	m
0.0 to 1.0	10-00	3.05
1.1 to 15.0	10-00	3.05
15.1 to 36.0	10-00	3.05
36.1 to 50.0	10-00	3.05
50.1 to 72.5	10-09	3.28
72.6 to 121.0	12-04	3.76
138.0 to 145.0	13-02	4.00
161.0 to 169.0	14-00	4.24
230.0 to 242.0	16-05	4.97
345.0 to 362.0	20-05	6.17
500.0 to 550.0	26-08	8.05
785.0 to 800.0	35-00	10.55

\*Exceeds phase to ground per 29 CFR 1910.333.

- 4.2.5 Qualified line-clearance arborists and line-clearance arborist trainees shall maintain minimum approach distances from energized electrical conductors in accordance with Table 1.
- 4.2.6 All other arborists and other workers shall maintain a minimum approach distance from energized electrical conductors in accordance with Table 2.
- 4.2.7 Branches hanging on an energized electrical conductor shall be removed using nonconductive equipment.
- 4.2.8 The tie-in position should be above the work area and located in such a way that a slip would swing the arborist away from any energized electrical conductor or other identified hazard.
- 4.2.9 While climbing, the arborist should climb on the side of the tree that is away from energized electrical conductors while maintaining the required distances shown in Table 1 or 2, as applicable.
- 4.2.10 Footwear, including lineman's overshoes or those with electrical-resistant soles, shall not be considered as providing any measure of safety from electrical hazards.
- 4.2.11 Rubber gloves, with or without leather or other protective covering, shall not be considered as providing any measure of safety from electrical hazards.
- 4.2.12 A rope that is wet, that is contaminated to the extent that its insulating capacity is impaired, or that is otherwise not to be considered insulated for the voltage involved may not be used near exposed energy lines.
- 4.2.13 Ladders, platforms, and aerial devices, including insulated aerial devices, shall be subject to minimum approach distances in accordance with Table 1 or 2, as applicable.
- 4.2.14 Aerial devices with attached equipment (such as chippers) brought into contact with energized electrical conductors shall be considered energized. Contact by people and/or equipment shall be avoided.
- 4.2.15 Emergency response to an electric contact shall be performed in accordance with section 3.3, Emergency Procedures and Readiness.

### **4.3 Storm Work and Emergency Conditions: Line Clearance**

- 4.3.1 The items contained in section 4.1 shall always be included in the review of this section.
- 4.3.2 Line clearance shall not be performed during adverse weather conditions such as thunderstorms, high winds, and snow and ice storms.
- 4.3.3 Qualified line-clearance arborists and qualified line-clearance arborist trainees performing line clearance after a storm or under similar conditions shall be trained in the special hazards associated with this type of work.

- 4.3.4 Line-clearance operations shall be suspended when adverse weather conditions or emergency conditions develop involving energized electrical conductors. Electrical system owners/operators shall be notified immediately.

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## **5 SAFE USE OF VEHICLES AND MOBILE EQUIPMENT USED IN ARBORICULTURE**

### **5.1 General**

- 5.1.1 Prior to daily use of any vehicles and mobile equipment (units), visual walk-around inspections and operational checks shall be made in accordance with manufacturers' and owners' instructions and applicable federal, state, and local requirements.
- 5.1.2 Units shall be equipped and maintained with manufacturers' safety devices, instructions, warnings, and safeguards. Arborists and other workers shall follow instructions provided by manufacturers.
- 5.1.3 Manufacturers' preventive maintenance inspections and parts replacement procedures shall be followed.
- 5.1.4 Manufacturers' instructions shall be followed in detecting hydraulic leaks. No part of the body shall be used to locate or stop hydraulic leaks.
- 5.1.5 Units shall be operated or maintained only by **authorized and qualified personnel** in accordance with company policies and federal, state, or local laws.
- 5.1.6 Material and equipment carried on vehicles shall be properly stored and **secured** in compliance with the design of the unit in order to prevent the movement of material or equipment.
- 5.1.7 Step surfaces and platforms on mobile equipment shall be skid resistant.
- 5.1.8 Safety seat belts, when provided by the manufacturer, shall be worn while a unit is being operated.
- 5.1.9 Riding or working outside or on top of units shall not be permitted unless the units are designed for that purpose or the operator is performing maintenance or inspection.
- 5.1.10 Hoisting or lifting equipment on vehicles shall be used within rated capacities as stated by the manufacturers' specifications.
- 5.1.11 Units with obscured rear vision, particularly those with towed equipment, should be backed up only when absolutely necessary and then should be used with external rear guidance, such as a **spotter**, or a backup alarm.
- 5.1.12 When units are left unattended, keys shall be removed from ignition, the wheels chocked, and, if applicable, the parking brake applied.

- 5.1.13 Units shall be turned off, keys removed from the ignition, and rotating parts at rest prior to making repairs or adjustments, except where manufacturers' procedures require otherwise. Defects or malfunctions affecting the safe operation of equipment shall be corrected before such units are placed into use.
- 5.1.14 Personal protective equipment (for example, eye, head, hand, and ear protection) shall be worn in accordance with section 3.4, Personal Protective Equipment.
- 5.1.15 When towing, safety chains shall be crossed under the tongue of the unit being towed and connected to the towing vehicle.
- 5.1.16 Care should be taken to ensure that a unit's exhaust system does not present a fire hazard.
- 5.1.17 Towed units that detach from another unit (for example, a motorized vehicle) shall be chocked or otherwise secured in place.
- 5.1.18 Units operated off-road shall be operated in the proper gear and at the proper speed relative to the operating environment and the manufacturers' instructions and guidelines.

## **5.2 Aerial Devices**

- 5.2.1 The items contained in section 5.1 shall always be included in the review of this section.
- 5.2.2 Aerial devices shall be provided with an approved point of attachment on which to secure a full-body harness with an energy-absorbing lanyard or body belt and lanyard, which shall be worn when aloft.
- 5.2.3 Booms, buckets, or any other part of the aerial device shall not be allowed to make contact or violate minimum approach distances with energized electrical conductors, poles, or similar conductive objects.
- 5.2.4 Aerial devices or aerial ladders shall not be used as cranes or hoists to lift or lower materials or tree parts, unless they were specifically designed by the manufacturer to do so.
- 5.2.5 Wheel chocks shall be set before using an aerial device unless the device has no wheels on the ground or is designed for use without chocks.
- 5.2.6 Units equipped with outriggers or a stabilizing system shall be operated in a manner consistent with manufacturers' requirements.
- 5.2.7 The operator shall ensure adequate clearance exists and give warning prior to lowering outriggers. Pads shall be placed under outrigger feet when they are needed to ensure stable footing.
- 5.2.8 When operating aerial devices, the operator shall look in the direction the bucket is traveling and be aware of the location of the booms in relation to all other objects and hazards.



- 5.2.9 Clearances from passing vehicles shall be maintained, or traffic control shall be provided when booms or buckets are operated over roads.
- 5.2.10 One-person buckets shall not have more than one person in them during operations.
- 5.2.11 Hydraulic/pneumatic tools shall be disconnected when they are being serviced or adjusted, except where manufacturers' procedures require otherwise.
- 5.2.12 To avoid flying particles or whipping hydraulic/pneumatic hoses, pressure shall be released before connections are broken, except where **quick-acting connectors** are used. Hydraulic/pneumatic hoses shall never be kinked in order to cut off pressure.
- 5.2.13 No part of the body shall be used to locate or stop hydraulic leaks.
- 5.2.14 Hoses affecting dielectric characteristics of equipment shall meet manufacturers' requirements.
- 5.2.15 The flash point of hydraulic fluid shall meet the minimum set by the manufacturer.
- 5.2.16 Combined loads shall not exceed rated lift capacities. Load ratings shall be conspicuously and permanently posted on aerial devices in accordance with ANSI A92.2.
- 5.2.17 Electric cables/cords used with electric saws or lights, or other conductive material shall not be run from the vehicle to the bucket when arborists are working in proximity to energized electrical conductors.
- 5.2.18 Aerial devices shall not be moved with an arborist on an elevated platform (for example, a bucket) except when equipment is specifically designed for such operation.
- 5.2.19 Holes shall not be drilled in buckets or liners.
- 5.2.20 During aerial device operations, arborists and other workers who are not qualified line-clearance arborists shall maintain a minimum approach distance from energized electrical conductors in accordance with Table 2. Only qualified line-clearance arborists or qualified line-clearance arborist trainees using an insulated aerial device may operate in accordance with minimum approach distances provided in Table 1.
- 5.2.21 Arborists and other workers shall be instructed that insulated aerial buckets do not protect them from other electric paths to the ground, such as paths through trees, guy wires, or from one phase wire to the second phase wire, any one of which can be fatal.
- 5.2.22 All underground hazards shall be located prior to operating aerial lift devices off-road. These hazards could include natural gas tanks, underground oil tanks, and septic systems.

### **5.3 Brush Chippers**

- 5.3.1 The items contained in section 5.1 shall always be included in the review of this section.
- 5.3.2 Access panels (for example, guards) for maintenance and adjustment, including discharge chute and cutter housing, shall be closed and secured prior to starting the engine of brush chippers. These access panels shall not be opened or unsecured until the engine and all moving parts have come to a complete stop (see Annex C, General Safety Procedures That Apply to All Tree Work).
- 5.3.3 Rotary drum or disc brush chippers not equipped with a mechanical infeed system shall be equipped with an infeed hopper not less than 85 inches (2.15 m) measured from the blades or knives to ground level over the center line of the hopper. Side members of the infeed hopper shall have sufficient height so as to prevent workers from contacting the blades or knives during operations.
- 5.3.4 Rotary drum or disc brush chippers not equipped with a mechanical infeed system shall have a flexible anti-kickback device installed in the infeed hopper to reduce the risk of injury from flying chips and debris.
- 5.3.5 Chippers equipped with a mechanical infeed system shall have a quick-stop and reversing device on the infeed system. The activating mechanism for the quick-stop and reversing device shall be located across the top, along each side, and close to the feed end of the infeed hopper within easy reach of the worker.
- 5.3.6 Vision, hearing, and/or other appropriate personal protective equipment shall be worn when in the immediate area of a brush chipper in accordance with section 3.4, Personal Protective Equipment.
- 5.3.7 Arborists, mechanics, and other workers shall not, under any circumstances, reach into the infeed hopper when the cutter disc, rotary drum, or feed rollers are moving.
- 5.3.8 When trailer chippers are detached from the vehicles, they shall be chocked or otherwise secured in place.
- 5.3.9 When in a towing position, chipper safety chains shall be crossed under the tongue of the chipper and properly affixed to the towing vehicle.
- 5.3.10 See section 8.6, Brush Removal and Chipping, for additional requirements.

### **5.4 Sprayers and Related Equipment**

- 5.4.1 The items contained in section 5.1 shall always be included in the review of this section.
- 5.4.2 Working and walking surfaces of all sprayers and related equipment shall be covered with skid-resistant material.

- 5.4.3 Equipment on which the applicator/operator stands while the vehicle is in motion shall be equipped with guardrails around the working area. Guardrails shall be constructed in accordance with ANSI A1264.1.
- 5.4.4 The applicator/operator shall make a visual inspection of hoses, fittings, exposed plumbing, tanks, covers, and related equipment prior to its use each workday.
- 5.4.5 The applicator/operator shall not allow hoses or other parts of the equipment to create a tripping hazard for coworkers or the public.
- 5.4.6 The applicator/operator shall have a firm grip on the spray gun/excavation tool when pulling the trigger.
- 5.4.7 The operator of **high-pressure excavation** equipment shall wear a face shield in addition to eye protection.
- 5.4.8 Related Equipment
  - 5.4.8.1 The applicator/operator shall be aware of underground utility locations when drilling holes in the ground for fertilizer or pesticide applications.
  - 5.4.8.2 The equipment shall have splash guards, and the applicator shall wear eye protection when injecting liquid fertilizer or pesticides into the ground.
  - 5.4.8.3 The applicator shall wear eye protection and follow label instructions when injecting liquids into trees.

## **5.5 Stump Cutters**

- 5.5.1 The items contained in section 5.1 shall always be included in the review of this section.
- 5.5.2 Stump cutters shall be equipped with enclosures or guards that reduce the risk of injury during operation. Enclosures or guards shall be kept in place when stump cutters are operative.
- 5.5.3 Arborists and other workers in the immediate stump-cutting work zone shall wear vision, hearing, and/or other personal protective equipment in accordance with section 3.4, Personal Protective Equipment.
- 5.5.4 When in a towing position, stump-cutter safety chains shall be crossed under the tongue of the stump cutter and properly affixed to the towing vehicle.
- 5.5.5 Towable stump cutters or stump-cutter trailers, when detached from the vehicle, shall be chocked or otherwise secured in place.
- 5.5.6 The operator shall be aware of underground utility locations prior to performing work.

## **5.6 Vehicles**

- 5.6.1 The items contained in section 5.1 shall always be included in the review of this section.
- 5.6.2 A steel bulkhead or equivalent protective devices shall be provided to protect workers from load shifts in vehicles carrying logs or other material.
- 5.6.3 Load securement procedures shall be followed to prevent accidental shifting or discharge of logs or other materials from the vehicle during transport.
- 5.6.4 Logs or other material shall not overhang the sides; obscure taillights, brake lights, or vision; or exceed height limits per state and local requirements for bridges, overpasses, utility lines, or other overhead hazards.
- 5.6.5 To avoid the hazard of spontaneous combustion or the generation of undesirable odors, wood chips should not be left in vehicles for extended periods.

## **5.7 Log Loaders, Knucklebooms, Cranes, and Related Hoists**

- 5.7.1 The items contained in section 5.1 shall always be included in the review of this section.
- 5.7.2 Log loaders, cranes, and related hoisting equipment shall be inspected in accordance with applicable standards as well as manufacturers' instructions and guidelines. Chokers, slings, and other means of lifting, lowering, or rigging equipment shall be inspected before each use. An inspection procedure checklist should be available to the crew.
- 5.7.3 Operators of hoisting equipment shall be trained and shall maintain a minimum approach distance from energized conductors in accordance with Table 1 or 2, as applicable. A spotter shall be used when work is being performed in proximity to electrical conductors. Personnel assigned to work in proximity to the tree removal shall be trained and follow guidelines for electrical hazards (section 4, Electrical Hazards).
- 5.7.4 The crane operator shall be familiar with the potential hazards encountered and operational techniques used in tree work.
- 5.7.5 Cranes with telescoping booms shall be equipped with an **anti-two block device**. A boom angle indicator and a device to indicate the boom's extended length shall be clearly visible to the operator at all times. A load rating chart with clearly legible letters and figures shall be provided with each crane and securely fixed at a location easily visible to the operator.
- 5.7.6 Operators of hoisting equipment shall remain at the controls while a load is lifted, suspended, or lowered.
- 5.7.7 Tree sections shall be rigged to minimize load shifting. Controlled load lowering shall be employed. Shock-loading shall be avoided, and free fall is prohibited. A green log weight chart (Annex E) shall be available to the crew.

- 5.7.8 Riding the load line of a crane while it is under load tension shall be prohibited, except for circumstances outlined in subsection 5.7.9.11.
- 5.7.9 A qualified arborist may be hoisted into position utilizing a crane if the arborist is **tyed in with an arborist climbing line and arborist saddle** and secured to a designated anchor point on the boom line or crane. The following procedures shall be followed when an arborist is to be lifted by a crane:
- 5.7.9.1 The person specifically responsible for the work shall authorize the use of a crane for hoisting an arborist into position only when he or she has determined that it is the safest, most practical way to perform the work or gain access to the tree.
  - 5.7.9.2 The qualified crane operator and the person responsible for the work to be performed shall meet prior to the work to review the procedures to be followed. If the work involves a signal person and/or arborist being lifted, these persons shall participate in the review as well. A job briefing shall be done before any work begins, in accordance with subsection 3.1.4.
  - 5.7.9.3 The arborist climbing line shall be secured to the crane in such a way that it does not interfere with the function of any damage-prevention or warning device on the crane and so that no part of the crane compromises the climbing line or any component of the climbing system.
  - 5.7.9.4 The crane operator shall test the adequacy of footing prior to any lifting. The crane shall be uniformly level and located on firm footing. If necessary, blocking shall be used so that the support system does not exceed its load-bearing capabilities. Cranes equipped with outriggers shall have them all fully extended and properly set, as applicable, before lifting and lowering operations begin and/or before the qualified arborist is lifted.
  - 5.7.9.5 Lifting and supporting shall be done under controlled conditions and under the direction of a qualified arborist or an appointed signal person.
  - 5.7.9.6 The load-line hoist drum shall have a system or other device on the power train, other than the load hoist brake, that regulates the lowering speed of the hoist mechanism.
  - 5.7.9.7 Communication between the crane operator and the arborist being lifted shall be maintained either directly or through the appointed signal person. This communication shall either be visual, using the accepted hand signals, or audible, using voice or radio. Radio communication should be used to control blind picks. The crew members shall know and follow hand signals for standard crane operations (Annex G).
  - 5.7.9.8 The crane operator shall remain at the controls when the qualified arborist is attached to the crane and during lifting and lowering operations.

- 5.7.9.9 The crane boom and load line shall be moved in a slow, controlled, cautious manner when the arborist is attached. Lifting or lowering speed shall not exceed 100 feet/minute (0.5 m/sec), and any sudden movements should be avoided. The crane shall be operated so that lowering is power controlled.
- 5.7.9.10 The crane carrier shall not travel at any time while the qualified arborist is attached. An accurate determination of the load radius to be used during lifting shall be made before the qualified arborist is hoisted.
- 5.7.9.11 The qualified arborist shall be detached from the crane any time it comes under load tension.

**EXCEPTION**

When it has been determined that all reasonably possible alternate methods are inaccessible and attachment to the subject tree would create a greater safety risk due to its hazardous condition, the qualified crane operator and the qualified arborist shall allow the qualified arborist to remain attached to the crane when it is under load. Possible alternate methods include, but are not limited to,

- (a) the qualified arborist securing to the tree and detaching from the crane before it comes under load;
  - (b) using a second crane;
  - (c) using an aerial lift device; or
  - (d) using an adjacent tree.
- 5.7.9.12 When the qualified arborist is attached to the crane while it is under load, the total weight shall not exceed 50 percent of the load capacity for the radius and configuration of the crane.

**5.8 Specialized Units**

- 5.8.1 The items contained in section 5.1 shall always be included in the review of this section.
- 5.8.2 Off-road and tracked vehicles shall be operated at the proper speed and in the proper gear relative to the operating environment and the manufacturer's instructions and guidelines.
- 5.8.3 Towing equipment for brush hogs and similar implements should be equipped with a **deadman control**. When deadman controls are not available, the worker shall disengage the power source to the rotary or cutter head before dismounting.

**5.9 Equipment-Mounted Winches**

- 5.9.1 The items contained in section 5.1 shall always be included in the review of this section.
- 5.9.2 Operators shall wear the appropriate personal protective equipment during winch operations.
- 5.9.3 The winch cable shall be inspected daily for broken or worn strands, bird caging, and major kinks. Damaged cables shall be taken out of service.

- 5.9.4 Cable hooks and attachment points shall be inspected for damage. Damaged hooks or attachment assemblies shall be taken out of service.
- 5.9.5 All mounting bolts and hardware shall be inspected for loose or missing components. The winch shall not be used until complete repairs are made to damaged or missing bolts and hardware.
- 5.9.6 Operators shall be aware of the dangers of load or cable breakage and ensure that all personnel remain clear of the recoil area in the event of load or cable breakage.
- 5.9.7 All winch operators shall be properly trained and be aware of the inherent dangers associated with winch operations.
- 5.9.8 Operators shall be aware of the winch cable at all times during extension and ensure that it does not become a hazard to personnel or machinery.
- 5.9.9 Winch systems and cables shall be used only as intended and instructed by the manufacturer.
- 5.9.10 The winch shall never be used with personnel, including the operator, within the span of the winch cable and the winch.
- 5.9.11 Pinch point hazards develop during winching operations; therefore, all operators involved in the winching operation shall constantly be aware of such hazards and stand clear of these areas.
- 5.9.12 All loads shall be pulled in such a manner as to avoid angles that may result in tipping, cause the vehicle to become unstable, or result in unintended movement of the vehicle.
- 5.9.13 Pulling loads from the side requires special equipment and techniques. Therefore, loads shall be pulled in line with the winch unless the winch is properly equipped with a fair lead and the operator is trained to pull loads at an angle.
- 5.9.14 The operator shall ensure that the vehicle supporting the winch is secured to avoid unintended movement.
- 5.9.15 The operator shall ensure that all rigging points comply with section 8.4, Rigging.
- 5.9.16 To ensure precise communication, an effective means of communication shall be established and used with all workers involved in the winching operations (see subsection 8.4.11).

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## **6 PORTABLE POWER HAND TOOLS**

### **6.1 General**

- 6.1.1 The purpose of this section is to provide guidelines for arborists and other workers pertaining to the safe use and care of portable power hand tools.
- 6.1.2 Manufacturers' operating and safety instructions shall be followed unless modified by this standard.
- 6.1.3 Communications shall be established among arborists working aloft, either in a tree or from an aerial device, and arborists and other workers on the ground, before starting or otherwise using any portable power hand tools. The command "stand clear" from aloft and response "all clear" from the ground are terms that may be used for this purpose. Pre-arranged, two-way hand signals may also be used. Arborists and other workers returning to the work area shall be acknowledged by arborists aloft.

### **6.2 Portable Electric Power Tools**

- 6.2.1 The items contained in section 6.1 shall always be included in the review of this section.
- 6.2.2 Corded electric power tools shall not be used in trees or aerial devices near energized electrical conductors where there is a possibility of power tools or supply cords contacting the conductor.
- 6.2.3 All corded portable electric power tools shall be
  - (a) equipped with three-wire cords having the ground wire permanently connected to the tool frame and a means for grounding the other end; or
  - (b) double insulated and permanently labeled as "double insulated"; or
  - (c) connected to power supplies by means of an isolating transformer or other isolated power supply.
- 6.2.4 Extension cords shall be maintained in safe condition. Exposed metal sockets shall not be used.
- 6.2.5 Arborists and other workers shall
  - (a) prevent cords from becoming entangled, damaged, or cut by blades and bits;
  - (b) avoid laying extension cords in water; and
  - (c) support electric power tools and supply cords by a tool lanyard or separate line, as appropriate to the work, when used aloft.



### **6.3 Chain Saws**

- 6.3.1 The items contained in section 6.1 shall always be included in the review of this section.
- 6.3.2 Chain saws shall not be operated unless the manufacturer's safety devices are in proper working order. Chain-saw safety devices shall not be removed or modified.
- 6.3.3 When an arborist or other worker is working in a tree other than from an aerial device, chain saws weighing more than 15 pounds (6.8 kg) service weight shall be made safe against falling (i.e., supported by a separate line or tool lanyard).
- 6.3.4 Secure footing shall be maintained when starting the chain saw.
- 6.3.5 When starting a chain saw, the operator shall hold the saw firmly in place on the ground or otherwise support the saw in a manner that minimizes movement of the saw when pulling the starter handle. The chain saw shall be started with the chain brake engaged, on saws so equipped. Drop-starting a chain saw is prohibited.
- 6.3.6 Chain-saw engines shall be started and operated only when other arborists and workers are clear of the chain saw.
- 6.3.7 When operating a chain saw, the arborist or other worker shall hold the saw firmly with both hands, keeping the thumb and fingers wrapped around the handle.
- 6.3.8 Arborists shall use a second point of attachment (for example, lanyard or double-crocheted climbing line) when operating a chain saw in a tree, unless the employer demonstrates that a greater hazard is posed by using a second point of attachment while operating a chain saw in that particular situation. Using both ends of a two-in-one lanyard shall not be considered two points of attachment when using a chain saw.
- 6.3.9 Chain-saw mufflers and spark arresters (if the latter are provided) shall be maintained in good condition.
- 6.3.10 The chain brake shall be engaged, or the engine shut off, before setting a chain saw down.
- 6.3.11 When a chain saw is being carried more than two steps, the chain brake shall be engaged or the engine shut off. The chain saw shall be carried in a manner that will prevent operator contact with the cutting chain and the muffler.
- 6.3.12 The chain-saw operator shall be certain of footing before starting to cut. The chain saw shall not be used in a position or at a distance that could cause the operator to become off-balance, have insecure footing, or relinquish a firm grip on the saw.

#### **6.4 Powered Pole Tools and Backpack Power Units**

- 6.4.1 The items contained in section 6.1 shall always be included in the review of this section.
- 6.4.2 Only workers operating the equipment shall be within 10 feet (3.05 m) of the cutting head of a brush saw during operations.
- 6.4.3 Power units shall be equipped with a readily accessible, quick shutoff switch.
- 6.4.4 Operators shall observe the position of all other workers in the vicinity while the equipment is running.
- 6.4.5 Engines shall be stopped for all cleaning, refueling, adjustments, and repairs to the saw or engine, except where manufacturers' procedures require otherwise.
- 6.4.6 Powered pole tools with poles made of metal or other conductive material shall not be used in operations where electrical hazards exist.

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### **7 HAND TOOLS AND LADDERS**

#### **7.1 General**

- 7.1.1 Correct hand tools and equipment shall be selected for the job.
- 7.1.2 Hand tools and equipment that have been made unsafe by damage or defect, including tools with loose or cracked heads or cracked, splintered, or weakened handles, shall not be used.
- 7.1.3 Workers shall maintain a safe working distance from other workers when using hand tools and equipment.
- 7.1.4 When climbing into a tree, arborists shall not carry hand tools and equipment in their hands unless the tools are used to assist them in climbing. Tools other than ropes or throwlines shall not be thrown into a tree or between workers aloft.
- 7.1.5 Arborist climbing lines or **handlines** should be used for raising and lowering hand tools and equipment. Arborists should raise or lower hand tools and equipment in a manner such that the cutting edge will not contact the arborist climbing line or handline.
- 7.1.6 Hand tools and equipment shall be properly stored or placed in plain sight out of the immediate work area when not in use.

#### **7.2 Cant Hooks, Cant Dogs, Peaveys, and Tong**

- 7.2.1 The items contained in section 7.1 shall always be included in the review of this section.
- 7.2.2 **Cant hooks** should be firmly set before applying force.

- 7.2.3 Points of hooks shall be at least 2 inches (5 cm) long and kept sharp.
- 7.2.4 Arborists and other workers shall always stand uphill from rolling logs, and all workers shall be warned and in the clear before logs are moved.

### **7.3 Wedges, Chisels, and Gouges**

- 7.3.1 The items contained in section 7.1 shall always be included in the review of this section.
- 7.3.2 **Wedges**, chisels, and gouges shall be inspected for cracks and flaws before use. Tools with damaged heads shall not be used.
- 7.3.3 Wedges and chisels shall be properly pointed and tempered.
- 7.3.4 Eye protection shall be used during impact operations.
- 7.3.5 Only wood, plastic, or soft-metal wedges shall be used while operating chain saws.
- 7.3.6 Wood-handled chisels should be protected with a ferrule on the striking end.
- 7.3.7 Wood, rubber, or high-impact plastic **mauls**, sledges, or hammers should be used when striking wood-handled chisels or gouges.

### **7.4 Chopping Tools**

- 7.4.1 The items contained in section 7.1 shall always be included in the review of this section.
- 7.4.2 **Chopping tools** should not be used while working aloft.
- 7.4.3 Chopping tools shall not be used as wedges or used to drive metal wedges.
- 7.4.4 Chopping tools shall be swung away from the feet, legs, and body, using the minimum force practical for function and control.
- 7.4.5 When swinging tools such as grub hoes, mattocks, and axes, a secure grip, firm footing, and clearance of workers and overhead hazards shall be maintained.

### **7.5 Ladders**

- 7.5.1 The items contained in section 7.1 shall always be included in the review of this section.
- 7.5.2 **Ladders** made of metal or other conductive material shall not be used where electrical hazards exist. Only wooden ladders (constructed in accordance with ANSI A14.1) or nonconductive ladders made of synthetic material equal to or exceeding the strength of wooden ladders shall be used.
- 7.5.3 Metal ladders used where no electrical hazard exists shall conform to ANSI A14.2.

- 7.5.4 All ladders shall be inspected before use and removed from service if found defective.
- 7.5.5 Cleats, metal points, skid-resistant feet, lashing, or other effective means of securing the ladder shall be used when there is danger of slipping.
- 7.5.6 Ladders shall not be used as bridges or inclined planes to load or handle logs or other material.
- 7.5.7 Ladders shall be supported while in storage to prevent sagging. Except when on mobile equipment, ladders should be stored under suitable cover, protected from the weather, and kept in a dry location away from excessive heat.
- 7.5.8 The third, or hinged, leg of a tripod/orchard ladder shall be braced or fastened when on hard or slick surfaces.
- 7.5.9 All ladders shall be used in accordance to the manufacturers' recommendations and shall not be altered in a way that contradicts those recommendations.

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## **8 WORK PROCEDURES**

### **8.1 Ropes and Arborist Climbing Equipment**

- 8.1.1 A visual hazard assessment, including a root collar inspection, shall be performed prior to climbing, entering, or performing any work in a tree.
- 8.1.2 A second arborist or other worker trained in emergency procedures shall be within visual or voice communication during arboricultural operations above 12 feet (3.65 m) that are not subject to the requirements of subsection 4.2.4.
- 8.1.3 Climbing lines used in a split-tail system and split-tails shall be terminated with an eye splice or a knot that interfaces appropriately with the connecting link that it is attached to. The **termination knot** selected shall remain secure under normal loading and unloading. When using a **carabiner** without a captive eye, the knot or eye splice shall cinch in place to prevent accidental opening and/or side-loading of the carabiner.
- 8.1.4 Arborists shall inspect climbing lines, worklines, lanyards, and other climbing equipment for damage, cuts, abrasion, and/or deterioration before each use and shall remove them from service if signs of excessive wear or damage are found.
- 8.1.5 Arborist saddles and lanyards used for work positioning shall be identified by the manufacturer as suitable for tree climbing.
- 8.1.6 Arborist saddles and lanyards used for work positioning shall not be altered in a manner that would compromise the integrity of the equipment.

- 8.1.7 Hardware used in the manufacture of arborist saddles shall meet the hardware material, strength, and testing requirements outlined in ANSI 359.1.
- 8.1.8 Arborist climbing lines shall have a minimum diameter of 1/2 inch (12.7 mm) and be constructed from a synthetic fiber, with a minimum breaking strength of 5,400 pounds (24.02 kilonewtons [kN]) when new. Maximum working elongation shall not exceed 7 percent at a load of 540 pounds (2.402 kN). Arborist climbing lines shall be identified by the manufacturer as suitable for tree climbing.

**EXCEPTION**

In arboricultural operations not subject to regulations that supersede Z133.1, a line of not less than 7/16 inch (11 mm) diameter may be used, provided the employer can demonstrate it does not create a safety hazard for the arborist and the arborist has been instructed in its use. The strength and elongation ratings of the line selected shall meet or exceed that of 1/2-inch (12.7 mm) arborist climbing line.

- 8.1.9 Prusik loops, split-tails, and work-positioning lanyards used in a climbing system shall meet the minimum strength standards for arborist climbing lines.
- 8.1.10 Snap hooks (rope snaps) used in climbing shall be self-closing and self-locking, with a minimum tensile strength of 5,000 pounds (22.24 kN).
- 8.1.11 Carabiners used in climbing shall be self-closing and self-locking, with a minimum tensile strength of 5,000 pounds (22.24 kN). Carabiners shall be designed to release the load by requiring at least two consecutive, deliberate actions to prepare the gate for opening.
- 8.1.12 Splicing shall be done in accordance with cordage manufacturers' specifications.
- 8.1.13 All load-bearing components of the climbing system shall meet the minimum standards for arborist climbing equipment.
- 8.1.14 Equipment used to secure an arborist in the tree or from an aerial lift shall not be used for anything other than its intended purpose.

**EXCEPTION**

The arborist climbing line may be used to raise and lower tools.

- 8.1.15 Rope ends shall be finished in a manner to prevent raveling.
- 8.1.16 Ropes and climbing equipment shall be stored and transported in such a manner to prevent damage through contact with sharp tools, cutting edges, gas, oil, or chemicals.
- 8.1.17 Arborist climbing lines shall never be left in trees unattended.
- 8.1.18 Arborists shall have available a climbing line and at least one other means of being secured while working aloft; for example, an arborist climbing line and a work-positioning lanyard.

- 8.1.19 The arborist shall be **secured** while ascending the tree. The arborist shall be tied in once the work begins and shall be tied in until the work is completed and he or she has returned to the ground. The arborist shall be secured when repositioning the climbing line.
- 8.1.20 While ascending a ladder to gain access to a tree, the arborist shall not work from or leave the ladder until he or she is tied in or otherwise secured.
- 8.1.21 Hands and feet should be placed on separate limbs, if possible, and three points of contact should be maintained with the tree while climbing.
- 8.1.22 A **false crotch** and/or false crotch redirect may be used at the discretion of the arborist in lieu of a natural crotch.
- 8.1.23 The tie-in position should be well above the work area so that the arborist will not be subjected to an uncontrolled pendulum swing in the event of a slip.
- 8.1.24 When a climber is working at heights greater than one-half the length of the arborist climbing line, a figure-8 knot shall be tied in the end of the arborist climbing line to prevent pulling the rope through the **climbing hitch**.

## **8.2 Pruning and Trimming**

- 8.2.1 Communications among arborists aloft and among arborists and other workers on the ground shall be established before cutting and dropping limbs. The command "stand clear" from aloft and the response "all clear" from the ground are terms that may be used for this purpose. Pre-arranged, two-way hand signals may also be used. Arborists and other workers returning to the work area shall be acknowledged by arborists aloft.
- 8.2.2 Pole pruners and pole saws, when hung, shall be securely positioned to prevent dislodgment. Pole pruners or pole saws shall not be hung on electrical conductors or left in a tree unattended. Pole saws and pole pruners shall be hung so that sharp edges are away from the arborist and shall be removed when the arborist leaves the tree.
- 8.2.3 Scabbards or sheaths shall be used to carry handsaws when not in use. Folding saws, when not in use, shall be closed and hooked to the arborist saddle.
- 8.2.4 Pole tools used in line-clearance operations shall be constructed with fiberglass reinforced plastic (FRP) or wooden poles meeting the requirements of OSHA 1910.269.
- 8.2.5 A separate workline shall be attached to limbs that cannot be dropped safely or controlled by hand. Arborist climbing lines and worklines shall not be secured to the same **crotch**.

- 8.2.6 Dry conditions and dead palm fronds present an extreme fire hazard. When dry conditions exist, arborists and other workers shall not smoke while working in or near dead palm fronds. All chain saws used under such conditions shall have mufflers and spark arresters in good working condition.
- 8.2.7 Palm frond skirts that have three years or more of growth shall be removed from the top down. Arborists performing this work shall be supported by an arborist climbing line and a false crotch. Arborists shall never attempt to remove skirts of three years or more by positioning themselves below work areas while being supported by a lanyard.
- 8.2.8 Cut branches shall not be left in trees upon completion of work.

### **8.3 Cabling**

- 8.3.1 Arborists and other workers on the ground shall not stand under the work area of a tree when a cabling system is being installed.
- 8.3.2 Tools used for cabling, bark tracing, and cavity work shall be carried in a bag, on a belt designed to hold such tools, or attached to a tool lanyard.
- 8.3.3 Arborists installing cabling systems in trees shall be positioned off to one side in order to avoid injury in case of cable system failure that could occur when a block and tackle or a hand winch is released.

### **8.4 Rigging**

- 8.4.1 Arborists performing rigging operations shall inspect trees for their integrity to determine whether the trees have any visible defect that could affect the operation. If it is determined that the tree poses a risk of failure due to the forces and strains that will be created by the design of the rigging operation, an alternate plan shall be used.
- 8.4.2 The number of connecting links used for connecting components of a rigging system shall be minimized when possible. Care shall be taken to ensure that connecting links interface properly and in compliance with manufacturers' recommendations.
- 8.4.3 The qualified arborist shall ensure that load ratings shown on the rigging equipment or provided by the manufacturer for all ropes, connecting links, and rigging equipment are observed in all rigging operations. Rigging equipment shall be chosen for the specific task based on **working-load limits** and design specifications.
- 8.4.4 All equipment used for rigging operations shall be in **good working condition**. Equipment that has been damaged or overloaded shall be removed from service.
- 8.4.5 When the potential exists for rigging equipment to be confused with climbing equipment, the equipment shall be clearly marked to indicate their different purposes.

- 8.4.6 Rigging points shall be assessed for their structural integrity by a qualified arborist. The rigging plan and the tree shall be considered relative to the forces being applied to any part of the tree, including branch attachments and anchoring roots, before a rigging point is chosen and established.
- 8.4.7 Climbers shall choose tie-in points that will provide proper protection while allowing for a separation between the rigging system and the climbing system. Running rigging lines shall not be allowed to come into contact with any part of the climbing system.
- 8.4.8 Arborists performing rigging operations shall be educated to understand and trained to estimate the potential forces at any point in the rigging system being used. The system components shall comply with working-load limits relative to the operation and the maximum potential forces.
- 8.4.9 Careful consideration shall be given to the potential forces resulting from the specific influences of rope angles as well as the number of lines and/or line parts that will act on any rigging point.
- 8.4.10 Arborists working aloft (either climbing the tree or from an aerial device) shall establish a communication system with arborists and other workers on the ground.
- 8.4.11 A method of verbal/visual communication shall be discussed and established during the job briefing, prior to the start of removal/rigging operations. The verbal/visual communication system shall use an established command and response system (see example) or pre-arranged, two-way hand signals. The communication method shall be clearly understood and used during all rigging operations.
- Example**  
Command: Stand clear!  
Response: All Clear!, Underneath!, or No!
- 8.4.12 A work zone shall be established prior to the start of rigging operations. Workers not directly involved in the rigging operation shall stay out of the pre-established work zone until it has been communicated by a qualified arborist or **qualified arborist trainee** directly involved in the rigging operation that it is safe to enter the work zone. Workers shall be positioned and their duties organized so that the actions of one worker will not create a hazard for any other worker.
- 8.4.13 Only qualified arborists or qualified arborist trainees directly involved in the operation shall be permitted in the work zone when a load is being suspended by the rigging system.
- 8.4.14 Taglines or other means may be used to help control and handle suspended loads.



- 8.4.15 Arborists working aloft shall position themselves so as to be above or to the side of the piece being rigged and out of the path of movement of the piece when it has been cut. Climbers and their climbing systems shall be positioned outside of the rigging system itself when a cut is being made or a load is being moved or lowered. Climbers shall have an escape plan prepared.
- 8.4.16 The spars, limbs, or leaders being worked on and the spars being used for tie-in and/or rigging points shall be assessed for structural integrity and potential reaction forces that could cause a spar to split when it is cut.
- 8.4.17 Steps shall be taken to prevent spars from splitting or tearing during the rigging operation, and climbers shall take steps to avoid trapping, pinning, or entangling themselves in the system should the tree split or the rigging fail. Load binders are one possible means of preventing splitting.

## 8.5 Tree Removal

- 8.5.1 Before beginning any tree removal operation, the chain-saw operator and/or crew leader shall carefully consider all relevant factors pertaining to the tree and site and shall take appropriate actions to ensure a safe removal operation. The following factors should be considered:
- (a) the area surrounding the tree to be removed, including nearby trees;
  - (b) species and shape of the tree;
  - (c) lean of the tree;
  - (d) loose limbs, chunks, or other overhead material;
  - (e) wind force and direction;
  - (f) decayed or weak spots throughout the tree (be aware of additional hazards if these conditions exist in the hinge area);
  - (g) location and means to protect other persons, property, and electrical conductors;
  - (h) size and terrain characteristics or limitations of the work area; and
  - (i) evidence of bees or wildlife habitation in the tree.
- 8.5.2 Work plans for removal operations shall be communicated to all workers in a job briefing before commencing work.
- 8.5.3 Workers not directly involved in the removal operation shall be clear of the work area, where practicable, beyond the length of the tree, unless a team of workers is necessary to remove a particular tree.

- 8.5.4 A planned escape route for all workers shall be prepared before cutting any standing tree or trunk. The preferred escape route is 45 degrees on either side of a line drawn opposite the intended direction of the fall. Obstructions shall be cleared along the escape path. The chain-saw operator shall use this path for egress once the cut has been completed.
- 8.5.5 When it is necessary to shorten or remove branches before removing the tree, the arborist shall attempt to determine whether the tree can withstand the strain of the lowering procedures. If not, other means of removing the tree should be considered.
- 8.5.6 The crew leader shall determine the number of workers necessary for tree removal operations.
- 8.5.7 The crew leader shall develop a work plan so that operations do not conflict with each other, thereby creating a hazard.
- 8.5.8 Climbing spurs shall have gaffs of a type and length compatible for the tree being climbed.
- 8.5.9 Wedges, block and tackle, rope, wire cable (except where an electrical hazard exists), or other appropriate devices shall be used when there is a danger that the tree or trees being removed may fall in the wrong direction or damage property. All limbs shall be removed to a height and width sufficient to allow the tree to fall clear of any wires and other objects in the vicinity.
- 8.5.10 **Tackle blocks and pulleys** and their connecting links shall be inspected immediately before use and removed from service if they are found to be defective.
- 8.5.11 Workers returning to the work area shall not enter until the chain-saw operator has acknowledged that it is safe to do so.
- 8.5.12 When a pull line is being used, workers involved in removing a tree or trunk shall be clear by a minimum of one tree length.
- 8.5.13 Workers not directly involved in **manual land-clearing** operations shall be at least two tree lengths away from the tree or trunk being removed.

**EXCEPTION**

This requirement does not apply in the presence of site restrictions, such as waterways or cliffs. Other arborists and workers shall be beyond the trees' striking range and at a distance as close to twice the tree's height as practicable.

- 8.5.14 Notches shall be used on all trees and trunks greater than 5 inches (12.7 cm) in diameter at breast height.
- 8.5.15 Notches and back cuts shall be made at a height that enables the chain-saw operator to safely begin the cut, control the tree or trunk, and have freedom of movement for escape.

- 8.5.15.1 The notch cut used shall be a **conventional notch**, an **open-face notch**, or a **Humboldt notch**.
- 8.5.15.2 Notches shall be 45 degrees or greater and large enough to guide the fall of the tree or trunk to prevent splitting.
- 8.5.15.3 Notch depth should not exceed one-third the diameter of the tree.
- 8.5.15.4 The back cut shall not penetrate into the predetermined hinge area.
- 8.5.16 With a conventional notch or Humboldt notch, the back cut shall be 1 to 2 inches (2.5 to 5 cm) above the apex of the notch to provide an adequate platform to prevent kick-back of the tree or trunk. With an open-face notch (greater than 70 degrees), the back cut should be at the same level as the apex of the notch.
- 8.5.17 The two cuts that form the notch shall not cross at the point where they meet.
- 8.5.18 Before making the back cut, there shall be a command such as "stand clear" from the arborist operating the chain saw and a response such as "all clear" from the workers supporting the removal operation. Pre-arranged, two-way hand signals may also be used. Only designated persons shall give such signals. All workers in the vicinity shall be out of range when the tree or trunk falls. Visual contact should be maintained with the tree or trunk until it is on the ground.
- 8.5.19 When the back cut has been completed, the chain-saw operator shall immediately move a safe distance away from the tree or trunk using the planned escape route.
- 8.5.20 Workers shall not approach mechanical tree removal or mechanical re-clearing operations, such as with a rotary or flail mower, until the operator has acknowledged that it is safe to do so.

## **8.6 Brush Removal and Chipping**

- 8.6.1 Traffic control around the jobsite shall be established prior to the start of chipping operations along roads and highways (see section 3.2, Traffic Control Around the Jobsite).
- 8.6.2 Brush and logs shall not be allowed to create hazards in the work areas.
- 8.6.3 To prevent an entanglement hazard, loose clothing, climbing equipment, body belts, harnesses, lanyards, or gauntlet-type gloves (for example, long-cuffed lineman's or welder's gloves) shall not be worn while operating chippers.
- 8.6.4 Personal protective equipment shall be worn when in the immediate area of chipping operations in accordance with section 3.4, Personal Protective Equipment, of this standard.
- 8.6.5 Training shall be provided in the proper operation, feeding, starting, and shutdown procedures for the chipper being used.

- 8.6.6 Maintenance shall be performed only by those persons authorized by the employer and trained to perform such operations.
- 8.6.7 Brush and logs shall be fed into chippers, butt or cut end first, from the side of the feed table center line, and the operator shall immediately turn away from the feed table when the brush is taken into the rotor or feed rollers. Chippers should be fed from the curb-side whenever practical.
- 8.6.8 The brush chipper discharge chute or cutter housing cover shall not be raised or removed while any part of the chipper is turning or moving. Chippers shall not be used unless a discharge chute of sufficient length or design is provided that prevents personal contact with the blades (see Annex C, General Safety Procedures That Apply to All Tree Work).
- 8.6.9 Foreign material, such as stones, nails, sweepings, and rakings, shall not be fed into chipper.
- 8.6.10 Small branches shall be fed into chippers with longer branches or by being pushed with a long stick.
- 8.6.11 Hands or other parts of the body shall not be placed into the infeed hopper. Leaning into or pushing material into infeed hoppers with feet is prohibited.
- 8.6.12 While material is being fed into the chipper infeed hopper chute, pinch points continually develop within the material being chipped and between the material and machine. The operator shall be aware of this situation and respond accordingly.
- 8.6.13 When feeding a chipper during roadside operations, the operator shall do so in a manner that prevents him or her from stepping into traffic or being pushed into traffic by the material that is being fed into the chipper.
- 8.6.14 When using a winch in chipper operations, the operator shall ensure that the winch cable is properly stored before initiating chipper operations.
- 8.6.15 Refer to section 5.3, Brush Chippers, for additional information.

## **8.7 Limbing and Bucking**

- 8.7.1 Work plans for limbing and bucking operations shall be communicated to all workers a job briefing before work begins.
- 8.7.2 When more than one worker is limbing or bucking a tree, each shall be positioned and their duties organized so that the actions of one worker will not create a hazard for any other worker.
- 8.7.3 Chain saws should be operated away from the vicinity of the legs and feet. Natural barriers, such as limbs between the saw and the body, should be employed where possible while ensuring proper balance. While operating a chain saw, the preferred working position is on the uphill side of the work.

- 8.7.4 The worker shall make sure of firm footing before and during limbing and bucking. The worker shall not stand on loose chunks or logs that will roll when the log being bucked is sawed off.
- 8.7.5 Trees, limbs, or saplings under tension shall be considered hazardous. Appropriate cutting techniques and precautions shall be followed.
- 8.7.6 Wedges should be used as necessary to prevent binding of the guide bar or chain when bucking trunks of trees.
- 8.7.7 Cant hooks or peaveys should be used as an aid in rolling large or irregular logs to complete bucking.
- 8.7.8 If mechanized equipment is to be used, the equipment operator shall establish an effective means of communication with other workers (see subsection 8.4.11).
- 8.7.9 Workers shall not approach mechanized equipment operations until the equipment operator has acknowledged that it is safe to do so.

## **8.8 Pesticide Application**

- 8.8.1 The applicator shall follow label instructions in regard to pesticide applications.
- 8.8.2 The applicator shall follow pesticide label instructions in regard to laundering his or her clothing.
- 8.8.3 The applicator should shower or bathe at the end of each workday.
- 8.8.4 The employer shall provide a clean water source at the worksite, which may be used for emergency personal decontamination. Precautions shall be taken to prevent contamination of the clean water source. Drinking water and decontamination water shall be kept in separate containers.
- 8.8.5 The applicator shall not direct a solid spray column into contact with electrical conductors.

**ANNEX A**  
**(Informative)**  
**Glossary of Terms for ANSI Z133.1**

*NOTE—The numbers in parentheses after these terms are cross-references to the section in the standard where the term is first used in a major context. See index for other uses of these terms in the standard.*

**aerial device (5.2.2):** Any one of the following types of vehicle-mounted apparatus used to elevate personnel to jobsites above ground:

- extensible boom platform
- aerial ladder
- articulating boom platform
- vertical tower
- a combination of any of the above, as defined in ANSI A92.2

**anti-two block device (5.7.5):** A device consisting of a hollow weight suspended from the boom nose or jib of log loaders, cranes, or related hoists by a chain. The weight hangs with hoist cable running through its center. An electromechanical switch mounted on the boom nose or jib is connected to the chain via a retractable steel cable. When contact is made with the suspended weight by the hook block or any other lifting device nearing the nose or jib, the anti-two block switch circuit is deactivated, and hoist up or telescope out is prevented.

**apex (8.5.16):** The point at which two saw cuts meet to form a notch.

**applicator (5.4.3):** A qualified person engaged in the application of materials such as, but not limited to, pesticides, growth regulators, and fertilizers.

**approved (3.4.4):** Acceptable to the federal, state, or local jurisdiction having enforcement authority.

**arboriculture (1.1):** The art, science, technology, and business of utility, commercial, and municipal tree care.

**arborist (1.2):** An individual engaged in the profession of arboriculture.

**arborist climbing line (5.7.9):** A line designated to support the climber while aloft in a tree or attached to a crane, constructed according to specifications outlined in subsection 8.1.8.

**arborist saddle (5.7.9):** An arrangement of straps, fittings, and buckles or other elements in the form of a waist belt with a low attachment element or elements and connecting support encircling the legs, suitably arranged to support the body in a sitting position.

**authorized (5.1.5):** Designated by the entity that has care, custody, and control of the unit.

**back cut (8.5.15):** The cut made in a tree limb or trunk on the side opposite the intended direction of fall.

**brush hog (5.8.3):** A heavy-duty rotary mower, normally pulled by a farm-type tractor, used for cutting and mulching brush.

**bucket (5.2.3):** A basket-type platform approximately 4 feet (1.22 m) high, which is attached to the end of the upper boom on an aerial device, providing a work platform for working aloft.

**bucking (8.7.1):** The act of sawing trees, limbs, or both, into smaller sections once they are on the ground.

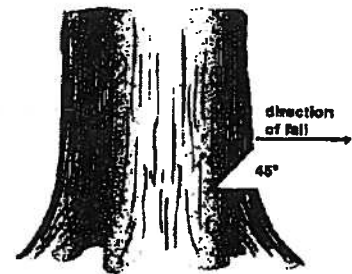
**cant hook (7.2.2):** A long-handled lever fixed with a blunt metal end to handle logs; includes a swinging, metal hook opposing the blunt end to create leverage.

**carabiner (8.1.3):** A connector generally composed of a trapezoidal or oval-shaped body with a closed gate or similar arrangement that may be opened to receive an object and, when released, automatically closes to retain the object.

**chopping tool (7.4.2):** A wooden-, fiberglass-, or steel-handled tool with a sharp, single- or double-edged steel head or blade mounted to it that is used to cut or split wood (for example, an ax or machete).

**climbing hitch (8.1.24):** A hitch used for securing a tree climber to the climbing line, permitting controlled ascent, descent, and work positioning. Examples of climbing hitches include, but are not limited to, the tautline hitch, Blake's hitch, and the Prusik hitch.

**conventional notch (8.5.15.1):** A directional felling cut into the side of a tree, facing the intended direction of fall and consisting of a horizontal face cut and an angle cut above it, creating a notch of approximately 45 degrees (see drawing).



**crew leader (8.5.1):** The qualified arborist designated as the individual in charge of a specific job or group of workers.

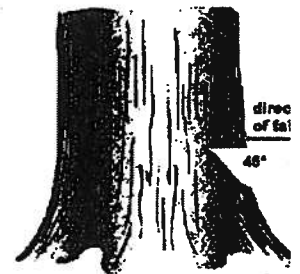
**crotch (8.2.5):** (n.) Branch union; the angle formed by two branches in the tree. (v.) To place a line through a branch union.

**deadman control (5.8.3):** A safety switch, electrical or mechanical, that deactivates the equipment's function when released by the operator.

**dielectric (3.4.2):** Nonconductive of electrical current.

**direct contact (4.1.3[a]):** A direct contact is made when any part of the body touches or contacts an energized electrical conductor.

- direct supervision (3.1.3):** Direct supervision occurs when a qualified arborist or a qualified arborist supervisor is physically present on the jobsite.
- drop-starting (6.3.5):** The act of starting a chain saw by pushing the saw away from the body with one hand while simultaneously pulling on the starter cord handle with the other.
- electrical conductor (3.4.2):** Any overhead or underground electrical device capable of carrying an electric current, including communications wires and cables, power lines, and other such fixtures or apparatus.
- electrical hazard (4.2.2):** An object or situation that poses risk of injury or death due to direct or indirect contact with an electrical conductor. Where unguarded, energized electrical conductors are present, specific minimum approach distances based on the arborist's or worker's level training, as set forth in this standard, shall be followed.
- electrical system owner/operator (4.1.4):** An organization that operates or controls the transmission and/or distribution of electric power through electrical conductors.
- false crotch (8.1.22):** A system, other than a natural crotch, used to support an arborist climb line.
- good working condition (8.4.4):** A term describing a piece of equipment that has no mechanical defects, has all guards in place, and is operated as intended by the manufacturer.
- ground fault (4.1.3[b]):** Any undesirable current path from a current-carrying conductor to ground.
- handline (7.1.5):** A length of rope designated as a tool to leverage, lift, and hold tools, equipment, wood, or other objects; the proper rope strength is specified for each particular use.
- high-pressure excavation (5.4.7):** The removal or displacement of soil using pressurized air or water.
- Humboldt notch (8.5.15.1):** A directional felling cut into the side of a tree, facing the intended direction of fall and consisting of a horizontal face cut and an angled cut below it, creating a notch of approximately 45 degrees (see drawing). A Humboldt cut is usually reserved for larger trees on steep slopes.
- indirect contact (4.1.3[a]):** Indirect contact is made when any part of the body touches any conductive object, including tools, tree branches, trucks, equipment, or other objects, that is in contact with an energized electrical conductor. Such contact can also be made as the result of communication wires and cables, fence or guy wires being accidentally energized.





**job briefing** (3.1.4): The communication of at least the following subjects for arboricultural operations: hazards associated with the job, work procedures involved, special precautions, electrical hazards, job assignments, and personal protective equipment.

**kilovolt, kV** (Tables 1 and 2): The term for 1,000 volts, abbreviated as kV. Higher voltages are generally given as kilovolts. Example: 12.5 kV (12,500 volts) and 19.9 kV (19,900 volts).

**kilonewton, kN** (8.1.8): The measurement of force, abbreviated as kN. Equal to 224.8 pounds. Example: 24.02 kilonewtons equals 5,400 pounds.

**ladder** (7.5.2): A two-, three-, or four-legged structure that utilizes vertical side legs with cross sections uniformly placed between the side legs to be used as steps; available in wood, aluminum, or fiberglass; used to ascend to and descend from a height. Also see *tripod/orchard ladder*.

**lanyard** (6.3.8): A component of a climbing system consisting of a flexible line of rope, wire rope, or a strap that generally has a connector at each end for connecting the body support to a fall arrester, energy absorber, anchorage connector, or anchorage.

**leg protection** (3.4.8): Personal protective equipment intended to reduce the risk of injury to the legs during chain-saw operations.

**line clearance** (4.3.2): The pruning, trimming, repairing, maintaining, removing, treating, or clearing of trees or the cutting of brush (vegetation management) that is within 10 feet (3.05 m) of electric supply lines and equipment; vegetation management work performed by qualified line-clearance arborists or qualified line-clearance arborist trainees for the construction or maintenance of electric supply lines and/or the electric utility right-of-way corridor.

**manual land clearing** (8.5.13): The removal of trees, shrubs, and vines using chain saws or other cutting tools where there are no structures or objects that need to be avoided and pull lines are not used to pull or drop a tree and/or trunk to the ground.

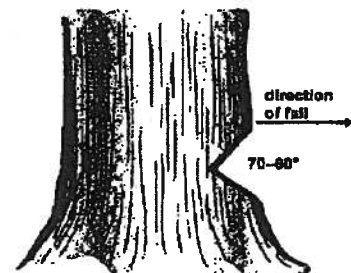
**maul** (7.3.7): A heavy-handled hammer, sometimes made with a single edge; used to drive wedges or split wood.

**minimum approach distance** (4.1.4): Safe working distances from overhead electrical conductors as defined in Tables 1 and 2 of this standard.

**open-face notch** (8.5.15.1): A directional felling cut into the side of the tree, facing the intended direction of fall and consisting of two cuts creating a notch greater than 70 degrees (see drawing).

**outrigger** (5.2.6): Built-in device used to stabilize cranes, aerial devices, and similar equipment.

**phase** (4.1.3[a]): Any current-carrying conductor that has an electric potential other than ground (ground is assumed to be 0 volts).



**phase to ground** (Tables 1 and 2): The electric potential (voltage) between a conductor and ground.

**phase to phase** (4.1.3[a]): The electrical potential (voltage) between two conductors, each having its own electric potential relative to ground.

**primary conductor** (4.2.4): Any conductor, including aluminum, copper, or aluminum conductor steel reinforced (ACSR), that is bare, covered, or insulated, with a nominal voltage above 7 volts.

**proximity** (3.4.2): An area within 10 feet (3.05 m) of energized overhead electrical conductor rated 50 kV phase to phase or less. For overhead electrical conductors rated more than 50 kV phase to phase, the distance is increased 4/10 inch (10 mm) for each additional kV.

**Prusik loop** (8.1.9): An endless loop of rope used to fashion a Prusik knot. The endless loop may be spliced or knotted with, at minimum, a double fisherman's knot.

**qualified arborist** (3.1.3): An individual who, by possession of a recognized degree, certification, or professional standing, or through related training and on-the-job experience, is familiar with the equipment and hazards involved in arboricultural operations and who has demonstrated ability in the performance of the special techniques involved.

**qualified arborist trainee** (8.4.12): An individual undergoing on-the-job training under the direct supervision of a qualified arborist. In the course of such training, the trainee becomes familiar with the hazards and equipment involved in arboricultural operations and demonstrates ability in the performance of the special techniques involved.

**qualified crane operator** (5.7.9.2): An individual who, by reason of a recognized credential or professional standing, or through related training and on-the-job experience, is familiar with the equipment and hazards involved with arboriculture crane operations and who has demonstrated competence in operating a crane and performing the special techniques involved.

**qualified line-clearance arborist** (4.1.4): An individual who, through related training and on-the-job experience, is familiar with the equipment and hazards in line clearance and has demonstrated the ability to perform the special techniques involved. This individual may or may not currently be employed by a line-clearance contractor.

**qualified line-clearance arborist trainee** (4.2.3): An individual undergoing line-clearance training under the direct supervision of a qualified line-clearance arborist. In the course of such training, the trainee becomes familiar with the equipment and hazards in line clearance and demonstrates ability in the performance of the special techniques involved.

**qualified personnel** (5.1.5): An individual who, by reason of training and experience, has demonstrated the ability to safely perform assigned duties and, where required, is properly licensed in accordance with federal, state, or local laws and regulations.

**quick-acting connector** (5.2.12): Hose connectors in a hydraulic or pneumatic system designed to allow rapid connection or disconnection without leakage when the system is pressurized.

**saddle, arborist** (5.7.9): See *arborist saddle*.

**secured (object)** (5.1.6): Made firm or tight; fastened. Example: The load is secured to the truck.

**secured (person)** (8.1.19): When an arborist is safeguarded from unintended movement by utilizing a climbing system that is attached to the arborist and connected to a tree or other stable support. Examples of being secured include, but are not limited to, (a) being tied in, (b) using a work-positioning lanyard, (c) being on belay, and (d) ascending the arborist climbing line using the footlock technique while utilizing a Prusik loop or ascenders.

**shall** (1.4): As used in this standard, denotes a mandatory requirement.

**should** (3.1.3): As used in this standard, denotes an advisory recommendation.

**snap hook** (8.1.10): Commonly called a self-locking or double-locking rope snap. The locking type (required by this standard for climbing) has a self-closing, self-locking gate that remains closed and locked until intentionally opened by the user for connection or disconnection. A captive eye is an integral part of a snap hook but is independent of the hook and gate portion.

**spotter** (5.1.11): A person within voice and visual communication of the driver and located in a position to view the area in which the vehicle (unit) is backing to help ensure that the backing operation is, and will remain, safe.

**step potential** (4.1.3[c]): The voltage between the feet of a person standing near an energized grounded object. It is equal to the difference in voltage, given by the voltage distribution curve, between two points at different distances from the electrode. A person could be at risk of injury during a fault simply by standing near the grounding point.

**tackle blocks and pulleys** (8.5.10): Equipment used in most tree situations to take a strain rather than move a load. Critical components of the system are the appropriate ropes, blocks, and, especially, the lock or connecting link.

**termination knot** (8.1.3): Any knot suitable for rope termination; includes, but is not limited to, double fisherman's loop (scaffold hitch), anchor hitch, and buntline hitch.

**tied in** (5.7.9): The term that describes an arborist whose climbing line has been run through a natural or false crotch attached to an arborist's saddle and completed with a climbing hitch or mechanical device, permitting controlled movement and work positioning.

**tool lanyard** (6.2.5[c]): Short line or strap used to secure a tool while working aloft.

**tripod/orchard ladder (7.5.8):** A three-legged ladder that utilizes the third leg to form a tripod to stabilize itself among orchard trees and/or shrubs. It is recommended for use on turf for better stability and to avoid slippage of the legs. Not recommended for use on hard surfaces.

**volt (4.2.4):** A unit of electric potential difference between two points. Lower-voltage systems generally expressed in terms of volts; for example, 120 volts or 240 volts.

**wedge (7.3.2):** A piece of material with two sides meeting at an angle; used to raise or split objects by applying a driving force, such as with a hammer.

**wheel chock (5.2.5):** Wedge-shaped block manufactured or employer approved to prevent unintentional movement of vehicle. Wheel chocks are placed in front of or in back of a vehicle's tires or tracks. If necessary, the chocks can be placed both in front and in back of the tires or tracks.

**worker (1.2):** An individual involved in an arboricultural operation, such as ground operation, equipment operations, and removal operations.

**working-load limit (8.4.3):** The working load that must not be exceeded for a particular application as established by a regulatory or standards-setting agency (see *working load* under Additional Terms, below).

**workline (8.1.4):** Rope used for lifting, lowering, or guiding limbs or equipment, or both, in or out of the tree.

### **Additional Terms**

**ascender:** A mechanical device used for climbing rope.

**belay:** Roping technique, managed by the ground person, to safeguard the arborist while climbing.

**dbh:** Acronym for diameter at breast height; diameter of a tree measured at 4.5 feet (1.3 m) above ground.

**electric supply:** Conductors used to transmit electric energy and their necessary supporting containing structures. Signal lines of more than 400 volts are always supply lines, and those less than 400 volts are considered as supply lines if so run and operated throughout.

**energy (shock) absorber:** A component of a climbing system whose primary function is to dissipate energy and limit deceleration forces that the system imposes on the body during fall arrest.

**fall-arrest lanyard:** A rope or strap designed to be used with a full-body harness to limit maximum arresting force on a climber to 1,800 pounds (8 kN) in a fall.

**false crotch for rigging:** A pulley, block, sling, lashing, or metal ring affixed to a tree's leader limb, through which a load line is passed, to lower or raise limbs or equipment.

**footlock:** To climb up a suspended rope by pulling with the hands and arms and pushing upward with the feet. The loose end of the rope is wrapped under the middle and over the top of one foot and is locked in place with pressure from the other foot.

**friction point:** The point at which the rope surface of the climber's hitch rubs against the climbing line.

**guarded:** Covered, fenced, enclosed, or otherwise protected by suitable covers or casings, barrier rails or screens, mats, or platforms that have been designed by the electrical system owner/operator to minimize the possibility of dangerous approach or accidental contact by persons or objects under normal conditions. Also see *unguarded*.

**Prusik knot:** A sliding friction knot, as in a work-positioning lanyard.

**unguarded:** Not guarded from approach or contact with electrical conductors.

**working load:** Limiting load values derived from the minimum breaking strength of a cord or rope divided by the design factor. For example, given a minimum breaking strength of 10,000 pounds (44.48 kN) and a design factor of 10:

$$10,000/10 = 1,000 \text{ (working load, in pounds)}$$

Or, given a minimum breaking strength of 10,000 pounds (44.48 kN) and a design factor of 5:

$$10,000/5 = 2,000 \text{ (working load, in pounds)}$$

**work-positioning system:** An arborist climbing system designed to be used under tension to support the arborist or other worker on an elevated vertical surface, such as a tree limb, and allow him or her to work with both hands free.

**ANNEX B**  
**(Informative)**  
**Recommended Guidelines for Standard Performance and Safety Training for**  
**Qualified Line-Clearance Arborists/Qualified Line-Clearance Arborist Trainees**  
**and Qualified Arborists/Qualified Arborist Trainees**

*NOTE: The content of this training outline is generic and may be customized to achieve equivalent level of safe practice by substituting or, where deemed appropriate to the circumstances, omitting portions of this outline. Use or nonuse of training aids that may be available shall not be evidence of noncompliance with this standard or annex.*

**B.1 GENERAL REQUIREMENTS**

Specific training in the area of individual expertise and work required of a qualified line-clearance arborist or qualified arborist should be provided by the employer and documentation of training retained on file for the duration of employment.

**B.1.1 Introduction and employer/employee responsibilities.**

**B.1.2 Employee orientation, to include**

- job description appropriate to job assignment (qualified line-clearance arborist or qualified arborist)
- introduction to immediate supervisor and crew members
- familiarization with appropriate personal protective clothing and equipment and proper use and maintenance
- familiarization with equipment
- introduction to company policies, procedures, and safe work practices
- safe work practices as related to job assignments
- written acknowledgment by employee that he or she has participated in such training

**B.1.3 Line-clearance or tree care pruning techniques appropriate to job assignments, as follows:**

- B.1.3.1 Provide education and training in accordance with prevailing national standards for utility pruning. Refer to recommended resources in Annex D for further information.
- B.1.3.2 Provide education and training in accordance with prevailing local, state, or regional standards for utility pruning, as well as those specified by utility contracts.
- B.1.3.3 Provide tree knowledge for line-clearance or tree care techniques appropriate to job assignments.

- B.1.3.4 Provide education and training relative to predominant tree species within geographic area, such as identification, growth habits, structure, and wood strength.
- B.1.3.5 Provide education and training for recognition and evaluation of potentially hazardous conditions related to tree structure. Refer to recommended resources in Annex D.

## **B.2 GENERAL SAFETY**

### **B.2.1 OSHA Standards**

Familiarize employees with the requirements of federal and/or state OSHA standards as applicable to employee job assignments. Refer to recommended resources in Annex D.

### **B.2.2 American National Standards**

Familiarize employees with the requirements in ANSI Z133.1 as applicable to employee job assignments. Refer to additional recommended standards in Annex D.

### **B.2.3 Public Safety and Traffic Control**

Provide education and training in the use of public safety and traffic control devices as applicable under federal, state, or local regulations.

### **B.2.4 Electrical Hazards**

Provide education and training in the recognition and avoidance of electrical hazards applicable to employee job assignments (line clearance or tree care).

### **B.2.5 Emergency Conditions**

Provide education and training in the proper procedures for safely performing work in emergency conditions applicable to employee job assignments.

### **B.2.6 Jobsite Briefings**

Provide education and training in jobsite-specific hazards associated with the job, work procedures, and practices involved. Instruct employees about special precautions, personal protective clothing, and equipment requirements as applicable to employee job assignments.

## **B.3 PERSONAL SAFETY**

### **B.3.1 Personal Protective Equipment**

Provide personal protective equipment as required for applicable job assignments, and instruct employees in its proper use, fit, life, and maintenance.

### **B.3.2 Emergency Response Procedures**

Furnish employees with appropriate information and training necessary to expedite a response to worksite emergency, such as first aid, CPR, and aerial rescue (see Annex F, Aerial Rescue Flowchart).

### **B.3.3 Prevention of Back and Other Injuries**

Provide education and training in the techniques required to avoid back and other injuries applicable to job assignments.

### **B.3.4 Identification and Avoidance of Animals and Poison Plants**

Provide education and training in the identification of and the need to avoid contact with poisonous plants and instructions for treating insect stings/bites and snake bites.

## **B.4 EQUIPMENT SAFETY**

### **B.4.1 Mobile Equipment and Aerial Lifts**

Provide education and training in the inspection, operation, and maintenance of all vehicles and equipment, such as aerial lifts, brush chippers, stump grinders, log loaders, tree cranes, mowers, and pesticide application equipment. All equipment shall comply with applicable federal and state regulations, local ordinances, and manufacturers' operating instructions. Such training shall be appropriate to employee job assignments.

### **B.4.2 Aerial Equipment and Electrical Hazards**

Provide education and training so that affected employees understand the required and recommended procedures for operating aerial devices in proximity to electrical hazards. Such training shall be appropriate to employee job assignments.

### **B.4.3 Chain Saw, Power Tool, and Hand Tool Use and Safety**

Provide education and training in the safe use of chain saws, power tools, and hand tools in accordance with manufacturers' instructions. Such training shall be appropriate to employee job assignments.

### **B.4.4 Climbing Equipment Use and Safety**

Provide education and training in the inspection, maintenance, and storage of climbing equipment such as ropes, saddles, personal lanyards, rope snaps, carabiners, and related equipment. Such training shall be appropriate to employee job assignments.



## **B.5 OPERATIONAL SAFETY**

### **B.5.1 Climbing Techniques**

Provide education and training in climbing techniques as appropriate to employee job assignments.

### **B.5.2 Rigging and Tree Removal**

B.5.2.1 Provide education and training appropriate to employee job assignments, such as knots and ropes, rigging techniques, tree strength and weight characteristics, and potential electrical hazards.

B.5.2.2 Provide education and training in the identification and removal of hazard trees. Such training shall be appropriate to employee job assignments.

### **B.5.3 Hazard Communications**

Provide education and training necessary to comply with federal and state regulations appropriate to employee job assignments.

### **B.5.4 Pesticide Use**

Provide education and training necessary to comply with federal and state regulations appropriate to employee job assignments.

**ANNEX C**  
**(Informative)**  
**General Safety Procedures That Apply to All Tree Work**

**C.1 LIFTING**

Before lifting any weight, workers should

- (a) be sure there is a clear path available if the weight is to be carried from one place to another;
- (b) decide exactly how the object should be grasped to avoid sharp edges, splinters, splinters, or other factors that might cause injury;
- (c) make a preliminary lift to be sure the load can be safely handled;
- (d) place feet solidly on the walking surface;
- (e) crouch as close to the load as possible, with legs bent at an angle of about 90 degrees;
- (f) lift with the legs, not the back, keeping the weight as close to the body as possible;
- (g) use additional workers or material-handling equipment when necessary.

**C.2 CONTROL OF HAZARDOUS ENERGY**

When a worker, hereafter referred to as the "authorized person," is doing mechanical work, precautions must be taken to prevent injury caused by moving or elevated parts, or the release of stored energy, such as hydraulic pressure. Failure to do so could result in a serious, potentially disabling, or fatal injury. The authorized person performing maintenance/repair shall comply with the employer's procedures.

The specific Control of Hazardous Energy requirements established by the Occupational Safety and Health Administration (OSHA) may be obtained by consulting 29 CFR 1910.147 or by contacting the Department of Labor, OSHA, 200 Constitution Avenue NW, Washington, DC 202

***The following is a sample procedure.***

**Sequence for Securing Equipment (Sample)**

1. The authorized person shall notify the crew and/or affected employees that maintenance or repair is to be done and that such equipment must be shut down and secured.
2. The authorized person shall refer to the manufacturer's manual for proper procedures (as needed).
3. If equipment is in an operational mode, it shall be shut down by normal procedures.
4. Rotating parts, such as chipper blades, shall be stopped before maintenance or repair. Keyed ignition systems must be in working order.
5. Keys shall be removed and pocketed by the foreman or mechanic. When there is no keyed ignition system, the battery cables or spark plug wires may be disconnected.
6. The power takeoff should be disengaged before beginning service or repair tasks, such as hose replacement. All hydraulic tools should be disconnected before equipment is adjusted or serviced.
7. An employee shall never attempt to stop a hydraulic leak with his or her body.
8. Materials or parts that must be raised or disconnected and suspended shall be properly secured, such as with an appropriate sling or jackstand. Flywheels, such as chipper cutter heads, are to be blocked to prevent pinch points.
9. Before proceeding with maintenance or repair, the authorized person shall ensure that equipment is isolated and will not operate.
10. Any piece of equipment being serviced or repaired shall not be started, energized, or used by any other worker not under the direction of the authorized person.
11. When the engine must be running for tuning or adjustment, special care must be given to moving parts.

**Restoring Equipment to Service (Sample)**

When maintenance or repair is complete and equipment is ready to return to normal operation, the following steps shall be taken by the authorized person to restore the equipment to service:

1. To prevent accidental contact with moving or electrical components when the equipment is engaged, check for loose parts or tools that may have been left in the immediate area.
2. Ensure that all guards are in place and employees are in the clear.
3. Confirm that controls are in neutral.
4. Reconnect key, cable, or plug wires.
5. Notify affected employees that equipment is ready to return to service.

**ANNEX D**  
**(Informative)**  
**Additional Resources**

**D.1 APPLICABLE AMERICAN NATIONAL STANDARDS**

- Fall protection systems for construction and demolition operations (A10.32-2004)
- Gasoline-powered chain saws (B175.1-2000)
- High-visibility safety apparel and head wear (107-2004)
- Mast-climbing work platforms (A92.9-1993)
- Occupational and educational eye and face protection devices (Z87.1-2003)
- Personal fall arrest systems, subsystems, and components (Z359.1-1992 [R1999])
- Portable metal ladders (A14.2-2002)
- Portable reinforced plastic ladders (A14.5-1992)
- Portable wood ladders (A14.1-2000)
- Protective headgear for industrial workers (Z89.1-2003)
- Respiratory protection (Z88.2-1991)
- Tree care operations—tree, shrub, and other woody plant maintenance (A300)
- Vehicle-mounted elevating and rotating aerial devices (A92.2-2002)
- Workplace floor and wall openings, stairs, and railing systems (A1264.1-1995 [R2002])

**D.2 CORDAGE INSTITUTE ROPE STANDARDS**

The Cordage Institute, [www.ropecord.com](http://www.ropecord.com)

**D.3 APPLICABLE FEDERAL REGULATIONS (U.S. DEPARTMENT OF LABOR/  
OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION and U.S. DEPARTMENT OF LABOR/FEDERAL MOTOR CARRIER SAFETY ADMINISTRATION**

- Electric Power Generation, Transmission, and Distribution (29 CFR 1910.269)
- General Industry (29 CFR 1910)
- Hazard Communication (29 CFR 1915.1200)
- Medical Services and First Aid (29 CFR 1910.151)
- Occupational Noise Exposure (29 CFR 1910.95)
- Personal Protective Equipment (29 CFR 1910.132-136)
- Electrical — Safety-Related Work Practices (29 CFR 1910.331-335)
- Telecommunication (29 CFR 1910.268)
- Transportation (49 CFR, Subchapter B, Federal Motor Carrier Safety Regulations)

## **D.4 OTHER RESOURCES**

### **D.4.1 Associations**

International Society of Arboriculture; P.O. Box 3129, Champaign, IL 61826-3129  
([www.isa-arbor.com](http://www.isa-arbor.com))

Tree Care Industry Association; 3 Perimeter Road, Unit 1, Manchester, NH 03103  
([www.treecareindustry.org](http://www.treecareindustry.org))

### **D.4.2 Government Agencies**

National Institute for Occupational Safety and Health/Fatality Assessment and Control  
Evaluation Program ([www.cdc.gov/niosh/face](http://www.cdc.gov/niosh/face))

Occupational Safety and Health Administration Safety and Health Topics for Tree Care  
([www.osha.gov/SLTC/treecare](http://www.osha.gov/SLTC/treecare))

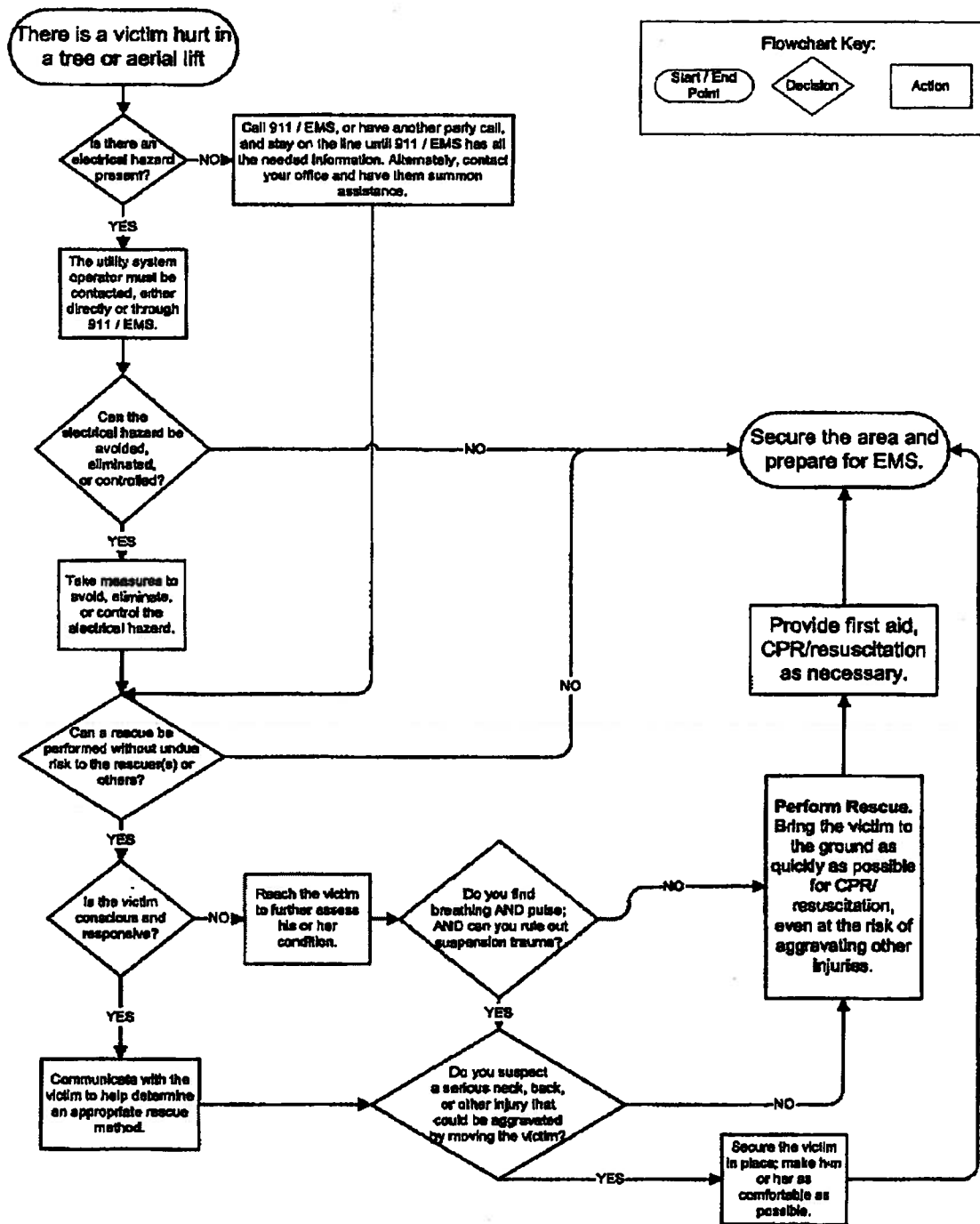
Occupational Safety and Health Administration Safety and Health Topics for Landscape  
and Horticultural Services ([www.osha.gov/SLTC/landscaping](http://www.osha.gov/SLTC/landscaping))

**ANNEX E**  
**(Informative)**  
**Weight of Green Logs**

Scientific name	Common name	Weight, lb per ft <sup>3</sup>	Weight of a 1-foot section, based on average diameter							
			10"	12"	14"	16"	18"	20"	22"	24"
<i>Abies concolor</i>	white fir	47	25	37	50	66	83	102	124	148
<i>Abies procera</i>	noble fir	29	16	23	31	41	51	63	77	91
<i>Acer rubrum</i>	red maple	50	27	39	53	70	88	109	132	157
<i>Acer saccharinum</i>	silver maple	45	25	35	48	63	79	98	119	141
<i>Acer saccharum</i>	sugar maple	56	31	44	60	78	99	122	148	176
<i>Aesculus hippocastanum</i>	horsechestnut	41	22	32	43	57	72	89	108	129
<i>Alnus rubra</i>	red alder	46	25	36	49	64	81	100	121	144
<i>Betula papyrifera</i>	paper birch	50	27	39	53	70	88	109	132	157
<i>Calocedrus decurrens</i>	incense-cedar	45	25	35	48	63	79	98	119	141
<i>Carya illinoensis</i>	pecan	61	33	48	65	85	108	133	161	192
<i>Carya ovata</i>	shagbark hickory	64	35	50	68	89	113	140	169	201
<i>Celtis occidentalis</i>	hackberry	50	27	39	53	70	88	109	132	157
<i>Diospyros virginiana</i>	persimmon	63	34	49	67	88	111	137	166	198
<i>Eucalyptus camaldulensis</i>	red gum	50	27	39	53	70	88	109	132	157
<i>Fagus spp.</i>	beech	54	29	42	58	75	95	118	142	169
<i>Fraxinus americana</i>	white ash	48	26	38	51	67	85	104	126	150
<i>Fraxinus latifolia</i>	Oregon ash	48	26	38	51	67	85	104	126	150
<i>Fraxinus pennsylvanica</i>	green ash	47	25	37	50	66	83	102	124	148
<i>Gleditsia triacanthos</i>	honeylocust	61	33	48	65	85	108	133	161	192
<i>Juglans nigra</i>	black walnut	58	32	45	62	81	102	126	153	182
<i>Larix spp.</i>	larch	51	28	40	54	71	90	111	135	160
<i>Liquidambar styraciflua</i>	sweetgum	55	30	43	58	77	97	120	145	173
<i>Liriodendron tulipifera</i>	yellow poplar, tuliptree	38	21	30	40	53	67	83	99	119
<i>Melia azedarach</i>	Chinaberry	50	27	39	53	70	88	109	132	157
<i>Nyssa sylvatica</i>	black gum	45	25	35	48	63	79	98	119	141
<i>Picea rubens</i>	red spruce	34	19	27	36	47	60	74	90	106
<i>Picea sitchensis</i>	Sitka spruce	32	17	25	34	45	56	70	84	100
<i>Pinus contorta</i>	lodgepole pine	39	21	30	41	55	69	85	103	122
<i>Pinus elkhottii</i>	slash pine	58	32	45	62	81	102	126	153	182
<i>Pinus lambertiana</i>	sugar pine	52	28	41	55	72	92	113	137	163
<i>Pinus monticola</i>	western white pine	36	20	28	38	50	64	78	95	113
<i>Pinus palustris</i>	longleaf pine	55	30	43	58	77	97	120	145	173
<i>Pinus ponderosa</i>	ponderosa pine	46	25	36	49	64	81	100	121	144
<i>Pinus strobus</i>	eastern white pine	36	20	28	38	50	64	78	95	113
<i>Pinus taeda</i>	loblolly pine	53	29	41	56	74	93	116	140	166
<i>Platanus occidentalis</i>	sycamore	52	28	41	55	72	92	113	137	163
<i>Populus spp.</i>	cottonwood	49	27	38	52	68	86	107	129	154
<i>Populus tremuloides</i>	quaking aspen	43	23	34	46	60	76	94	114	135

Scientific name	Common name	Weight, lb per ft <sup>3</sup>	Weight of a 1-foot section, based on average diameter							
			10"	12"	14"	16"	18"	20"	22"	24"
<i>Prunus serotina</i>	black cherry	45	25	35	48	63	79	98	119	141
<i>Pseudotsuga menziesii</i>	Douglas-fir	39	21	30	41	55	69	85	103	122
<i>Quercus alba</i>	white oak	62	34	48	66	86	109	135	163	194
<i>Quercus coccinea</i>	scarlet oak	64	35	50	68	89	113	140	169	201
<i>Quercus kelloggii</i>	California black oak	66	36	51	70	92	116	144	174	207
<i>Quercus palustris</i>	pin oak	64	35	50	68	89	113	140	169	201
<i>Quercus robur</i>	English oak	52	28	41	55	72	92	113	137	163
<i>Quercus rubra</i>	red oak	63	34	49	67	88	111	137	166	198
<i>Quercus stellata</i>	post oak	63	34	49	67	88	111	137	166	198
<i>Quercus virginiana</i>	live oak	76	41	60	81	106	134	166	200	238
<i>Robinia pseudoacacia</i>	black locust	58	32	45	62	81	102	126	153	182
<i>Salix</i> spp.	willow	32	17	25	34	45	56	70	84	100
<i>Sequoia sempervirens</i>	coast redwood	50	27	39	53	70	88	109	132	157
<i>Taxodium distichum</i>	baldcypress	51	28	40	54	71	90	111	135	160
<i>Thuja plicata</i>	western red cedar	28	15	22	30	39	49	61	74	88
<i>Tilia americana</i>	basswood	42	23	33	45	59	74	92	111	132
<i>Tsuga canadensis</i>	eastern hemlock	49	27	38	52	68	86	107	129	154
<i>Tsuga heterophylla</i>	western hemlock	41	22	32	43	57	72	89	108	129
<i>Ulmus americana</i>	American elm	54	29	42	58	75	95	118	142	169

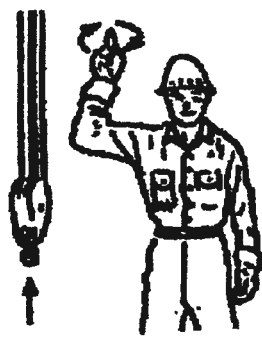
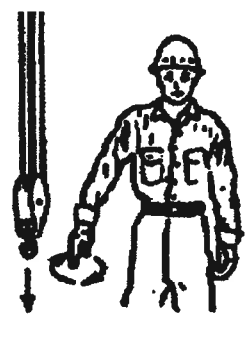
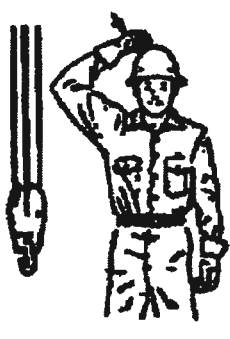

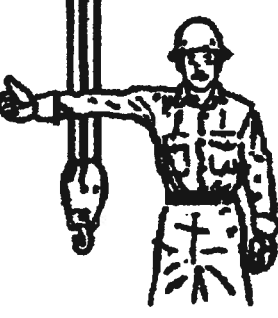
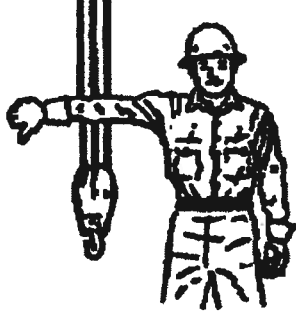
## ANNEX F (Informative) Aerial Rescue Flowchart

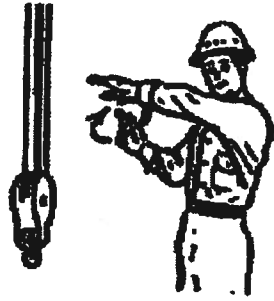




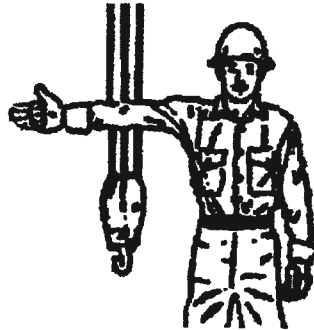
**ANNEX G**  
**(Informative)**  
**Hand Signal Chart for Crane Operations**

From DOE-STD-1090-2004

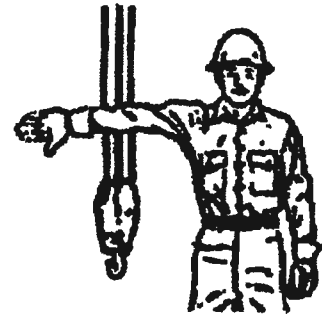
 <p><b>HOIST.</b> With forearm vertical, forefinger pointing up, move hand in small horizontal circles.</p>	 <p><b>LOWER.</b> With arm extended downward, forefinger pointing down, move hand in small horizontal circles.</p>	 <p><b>USE MAIN HOIST.</b> Tap fist on head, then use regular signals.</p>
 <p><b>USE WHIPLINE. (Auxiliary Hoist)</b> Tap elbow with one hand, then use regular signals.</p>	 <p><b>RAISE BOOM.</b> Extend arm, fingers closed, thumb pointing upward.</p>	 <p><b>LOWER BOOM.</b> Extend arm, fingers closed, thumb pointing downward.</p>



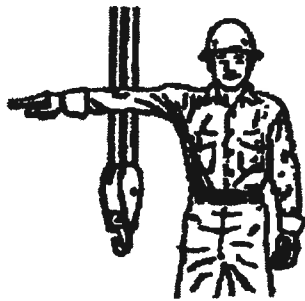
**MOVE SLOWLY.** Use one hand to give any motion signal and place other hand motionless above the hand giving the motion signal. (Hoist slowly shown as example.)



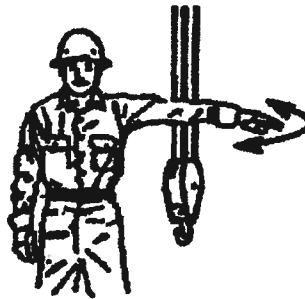
**RAISE THE BOOM AND LOWER THE LOAD.** With arm extended, thumb pointing up, flex fingers in and out as long as load movement is desired.



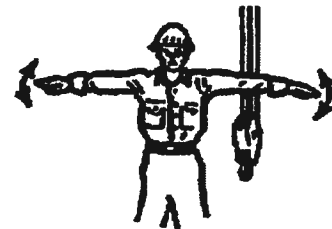
**LOWER THE BOOM AND RAISE THE LOAD.** With arm extended, thumb pointing down, flex fingers in and out as long as load movement is desired.



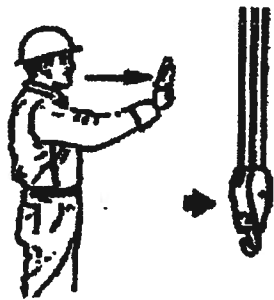
**SWING.** Extend arm, point with finger in direction of swing of boom.



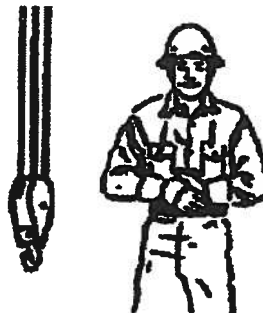
**STOP:** Extend arm, palm down; move arm back and forth horizontally.



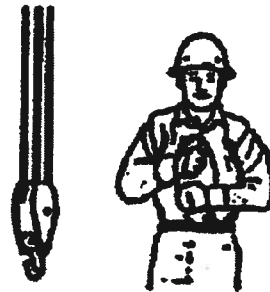
**EMERGENCY STOP.** Both arms extended, palms down, move arms back and forth horizontally.



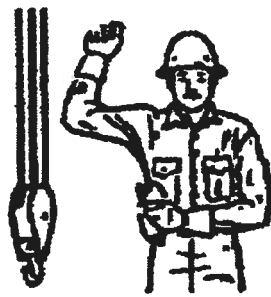
**TRAVEL.** Extend arm forward, hand open and slightly raised; make pushing motion in direction of travel.



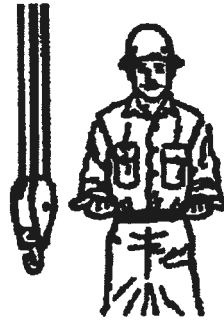
**DOG EVERYTHING.** Clasp hands in front of body.



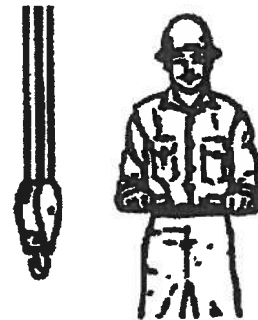
**TRAVEL (Both Tracks).** Use both fists in front of body, making a circular motion about each other, indicating direction of travel, forward or backward (for land cranes only).



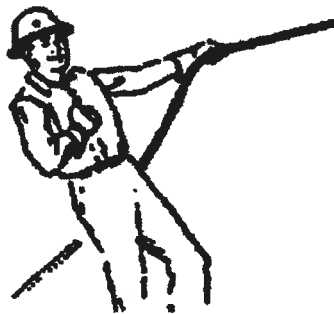
**TRAVEL. (One Side Track).** Lock the track on side indicated by raised fist. Travel opposite track indicated by circular motion of other fist, rotated vertically in front of body (for land cranes only).



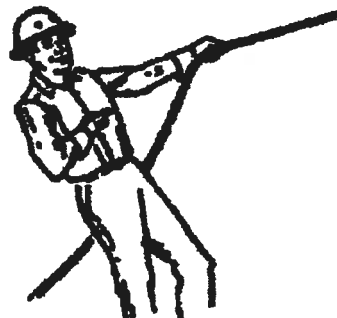
**EXTEND BOOM. (Telescoping Booms).** Hold both fists in front of body, thumbs pointing outward.



**RETRACT BOOM (Telescoping Booms).** Hold both fists in front of body, thumbs pointing toward each other.



**EXTEND BOOM (Telescoping Boom).** One-hand signal. Hold one fist in front of chest, thumb tapping chest.



**RETRACT BOOM (Telescoping Boom).** One-hand signal. Hold one fist in front of chest, thumb pointing outward and heel of fist tapping chest.