For Public Review and Comment:

Proposed Draft Revision of

American National Standard for Arboricultural Operations—Safety Requirements

ANSI Z133-2017

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SCAN ME

The only portion of this document subject to public review and comment is the standard (numbered sections pages 7 to 70). The front matter (foreword, contributors) and the back matter (annexes) are not part of the standard and are not subject to public review. Some parts of the front and back matter are not finalized and are included here for placement only. Any comments submitted that relate to the front and back matter will be reviewed by ISA but may not be brought to the Z133 Committee and will not receive a committee response.

FOREWORD

(The information contained in this Foreword will not be part of this American National Standard (ANS) and will not be processed in accordance with ANSI's requirements for an ANS. As such, this Foreword may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the standard. Any comments submitted that relate to this Foreword will be reviewed by ISA but may not be brought to the Z133 Committee and will not receive a committee response).

This standard was developed for the arboriculture industry under the procedures of the American National Standards Institute by the Accredited Standards Committee on Safety Requirements for Arboricultural Operations, Z133. The secretariat of the Z133 Committee is held by the International Society of Arboriculture.

The Accredited Standards Committee Z133 was organized on 4 April 1968, in response to efforts by Mrs. Ethel M. Hugg of Johnstown, New York. Mrs. Hugg's son had died while trimming trees, and this tragic incident caused her to write to federal and state authorities and to various other organizations in an attempt to have measures initiated that would make tree trimming safer.

The Z133 Committee was organized with the National Arborist Association (now the Tree Care Industry Association) as secretariat. Committee delegates included representatives of industry, labor, the academic community, government, equipment manufacturers, insurance carriers, and other interested experts. The International Shade Tree Conference (now the International Society of Arboriculture) became the secretariat of the committee in November 1969.

The initial standard was unanimously adopted by the committee on 14 July 1971, and was approved as an American National Standard on 20 December 1972.

The Z133 Committee continues to monitor arboriculture safety performance, providing interpretation and clarification of the intent of the requirements in the standard and for any adjustments or revisions of the standard.

Portions of the safety standard have been adopted by the Occupational Safety and Health Administration (OSHA).

The committee recognizes that manufacturers provide instruction manuals regarding operation of their products, but these manuals are not dispositive of whether a particular risk or hazard exists.

This standard is reviewed on a continual basis by the committee and reviewed by the public. Revisions have occurred in 1978, 1982, 1987, 1994, 2000, 2006, 2012, and 2017. The 2024 revision has undergone significant changes. Editorial and substantive changes have been made as a result of committee review and public comment.

There are 11 annexes in this standard. All 11 are informative and are not considered part of this standard.

Suggestions for improvement of this standard are welcome. For general comments or questions, email the International Society of Arboriculture at Z133@isa-arbor.com.

This standard was processed and approved for submittal to ANSI by the Accredited Standards Committee on Safety Requirements for Arboricultural Operations, Z133. Committee approval of the standard does not necessarily imply that all committee members voted for its approval. At the time the Z133 Committee approved this standard, it included the following members:

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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 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, Glossary of Terms, for ANSI Z133.

1.2 Purpose

The purpose of this document is to provide safety standards 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 serve as a reference for safety requirements that will apply to all **employers** or persons engaged in the business, trade, or performance of arboriculture for pay, operations of which include, but are not limited to, pruning, repairing, or maintaining trees; removing trees; cutting brush; and 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 their own safety while at work and shall comply with the appropriate federal or state occupational safety and health standards as well as all rules, regulations, and orders that are applicable to their own actions and conduct.

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, Additional Resources, 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, Additional Resources.

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

3 GENERAL SAFETY REQUIREMENTS

3.1 General

3.1.1 Tools and equipment used in arboricultural operations shall comply with applicable governing regulations and consensus standards.

Note: See Annex D, Additional Resources

3.1.2 Employers shall **train** their employees on the equipment and processes utilized in arboricultural operations to which the employee is exposed.

3.1.3 Employers shall require that appropriate safety-related work practices be followed.

3.1.4 As applicable, manufacturers' recommendations **should** be followed.

3.2 Emergency Procedures and Readiness

3.2.1 All personnel engaged in arboricultural operations shall be instructed in the correct procedures for emergency response, including making 911 calls and calls to other applicable emergency phone numbers.

3.2.2 The employer shall provide and maintain a first-aid kit that meets the requirements of ANSI Z308.1, with contents appropriate for the type of job and number of workers.

3.2.3 Instruction shall be provided in the identification of, preventive measures against, and first-aid treatment for recognized poisonous plants, stinging and biting insects, and other pests found in the area in which work is to be performed.

3.2.4 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.

Note: See Annex F, Aerial Rescue Flowchart, for further guidance.

3.2.5 For field crews involving two or more workers at a work location, at least two workers trained in first aid/CPR shall be available.

EXCEPTION

Only one trained person need be available if all new employees are trained in first aid/CPR within three months of their hiring dates.

3.3 Personal Protective Equipment (PPE)

3.3.1 The employer shall provide and require the use of personal protective equipment (PPE), including personal fall-protection systems, as outlined in this section and in other areas of this standard, when there is a reasonable probability of injury or illness that can be prevented by such protection.

Note: See Annex J, Fall-Protection Systems.

3.3.2 The employer shall assess the workplace to determine if hazards are present or are likely to be present as well as what type of PPE is required. The employer shall complete a **personal protective equipment hazard assessment certification**.

3.3.3 Employers shall train their employees in the proper use, inspection, care, fit, maintenance, and replacement of PPE, including personal fall-protection systems.

3.3.4 Workers engaged in arboricultural operations shall wear head protection (helmet) 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.

3.3.5 The employer shall provide employees protection against the effects of noise exposure when sound levels exceed an 8-hour, time-weighted average (TWA) of 85 decibels (dB). Hearing protection provided by the employer shall be worn when it is not practical to decrease or isolate noise levels that exceed acceptable standards.

3.3.6 Arborists engaged in arboricultural operations shall wear eye protection that conforms to ANSI Z87.1.

3.3.7 Clothing and footwear appropriate to the known **work site** hazards shall be approved by the employer and worn by the employee.

3.3.8 Cut-resistant **leg protection** that meets or exceeds ASTM F1414 and ASTM F1897 shall be worn while operating a chain saw during ground operations. Cut-resistant leg protection shall be maintained in accordance with manufacturers' recommendations.

3.3.9 Face protection shall conform to applicable federal regulations and ANSI Z87.1.

3.3.10 Respiratory protection shall conform to applicable federal regulations and ANSI Z88.2.

3.4 Job Briefing and Work Site Setup

3.4.1 The employer shall provide the qualified arborist in charge of performing a **job briefing** with available information on the known hazards pertaining to each job.

3.4.2 Prior to the beginning of work, the arborist in charge shall ensure that hazards pertaining to the work or task at hand are identified and that measures are taken to reduce, eliminate, or avoid the identified hazards.

> **Note:** The NIOSH hierarchy of controls may be of use to assist an arborist in mitigating recognized hazards. See Annex K, Hierarchy of Controls, for further guidance.

3.4.3 A job briefing shall be performed on the **job site** by the arborist in charge before the start of each job. The briefing shall be communicated to all affected workers.

> 3.4.3.1 The job briefing shall cover the hazards associated with the job, work procedures involved, job assignments, special precautions, energy-source controls, and PPE requirements.
>
> **EXCEPTION**
>
> An arborist working alone need not conduct a job briefing. The arborist working alone shall consider hazards associated with the job, work procedures involved, special precautions, energy-source controls, and PPE requirements, as if a briefing had been conducted.
>
> 3.4.3.2 At least one job briefing shall be conducted before each day or shift.
>
> 3.4.3.3 Additional job briefings shall be held if changes that may affect the safety of the workers occur during the course of the day or if additional hazards are found.
>
> 3.4.3.4 The job briefing should be documented.

3.4.4 An inspection shall be made by a qualified arborist with specific training in **electrical hazard** recognition to determine whether an electrical hazard exists before performing arboricultural operations.

3.4.5 An arborist with specific training in tree hazard assessment shall visually inspect the tree, including the root collar and the area immediately surrounding the tree, for hazards before anyone enters the tree or performs any work on the tree.

3.4.6 When definite indicators of decay, weakly attached branches, or dead bark are seen, the qualified arborist shall determine if the tree can withstand the forces to be applied during the work.

> 3.4.6.1 If there is a question as to the condition of the tree relative to the task to be performed, work shall not commence until a more thorough assessment can be made.

3.4.7 A second arborist, an **arborist trainee**, or another worker trained in emergency procedures shall be within visual or voice communication during

arboricultural operations above 12 ft (3.65 m) that are not subject to the requirements of Section 4.5.15.

3.4.8 Before beginning any operation that creates a falling object hazard, a command-and-response-and-acknowledge system shall be established among all affected workers on site. Verbal communication, hand signals, or whistles shall:

1) begin with a command,

2) be followed by a response, and

3) end with an acknowledgment of the response.

Note: Example of how to use (arborist aloft cutting, personnel on ground below):

- Command: "Stand clear."
- Response: "Hold."
- Acknowledge: "Holding."

3.4.9 The arborist in charge shall establish a plan to safely manage the work site. Communications among arborists aloft and arborists on the ground shall be established before commencing operations. Radios or predetermined, nonverbal communication such as whistles or two-way hand signals may also be used.

3.4.10 Visual contact between the arborist aloft and a designated arborist(s) on the ground should be established when communicating.

3.4.11 The arborist in charge shall determine whether **direct supervision** is needed on a work site.

3.4.12 Prior to dropping or lowering trunks, branches, fruit, or equipment, a landing area (**drop zone**) shall be established.

3.4.12.1 People shall be excluded from the drop zone when active unless **authorized** by the worker aloft or needed for emergency response.

3.4.12.2 A visible drop zone should be established as an aid to avoid falling objects.

3.4.13 Before **digging**, underground utilities shall be marked by utility-locating services.

Note: Many utility-based locating services will not locate privately owned underground lines, such as, but not limited to, irrigation, electrical wires, and propane lines. Further resources or research may be necessary to locate underground utilities on private properties.

3.5 Traffic Control

3.5.1 Traffic and pedestrian control around the work site shall be established prior to the start of all arboricultural operations.

3.5.2 Arborists and other workers having specific **temporary traffic control (TTC) zone** responsibilities shall be trained in temporary traffic control techniques, device usage and placement, and how to work next to traffic in a manner that minimizes their exposure.

3.5.3 Arborists and other workers exposed to risks of moving roadway traffic shall wear high-visibility safety apparel that conforms to the requirements of ANSI/ISEA 107.

3.5.4 The TTC zone should minimally impede the flow of vehicular traffic. Arborists and other workers should use the necessary devices to capture the attention of and positively direct road users in accordance with the Manual on Uniform Traffic Control Devices (MUTCD).

3.5.5 Pedestrians and nonvehicular traffic should have separate movement from the work site and vehicular traffic, with a safe, convenient, and accessible path.

3.6 Fire Protection

3.6.1 All personnel shall be instructed in the use and location of vehicle-mounted fire extinguishers.

3.6.2 Equipment shall be fueled only:

- when the engine has been shut down,
- from **approved containers**, and
- at least 10 ft (3.05 m) from any operating equipment.

3.6.3 Spilled fuel shall be cleaned up before restarting the equipment that was fueled.

3.6.4 Flammable liquids shall be stored, handled, and dispensed from **approved** and clearly marked containers.

3.6.5 Equipment shall not be operated within 10 ft (3.05 m) of areas in which refueling has recently taken place.

3.6.6 Smoking shall be prohibited when working around or handling flammable liquids or while wearing clothing contaminated by fuel.

3.6.7 Clothing contaminated with fuel shall be changed, removed, or replaced as soon as possible.

3.6.8 Open flame and other sources of ignition shall be avoided.

3.6.9 Workers shall ensure dead and/or combustible materials are clear of hot and/or operating equipment.

3.6.10 Where required, all internal or external combustion engines shall be equipped with spark arresters that conform to SAE Standard J335 or USDA Forest Service Specification 5100-1.

Note: Federal requirements are explained in 36 CFR 261.52.

3.7 Training and Education

3.7.1 The employer shall require the employee to demonstrate **competency** before performing any **safety-sensitive task** without direct supervision.

3.7.2 The employer shall ensure that each employee has demonstrated competency in the work practices involved. Employees who cannot demonstrate competency shall be trained in, and made familiar with, the safety-related work practices, safety procedures, and other safety requirements pertaining to their job assignments.

Note: On-the-job training with direct supervision may be used to develop competency.

3.7.3 Learning objectives should be established at the beginning of training.

3.7.4 Employee training and retraining should be documented.

3.7.5 The employer shall determine, through regular supervision and on-the-job assessments conducted on at least an annual basis, that each employee is complying with the safety-related work practices required by their job assignments.

3.7.5.1 On-the-job assessments should be documented.

3.7.6 The employer shall provide additional training or retraining to an employee under any one or more of the following conditions:

- It is determined that the employee has performed a safety-sensitive task incorrectly,
- New technology, new types of equipment, and/or changes in procedures necessitate the use of safety-related work practices that are different from those which the employee would normally use.
- It is otherwise determined as needed by the employer.

4 ELECTRICAL HAZARDS

4.1 General

4.1.1 The items contained in Section 3, General Safety Requirements, shall be included in the review of this section.

4.1.2 The employer shall ensure that the arborists' training and degree of training in electrical hazards are determined by the risk to the arborist for the hazard(s) involved. Such training shall include, but is not limited to:

a) the **minimum approach distance** (**MAD**) for the maximum voltage within the area as well as the skills and techniques necessary to maintain that distance,

b) that under normal operating conditions, **electric supply lines** are energized and could cause serious injury or death if **direct contact** or **indirect contact** occurs,

c) that under abnormal conditions or configuration (e.g., natural disasters), all wires and cables have the potential to become energized. In such situations, all utility infrastructure is to be considered energized and could cause serious injury or death if direct or indirect contact occurs,

d) that the human body is **conductive** and will provide a path for the flow of electricity to a **grounded** object or to the ground itself,

e) that vegetation is conductive, and

f) that **electric shock** that can result in debilitating injuries and may lead to **electrocution** (death) that may arise from direct contact with an energized electric supply line or indirect contact with an energized tree part, tool, equipment, the human body or other energized object. **Step potential** and **touch potential** are forms of indirect contact.

4.1.3 A qualified arborist shall inspect to determine whether an electrical hazard as described in this section exists and shall consult with the **electrical system owner/operator** if uncertain about the presence or nature of an electrical hazard before climbing, otherwise entering, or performing work in or on a tree.

4.1.4 Storm work and emergency conditions create special hazards. Only authorized representatives of the electric utility system operator/owner shall perform tree work in these situations where energized electric supply lines electrical conductors are involved.

4.1.5 Arborists who are performing work that is approaching proximity to electrical facilities shall be aware that the components of those systems, mainly the electric supply lines, have the ability to move due to influences such as weather conditions (e.g., ambient air temperature, wind, snow/ice load) or operational conditions (e.g., span length, electric supply line type, system age, electrical load).

4.1.6 Climbing arborists should ascend and descend on the side of the tree that is away from energized electric supply lines.

4.1.7 Tie-in point(s) should be above the work position and located in such a way that prevents a swing toward an energized electric supply line or other identified hazard.

4.1.8 The arborist's body, conductive gear (including, but not limited to, climbing lines, rigging lines, throwlines), tools, and equipment shall maintain the MAD shown in Tables 1, 2, 3, or 4, as applicable.

4.1.9 Portable **ladders** shall not have conductive side rails if they are used where the arborist or the ladder could contact exposed energized parts.

4.1.10 Ladders; **platforms**; equipment, including remote controlled equipment; and **aerial devices**, including **insulated** aerial devices, shall maintain the MAD as shown in Tables 1, 2, 3, or 4, as applicable.

4.1.11 Due to the hazards of step and touch potential, if the distance between the aerial device and energized electric supply lines(s) is unintentionally less than required, workers on the ground shall alert all persons to move away and remain clear of the aerial device vehicle and attached equipment (e.g., chipper) until the aerial lift **operator** has been notified and the required MAD is reestablished.

4.1.12 Emergency response to an incident involving electrical contact shall be performed in accordance with Section 3.2, Emergency Procedures and Readiness.

4.1.13 Arboricultural operations in proximity to energized electric supply lines shall not be performed during adverse weather conditions, such as thunderstorms, high winds, snowstorms, or ice storms.

> **Note:** A high wind is one which would expose an arborist to being blown from an elevated location or cause an arborist or material-handling equipment to lose control of the material or expose the arborist to other hazards not controlled by the requirements of this section. Winds exceeding 40 mph (64.37 kph), or 30 mph (48.28 kph) if material handling is involved, meet this criteria unless the employer takes precautions to protect the employees from the hazardous effects of the wind.

4.1.14 Rubber gloves, with or without leather protective coverings, shall not be considered as providing any measure of safety from electrical hazards.

4.1.15 Footwear, including **dielectric** overshoes or those with electrical-resistant soles, shall not be considered as providing any measure of safety from electrical hazards.

4.1.16 When working in proximity to energized electric supply lines with insulated covers, blankets, hoses, sleeves, or any other covering or coating, MAD shall be maintained.

4.1.17 Pole tools used in proximity to energized electric supply lines shall be constructed with fiberglass reinforced plastic (FRP) or wood.

4.1.18 **Radiofrequency** Safety

4.1.18.1 The employer shall provide radiofrequency (RF) awareness training for arborists who work in an area where sources of hazardous, nonionizing radiation are present. At minimum, the training should include hazards of working near RF antennas and necessary protective measures.

Note: Small cell sites can be found on or near utility poles, sides of buildings, and rooftops.

Note: Small cell sites require secondary 120 V electrical supply and may include battery backup for each pole or location. Approach distances vary between each site.

4.1.19.2 All small cell antennas shall be considered active, and caution shall be taken until the power source has been tested and verified as "OFF" or the site has been locked out/tagged out.

4.1.19.3 Work times may need to be scheduled in advance due to network functions or loading; therefore, the appropriate scheduling should be taken into account for purposes of completing work.

Note: Federal Communications Commission (FCC) requires each site to be labeled with cell owner and contact number to communicate with the appropriate network operations center (NOC).

4.2 Electrical Level 1 Arborist - Unqualified

4.2.1 The items contained in Section 4.1, General, shall be applicable to this section.

4.2.2 The **Electrical Level 1 Arborist** and trainees shall receive fundamental electrical hazard awareness training prior to performing tasks where electrical hazards exists. However, they have not received related training nor have they demonstrated competency in the skills and techniques necessary to qualify for an Electrical Level 2 Arborist – Low Voltage, Electrical Level 3 Arborist – Primary Voltage, or Electrical Level 4 Arborist – Line Clearance.

4.2.3 The Electrical Level 1 Arborist shall not access or perform work that is within the MADs shown in Table 1.

4.2.4 The Electrical Level 1 Arborist shall not cause any vegetation to violate the applicable MADs shown in Table 1.

4.2.5 There shall be no direct or indirect contact with electric supply lines, communication lines, or equipment, regardless of whether they are energized or **deenergized** and grounded.

Table 1. MADs to energized electric supply lines for Electrical Level 1 Arborist – Unqualified.

Nominal Voltage (Phase-to-Phase)*	**MAD**	
kV	**ft-in**	**m**
50.0 and less	10-00	3.048
50.1 to 72.5	11-00	3.353
72.6 to 121.0	12-08	3.861
121.1 to 145.0	13-04	4.064
145.1 to 169.0	14-00	4.267
169.1 to 242.0	16-08	5.080
242.1 to 362.0	20-08	6.299
362.1 to 550.0	26-08	8.128
550.1 to 800.0	35-00	10.668

*Exceeds **phase-to-ground** per 29 CFR 1910.333.

4.3 Electrical Level 2 Arborist – Low Voltage (750 V and less)

Note: Formerly: Incidental Line Clearance.

4.3.1 The items contained in Section 4.1, General, shall be applicable to this section.

4.3.2 The **Electrical Level 2 Arborist** is an arborist who performs tree work where an electrical hazard exists, but the arborist is not working for the purpose of clearing space around the electric supply lines on behalf of the utility that controls or operates the wires/lines. The Electrical Level 2 Arborist shall have related training and on-the-job experience, be familiar with the equipment and of performing arboricultural operations in proximity to low voltage, and have demonstrated the ability to perform hazard mitigation techniques involved at low voltages.

4.3.2.1 The Electrical Level 2 Arborist is trained and competent to perform arboricultural operations within 10 ft (3 m) of 750 V and lower, but not closer than distances shown in Table 2. The Electrical Level 2 Arborist may enter a tree and perform work within the tree but not bring their body nor conductive material within 10 ft (3 m) of the primary electric supply line in excess of 750 V.

4.3.2.1.1 When the low voltage safety regulations of an individual OSHA state plan require it, voltages below 750 V shall be utilized.

4.3.3 The employer shall verify that the Electrical Level 2 Arborist is trained and has demonstrated competency to work within proximity to electrical hazards consistent with 1910.332 Subpart S, Training.

4.3.4 The employer shall ensure that the Electrical Level 2 Arborist and Electrical Level 2 Arborist Trainee's training and degree of training in electrical hazards is determined by the risk to the arborist for the hazard(s) involved. Such training shall include, but is not limited to:

a) familiarity with the safety-related work practices, safety procedures, and other safety requirements in this section that pertain to their job assignments;

b) familiarity with any other safety practices, including applicable emergency procedures (e.g., aerial rescue), that are not specifically addressed by this section but that are related to their work and are necessary for their safety;

c) the skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment;

d) the skills and techniques necessary to determine the nominal voltage of exposed live parts; and

e) the MADs specified in this section (Table 2) which correspond to the voltages to which the arborist will be exposed, and the skills and techniques necessary to maintain those distances.

4.3.5 The employer shall determine, through ongoing supervision and through inspections conducted on at least an annual basis, that the arborist is complying with the safety-related work practices required by this section.

4.3.6 An Electrical Level 2 Arborist shall receive additional training (or retraining) if the Electrical Level 2 Arborist must employ safety-related work practices that are not normally used during their regular job duties.

Note: The Occupational Safety and Health Administration (OSHA)

considers tasks that are performed less often than once per year to necessitate retraining before the performance of the work practices involved.

4.3.6.1 An arborist shall receive additional training (or retraining) under either of the following conditions:

a) The supervision or annual inspections indicate that the Electrical Level 2 Arborist is not complying with the safety-related work practices required by this section.

b) New technology, new types of equipment, or changes in procedures necessitate the use of safety-related work practices that are different from those which the arborist would normally use.

4.3.7 The training required in this section shall be of the classroom or on-the-job type.

4.3.8 The training shall establish arborist competency in the work practices required by this section and shall introduce the procedures necessary for compliance with this section.

4.3.9 The employer shall ensure that the Electrical Level 2 Arborist has demonstrated competency in the work practices involved before that arborist is considered as having completed the training required by this section.

4.3.10 For an Electrical Level 2 Arborist with previous training, an employer may determine that that arborist has demonstrated the competency required by this paragraph using the following process:

1) Confirm that the arborist has the training required by this section.

2) Use an examination or interview to make an initial determination that the arborist understands the relevant safety-related work practices before they perform any work covered by this section.

3) Supervise the arborist closely until that arborist has demonstrated competency as required by this section.

4.3.11 When Electrical Level 2 Arborist Trainees are assigned to work where an electrical hazard exists, the Electrical Level 2 Arborist Trainees shall be under the direct supervision of an Electrical Level 2 Arborist.

4.3.12 The Electrical Level 2 Arborist should not cause any vegetation to violate applicable MADs (reflected in Table 2) to which they are qualified.

4.3.13 When MAD cannot be maintained, work shall stop, and the Electrical Level 2 Arborist's supervisor shall develop an electrical hazard abatement plan with the designated electrical system owner/operator supervisor.

Note: See Annex H, Electrical Hazard Abatement, for guidance.

4.3.14 Vegetation within the MAD which have been browned or charred by past electrical arcing or contact should be considered likely to become energized without warning and thus should be treated as energized. Climbing trees in such conditions should be avoided.

4.3.15 Tools that are not rated as insulated for the voltage to which they are exposed shall be considered conductive. Electrical Level 2 Arborists shall use pole tools, including, but not limited to, pole saws and pole pruners, identified by the manufacturer as suitable for use within MAD.

4.3.16 Trees with energized electric supply lines attached shall not be climbed or otherwise worked in, with or without insulated tools and equipment (aerial lifts), unless the line has been deenergized and an electrical hazard abatement plan has been developed with the designated system owner/operator supervisor.

Table 2. MADs to energized electric supply lines for Electrical Level 2 Arborist – Low Voltage (750 V and less).

Nominal Voltage Range (Phase-to-Phase)	**MAD***	
kV	**ft-in**	**m**
0.300 and less	*Avoid contact*	*Avoid contact*
0.301 to 0.750	1-06	0.46
0.751 to 50.0	10-00	3.05
50.1 to 72.5	11-00	3.36
72.6 to 121.0	12-08	3.86
121.1 to 145.0	13-04	4.06
145.1 to 169.0	14-00	4.27
169.1 to 242.0	16-08	5.08
242.1 to 362.0	20-08	6.30
362.1 to 550.0	26-08	8.13
550.1 to 800.0	35-00	10.67

*Exceeds Table S-5 in 29 CFR 1910.333

4.4 Electrical Level 3 Arborist – Primary Voltage (35 kV and less)

Note: Formerly: Incidental Line Clearance

4.4.1 The items contained in Section 4.1, General, shall be applicable to this section.

4.4.2 The **Electrical Level 3 Arborist** is an arborist who performs tree work where an electrical hazard exists, but the arborist is not working for the purpose of clearing space around the electric supply lines on behalf of the utility that controls or operates the wires/lines. The Electrical Level 3 Arborist shall have related training and on-the-job experience, be familiar with the equipment and hazards of performing arboricultural operations in proximity to primary voltage not to exceed 35 kV, and have demonstrated the ability to perform the special techniques involved at primary voltages.

4.4.2.1 The Electrical Level 3 Arborist (35 kV and lower) is trained and competent to perform arboricultural operations within 10 ft of 35 kV and lower but not closer than distances shown in Table 3. The Electrical Level 3 Arborist may enter a tree and perform work within the tree but not bring their body nor conductive material within distances shown in Table 3 of the primary electric supply line in excess of 35 kV.

4.4.3 The employer shall verify that the Electrical Level 3 Arborist is trained and has demonstrated competency to work within proximity to electrical hazards consistent with 1910.332 Subpart S – Training.

4.4.4 The employer shall ensure that the Electrical Level 3 Arborist and Electrical Level 3 Arborist Trainee's training and degree of training in electrical hazards is determined by the risk to the arborist for the hazard(s) involved. Such training shall include, but is not limited to:

a) familiarity with the safety-related work practices, safety procedures, and other safety requirements in this section that pertain to their job assignments;

b) familiarity with any other safety practices, including applicable emergency procedures (e.g., aerial rescue), that are not specifically addressed by this section but that are related to their work and are necessary for their safety;

c) the skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment;

d) the skills and techniques necessary to determine the nominal voltage of exposed live parts; and

e) the MADs specified in this section (Table 3) which correspond to the voltages to which the Electrical Level 3 Arborist will be exposed and the skills and techniques necessary to maintain those distances.

4.4.5 The employer shall determine, through regular supervision and through inspections conducted on at least an annual basis, that the Electrical Level 3 Arborist is complying with the safety-related work practices required by this section.

4.4.6 An Electrical Level 3 Arborist shall receive additional training (or retraining) if the Electrical Level 3 Arborist must employ safety-related work practices that are not normally used during their regular job duties.

Note: OSHA considers tasks that are performed less often than once per year to necessitate retraining before the performance of the work practices involved.

4.4.5.1 An arborist shall receive additional training (or retraining) under either of the following conditions:

a) The supervision or annual inspections indicate that the Electrical Level 3 Arborist is not complying with the safety-related work practices required by this section.

b) New technology, new types of equipment, or changes in procedures necessitate the use of safety-related work practices that are different from those which the arborist would normally use.

4.4.7 The training required of this section shall be of the classroom or on-the-job type.

4.4.8 The training shall establish arborist competency in the work practices required by this section and shall introduce the procedures necessary for compliance with this section.

4.4.9 The employer shall ensure that the Electrical Level 3 Arborist has demonstrated competency in the work practices involved before that arborist is considered as having completed the training required by this section.

4.4.10 For an Electrical Level 3 Arborist with previous training, an employer may determine that that

arborist has demonstrated the competency required by this paragraph using the following process:

1) Confirm that the Electrical Level 3 Arborist has the training required by this section.

2) Use an examination or interview to make an initial determination that the arborist understands the relevant safety-related work practices before they perform any work covered by this section.

3) Supervise the arborist closely until that arborist has demonstrated competency as required by this section.

4.4.11 When Electrical Level 3 Arborist Trainees are assigned to work where an electrical hazard exists, the Electrical Level 3 Arborist Trainees shall be under the direct supervision of an Electrical Level 3 Arborist.

4.4.12 The Electrical Level 3 Arborist should not cause any vegetation to violate applicable MADs (reflected in Table 3) to which they are qualified.

4.4.13 When MAD cannot be maintained, work shall stop, and the Electrical Level 3 Arborist's supervisor shall develop an electrical hazard abatement plan with the designated electrical system owner/operator supervisor.

Note: See Annex H, Electrical Hazard Abatement, for guidance.

4.4.14 Vegetation within the MAD which have been browned or charred by past electrical arcing or contact should be considered likely to become energized without warning and thus should be treated as energized. Climbing of trees in such conditions should be avoided.

4.4.15 Tools that are not rated as insulated for the voltage to which they are exposed shall be considered conductive.

4.4.15.1 Electrical Level 3 Arborists shall use pole tools, including but not limited to pole saws and pole pruners, identified by the manufacturer as suitable for use within MAD.

4.4.16 Trees with energized electric supply lines attached shall not be climbed or otherwise worked in, with or without insulated tools and equipment (aerial lifts) unless the line has been deenergized and an electrical hazard abatement plan has been developed with the designated system owner/operator supervisor.

Table 3. MADs to energized electric supply lines for Electrical Level 3 Arborist – Primary Voltage (35 kV and less).		
Nominal Voltage Range (Phase-to-Phase)	**MAD***	
kV	**ft-in**	**m**
0.300 and less	*Avoid contact*	*Avoid contact*
0.301 to 0.750	1-06	0.46
0.751 to 5.0	2-09	0.84
5.1 to 15.0	2-10	0.86
15.1 to 35.0	3-04	1.02
35.1 to 50.0	10-00	3.05
50.1 to 72.5	11-00	3.36
72.6 to 121.0	12-08	3.86
121.1 to 145.0	13-04	4.06
145.1 to 169.0	14-00	4.27
169.1 to 242.0	16-08	5.08
242.1 to 362.0	20-08	6.30
362.1 to 550.0	26-08	8.13
550.1 to 800.0	35-00	10.67
*Exceeds Table S-5 in 29 CFR 1910.333		

4.5 Electrical Level 4 Arborist – Line Clearance

4.5.1 The items contained in Section 4.1, General, shall be included in the review of this section.

4.5.2 The **Electrical Level 4 Arborist** is an arborist who performs **line clearance** vegetation management work for the purpose of clearing space around the electric supply lines on behalf of the utility that controls or operates the wires/lines.

4.5.3 The employer shall verify that the Electrical Level 4 Arborist is trained and has demonstrated competency to work within proximity to electrical hazards consistent with 1910.269(a)(2) training requirements.

4.5.4 The **contract employer** shall ensure that the Electrical Level 4 Arborist and Electrical Level 4 Arborist Trainee's training and degree of training in electrical

hazards is determined by the risk to the arborist for the hazard(s) involved. Such training shall include, but is not limited to:

a) familiarity with the safety-related work practices, safety procedures, and other safety requirements in this section that pertain to their job assignments;

b) familiarity with any other safety practices, including applicable emergency procedures (such as aerial rescue), that are not specifically addressed by this section but that are related to their work and are necessary for their safety;

c) the skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment;

d) the skills and techniques necessary to determine the nominal voltage of exposed live parts; and

e) the MADs specified in this section (Table 4) which correspond to the voltages to which the Electrical Level 4 Arborist will be exposed and the skills and techniques necessary to maintain those distances.

4.5.5 The contract employer shall determine, through regular supervision and through inspections conducted on at least an annual basis, that the arborist is complying with the safety-related work practices required by this section.

4.5.6 An Electrical Level 4 Arborist shall receive additional training (or retraining) if the Electrical Level 4 Arborist must employ safety-related work practices that are not normally used during their regular job duties.

Note: OSHA considers tasks that are performed less often than once per year to necessitate retraining before the performance of the work practices involved.

4.5.6.1 An arborist shall receive additional training (or retraining) under either of the following conditions:

- The supervision or annual inspections indicate that the Electrical Level 4 Arborist is not complying with the safety-related work practices required by this section.

- New technology, new types of equipment, or changes in procedures necessitate the use of safety-related work practices that are different from those which the Electrical Level 4 Arborist would normally use.

4.5.7 The training required of this section shall be of the classroom or on-the-job type.

4.5.8 The training shall establish arborist competency in the work practices required by this section and shall introduce the procedures necessary for compliance with this section.

4.5.9 The contract employer shall ensure that the Electrical Level 4 Arborist has demonstrated competency in the work practices involved before that arborist is considered as having completed the training required by this section.

4.5.10 For an Electrical Level 4 Arborist with previous training, an employer may determine that that arborist has demonstrated the competency required by this paragraph using the following process:

1) Confirm that the Electrical Level 4 Arborist has the training required by this section.

2) Use an examination or interview to make an initial determination that the Electrical Level 4 Arborist understands the relevant safety-related work practices before they perform any work covered by this section.

3) Supervise the Electrical Level 4 Arborist closely until that arborist has demonstrated competency as required by this section.

4.5.11 The contract employer shall ensure that the Electrical Level 4 Arborist is instructed in the hazardous conditions relevant to the arborist's work that the contract employer is aware of as a result of information communicated to the contract employer by the **host employer**.

4.5.12 When Electrical Level 4 Arborist Trainees are assigned to work where an electrical hazard exists, the Electrical Level 4 Arborist Trainees shall be under the direct supervision of an Electrical Level 4 Arborist.

4.5.13 Electrical Level 4 Arborist and Electrical Level 4 Arborist Trainees performing **line clearance** after a storm or under similar conditions shall be trained in the hazards associated with this type of work and in the recognition of the hazards of step potential.

4.5.14 When a line-clearance employer is performing work for an electrical system owner/operator (host employer), it shall be the responsibility of the line-clearance employer, who is receiving host-employer information, to communicate the information and any other known hazardous conditions relevant to the affected workers performing the affected work.

> 4.5.14.1 Before work begins, the line-clearance employer and the host employer shall coordinate their work rules and procedures so that each arborist of the line-clearance employer and the host employer is protected.

4.5.14.2 Before work begins, the line-clearance employer shall advise the host employer of any unique hazardous conditions presented by the line-clearance employer's work. Weather and operational factors shall be taken into consideration when establishing work plans for maintaining the MAD required under all operating conditions. Work plans shall require monitoring of electric-supply-line positioning, communication with the host employer to relay work plans, and other specific requirements.

4.5.14.3 The line-clearance employer shall advise the host employer of any unanticipated hazardous conditions of the electrical system found during that employer's work. This information shall be provided to the host employer within two working days after discovering the hazardous condition.

4.5.15 An Electrical Level 4 Arborist or Electrical Level 4 Arborist Trainee shall be within unassisted voice communication and should be within visual contact during line-clearance operations aloft when:

- the arborist/trainee aloft must approach closer than 10 ft (3.05 m) of applicable MAD in Table 4 to any energized electric supply lines in excess of 750 V (primary electric supply line);

- vegetation, which cannot first be cut (with an insulated pole pruner/pole saw), is being removed to sufficiently clear electric supply lines so as to avoid contact; and/or

- roping is required to remove vegetation from such electric supply lines.

4.5.16 Insulated pruning tools shall be designed and constructed to withstand the line voltage, as outlined in Annex J, Insulating Pruning Tools. Arborist pole tools, including, but not limited to, pole saws and pole pruners, shall be identified by the manufacturer as suitable for use in proximity to energized electric supply lines.

4.5.17 Electrical Level 4 Arborist and Electrical Level 4 Arborist Trainees shall maintain MAD from energized electric supply lines in accordance with Table 4.

4.5.18 If MAD (shown in Table 4) cannot be maintained during arboricultural operations, the Electrical Level 4 Arborist shall request that the electrical system owner/operator's designated supervisor in charge coordinate communications and operations between the electrical system owner/operator and the line-clearance arborist to **mitigate** the electrical hazard. Mitigation options should include all safe, OSHA-compliant, practical work methods, and, where necessary, deenergizing, **testing**, isolating, and grounding the electric supply lines by the electrical system owner/operator (see Annex H, Electrical Hazard Abatement). The designated electrical system owner/operator arborist and the designated Electrical Level 4 Arborist in charge shall confirm that protective ground(s) have been installed as

close as is practical to the line-clearance work to be performed to prevent hazardous differences in electrical potential.

4.5.19 When vegetation is contacting energized electric supply lines, contacting electric equipment, or is within MAD as specified in Table 4, it shall only be removed using clean, dry insulated tools or equipment.

4.5.20 Vegetation within the MAD which has been browned or charred by past electrical arcing or contact should be treated with caution. The following steps should be followed when this condition is present:

> 4.5.20.1 Climbing trees in such condition should be assessed by an Electrical Level 4 Arborist and supervisor to determine whether or not an electrical hazard exists, and mitigation is necessary before performing arboricultural operations.
>
> 4.5.20.2 The Electrical Level 4 Arborist in charge shall establish a plan to safely manage the work.
>
> 4.5.20.3 Work strategies, in accordance with work rules of contract employer and host employer, shall be employed so that each Electrical Level 4 Arborist of the contract employer and the host employer is protected.
>
> > **Note:** See Section 4.4.13 and Annex H, Electrical Hazard Abatement, on determining an electric hazard mitigation plan.

4.5.21 Tools that are not rated as insulated for the voltage to which they are exposed shall be considered conductive. Electrical Level 4 Arborists shall use pole tools, including, but not limited to, pole saws and pole pruners, identified by the manufacturer as suitable for use within MAD.

4.5.22 Trees with energized electric supply lines attached shall not be climbed; however, they may be worked with an insulated aerial lift and insulated tools. Such trees that must be climbed shall first have the line deenergized, tested, isolated and grounded and an electrical hazard abatement plan developed with the designated system owner/operator supervisor.

Table 4. MADs from energized electric supply lines for Electrical Level 4 Arborist – Line Clearance.

Nominal Voltage Range (Phase-to-Phase)	Altitude Correction Factor Sea Level to 5,000 ft (0 to 1,524 m) * (Phase-to-Ground)		Altitude Correction Factor 5,000 to 10,000 ft (1,524 to 3,048 m) * (Phase-to-Ground)		Altitude Correction Factor 10,000 to 14,000 ft (3,048 to 4,267 m) * (Phase-to-Ground)	
kV	**ft-in**	**m**	**ft-in**	**m**	**ft-in**	**m**
0.300 and less	*Avoid contact*		*Avoid contact*		*Avoid contact*	
0.301 to 0.750	1-02	0.356	1-04	0.407	1-06	0.458
0.751 to 5.0	2-03	0.686	2-06	0.762	2-09	0.839
5.1 to 15.0	2-03	0.686	2-07	0.788	2-10	0.864
15.1 to 36.0	2-08	0.813	3-01	0.940	3-04	1.016
36.1 to 46.0	2-11	0.889	3-04	1.016	3-08	1.118
46.1 to 72.5	3-06	1.067	4-00	1.220	4-04	1.321
72.6 to 121.0	3-11	1.194	4-06	1.372	4-10	1.474
121.1 to 145.0	4-06	1.372	5-02	1.575	5-07	1.702
145.1 to 169.0	5-01	1.550	5-09	1.753	6-03	1.905
169.1 to 242.0	7-00	2.134	7-11	2.413	8-07	2.617
242.1 to 362.0	11-09	3.582	13-06	4.115	14-07	4.445
362.1 to 420.0	14-08	4.471	16-09	5.106	18-02	5.538
420.1 to 550.0	17-06	5.334	20-00	6.096	21-08	6.604
550.1 to 800.0	23-09	7.239	27-02	8.281	29-05	8.967

From 29 CFR 1910.269, Tables R-6 and R-7, altitude corrected (R-5) for 1,500 m, 3,000 m, and 4,200 m.

5 VEHICLE OPERATIONS

5.1 General

5.1.1 All applicable requirements in Section 3, General Safety Requirements, shall apply to this section.

5.1.2 When the National Traffic and Motor Vehicle Safety Act, state laws, or other regulatory bodies have jurisdiction over the use and operation of **motor vehicles**, **mobile equipment**, **machinery** and/or specialized equipment, laws, acts, and regulations shall be followed.

5.1.3 Inspections intended for the safety of workers and operators riding on or in motor vehicles or equipment shall be performed prior to workers and/or operators using the units.

5.1.4 When an inspection or maintenance reveals a defect that would affect the safe operation of the unit, the unit shall be removed from service until repairs have been made.

5.1.5 Maintenance of units shall only be performed by employer-authorized personnel.

5.1.6 If the operator's view of a hazard is obstructed, a closer inspection of the area shall be performed, when it is safe to do so, before moving the unit.

5.1.7 Hazards found in a prejob walk-through that cannot be removed shall be flagged, marked, or otherwise identified. The operator shall be made aware of such hazards prior to proceeding.

> **Note:** Use of reverse signal alarms (audible above the surrounding noise level), a backup camera, or a **spotter** are methods to help mitigate the risks associated with backing.

5.1.8 Units shall be equipped and maintained with manufacturers' safety devices, instructions, decals, and safeguards.

5.1.9 Manufacturers' preventive maintenance inspections and parts replacement procedures should be followed. When manufacturers' procedures are not followed, the following procedures shall be used:

> 5.1.9.1 Units shall be turned off.
>
> 5.1.9.2 Keys shall be removed from the ignition.
>
> 5.1.9.3 All rotating parts and moving parts shall be stopped and **secured**, if applicable.

5.1.9.4 All applicable sources of energy, including, but not limited to, mechanical, electrical, hydraulic, pneumatic, chemical, and thermal energy, shall be verified to be released.

Defects or malfunctions affecting the safe operation of equipment shall be corrected before the unit(s) is placed into use.

Note: See Annex C.2, Control of Hazardous Energy.

5.1.10 No part of the body shall be used to locate or stop hydraulic leaks.

5.1.11 Material, **dunnage**, and equipment carried on vehicles shall be properly stored and secured in compliance with the design of the units and, where applicable, in accordance with federal, state, or local regulations.

5.1.12 Manufacturer-provided slip/skid-resistant surfaces shall be maintained.

5.1.13 When provided by the manufacturer, seatbelts shall be worn by the driver, operator, and or passenger(s) while the unit is in motion.

5.1.14 Hoisting or lifting equipment mounted on units shall be used within rated capacities as stated by the manufacturers' specifications.

5.1.15 When a unit is left unattended, attachments should be stowed, cradled, or lowered to the ground; the wheels should be chocked; keys shall be removed from the ignition; and, if applicable, the parking brake shall be applied.

5.1.16 Precautions should be taken to ensure that exhaust systems do not present a fire hazard.

5.1.17 Units operated off road shall be operated in the appropriate gear and at an appropriate speed, relative to the operating environment and within employer instructions and guidelines.

5.1.18 Structures to protect the operator shall meet the requirements of the applicable Society of Automotive Engineers (SAE) standard.

5.1.19 When workers need to access the area under a raised dump body, workers shall use a body prop. The props should be accessible without reaching between the raised part and the chassis or body.

5.1.20 Drivers shall know the height of any unit prior to moving that unit and shall not attempt to drive under structures lower than the unit's height.

5.1.21 A steel bulkhead or equivalent protective device shall be provided to protect workers from load shifts in motor vehicles carrying logs.

5.1.22 Load securement procedures shall be followed to prevent accidental shifting or discharge of logs or other materials from the vehicle during transport.

5.1.23 Logs or other materials 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.

5.1.24 To avoid the hazard of spontaneous combustion, wood chips should not be left in units for extended periods.

5.2 Aerial Devices

5.2.1 The items contained in Section 4, Electrical Hazards, shall always be included in the review of this section.

5.2.2 The items contained in Section 5.1, General, shall always be included in the review of this section.

5.2.3 Aerial lift annual inspection and dielectric test shall be performed and documented per manufacturers' recommendations.

5.2.4 Prior to use of an aerial device, a visual inspection of all components shall be made for evidence of defects, such as deformation of any component, loose connections, damaged wire rope, hydraulic leaks, or other items critical to safe operation.

5.2.5 Before the aerial device is set up for use, the work site shall be surveyed for hazards, including:

Note:

- insufficient supporting surfaces, such as soft ground
- ditches
- excessive slopes, drop-offs, curbs
- debris
- overhead obstructions and electrical conductors
- weather conditions
- presence of unauthorized persons
- road or work site traffic
- subsurface chambers, such as underground utility components or septic systems
- factors affecting stability, including uneven surfaces and the manufacturer's maximum allowable slope and limits

5.2.6 Aerial devices or aerial ladders shall not be used as cranes or hoists to lift, support, or lower materials or tree parts unless specifically designed by the manufacturer for that purpose.

5.2.7 Operator shall not exceed the lifting capacity of the hoisting device.

5.2.7.1 Combined loads shall not exceed rated lift capacities. Load ratings shall be permanently posted on aerial devices (in accordance with ANSI/SIA A92 or A92.5), as applicable to the specific aerial device.

5.2.8 Before use of an aerial device, a minimum of two appropriate **wheel chocks** shall be set properly to prevent rolling of the vehicle whenever it is parked unless the device has no wheels on the ground or is designed for use without chocks.

5.2.9 **Outriggers** or stabilizers shall be used if the manufacturer's instructions require their use. All outriggers shall be properly set on appropriate pads recommended by the manufacturer (if applicable) before the aerial device is moved from the stowed position (cradle).

5.2.10 The operator of the outrigger controls shall ensure adequate clearance exists and give warning to all workers in the immediate vicinity of the unit prior to lowering or raising the outrigger.

5.2.10.1 The outrigger alarm, if so equipped, shall be operational.

5.2.10.2 If the alarm is found to be nonoperational in the field, command and response shall be used.

5.2.11 Aerial devices shall be provided with fall-protection anchor(s) meeting design requirements of the ANSI/SIA A92 standard on which to secure an **approved** system of personal fall protection which shall be worn by the operator(s) whenever aloft.

5.2.11.1 All fall protection shall be worn and adjusted in accordance with manufacturer specifications.

5.2.11.2 The **carabiners** and **snap hooks** used as part of a fall-arrest system shall have a 3,600-pound (16.01 **kN**) rated gate. Carabiners and snap hooks shall not be linked together unless designed to do so and accepted by the manufacturer.

5.2.12 Aerial **buckets**/platforms shall not have more occupants than allowed by the manufacturer's rating.

5.2.13 The operator shall stand firmly on the floor of the platform (aerial bucket) and shall not use railings, planks, ladders, or any other device in or on the bucket for achieving additional working height.

5.2.14 The platform should be kept clean from the accumulation of debris that may overload the platform and impact the safety of the operator.

5.2.15 Climbing spurs (gaffs) shall not be worn while working from an aerial device.

5.2.16 During pruning/removal operations, a sheath or scabbard shall be utilized inside the platform to cover sharp-edged tools, such as chain saws and hand saws, while stored.

EXCEPTION

A chain saw scabbard may be used on the outside of the platform if **lanyard**/tether is used to secure the saw while not in use.

5.2.17 During pruning/removal operations, the aerial device operator shall have a hand saw while working aloft.

5.2.18 Before moving an aerial device for travel, the operator shall inspect the aerial device to ensure the boom(s) are cradled and secured, the tools are secured, and the outriggers are stowed or positioned for travel per manufacturer specifications.

5.2.19 When operating aerial devices, the operator shall look primarily in the direction the platform (aerial bucket) is traveling and be aware of the location of the booms, including the elbow/knuckle area, in relation to all other objects and hazards.

5.2.20 When transferring from the platform (aerial bucket) of an aerial device to a tree, arborists shall remain **secured** to the aerial device until they are properly secured to the tree.

5.2.20.1 The arborist should choose a tie-in point that will not create an unbalanced swing when transferring to the tree.

5.2.20.2 The arborist shall preload the new tie-in point with their weight before releasing the current means of being secured.

5.2.20.3 At no time shall work be performed while an arborist is secured to both the aerial device and the tree.

5.2.21 Arborists shall remain properly secured at all times when transferring from the bucket of an inoperative aerial device to the platform (aerial bucket) of an operative aerial device to facilitate an emergency descent.

5.2.22 The lower controls of an aerial device shall not be used for continuous operation when the operator is in the platform (aerial bucket).

5.2.22.1 Lower controls shall not be operated unless permission has been obtained from the arborist in the platform, except in case of emergency.

5.2.23 Clearances from passing vehicles shall be maintained or traffic control shall be provided when booms or platforms (aerial buckets) are operated over roads, in accordance with the Manual on Uniform Traffic Control Devices (MUTCD), Part 6, and federal, state, or local regulations, as applicable.

5.2.23.1 Clearances shall be maintained for outriggers and any other portion of the vehicle that may extend into or over the lanes of travel or that work over them.

5.2.24 Workers shall not perform arboricultural operations, such as pruning or cutting of trees, from the top of vehicle bodies or cab protectors unless the worker is properly protected from the fall hazard.

5.2.25 Hydraulic/pneumatic tools shall be disconnected when they are being serviced or adjusted, except where manufacturers' procedures require otherwise.

5.2.26 To avoid flying particles and whipping hydraulic/pneumatic hoses, pressure shall be released before the hoses are disconnected, except where **quick-acting connectors** are used. Hydraulic/pneumatic hoses shall never be kinked in order to cut off pressure.

5.2.27 No part of the body shall be used to locate or stop hydraulic leaks.

5.2.28 Hoses affecting dielectric characteristics of equipment shall meet manufacturers' requirements.

5.2.29 The properties of hydraulic fluid (e.g., dielectric characteristics, flash point, etc.) shall meet the requirements set by the manufacturer.

5.2.30 Booms, platforms (aerial buckets), or any other part of the aerial device shall not be allowed to make contact or encroach upon minimum approach distances (MADs) with energized electrical conductors, poles, or similar conductive objects.

5.2.31 Due to hazards of step and touch potential, if the distance between the aerial device and energized conductor(s) is less than the required MAD, workers on the ground shall move away and remain clear of the aerial-device vehicle and attached equipment (e.g., chipper) until the required MAD is reestablished.

5.2.32 Aerial device equipment with an elevating structure that raises the turret and booms and changes the reach of the device's uninsulated portions shall be positioned so that no portion of the aerial device and its elevating structure encroach upon the MAD from energized electrical lines as specified in this standard. A **spotter(s)** shall be used when the aerial lift is working close to the MAD and could potentially encroach upon the MAD.

5.2.33 When the MAD could be encroached upon, the spotter(s) shall warn all ground personnel, including the equipment operator and direct ground personnel to keep clear of the vehicle and attachments until the MAD is visually established and communicated.

5.2.34 Electric cables/cords used with tools, lights, or other conductive material shall not be run from the vehicle or other power source to the platform (aerial bucket) when arborists are working in proximity to energized electrical conductors.

5.2.35

(a) Platforms (aerial buckets) on insulating aerial devices shall not have through-cracks or holes below the lip of the platform.

(b) Insulating liners shall have no holes below the lip of the liner or cracks greater than 6 in (15.24 cm) from the lip of the liner or the onset of the crack.

5.2.36 During aerial device operations, arborists and other workers shall maintain a MAD from energized electric conductors in accordance with the appropriate table of this standard as required by their level of **training**.

5.2.37 Arborists and other workers shall be instructed that aerial platforms (aerial buckets) do not protect them from other electric paths to the ground, such as paths through trees or guy wires, or from phase-to-phase contact. All paths of electric contact shall be considered to cause death or serious injury.

5.2.38 Arborists using a **boom-supported elevating work platform** shall operate the platform within the limits of intended use as defined by the manufacturer in the operator's manual, ANSI/SIA A92, and applicable governmental regulations.

5.2.38.1 Equipment shall be maneuvered at or below the appropriate travel speed to ensure stability, and the operator shall assess the surfaces on which the equipment will travel, including ground conditions and slope, and distances to obstacles and overhead lines.

5.2.38.2 A spotter shall be used when the equipment is travelling if the view in the direction of travel is obstructed.

5.2.39 Loading, unloading, and transporting shall comply with manufacturers' procedures.

5.2.39.1 Towing vehicles and trailers shall meet or exceed federal, state, and local Department of Transportation (DOT) requirements and manufacturers' specifications.

5.2.39.2 The unit shall not be operated in an elevated position on trailer unless specifically designed by the manufacturer for that purpose.

5.2.39.3 Equipment and cargo securement shall meet or exceed federal, state, and local DOT requirements and manufacturers' specifications.

5.2.40 Only operators who have received instruction and training regarding the inspection, application, responsibilities, and operation shall operate a boom-supported elevating work platform.

5.2.40.1 The operator shall be informed of the location of the manual and familiarized with the controls, safety devices, and operating characteristics of the work platform being operated.

5.2.41 Insulating boom-supported elevating work platforms shall meet the dielectric safety requirements of ANSI/SIA A92.

5.2.42 When an electrical hazard is present, uninsulated units, including those that may have an insulated liner or other insulating properties shall follow MADs as laid out in Table 1.

> 5.2.42.1 Due to hazards of electric step and touch potential, workers on the ground shall remain clear of the aerial device and attached equipment when the boom is aloft.

5.2.43 The operator shall assess the work site hazards present that pertain to the use of a boom-supported elevating work platform on that work site. The operator and other workers shall develop, communicate, and implement a work plan to mitigate the hazards identified on that work site.

5.3 Motor Vehicles

5.3.1 All applicable requirements in Section 5.1, General, shall apply to this section.

5.3.2 When used for business operations, motor vehicles in excess of 10,000 pounds (4,536 kg) gross combined vehicle weight or combined rated weight shall be considered a commercial motor vehicle and thus operated in compliance with the Federal Motor Carrier Safety Regulations (FMCSR), state, and local laws.

> **Note:** Pickup trucks, when towing machinery on public roadways, may have a combined weight or weight rating over 10,000 pounds (4,536 kg).

5.4 Mobile Equipment

5.4.1 All applicable requirements in Section 5.1, General, shall apply to this section.

5.4.2 Permanently mounted mechanical clearing devices and similar implements should be equipped with a deadman or interlocking control. When **deadman controls** are not available, the worker shall disengage the power source to the implement or device before dismounting.

5.5 Machinery

5.5.1 All applicable requirements in Section 5.1, General, shall apply to this section.

5.5.2 Worker access on or in machinery shall be limited to required occasional activities, such as inspection or maintenance, unless there is a manufactured designated seat or worker station.

5.5.3 When machinery is towed:

5.5.3.1 Safety chains, when equipped, shall be crossed under the tongue of the equipment being towed and adjusted to the appropriate length, without twists or knots.

5.5.3.2 Connecting links and repair links shall be of the same or greater strength as the safety chain(s) being used.

5.5.3.3 All coupling devices (e.g., pins, electrical connections, emergency break-away devices) shall be in place and in proper working condition. Towing units shall meet the towing capacities necessary for the intended load.

5.5.3.4 Drivers shall know and not exceed the gross vehicle weight rating (GVWR) and/or gross combination weight rating (GCWR) of any units, except where permitted by law.

5.5.4 Prior to being detached, towed machinery shall be chocked or otherwise secured in place.

5.6 Specialized Units

5.6.1 All applicable requirements in Section 5.1, General; Section 5.2, Aerial Devices; Section 5.3, Motor Vehicles; Section 5.4, Mobile Equipment; and Section 5.5, Machinery, shall apply to this section.

5.6.2 Brush Chippers

5.6.2.1 Access panels and guards for maintenance and adjustment, including the 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 and the ignition key has been removed and pocketed.

Note: See Annex C.2, Control of Hazardous Energy.

5.6.2.2 Rotary drum or disc brush chippers not equipped with a mechanical infeed system shall be equipped with an infeed hopper not less than 85 in (2.15 m) measured from the blades or knives to ground level over the center line of the hopper. Chippers with a mechanical infeed system shall also have a hopper not less than 85 in (2.15 m) measured from the pinch point of the feeder wheels to ground level over the center line of the hopper.

5.6.2.3 Rotary drum or disc brush chippers not equipped with a mechanical infeed system shall have a flexible antikickback device installed in the infeed hopper to reduce the risk of injury from flying chips and debris.

5.6.2.4 Hand-fed 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.

5.6.2.5 Vision, hearing, and other appropriate personal protective equipment (PPE) shall be worn when in proximity of an operating brush chipper, in accordance with Section 3.3, Personal Protective Equipment (PPE), and as defined by the personal protective equipment hazard assessment certification.

5.6.2.6 Arborists, mechanics, and other workers shall not reach beyond the plane of the infeed hopper when the cutter disc, rotary drum, or feed rollers are moving. If maintenance is needed, all moving parts shall come to a complete stop and keys shall be removed from the ignition and pocketed by the **authorized person** before proceeding.

Note: See Annex C.2, Control of Hazardous Energy.

5.6.2.7 When using a winch in chipper operations, the operator shall ensure that the winch line is properly stored before initiating chipper operations.

EXCEPTION

A winch line may be used to assist with positioning material onto the feed table and into infeed hopper. Once the material has been positioned, the winch line must be properly stored before continuing chipping operations.

5.6.2.8 For additional operational requirements, see Section 9.6, Brush Removal and Chipping.

5.6.3 Sprayers and Related Equipment

5.6.3.1 The items contained in Section 5.1, General, and Section 5.5, Machinery, that are applicable to sprayers and related equipment shall always be included in the review of this section.

5.6.3.2 Working and walking surfaces of all sprayers and related equipment shall be covered with skid resistant material.

5.6.3.3 A unit on which the **applicator**/operator stands while the unit is in motion shall be equipped with guardrails around the working area where the worker is exposed to a fall of more than 4 ft and/or if there is a danger of the applicator being run over by the vehicle. Guardrails shall be constructed in accordance with ANSI A1264.1.

5.6.3.4 All fittings and hoses shall be of sufficient strength to withstand or exceed the maximum pressure of the system. At no time should any part of the body be used to locate leaks or damaged sections of hose.

5.6.3.5 The operator shall be aware of the location and use of all safety shut-off valves. Tank shut-off valves should be marked as such.

5.6.3.6 All spray tanks shall have means to determine the level of liquid in the tanks without opening the tank lid.

5.6.3.7 The applicator/operator shall make a visual inspection of hoses, fittings, exposed plumbing, tanks, covers, and related equipment prior to use each workday.

5.6.3.8 The applicator/operator shall not allow hoses or other parts of the equipment to create a tripping hazard for coworkers or the public.

5.6.3.9 The applicator/operator shall have a firm grip on the spray gun/excavation tool when pulling the trigger.

5.6.3.10 Entering enclosed tanks or spaces shall be prohibited unless performed through a confined-space entry plan in compliance with OSHA 1910.146 requirements, which include atmospheric quality testing, training, PPE, supervision, and emergency response procedures.

5.6.3.11 The applicator/operator shall be aware of underground utility locations when drilling holes in the ground for fertilizer or **pesticide** applications. All work shall be in compliance with federal, state, and local underground facility protection laws (e.g., Dig Safe or one-call underground facility locator programs).

5.6.3.12 The equipment shall have splashguards when injecting liquid fertilizer or pesticides into the ground. The applicator shall wear eye protection and follow label instructions when injecting liquids.

5.6.4 Stump Grinders

5.6.4.1 The items contained in Section 5.1, General, and Section 5.5, Machinery, that are applicable to stump grinders shall always be included in the review of this section.

5.6.4.2 Stump grinders shall be equipped with enclosures or guards that reduce the risk of injury during operation. Enclosures and/or guards shall be kept in place when cutting wheels are rotating.

5.6.4.3 Arborists and other workers at the stump-grinding work site shall wear eye, hearing, and other PPE in accordance with Section 3.3, Personal Protective Equipment (PPE).

5.6.4.4 The operator shall be aware of underground utility locations, per Section 3.4.13, prior to performing work. All work shall be in compliance with federal, state, and local underground facility protection laws (e.g., Dig Safe or one-call underground facility locator programs).

5.6.4.5 The operator shall ensure that all other persons remain clear of the stump grinder while the cutting wheel is engaged, rotating, or grinding.

5.6.4.6 The operator shall ensure no secondary activities take place with the stump grinder, such as using the backfill blade, while the cutting wheel is engaged, rotating, or cutting.

5.6.4.7 The operator shall stay at the controls, including remote controls, during the operation of the stump grinder until the cutting wheel has stopped.

5.6.4.8 On equipment with remote controls, the operator shall remain at a safe working distance as established by the employer or manufacturer, clear of the materials being discharged, and clear of the cutting wheel while it is engaged, rotating, or grinding.

5.6.4.9 On equipment with tethered remote controls, the operator and tether shall remain clear of the cutting wheel while it is engaged, rotating, or grinding.

5.6.4.10 The operator shall ensure that the cutting wheel is disengaged and has stopped rotating prior to relocating unit or moving to a new work site.

5.6.5 Mounted Winches

5.6.5.1 The items contained in Section 5.1, General, that are applicable to mounted winches shall always be included in the review of this section.

5.6.5.2 Each day before use, the winch line, winch line attachment points, and all winch mounting bolts shall be inspected for damage or defects by a competent person. Additional inspections shall be performed during winch line use, where service conditions warrant. Damaged or defective winch lines shall be immediately removed from service.

5.6.5.3 Operators shall ensure that all personnel remain clear of the recoil area in the event of load or winch line breakage.

5.6.5.4 All winch operators shall be properly trained and be aware of the inherent dangers associated with winch operations.

5.6.5.5 Winch systems and winch lines shall be used only as intended, designed, and instructed by the manufacturer or employer instructions and guidelines.

5.6.5.6 A winch line should not be wrapped around a load. During winching operations of loads that do not have a manufactured attachment point, the load should be secured using a sling, choker, etc.

5.6.5.7 All operators and workers involved in the winching operation shall constantly be aware of pinch point hazards and stand clear of hazardous areas.

5.6.5.8 All loads shall be pulled in such a manner as to avoid angles that may result in equipment/vehicle becoming unstable or tipping.

5.6.5.9 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.

5.6.5.10 The operator shall ensure that all rigging points comply with Section 9.2, Rigging.

5.6.5.11 An effective means of communication shall be established and used with all workers involved in the winching operation.

Note: See Section 8.5.10.

5.6.5.12 Winch lines shall be **compatible** with the winch design and shall meet manufacturers' specifications.

5.6.5.13 When using a winch in chipper operations, the operator shall ensure that the winch line is properly stored before initiating chipper operations.

EXCEPTION

A winch line may be used to assist with positioning material onto the feed table and into infeed hopper. Once the material has been positioned, the winch line must be properly stored before continuing chipping operations.

5.7 Cranes and Knucklebooms (Articulating Cranes)

5.7.1 The items contained in Section 5.1, General, shall always be included in the review of this section.

5.7.2 Cranes shall be inspected in accordance with ASME B30.5 or ASME B30.22 (articulating boom) standards and manufacturers' guidelines. Rigging equipment shall be inspected before each use in accordance with OSHA 1910.184 and manufacturers' guidelines.

5.7.3 Operators of hoisting equipment shall be trained and shall maintain a 10 ft (3.05 m) MAD from unguarded, overhead energized conductors, or greater separation in accordance with Table 1 of this standard. A **spotter** shall be used when work is being performed that could encroach on MAD from energized conductors. The spotter shall be positioned to effectively gauge the clearance distance and give timely information to the qualified crane operator.

5.7.4 Only a qualified crane operator shall be used.

5.7.4.1 A qualified crane operator should hold a license/certification from a qualifying state or local government, nationally accredited crane operator testing facility, or an employer-audited program for the specific type of crane being used in arboricultural operations.

5.7.4.2 All testing organizations shall be accredited by a nationally recognized accrediting agency.

5.7.4.3 A qualified operator shall receive training specific to the crane being operated and task being performed.

5.7.4.4 Only authorized people shall operate the crane.

5.7.5 Cranes shall be equipped to comply with the design standards published in ASME B30.5 or ASME B30.22 (for articulating booms).

5.7.6 Hooks on overhaul ball assemblies, lower load blocks, or other attachment assemblies shall be of a type that can be closed and locked, eliminating the hook throat opening.

5.7.7 Crane operators shall remain at the controls while a load is **suspended**.

5.7.8 Tree sections shall be rigged to minimize load shifting. Controlled load lowering shall be used.

5.7.8.1 **Shock-loading** shall be avoided, and free fall is prohibited.

5.7.9 The qualified crane operator and the arborist in charge shall meet prior to the work to review procedures to be followed. If the work involves a spotter/signal person and/or an additional qualified arborist being hoisted by the crane, these persons shall participate in the review as well. A job briefing shall be done before any work begins in accordance with Section 3.4.3.

5.7.10 Cranes shall be set up in accordance with manufacturers' specifications.

5.7.11 A qualified arborist may be hoisted into position utilizing a crane if they are **tied in** with an **arborist climbing line** and **arborist saddle** as well as secured to an anchor point on or above the crane hook or to the crane boom. The following procedures shall be followed when a qualified arborist is to be hoisted by a crane:

5.7.11.1 Only a qualified arborist shall authorize the use of a crane for hoisting a qualified arborist into position when they have determined that it is the safest and/or only feasible method to perform the work or gain access to a tree.

5.7.11.2 The arborist climbing line shall be secured to the crane in such a way that it does not interfere with the function of any of the crane's components.

5.7.11.2.1 No part of the crane shall be allowed to compromise the climbing line or any component of the climbing system.

5.7.11.2.2 The qualified arborist shall use a second point of attachment on or above the crane hook or to the crane boom while being hoisted into position in the tree.

5.7.11.2.3 While being hoisted, a qualified arborist's second point of attachment shall be to a separate point rated for suspension on the arborist saddle.

5.7.11.3 Continuous communication between the crane operator and the qualified arborist being hoisted shall be maintained, either directly or through a spotter/signal person, using two-way radio, vocal communication, or accepted hand signals.

Note: See Annex G, Hand Signals for Crane Operations.

5.7.11.4 The qualified crane operator shall remain at the controls while the qualified arborist is attached to the crane.

5.7.11.5 When the qualified arborist is being hoisted, hoisting speed shall not exceed 100 ft/min (0.5 m/sec). During hoisting operations, there shall be no sudden acceleration or deceleration of the moving load.

5.7.11.6 If an employee is being hoisted, controlled load lowering is required and free fall of the load line hoist is prohibited.

5.7.11.7 The crane carrier shall not travel at any time while a qualified arborist is attached.

5.7.11.8 An accurate estimation of the **load radius** to be used during lifting shall be made before a qualified arborist is hoisted.

5.7.11.9 The qualified arborist shall be detached from the crane any time a load is suspended.

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 while a load is suspended. Possible alternate methods include, but are not limited to:

- the qualified arborist securing to the tree and detaching from the crane before it comes under load,
- using a second crane,
- using an aerial lift device, or
- using an adjacent tree.

5.7.11.9.2 When the qualified arborist is attached to the crane with a suspended load, the total weight shall not exceed 50 percent of the load capacity for the radius and configuration of the crane.

5.7.11.9.3 The qualified arborist shall descend to the ground as soon as they have determined that the piece is detached from the tree and that it is safe to do so.

5.7.12 The qualified arborist shall estimate the weight of the tree section to be suspended prior to cutting the section. The load weight estimate shall be communicated to the crane operator. After the pick is complete, the crane operator should verify, compare, and communicate the actual weight to the qualified arborist. A green log weight chart (as shown in Annex E, Weight of Green Logs) shall be available to the crew. The suspended load should not exceed 75 percent of the load chart capacity of the crane.

5.7.13 Radio communication between the qualified arborist and qualified crane operator shall be used during **blind picks**. Radio communication shall be hands free.

5.8 Remote Control(led) Device Operation

5.8.1 All applicable requirements of Section 3, General Safety Requirements, shall apply to this section.

5.8.2 All applicable requirements of the Z133 shall apply to this section.

5.8.3 All federal (e.g., OSHA, Federal Aviation Administration), state, and local laws/ordinances governing remote controlled devices shall be followed.

5.8.4 Devices should be operated in accordance with OSHA, ANSI, and ASME standards, and all manufacturers' recommendations should be followed.

5.8.5 Remote control operators shall always maintain a safe distance from drop zones, machinery/equipment, work aloft, and/or hazards present on job sites, such as energized conductors.

5.8.6 Remote control operators shall always maintain a safe physical location free of hazards, such as slip/trip obstacles, struck bys, entanglement, and/or unprotected edges.

5.8.7 Remote control operators shall follow MAD and guidelines established in Section 4, Electrical Hazards.

5.8.8 Remote control operators shall not create a hazard for other workers and/or the public.

6 POWER TOOLS

6.1 General

6.1.1 All applicable requirements in Section 3, General Safety Requirements, shall apply to this section.

6.1.2 Items applicable to this section which are constructed of conductive materials shall be subject to the applicable minimum approach distances (MADs) specified in Section 4, Electrical Hazards.

6.1.3 Operators shall communicate with all other workers and ensure they are clear of the equipment, swing radius, and immediate work site before starting or operating **power tools**.

6.1.4 When a power tool is carried aloft and is not in use, it shall be secured against falling.

6.1.5 Before and during use of a power tool, the operator shall ensure all manufacturers' safety devices are working properly and unmodified, or, if they are not, the operator shall remove the tool from service.

6.2 Corded Electric Power Tools

6.2.1 The items contained in Section 6.1, General, shall always be included in the review of this section.

6.2.2 All corded electric power tools shall be:

(a) plugged into a ground-fault circuit interrupter (GFCI).

(b) accepted, certified, listed, labeled, or otherwise determined to be safe by a nationally recognized testing laboratory.

(c) equipped with three-wire cords, having the ground wire permanently connected to the tool frame and a means for grounding the other end, or double insulated and permanently labeled as "double insulated."

6.2.3 Extension cords shall be maintained and used in accordance with manufacturers' specifications. Exposed metal sockets shall not be used.

6.2.4 Arborists and other workers shall prevent cords from contacting water and becoming entangled, damaged, or cut.

6.3 Power Pruning Saws

6.3.1 All power-driven tools designed to cut wood with a saw chain and consisting of an integrated compact unit (handles, power source, and cutting attachment) shall have provisions for two-hand operation and be used with two hands at all times.

6.4 Chain Saws

6.4.1 The items contained in Section 6.1, General, shall always be included in the review of this section.

6.4.2 When starting and operating a chain saw, the operator shall maintain a stable body position.

6.4.3 **Drop-starting** a chain saw is prohibited. A chain saw shall be started with the chain brake engaged and the operator holding the saw firmly in a manner that minimizes movement of the saw when pulling the starter handle.

6.4.4 A chain saw shall be operated:

a) with two hands at all times.

b) with each handle encircled (held in the palm of the hand, thumb positioned opposite the fingers, fingers and thumb tightly gripping the handle).

c) with the left hand encircling the forward handle and the right hand encircling the rear handle. If the employer demonstrates that this hand positioning poses a greater hazard in a particular situation, hand position may be switched, so the operator's right hand encircles the forward handle and the left hand encircles the rear handle.

6.4.5 While operating a chain saw aloft, a climbing arborist shall be tied in with a climbing line and use at least one other means of being **secured** unless the employer demonstrates that a greater hazard is posed by using a second means of being secured while operating a chain saw in that particular situation.

6.4.6 The chain brake shall be engaged, or the engine shut off, anytime a chain saw is not actively cutting, including before starting, setting down, repositioning aloft, and moving both feet on the ground.

6.4.7 The chain saw shall be handled in a manner that will prevent unintended contact with the chain, muffler, or spiked bumper.

6.4.8 No part of the chain saw shall be used above shoulder height unless the employer demonstrates that a greater hazard is posed by operating the chain saw that way in that particular situation.

7 HAND TOOLS AND LADDERS

7.1 General

7.1.1 All applicable requirements in Section 3, General Safety Requirements, shall apply to this section.

7.1.2 Correct hand tools and ladders shall be selected for the job.

7.1.3 Electrical hazards should be considered when selecting tools for going underground.

7.1.4 Before and during use, hand tools and ladders shall be inspected and either deemed to be in **good working condition** or removed from service.

7.1.5 Workers shall maintain a safe working distance from other workers when using hand tools and ladders.

7.1.6 When climbing into a tree, arborists shall not carry hand tools 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.

7.1.7 Arborist climbing lines or **handlines** can be used for raising and lowering hand tools. This action shall be done in a manner to prevent damaging the climbing line or handline.

7.1.8 Hand tools and ladders shall be properly stored or placed in a designated area when not in use.

7.2 Cant Hooks, Cant Dogs, Peaveys, and Tongs

7.2.1 The items contained in Section 7.1, General, shall always be included in the review of this section.

7.2.2 Points of hooks shall be at least 2 in (5 cm) long and kept sharp.

7.2.3 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, General, 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 be taken out of service.

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, General, 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 A stable body position and a secure grip shall be maintained while swinging chopping tools.

7.4.5 When swinging tools, a safe working distance from overhead hazards and other workers shall be maintained.

7.5 Ladders

7.5.1 The items contained in Section 7.1, General, shall always be included in the review of this section.

7.5.2 When ladders are used, they shall conform with OSHA 1910.23.

7.5.3 Ladders made of metal or other conductive material shall not be used where electrical hazards exist. Only wooden ladders (constructed in accordance with ANSI ASC A14.1) or nonconductive ladders (constructed in accordance with ANSI ASC 14.5) shall be used.

7.5.4 Metal ladders used where no electrical hazard exists shall conform to ANSI ASC A14.2.

7.5.5 All ladders shall be inspected prior to use and removed from service if found defective.

7.5.6 Cleats, metal points, skid-resistant feet, lashing, or other effective means of securing the ladder shall be used when there is danger of slipping.

7.5.7 Ladders shall not be used as bridges or inclined planes.

7.5.8 Ladders shall be supported while in storage to prevent sagging. Ladders on mobile equipment shall be secured in a manner to prevent it from falling off or becoming damaged during transit.

7.5.9 The third, or hinged, leg of a **tripod/orchard ladder** shall be braced or fastened when on hard or slick surfaces.

> **Note:** When accessing a tree with a ladder, see Section 8.2.22.

8 Tree Climbing

8.1 Ropes and Arborist Equipment

8.1.1 All applicable requirements in Section 3, General Safety Requirements, shall apply to this section.

8.1.1.1 This section shall apply to **work-positioning (suspension) systems** only.

Note: Refer to Annex J, Fall-Protection Systems.

8.1.2 Arborist climbing lines shall be terminated with an eye splice or a knot that interfaces appropriately with the connecting link. When using a carabiner without a captive eye, the termination selected shall maintain loading along the major axis. The connections between carabiners and terminated rope ends shall be compatible to limit the possibility of accidental disconnection or minor-axis loading of carabiners.

8.1.3 The arborist shall assure that arborist saddles and climbing gaffs/spurs comply with an appropriate governing standard and that such products are marked accordingly when new (e.g., arborist saddles marked ASTM F887 if manufactured after 01 January 2018).

8.1.4 Arborist climbing equipment shall not be altered in a manner that would compromise the integrity of the equipment.

8.1.5 Arborist climbing lines and **work-positioning lanyards** shall:

a) have a minimum diameter of 0.44 in (11 mm).

b) be constructed of a synthetic fiber.

EXCEPTION

Work-positioning lanyards may be constructed of steel core rope. (See Section 8.1.18.)

c) have a minimum breaking strength of 5,000 pounds (22.24 kN) without terminations when new.

d) have a maximum working elongation not to exceed 7 percent at a load of 500 pounds (2.22kN).

e) be identified by the manufacturer as suitable for use in tree climbing.

f) be compatible with the components used in the climbing system.

8.1.6 Cordage used for **Prusik loops**, **split-tails**, and **hitch cords** used in a climbing system shall meet the minimum breaking strength without terminations when new of 5,000 pounds (22.24kN) in a single cord configuration (e.g., split-tail) or 5,000 pounds (22.24kN) in a basket configuration (e.g., hitch cord).

8.1.6.1 Prusik loops, and split-tails, and hitch cords shall be manufactured from material(s) suitable for arboriculture work.

8.1.7 Splicing shall be done in accordance with manufacturers' specifications.

8.1.7.1 Sewn terminations and swages shall meet a minimum breaking strength of 3,372 pounds (15kN) as used.

8.1.8 Snap hooks (rope snaps) used as part of a climber's work-positioning (suspension) system shall be self-closing and self-locking, with a minimum major-axis tensile strength of 5,000 pounds (22.24 kN).

8.1.8.1 Snap hooks should have a minor-axis/gate strength of 3,600 pounds (16.01 kN).

8.1.9 Carabiners used as part of a climber's work-positioning (suspension) system shall be self-closing and self-double-locking and shall have a gate-locking mechanism that requires at least two consecutive, deliberate actions to unlock. A carabiner shall be capable of withstanding a 5,000-pound (22.24 kN) load along its major axis with the gate closed without breaking or distortion sufficient to release the gate.

8.1.10 Carabiners and snap hooks used as part of a climber's work-positioning (suspension) system shall not be linked together unless designed to do so and accepted by the manufacturer.

8.1.11 Load-rated screw links used as part of a climber's work-positioning (suspension) system shall have a tensile strength of 5,000 pounds (22.24 kN) and shall be securely tightened to ensure they will not unintentionally open during use.

8.1.12 Equipment used to secure an arborist in a tree or to an aerial device shall not be used for anything other than its intended purpose.

EXCEPTION

An arborist's climbing line may be used to raise and lower lightweight tools and equipment, such as chain saws, hand tools, and additional lines.

8.1.13 Rope ends shall be finished in a manner to prevent raveling.

8.1.14 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.

8.1.15 Arborist climbing lines shall never be left in trees unattended.

8.1.16 Climbing spurs shall have gaffs of the type and length suitable for the tree being climbed.

> 8.1.16.1 Manufacturers' recommendations for inspection, maintenance, sharpening, and replacing worn gaffs shall be followed.

8.1.17 Work-positioning lanyards shall have a termination to prevent the running end from advancing through the friction device.

8.1.18 Steel-core work-positioning lanyards shall not be used in proximity to energized electrical equipment and/or conductors.

8.2 Climbing Procedures

8.2.1 All applicable requirements in Section 3, General Safety Requirements, shall apply to this section.

8.2.2 A second arborist, an arborist trainee, or other worker trained in emergency procedures shall be within visual or unassisted voice communication during arboriculture operations above 12 ft (3.65 m) above the ground that are not subject to the requirements of Section 4.5.15.

8.2.3 Arborists shall inspect climbing lines, **work lines**, work-positioning lanyards, and other climbing equipment for damage, cuts, abrasion, and/or deterioration before each use and shall remove them from service, per manufacturers' guidelines if applicable, if signs of excessive wear or damage are found.

> **Note:** The Cordage Institute provides rope inspection criteria.

8.2.4 While climbing, the arborist shall have on their person at all times a climbing line and at least one other means of being secured (e.g., an arborist climbing line and a work-positioning lanyard). Two means of being secured shall be used when the arborist determines that it is advantageous or when subject to the requirements of Section 6.4.5.

8.2.5 The arborist shall have a hand saw while working aloft. Hand saws aloft shall either have a scabbard or be of the folding type that covers the cutting teeth when not in use.

8.2.6 An **artificial anchorage point (false crotch)** may be used as a redirect in lieu of a branch union at the discretion of the arborist.

8.2.7 The arborist shall be secured (e.g., with an arborist climbing line and/or a work-positioning lanyard) at all times while ascending the tree, including when using climbing spurs/gaffs.

8.2.7.1 The arborist shall be tied in while performing work and remain tied in until the work is completed and they have returned to the ground.

8.2.7.2 The arborist shall be secured when repositioning the climbing line. When repositioning, the arborist shall preload the new tie-in point with their full weight before releasing the current means of being secured.

8.2.8 Hands and feet should be placed on separate limbs, if possible, and three points of contact should be maintained with the tree while climbing.

8.2.9 The arborist shall select a tie-in point/**primary suspension point** that will not allow the climbing line to move from the selected point to a potentially unsafe tie-in point/primary suspension point.

8.2.10 The tie-in point selected shall be able to withstand the forces applied during arboricultural operations.

8.2.11 When installing a climbing line or an artificial anchorage point (false crotch) from the ground, it should be positioned in a suitable location along the main stem/leader/lateral limb. The arborist shall visually inspect the condition of the anchor point from the ground and refer to Annex C.4, Climber Anchorage Selection Guidance.

8.2.12 An arborist climbing line redirect shall not be configured to allow the components to become unintentionally or accidentally disconnected from the **secondary suspension point**.

8.2.13 Arborist climbing line redirects or artificial anchorage points (false crotch) shall be installed on **suspension points** able to withstand the forces applied during climbing operations and configured to not put excessive stress on the tie-in/suspension point.

8.2.14 The tie-in point shall be positioned so that the arborist will not be subject to an uncontrolled swing.

8.2.15 When the arborist is working at height, a suitable stopper knot shall be tied near the end of the arborist climbing line unless the arborist has positively confirmed the system has enough rope for the arborist to reach the ground.

8.2.16 An arborist working from a stem or **spar** without a suitable branch union (natural **crotch**) shall select tie-in points or a tie-in method which prevents the climbing line from sliding down or up off the stem during climbing operations. Placing a climbing line around a stem in an area without a lateral limb is not acceptable unless the climbing line is cinched or choked around the stem or unless it runs through a double-wrapped or adjustable artificial anchorage point (false crotch) secured around the stem.

8.2.17 If a climbing line is compromised while in use, the arborist shall secure themselves with a work-positioning lanyard and immediately replace the compromised climbing line.

8.2.18 The ground crew shall keep the climbing line free of debris and obstructions, protect it from damage, and report any damage to the arborist.

8.2.19 The arborist shall check their system and climbing line beneath the **climbing hitch** for damage before and while descending.

8.2.20 Arborists and their climbing systems shall not make contact with moving or swinging parts of a rigging system when making a release cut or when the load is moving.

8.2.21 Arborists shall take steps to avoid trapping, pinning, or entangling themselves in the climbing system should the tree split or the rigging system fail.

8.2.22 When ascending a ladder to gain access to a tree, the arborist shall not work from or leave the ladder until they are tied in or secured.

9 Tree Care Operations

9.1 Pruning and Trimming

9.1.1 All applicable requirements in Section 3, General Safety Requirements, shall apply to this section.

9.1.2 Pruning should be conducted in accordance with the ANSI A300 (Part 1) standard.

9.1.3 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.

9.1.4 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.

9.1.5 Cut branches, tools, and equipment shall be removed from trees upon completion of work.

9.2 Rigging

9.2.1 Arborists performing rigging operations shall inspect trees' 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.

9.2.2 Rigging points shall be assessed for their structural integrity by a qualified arborist. The work 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.

9.2.3 Arborists performing rigging operations shall be 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.

9.2.4 Careful consideration shall be given to the potential for additional forces resulting from the influences of rigging design, rope angles, and the number of lines and/or line parts that will act on any rigging or anchor point.

9.2.5 For all ropes, connecting links, and rigging equipment, a qualified arborist shall ensure that load ratings shown on the equipment or provided by the manufacturer are observed in all rigging operations. Rigging equipment shall be chosen for the specific task based on working-load limits and design specifications.

If a carabiner is used in a rigging system, loading of the gate and/or the minor axis of the carabiner shall be prevented.

9.2.6 The number of connecting links used for connecting components of a rigging system shall be minimized when possible. Arborists shall ensure that shackles, screw links, and other connecting links are compatible and comply with manufacturers' recommendations.

9.2.7 All equipment used for rigging operations shall be in good working condition. Rigging equipment and its connecting links shall be inspected immediately before use and removed from service if found to be defective, damaged, or overloaded.

9.2.8 When the potential exists for rigging equipment to be confused with climbing equipment, the equipment shall be clearly marked to indicate its intended purpose.

9.2.9 When establishing a rigging point horizontally distant from the parent limb or main tree stem, the arborist should consider the need to provide additional support to help disperse the force of the proposed rigged load.

Options may include:

- Use of a **backstay** by securing an appropriately rated rope from the limb used as the load-bearing rigging point back to a higher point on the main trunk or other suitable limb.
- Installation of an additional and separate rigging system that utilizes supporting members, other than those already in use by the primary lowering point, in an effort to have both rigging systems share the load force.

9.2.10 A method of verbal, audible, or visual communication shall be discussed and established during the job briefing prior to the start of removal or rigging operations. The verbal, audible, or visual communication system shall use an established command-and-response-and-acknowledge system, which may include prearranged, two-way hand signals. The communication method shall be clearly understood and used during all rigging operations.

9.2.11 Workers aloft (either climbing the tree or from an aerial device) shall verify a communication system with arborists and other workers on the ground.

9.2.12 A ground worker should be designated to maintain control of the drop zone and participate in the three-part communication with the worker aloft, verifying whether the drop zone is clear.

Move to three-part communication response:

1. Command
2. Response
3. Acknowledgment

9.2.13 A drop zone shall be established prior to the start of rigging operations. Workers shall stay out of the drop zone until it has been communicated that it is safe to enter by a qualified arborist, a qualified arborist trainee, or the worker aloft directly involved in the rigging operation.

9.2.14 Only qualified arborists or qualified arborist trainees directly involved in the operation shall be permitted in the drop zone when a load is being suspended by the rigging system.

9.2.15 **Taglines** or other means may be used to help control and handle suspended loads.

9.2.16 Arborists involved in handling rigging lines shall not be underneath moving or suspended loads and should be out of the drop zone when practical.

9.2.17 Rigging lines should be of appropriate length to complete the rigging operations.

9.2.18 Arborists aloft shall position themselves above or to the side of the piece being rigged and out of the path of movement of the piece and attached rigging when the piece has been cut. Climbers shall have a retreat/escape plan prepared.

9.2.19 Climbers and their climbing systems shall not make contact with moving or swinging parts of the rigging system when making a release cut or when the load is moving. Rigging systems shall not compromise any part of the climbing system.

9.2.20 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.

9.2.21 A hand saw shall be with an arborist aloft to make or finish cuts.

9.3 Cabling

9.3.1 All applicable requirements in Section 3, General Safety Requirements, shall apply to this section.

9.3.2 Cabling should be conducted in accordance with the ANSI A300 (Part 3) standard.

9.3.3 Tree workers and other workers on the ground shall not stand in the drop zone while a cabling system is being installed.

9.3.4 Tools used for cabling shall be carried in a bag, placed on a belt designed to hold such tools, or securely attached to a lanyard (**tool lanyard**) to prevent the tools from falling.

9.3.5 When installing or replacing a support system, the arborist shall release the load onto the new support system in a slow and controlled manner to help prevent sudden or dynamic loading.

9.3.6 When a previously installed support system is to be removed or replaced, it shall not be removed until a new support system is installed to take the weight off of the previously installed system or until a temporary support system has been installed to slacken the previously installed system.

9.4 Tree Removal

9.4.1 Before beginning any tree removal operation, the chain saw operator and/or **crew leader** shall carefully consider relevant factors pertaining to the tree and site and shall take appropriate actions to ensure a safe removal operation. Factors to consider may be, but are not limited to, tree decay, tree lean, and wind.

> **Note:** See Annex C.3, Manual Tree Felling Procedure, for a more inclusive list.

9.4.2 The crew leader shall assess the number of workers necessary for the tree removal operation, develop a tree removal work plan, and communicate the work plan and job task assignments in a job briefing with the crew prior to beginning the tree removal work. In addition, a method of verbal, audible, or visual communication as set forth in Section 9.2.10 shall be discussed and established during the job briefing prior to the start of tree removal operations.

9.4.3 A drop zone shall be established prior to the start of removal operations. Workers shall stay out of the drop zone until it has been communicated that it is safe to enter by a qualified arborist, a qualified arborist trainee, or the worker aloft directly involved in the tree removal operation.

9.4.4 In **manual tree felling** operations workers not involved shall be positioned at a distance from the tree at least two times the height of the tree or trunk being removed until the chain saw operator and/or crew leader communicates that it is safe to approach. Involved workers other than the chain saw operator, including but not limited to those who handle ropes/taglines, come-alongs/winches, etc., shall be positioned at a distance from the tree at least one-and-one-half times the height of the tree or trunk being removed until the chain saw operator and/or crew leader communicates that it is safe to approach.

9.4.5 Just before the tree or trunk is ready to be felled, an audible warning shall be given to those in the area. Three-part communication should be used as a warning, provided that only qualified persons should give such warnings.

9.4.6 A planned retreat/escape path for all workers involved in the tree removal operation shall be prepared before piecing down tree parts or performing manual tree felling.

9.4.6.1 During manual tree felling, the preferred retreat/escape path for the chain saw operator is 45° on either side of a line drawn opposite the intended direction of the fall.

9.4.6.2 To the extent practical, the retreat/escape path shall be cleared of obstructions and objects that would hinder retreat.

9.4.6.3 The chain saw operator shall use this path for egress once the felling cuts have been completed or the tree begins to fall.

9.4.6.4 Other involved workers shall have and use retreat/escape paths that do not hinder other retreating workers or expose any involved workers to increased hazard.

9.4.7 When it is necessary to use rigging to shorten or remove branches, the qualified arborist shall consider whether the tree can withstand the strain of the lowering procedures. If the qualified arborist determines that the tree cannot withstand the strain of the lowering procedures, other means of removing the tree shall be implemented.

9.4.8 A rope should be attached to all trees and stems greater than 5 in (12.7 cm) in **diameter at breast height** (**DBH**) being felled to provide stabilization and/or directional pull where assisted directional felling is required.

9.4.9 When there is a risk of damage to property from a tree piece or tree falling in an unintended direction, rope(s), block and tackle, come-alongs/winches, wire cable (except where an electrical hazard exists), or another appropriate device(s) shall be used to control the direction of fall.

9.4.9.1 Loaders, skid steers, or other heavy equipment shall not be used to push over trees that are being manually felled while any worker is within one-and-a-half times the height of the tree being felled. The heavy equipment being utilized shall be of the appropriate size for the task and shall offer appropriate protection for the operator.

9.4.10 Wedges should be used when determined to be necessary to prevent binding of the guide bar or chain when felling trees or stems. Wedges may be used as an aid.

9.4.11 All equipment used for tree removal operations shall be in good working condition. Tree removal equipment and its connecting links shall be inspected immediately before use and removed from service if found to be defective, damaged, or overloaded.

9.4.12 Tree limbs shall be removed to a height and width sufficient to allow the tree parts or tree to fall clear of hazards, such as utility wires and/or other objects in the vicinity.

9.4.13 During manual tree felling operations, notches shall be used on all trees and trunks greater than 5 in (12.7 cm) DBH.

9.4.14 When developing and executing the plan for notches, **hinges**, and **back cuts** in manual felling operations, the following approximate dimensions and/or measurements shall be met:

1. The notches and back cuts are at a height that enables the chain saw operator to safely begin the cut and control the tree or trunk with freedom of movement toward a retreat/escape path.
2. The notch cut is an **open-face notch**, a **conventional notch**, or a **Humboldt notch**.
3. The notch is 45° or greater and wide enough to guide the fall of the tree or trunk.
4. Notch depth does not exceed one-third the diameter of the tree.
5. Saw cuts made to form the notch and back cut leave suitable hinge wood to adequately control the fall of the tree.
6. With an open-face notch (greater than 70°), the back cut is at the same level as the **apex** of the notch. With a conventional notch or Humboldt notch, the back cut is 1 to 2 in (2.5 to 5 cm) above the apex of the notch to provide an adequate platform to reduce kickback potential of the tree or trunk.

Note: See Annex C.3, Manual Tree Felling Procedure.

9.4.15 The hazard of **barber chair** should be considered when cutting trees under tension. Steps to prevent the sudden splitting of trunk wood should be taken. Preventive steps may include, but are not limited to:

- various back cut methods,
- wrapping a ratchet strap, rope, or chain around the tree above the notch and back cut area, or
- relieving the tension in or on the tree by slackening pull ropes or removing upper parts of the tree prior to felling.

9.4.16 Before making the back cut, there shall be a command, such as "Stand Clear," from the equipment operator and a response, such as "Clear," from the workers supporting the removal operation. Prearranged, two-way hand signals or two-way audible devices, such as air horn or whistle signals, may also be used. Only designated persons shall give such signals.

9.4.17 During manual tree felling operations, involved workers shall keep visual contact with the tree or trunk until it is on the ground.

EXCEPTION

When the tree or trunk begins to fall, the worker at the base of the tree shall immediately move a safe distance away from the tree or trunk using the retreat/escape path.

9.4.18 Workers shall not approach closer than manufacturers' or employers' specified distances to mechanical equipment in operation, such as a boom-mounted saw or a rotary or flail mower, until all cutting has halted and the equipment operator has acknowledged that it is safe to do so.

Note: In manual felling situations where the chain saw operator cannot be seen, reference Section 3.4.8.

9.5 Limbing and Bucking

9.5.1 Work plans for **limbing** and **bucking** operations shall be communicated in a job briefing to all workers before work begins.

9.5.2 Arborists shall be trained on the principles of tension and compression before limbing and bucking operations.

9.5.3 Tension and compression shall be evaluated prior to limbing and bucking operations.

9.5.4 Only one worker shall be cutting a single tree or tree part during the limbing and bucking process. When more than one worker is involved in noncutting operations associated with limbing, bucking, and/or moving debris from 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.

9.5.5 Before limbing or bucking wind-thrown trees, precautions shall be taken to prevent the root ball or butt log from striking a worker.

9.5.6 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 operating a chain saw, the preferred working position is on the uphill side of the work.

9.5.7 The worker shall ensure firm footing before and during limbing and bucking. The worker shall not stand on loose debris or logs that may roll when the log being bucked is cut.

9.5.8 Trees, limbs, or saplings under tension shall be considered hazardous. Appropriate cutting techniques and precautions shall be followed.

9.5.9 When necessary to prevent rolling, logs shall be blocked with wood or other suitable material.

9.5.10 Wedges should be used as necessary to prevent binding of the guide bar or chain when bucking.

9.5.11 Cant hooks or peaveys should be used as an aid in rolling large or irregular logs.

9.5.12 If mechanized equipment is used, the equipment operator shall establish an effective means of communication with other workers.

Note: See Section 9.2.10.

9.5.13 Workers shall not approach mechanized equipment operations until the equipment operator has acknowledged that it is safe to do so.

9.6 Brush Removal and Chipping

9.6.1 Prior to the start of chipping operations, vehicular and pedestrian traffic control around the **work zone** shall be established in accordance with applicable federal, state, or local requirements. See Section 3.5, Traffic Control.

9.6.2 Brush and logs shall be placed in such a way that does not create hazards in the work site.

9.6.3 Loose-fitting items that could create an entanglement hazard (e.g., clothing or jewelry), aerial lift or climbing equipment, improperly worn personal protective equipment (PPE), or gauntlet-type gloves shall not be worn while operating chippers.

9.6.4 PPE shall be worn when on the work site of chipping operations in accordance with Section 3.3, Personal Protective Equipment (PPE).

9.6.5 To reduce the hazard of entanglement from foreign objects being fed into the chipper, material and equipment on the job site should be properly managed.

9.6.6 During chipping operations, workers shall ensure that all throwlines, climbing lines, and rigging lines are clear of the chipping area.

Note: Incidents have occurred where brush dragged through work zones has entangled ropes and pulled them into the chipper. Reverse mechanisms on most chippers will not reverse the infeed of ropes.

9.6.7 Only persons trained in safe chipper operation may operate chippers. Training shall include, but is not limited to, inspection, starting, stopping, feeding, and shutdown. Training shall be provided for each type of chipper being used.

9.6.8 Only persons authorized by the employer shall perform maintenance.

Note: See Annex C.2, Control of Hazardous Energy.

9.6.9 During chipping operations, hands, feet, or other parts of the body shall not pass beyond the plane of the infeed hopper. Leaning into material or pushing material into infeed hoppers with feet is prohibited.

9.6.10 When hand-feeding a chipper, the operator shall feed brush and logs into chippers from the side of the feed table center line. Brush and logs should be fed butt or cut end first, and the operator shall immediately turn and step away from the feed table when the brush is taken into the rotor or feed rollers.

9.6.11 When hand-feeding a chipper during roadside operations, the operator should work from the curb or shoulder side whenever practical to prevent themselves from stepping into traffic or being pushed into traffic by the material that is being fed into the chipper.

9.6.12 While any part of the chipper is turning or moving, brush chipper discharge chutes shall not be removed, and the cutter housing cover shall not be opened or raised. Chippers shall not be used unless a discharge chute of sufficient length or design is provided that prevents personal contact with the blades.

Note: See Annex C.2, Control of Hazardous Energy.

9.6.13 Nonwoody material, such as stones, nails, or sweepings, shall not be fed into chippers.

9.6.14 Limbs, logs, brush, and other woody material should be cut/prepared prior to feeding into the chipper.

9.6.15 Small vegetation shall be fed into chippers with longer branches or pushed with a longer branch, push paddle, or suitable nonmetallic tool.

9.6.16 During chipping operations, operators shall be aware of potential pinch hazards between the machine and materials being chipped as well as within the material itself.

9.6.17 When a winch is used in chipper operations, the winch line and/or winch line hook shall never pass beyond the plane of the infeed hopper. Once the material is controlled by the feeder wheels, the feeding process shall be stopped and the winch line and/or hook shall be properly stowed before proceeding.

9.6.18 Should the chipper become clogged, procedures in Annex C.2, Control of Hazardous Energy, shall be referenced and followed as appropriate.

9.6.19 Due to the hazards of step and touch potential, if the distance between the aerial device and energized conductor(s) is unintentionally less than the required minimum approach distance (MAD), workers on the ground shall move away and remain clear of the aerial-device vehicle and attached equipment (e.g., chipper) until the required MAD is reestablished.

9.6.20 Refer to Subsection 5.6.2, Brush Chippers, for additional information.

9.6.21 Specialized material-handling equipment, such as, but not limited to, skid steers or miniloaders (whether wheeled or tracked), when used in chipping operations, shall not create a hazard for other workers.

10 Vegetation Management and Plant Health Care

10.1 General

10.1.1 All applicable requirements in Section 3, General Safety Requirements, shall apply to this section.

10.1.2 Applicators shall obtain and remain current with all licensing/certification requirements as required by the appropriate state regulatory authority prior to using pesticides.

10.1.3 Applicators shall follow all applicable laws and/or regulations pertaining to pesticide use, handling, and disposal.

10.1.4 The applicator shall follow label instructions in regard to pesticide applications.

10.1.5 Personal protective equipment (PPE) shall be selected, properly fitted, cleaned, maintained, and stored as specified on the product label.

10.1.6 Employee training shall be provided in the recognition of hazardous substances, proper handling, and emergency procedures, as required by the OSHA 1910.1200 Hazard Communication standard and the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

10.1.7 Safety data sheets (SDS) for all products in inventory shall be reviewed with and made available to all affected employees. All SDSs pertaining to pesticides in use shall be readily available on the worksite.

10.1.8 The applicator shall clean themselves and launder their clothing as outlined on the pesticide label.

10.1.9 The employer shall provide a clean water source at the work site, 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 and each labelled.

10.1.10 The applicator shall not direct a solid spray column into contact with electrical conductors.

10.2 Mixing and Storing Pesticides and Fertilizers

10.2.1 Mixing shall be done in an area that is outdoors or in a well-ventilated, illuminated area.

10.2.2 Devices used for mixing and measuring shall be specifically designated and marked for pesticide use and shall be used for no other purpose.

10.2.3 Pesticides and fertilizers shall be stored in their original containers or in clearly marked service containers that meet or exceed all applicable state and local regulations.

10.2.4 Pesticides and fertilizers shall be stored in locked designated areas that meet or exceed all applicable state and local regulations.

10.2.5 An emergency action plan, including spill response materials and procedures, shall be available where pesticides are stored, transported, or handled.

10.3 High-Pressure Air-Excavation Equipment

10.3.1 Personal protective equipment (PPE) shall be required for the operator and all crew members within the work site and shall include a hard hat with attached face shield, hearing protection, eye protection, and gloves. Additionally, long pants, a long-sleeved shirt, and/or coveralls shall be worn.

10.3.2 Respiratory protection should be worn when conditions warrant. When used, respiratory protection shall be in accordance with the OSHA 1910.134 Respiratory Protection standard.

10.3.3 A proper work site shall be identified; measures shall be taken to keep noninvolved individuals clear of the work site.

10.3.4 The operator shall understand and follow all operating instructions for the compressor.

10.3.5 The air hoses shall be properly attached and secured to each other and the compressor prior to starting the compressor. Air-hose restraint systems shall be used between the compressor and hose, with hose-to-hose connections, and with hose-to-tool connections to prevent hose whip.

10.3.6 Pneumatic power tools shall be secured to the hose or whip by some positive means to prevent the tool from becoming accidentally disconnected.

10.3.7 All hoses exceeding an inside diameter of 0.5 in (1.25 cm) should have a safety device at the source of supply or branch line to reduce pressure in case of hose failure.

10.3.8 Body parts shall not be placed in front of air jets.

10.3.9 When the operator is finished, the airline shall be depressurized prior to uncoupling the air hose.

11 Palms

11.1 All applicable requirements in Section 3, General Safety Requirements, shall apply to this section.

11.2 Additional measures should be taken to avoid falling **fronds** contacting electrical power lines. See Section 4, Electrical Hazards, for the proper minimum approach distances (MAD).

11.3 Dry conditions and dead palm fronds present an extreme fire hazard. Arborists shall not smoke while working on or near dead palm fronds. All gas-powered chain saws shall have mufflers and spark arresters in good working condition.

11.4 Prior to work, a qualified arborist shall visually inspect the palm for:

- structural defects, including those hidden by a **palm frond skirt**.
- sloughed fronds, missing or accumulated along the trunk.
- a potentially hazardous amount of frond **sloughing**. Sloughing can be hazardous with three or more continuous feet (nine-tenths of a meter or more) of palm skirt, measured vertically along the points of attachment to the trunk.
- a **root boss** that has been cut, damaged, or otherwise compromised in a way that affects the stability of the palm.

  11.4.1 The arborist shall continuously inspect the palm for wildlife.

  11.4.2 If there is a question as to the structural integrity of the palm relative to the task to be performed, work shall not commence until a more thorough assessment can be made.

  Note: Defects to look out for include, but are not limited to, **inverted root cone** (air-pruned perimeter roots), trunk erosion, fungal fruiting bodies, trunk cavities, abnormal shrinkage (hour-glassing) in the trunk, bleeding, oozing, watermarks, longitudinal splits, evidence of prior physical damage, and uncorrected lean.

11.5 Arborists should take precautions to avoid injuries from thorns and spines.

11.6 When climbing palms, all applicable requirements in Section 8.1, Ropes and Arborist Equipment, and Section 8.2, Climbing Procedures, shall apply.

11.7 Climbing arborists working in and amongst palm frond skirts shall:

- be supported by an arborist climbing system that is positioned above the skirt.
- remove fronds from the top down.

- ensure their body and climbing system are never positioned below the skirt or between the skirt and the trunk.

EXCEPTION

Climbing arborists may remove fronds from below only when sloughing or the potential for sloughing does not exist.

> **Note:** Frond skirts have the potential for sloughing and collapsing on the climber as well as for hiding defects in the trunk.

11.8 Climbing arborists should position their climbing line and work-positioning **lanyard** in a manner that reduces the likelihood of them being cut or damaged.

11.9 Arborists pruning palms should establish an expanded drop zone due to the unpredictable distance and direction of falling fronds and skirts.

(The information contained in the following Annexes will not be part of this American National Standard (ANS) and will not be processed in accordance with ANSI's requirements for an ANS. As such, these Annexes may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the standard. Any comments submitted that relate to these Annexes will be reviewed by ISA but may not be brought to the Z133 Committee and will not receive a committee response).

Annex A: Glossary of Terms

(Informative)

A.1 List of Terms

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 substantive context. See index for other uses of these terms in the standard.*

aerial device (4.1.10): Any one of the following types of vehicle-mounted apparatus used to elevate personnel to work positions aloft:

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

apex (9.4.14[6]): The point at which two saw cuts meet to form a notch.

applicator (5.6.3.3): A qualified person engaged in the application of materials such as, but not limited to, pesticides, growth regulators, and fertilizers.

approved (3.6.4): Acceptable to the federal, state, or local jurisdiction having enforcement authority.

approved container (3.6.2): Container having a spring-closing lid and spout cover designed to safely relieve internal pressure when subjected to fire exposure.

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

arborist (1.2): A person who, through related training, on-the-job experience, or both; is familiar with the techniques and hazards involved in their assigned task within arboricultural operations, as explained in Section 1.1, Scope.

arborist climbing line (5.7.11): A rope designated to support the climber while aloft in a tree or attached to a crane, constructed according to specifications outlined in Section 8.2.4 and Section 8.2.5.

arborist saddle (5.7.11): A body-holding device with a belt that fastens around the waist connected to a seat strap; used by arborists in conjunction with other components for work positioning and suspension in trees (i.e., tree saddle, sit harness).

arborist trainee (3.4.11): 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.

artificial anchorage point (false crotch) (8.2.6): A system, other than a natural branch union, used to support an arborist climbing line.

articulating crane (5.7): An apparatus whose boom consists of a series of folding, pin connected structural members, typically manipulated to extend or retract by power from hydraulic cylinders, intended for lifting material at considerable height and/or distance from the unit. Equipment whose intended purpose is to transfer material between ground and vehicle, or trailer, are exempt from this classification.

authorized (3.4.12.1): Designated by the entity that has care, custody, and control of the unit.

authorized person (5.6.2.6): A person approved or assigned by the employer to perform a specific type of duty or duties or to be at a specific location or locations at the work site.

back cut (9.4.14): The cut made in a tree limb or trunk on the side opposite the intended direction of fall.

backstay (9.2.9): A rope or cable that is set to share the load on a spar, limb, jib, pole, or other load-bearing member.

barber chair (9.4.15): Dangerous condition created when a tree or branch splits upward vertically from the back cut (a.k.a. slab up).

blind pick (5.7.13): A work situation where the qualified arborist or the load is not in full view of the qualified crane operator.

boom-supported elevating work platform (5.2.38): A self-propelled, integral-chassis aerial platform that can be positioned completely beyond the base and used to position personnel, along with their necessary tools and materials, at work locations. Aerial platforms are power-operated, and primary functions, including drive, are controlled from the platform. Such aerial platforms are intended to be occupied when driven.

bucket (5.2.12): see *platform*.

bucking (9.5.1): The act of sawing trees, limbs, or both, into smaller sections once they are on the ground.

cant hook (7.2): 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 (5.2.11.2): 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 axe or machete).

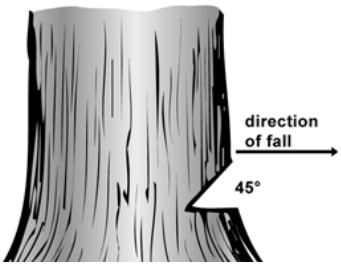
climbing hitch (8.2.19): A hitch used for securing a tree climber to the climbing line, permitting controlled ascent, descent, and work positioning. Examples of climbing hitches include, but are not limited to, the tautline hitch, Blake's hitch, and the Prusik hitch.

compatible [equipment] (5.6.5.12): Consistently capable of performing to specification when combined in specific arrangements.

competency (3.7.1): Having the knowledge and skill with the demonstrated ability to perform specific tasks safely, as determined by the employer.

conductive (4.1.2[d]): Capable of carrying an electrical current for the voltage likely to be present.

contract employer (4.5.4): An employer, other than a host employer, that performs work covered by 29 CFR 1910.269 under contract with an electrical system owner/operator.



conventional notch (9.4.14[2]): 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 (9.4.1): The qualified arborist designated as the individual in charge of a specific job or group of workers.

crotch (8.2.16): (n.) Branch union; the angle formed by two branches in the tree. (v.) To place a line through a branch union.

DBH (9.4.8): *See diameter at breast height.* Also called DSH.

deadman control (5.4.2): An electrical or mechanical safety switch that deactivates the equipment's function when released by the operator.

deenergized (4.2.5): Freed from any electrical connection to a source of potential difference and from electric charge; not having a potential different from that of the earth.

diameter at breast height (DBH) (9.4.8): Diameter of a tree measured at 4.5 ft (1.3 m) above ground. Also called diameter at standard height (DSH).

dielectric (4.1.15): Nonconductive of electrical current.

digging (3.4.13): Any man-made cut, cavity, trench, or depression in the earth's surface formed by earth removal for arboricultural operations, including, but not limited to, tree planting, stump grinding, or trenching.

direct contact (4.1.2[b]): Contact between any part of the body and an energized electric supply line or other energized electrical fixture or apparatus.

direct supervision (3.4.11): Oversight by a qualified arborist or a qualified arborist supervisor who is physically present on the jobsite.

drop-starting (6.4.3): 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.

drop zone (3.4.12): Area beneath workers aloft involved in arboricultural operations where the potential exists for struck-by injuries from falling objects.

dunnage (5.1.11): Wood or other material used to support equipment or a component (outrigger) and distribute loads to the ground. Also called cribbing or blocking.

electrical hazard (3.4.4): 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 of training, as set forth in this standard, shall be followed.)

Electrical Level 1 Arborist (4.2.2): An individual or trainee who has undergone essential training to develop an awareness of electrical hazards before engaging in tasks involving such hazards. However, they have not yet completed the necessary training or demonstrated proficiency in the requisite skills and techniques to qualify for higher levels of specialization within the field. These higher levels include Electrical Level 2 Arborist - Low Voltage, Electrical Level 3 Arborist - Primary Voltage, and Electrical Level 4 Arborist - Line Clearance.

Electrical Level 2 Arborist (4.3.2): An arborist who undertakes tree work in the presence of electrical hazards, excluding work carried out on behalf of utility companies for the purpose of clearing space around electric supply lines. This level of arborist possesses the necessary training, practical experience, and knowledge of equipment and hazards associated with incidental line clearance. They have also demonstrated the proficiency to implement hazard mitigation techniques specific to low voltage situations. The Electrical Level 2 Arborist is capable and qualified to perform arboricultural operations within a proximity of 10 ft (3 m) from power sources of 750 V or less while adhering to the distances specified in Table 2. However, they must not bring their body or any conductive material closer than 10 feet (3 meters) to primary electric supply lines exceeding 750 V. In cases where OSHA state plan regulations specify maximum low voltage thresholds other than 750 V, those regulations shall be followed.

Electrical Level 3 Arborist (4.4.2)**:** An arborist who carries out tree work in the presence of electrical hazards, excluding tasks related to clearing space around electric supply lines on behalf of utility companies. This level of arborist possesses the necessary training, practical experience, and understanding of equipment and hazards associated with incidental line clearance. They have also demonstrated proficiency in executing the specialized techniques required for working with primary voltages. The Electrical Level 3 Arborist is trained and competent to conduct arboricultural operations within a proximity of 10 ft (3 m) from power sources up to 35 kV while adhering to the distances specified in Table 3. However, they must not bring their body or any conductive material closer than 10 ft (3 m) to primary electric supply lines exceeding 35 kV. Additionally, the Electrical Level 3 Arborist may enter a tree and perform work within it, while maintaining the same 10 ft (3 m) distance from primary electric supply lines exceeding 35 kV.

Electrical Level 4 Arborist (4.5.2): An experienced professional in the field of arboriculture who specializes in line-clearance operations. This level of arborist has obtained the necessary expertise through comprehensive training and practical experience, acquiring in-depth knowledge of the equipment and hazards involved in line clearance activities. They have also demonstrated a high level of proficiency in executing the specialized techniques required for these tasks. The Electrical Level 4 Arborist is employed by the host employer and is responsible for conducting arboricultural operations within the specific context of line clearance work. Also known as qualified line-clearance arborist.

electrical system owner/operator (4.1.3): An organization that operates or controls the transmission and/or distribution of electric power through electrical conductors.

electric shock (4.1.2[f]): The physiological response of the human body due to electrical contact.

electric supply line (4.1.2[b]): Conductor used to transmit electric energy and their necessary supporting or containing structures (CFR 1910.269(x)).

electrocution (4.1.2[f]): Death by electrical contact.

employer (1.3): A person or entity engaged in a business or work activity who has employees working at their direction or the direction of a designated representative of this person or entity.

equipment, mobile (5.1.2): See *mobile equipment*.

frond (11.2): Large, divided leaf structures found in palms.

good working condition (7.1.4): A term describing a piece of equipment that has no mechanical defects, has all guards in place, and is operational as intended by the manufacturer.

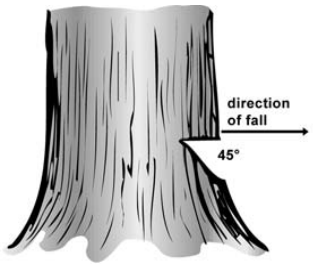
grounded (4.1.2[d]): Describing an electrical system or device that is directly connected to the earth in an attempt to redirect electrical current to help mitigate the risk of electrical shocks or equipment damage.

handline (7.1.7): Rope designated as a tool to leverage, lift, and hold tools, equipment, wood, or other objects.

hinge (9.4.14): Strip of uncut wood fibers created between the face cut or notch and the back cut that helps control direction in tree felling or limb removal. Also called holding wood.

hitch cord (8.1.6): Separate, short length of rope with two eye terminations used to tie the climbing hitch in a climbing system with two points of attachment (double cord) and employed in a system to create friction.

host employer [line clearance] (4.5.11): An employer that operates or controls the operating procedures for an electric power generation, transmission, or distribution installation on which a contract employer is performing work covered by Section 4.5, Electrical Level 4 Arborist – Line Clearance. See also *electrical system owner/operator*.



Humboldt notch (9.4.14[2]): 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° (see drawing); usually reserved for larger trees on steep slopes.

indirect contact (4.1.2[b]): Contact between any part of the body and any conductive object in contact with an energized electric supply line. (Indirect contact can be made through conductive objects [e.g., conductive tools, tree branches, trucks, equipment, another human body] or as a result of communication wires, cables, fences, or guy wires becoming energized.)

insulated (4.1.10): Resistant to the flow of electricity at the voltage for which it is rated.

inverted root cone (11.4.2): A condition resulting in the narrowing of the palm trunk (V-shaped) at the root zone.

job briefing (3.4.1): 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.

job site (3.4.3): see *work site*.

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

kilonewton (kN) (5.2.11.2): The measurement of force, abbreviated as kN. Equal to 224.8 pounds. Example: 24.02 kN equals 5,400 pounds.

ladder (4.1.9): 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

> **tool lanyard** (9.3.4): Short line or strap used to secure a tool while working aloft.
>
> **work-positioning lanyard** (8.1.5): A component of a climbing system used for work positioning and consisting of a flexible line of rope or a strap that may incorporate a knot or mechanical device to allow for adjustability.

leg protection (3.3.8): Personal protective equipment intended to reduce the risk of injury to the legs during chain saw operations.

limbing (9.5.1): See *bucking*.

line clearance (4.5.2): The pruning, trimming, repairing, maintaining, removing, treating, or clearing of trees or the cutting of brush (vegetation management) that is within the minimum approach distance (MAD) per Table 4 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 [only applicable when performed on behalf an organization that operates, or controls the operating procedures for, those electric lines or equipment].

load radius (5.7.11.8): The horizontal distance from the axis of rotation of the crane to the center of the vertical load rope or tackle with a load applied.

machinery (5.1.2): Wheeled/tracked units designed to be operated and/or driven off road by an operator on or within the unit. Mobile equipment is driven off road and, at times, on roadways, sometimes escorted, and does not require DMV or BMV licensing.

MAD (4.1.2[a]): See *minimum approach distance (MAD)*.

manual tree felling (9.4.4): The removal of a tree or tree trunk by an arborist from the ground by the incorporation of a notch and back cut.

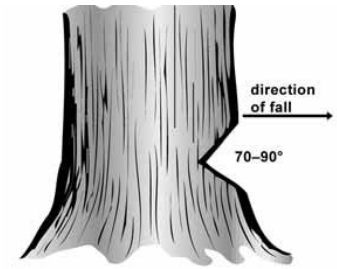
maul (7.3.7): A heavy hammer, sometimes made with a single edge; used to drive wedges or split wood.

minimum approach distance (MAD) (4.1.2[a]): The closest distance an employee may approach or bring any conductive object to an energized or a utility system grounded object; or the closest distance the employee may be to an energized or utility system grounded object, as outlined in Tables 1, 2, 3, and 4 of this standard.

mitigate (4.5.18): To lessen or make less severe a hazardous condition or dangerous situation.

mobile equipment (5.1.2): Wheeled/tracked units designed to be operated and/or driven off road by an operator on or within the unit. Mobile equipment is driven off road and, at times, on roadways, sometimes escorted, and doesn't require (DMV or BMV) licensing.

motor vehicle (5.1.2): A vehicle, such as a car or truck, licensed and tagged by the appropriate regulatory authority to be driven on or within roadways and used to transport people and/or goods.



open-face notch (9.4.14[2]): A directional felling cut into the side of the tree facing the intended direction of fall and consisting of two cuts that create a notch greater than 70° (see drawing).

operator (4.1.11): A person who:

- has demonstrated proficiency to use the type and capacity of equipment specified;
- is familiar with the equipment and hazards involved with arboriculture operations and has demonstrated proficiency in performing the special techniques involved; and
- where applicable, meets federal, state, or local requirements for licensure or training.

outrigger (5.2.9): Built-in device used to stabilize cranes, aerial devices, and similar equipment.

palm frond skirt (11.4): An accumulation of dead or dying fronds gathered down the stem of a palm.

personal protective equipment hazard assessment certification (3.3.2): Documentation of the employer's workplace hazard assessment that identifies the workplace evaluated; the person certifying that the evaluation has been performed; the date(s) of the hazard assessment; and, which identifies the document as a certification of hazard assessment.

pesticide (5.6.3.11): A substance used to manage unwanted plants, insects, or animals.

phase-to-ground (Table 1): The electric potential (voltage) between a conductor and ground.

phase-to-phase (Table 1): The electrical potential (voltage) between two conductors, each having its own electric potential relative to ground.

platform (4.1.10): The personnel-carrying component of an aerial device, such as a bucket, basket, stand, or equivalent.

power tool (6.1.3): Hand-held tool that has a power source (i.e., battery, electric, liquid fuel, hydraulic, pneumatic).

primary suspension point (PSP) (8.2.9): The rope anchor point in the tree that experiences the highest loads during the climb. Also known as primary support point. For an MRS climber, this is called the tie-in point (see *tied in*).

proximity (3.3.4): An area within 10 ft (3.05 m) of energized overhead electrical conductors rated 50 kV phase-to-phase or less. For overhead electrical conductors rated more than 50 kV phase-to-phase, the distance is increased by 4 in (10.16 cm) for each additional 10 kV.

Prusik loop (8.1.6): Loop of rope used to form a Prusik hitch for climbing or rigging.

qualified line-clearance arborist: See *Electrical Level 4 Arborist*.

quick-acting connector (5.2.26): Hose connectors in a hydraulic or pneumatic system designed to allow rapid connection or disconnection without leakage when the system is pressurized.

radiofrequency (4.1.18): A frequency or band of frequencies in the range 104 to 1011 or 1012 Hz suitable for use in telecommunications.

root boss (11.4): A conspicuously large root mass on a palm trunk.

saddle, arborist (5.7.11): See *arborist saddle*.

safety-sensitive task (3.7.1): A task that if performed incorrectly could cause injury, damage property, or disrupt activities.

secondary suspension point (SSP) (8.2.12): Any additional point in the tree that shares some of the load with the primary suspension point during the climb. Also known as secondary support point.

secured

> [aerial lift operator] (5.2.20): Protected from a fall from an aerial lift by use of a fall-arrest system.
>
> [climber] (6.4.5): 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, being tied in, using a work-positioning lanyard, being on belay, and ascending the arborist climbing line using the footlock technique while utilizing a Prusik loop or ascenders.
>
> [object] (5.1.9.3): Made firm or tight; fastened.

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

shock-loading (5.7.8.1): The force exerted by a falling or moving object on the structure supporting it, which is greater than the weight of the object. Also called dynamic load.

should (3.1.4): As used in this standard, denotes an advisory recommendation.

sloughing (11.4): Natural shedding or removal of dead tissue on palms.

snap hook (5.2.11.2): Locking type with a self-closing, self-locking gate that remains closed and locked until intentionally opened by the user for connection or disconnection. Also called self-locking or double-locking rope snap.

spar (8.2.16): A standing trunk or main stem of a tree without a crown and lateral limbs.

split-tail (8.1.6): Separate, short length of rope used to tie the climbing hitch in a climbing system with one point of attachment (single cord) and employed in a system to create friction.

spotter

> [aerial lift operations] (5.2.32): A qualified person within voice and/or visual communication of the operator of an aerial lift and located in a position to view the boom while it is aloft in order to help ensure clearances from obstacles and hazards (e.g., overhead energized lines, traffic, trees, other structures).

[crane] (5.7.3): A qualified person within voice and/or visual communication of the operator of a crane and located in a position to view the boom, load line, and load in order to help ensure clearances from obstacles and hazards (e.g., overhead energized lines, traffic, trees, or other structures).

[driving] (5.1.7): A person within voice and/or visual communication of the driver and located in a position to view the area in which the vehicle (unit) is moving to help ensure that the operation is and will remain safe.

step potential (4.1.2[f]): 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.)

suspended [load] (5.7.7): Any attached load held off the ground and against the force of gravity by the crane.

suspension point (8.2.13): A branch union or artificial anchor point that bears some or all of the load of the climber. See *primary suspension point* and *secondary suspension point*.

tagline (9.2.15): Rope used during the removal of limbs or other portions of trees, or whole trees during tree removal operations. The line is used to introduce force to influence the direction of fall of the piece being cut. In pruning and rigging operations, the line may also be used to direct the piece as it is being lowered.

temporary traffic control (TTC) zone (3.5.2): An area of highway, street, or road where road user conditions are changed because of a work zone, an incident zone, or a planned special event through the use of devices, uniformed law enforcement officers, or other authorized personnel.

testing [electric] (4.5.18): To determine the presence of electricity.

tied in (5.7.11): Term to describe an arborist whose climbing line has been run through one or more branch unions or artificial anchor points and is attached to the arborist's saddle with a climbing hitch or mechanical device, permitting controlled movement.

touch potential (4.1.2[f]): The voltage between the energized grounded object and the person in contact with the object.

train (3.1.2): To provide a trainee under direct supervision with any activity intended to help them gain, improve, or retain specific knowledge, skills, or abilities on the job.

tripod/orchard ladder (7.5.9): A three-legged ladder that utilizes the third leg to form a free-standing tripod to stabilize itself. It is recommended for use on turf or soil or with use of a hard surface kit for better stability and to avoid slippage of the legs.

unguarded [electricity] (5.7.3): Not guarded from approach or contact with electrical conductors.

volt (V) (4.3.2.1): A unit of electric potential difference between two points. Lower-voltage systems are generally expressed in terms of volts (for example, 120 V or 240 V). See also *kilovolts (kV)*.

wheel chock (5.2.8): Manufactured or employer-approved wedge-shaped block designed to prevent unintentional movement of vehicle.

working-load limit (9.2.3): The working load that must not be exceeded for a particular application as established by a regulatory or standards-setting agency.

work line (8.2.3): Rope used for lifting, lowering, or guiding limbs or equipment, or both, into or out of the tree.

work-positioning (suspension) system (8.1.1.1): An arborist climbing system designed to be used under tension to limit falls to no more than 2 ft and which supports the arborist on an elevated, vertical surface, such as a tree, and allows them to work with both hands free.

work site (3.3.7): Entire area where work will be performed as indicated during the job briefing, including:

- Areas that materials will be moved through (dragged, material handlers, cranes, etc.)
- Areas where material may fall or land, whether intentionally or not
- Areas where work vehicles and equipment are used or parked, including temporary traffic control (TTC) zones

work zone (9.6.1)**:** The area of a roadway with construction, maintenance, or utility work activities.

A.2 List of Abbreviations

Annex development in progress.

Annex B: Recommended Guidelines for Standard Performance and Safety Training for Electrical Level 2, 3, or 4 Arborists/Electrical Level 2, 3, or 4 Arborist Trainees

(Informative)

Note: The content of this training outline is generic and may be customized to achieve equivalent levels 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 is not evidence of noncompliance with this standard or annex.

B.1 General Requirements

Specific training to enable the safe and efficient completion of the work required of a qualified line-clearance arborist or qualified arborist should be provided by the employer, and documentation of training should be retained on file for the duration of employment.

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

B.1.2 **Education and training should be appropriate and as applicable to employee job assignments.**

B.1.3 **Employee orientation is to include:**

- job description appropriate to job assignment
- introduction to immediate supervisor and crew members
- familiarization with appropriate personal protective clothing and equipment and its 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 they have participated in such training

B.1.4 **Provide education and training on pruning techniques and safe work practices:**

(a) in accordance with prevailing national standards for tree care operations pruning, or for utility pruning for those employees engaged under utility contracts in utility line clearance operations. Refer to Annex D, Additional Resources, for further information.

(b) in accordance with prevailing local, state, or regional pruning standards, and those utility pruning standards that may be specified by utility contracts for those employees engaged in utility line clearance operations.

(c) as well as tree knowledge, including predominant tree species within geographic area, such as identification, growth habits, structure, wood strength, and recognition/evaluation of potentially hazardous conditions related to tree structure. Refer to recommended resources in Annex D, Additional Resources.

B.2 General Safety

Provide education and training in general safety, applicable to employee job assignments, as it relates to:

B.2.1 Safety Regulations

Familiarize employees with the requirements of federal and/or state OSHA, Federal Motor Carrier Safety Regulations (FMCSA), and Federal Highway Administration as applicable to employee job assignments. Refer to recommended resources in Annex D, Additional Resources.

B.2.2 Industry Standards

Familiarize employees with the requirements in ANSI and other applicable standards. Refer to additional recommended standards in Annex D, Additional Resources.

B.2.3 Public Safety and Traffic Control

Use of public safety and traffic control devices as applicable under federal, state, or local regulations.

B.2.4 Electrical Hazards

Recognition and avoidance of electrical hazards.

B.2.5 Emergency Conditions

Proper procedures for safely performing nonroutine work such as storm/fire restoration efforts.

B.2.6 Job Briefings

Job-site-specific hazards associated with the job, hazard-mitigating work procedures, and specific employee assignments. Instruct employees about special precautions, personal protective clothing, and equipment requirements.

B.3 Personal Safety

Provide education and training in personal safety, applicable to employee job assignments, as it relates to:

B.3.1 Personal Protective Equipment (PPE)

Instruct employees in the proper use, inspection, care, fit, maintenance, and replacement of PPE.

B.3.2 Emergency Response Procedures

Furnish employees with appropriate information and training necessary to expedite a response to a 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

Techniques required to avoid back and other injuries.

B.3.4 Identification and Avoidance of Animals and Poison Plants

Identification of and the need to avoid contact with poisonous plants and instructions for treating insect stings/bites and snake bites.

B.3.5 Heat Illness

Awareness of heat illness risk, causal factors, prevention measures, recognition of symptoms, and first aid for an affected worker.

B.4 Equipment Safety

Provide education and training in equipment safety, applicable to employee job assignments, as it relates to:

B.4.1 Vehicles, Mobile, and Towed Equipment

Inspection, operation, and maintenance of all vehicles and equipment, such as aerial lifts, brush chippers, stump grinders, log loaders, tree cranes, mowing equipment, and pesticide application equipment. For drivers of commercial motor vehicles, such training shall include requirements of federal and state motor carrier safety regulations.

B.4.2 Aerial Equipment and Electrical Hazards

Required and recommended procedures for operating aerial devices in proximity to electrical hazards for those employees with the required qualifications to work in proximity to electric hazards.

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

Use of chain saws, power tools, and hand tools in accordance with manufacturers' instructions.

B.4.4 Climbing Equipment Use and Safety

Inspection, maintenance, and storage of climbing equipment such as ropes, saddles, personal lanyards, rope snaps, carabiners, and related equipment.

B.5 Operational Safety

Provide education and training in operational safety, applicable to employee job assignments, as it relates to:

B.5.1 Climbing Safety

B.5.1.1 Includes, but is not limited to, preclimb inspection of tree and site, drop zone determination, climbing gear inspection, tie-in point selection, ascent methods, and planning of route, safe work methods aloft, aerial rescue procedures, communication with coworkers, and safe descent methods.

B.5.2 Rigging and Tree Removal

B.5.2.1 Knots and ropes, rigging techniques, tree strength and weight characteristics, and potential electrical hazards. Understanding and managing dynamic loads during rigging operations.

B.5.2.2 Use of rigging for the installation of tree support systems.

B.5.2.3 Identification and removal of hazard trees.

B.5.3 Hazard Communications

Awareness of potential exposure to hazardous substance and techniques to avoid exposure, in accordance with federal and state regulations as well as professional safe work practices.

B.5.4 Pesticide Use

Procedures for safe handling, mixing, application, and disposal of pesticide products, in accordance with federal and state regulations as well as professional safe work practices.

B.5.5 Fire Prevention

Awareness of the risks, prevention measures, and the appropriate response to fire, including, but not limited to, wildfire and the avoidance of wildfire smoke inhalation.

Annex C: General Safety Procedures

(Informative)

C.1 Lifting

Before lifting any weight, workers should

5 assess whether:
- they can safely lift the weight and get a good grip, avoiding sharp edges, slivers, splinters, or other factors that might cause injury;
- the object is too large or awkward to lift and carry safely; and/or
- gloves will help get a good grip.

6 make sure there is a clear path and solid terrain that isn't slippery if the weight will be carried from one place to another.

7 make sure their muscles, especially in the lower back and legs, are warmed up and ready for exertion.

8 make a preliminary lift to be sure the load can be safely handled.

9 choose an alternative approach such as additional workers or material-handling equipment if the weight cannot be safely lifted.

When lifting the weight, workers should

1. place feet solidly on the walking surface.
2. avoid leaning forward by bending in the hips and knees to squat deeply while keeping the head up, shoulders back, and lower back straight.
3. hold the weight close to the body at waist height.
4. engage the core muscles while pushing on the ground to straighten the legs.

C.2 Control of Hazardous Energy

Annex development in progress.

C.3 Manual Tree Felling Procedure

Before performing any work, conduct a site assessment and the following seven steps to determine whether a tree can be manually felled.

1. **Hazards and Obstacles Identification**
   Example of conditions to analyze include, but are not limited to:

   (a) tree size in relationship to the landing zone,
   (b) selected direction of fall,
   (c) obstacles to avoid or clear from the felling path,
   (d) vines or interlocking limbs,
   (e) species and shape of tree,
   (f) lean of tree,
   (g) loose limbs, hangers, broken tops, chunks, or other overhead material,
   (h) wind force and direction,

(i) decay, cavities, or weak spots throughout the tree,
(j) location of any electrical conductors or other wires,
(k) tree cables, bracing, lightning protection, or other tree hardware,
(l) size and terrain characteristics or limitations of work area,
(m) potential for flying debris from tree impact,
(n) adequate retreat path,
(o) evidence of bees or wildlife habitation in tree,
(p) poisonous plants,
(q) water hazards,
(r) ability to control access to work site,
(s) authority to remove tree,
(t) quality of wood fiber in hinge area,
(u) root mass stability,
(v) ice or snow load,
(w) throwback or bounceback potential,
(x) potential for spring poles,
(y) lodged trees or dead snags in area,
(z) access to tools or resources required for task;
(aa) lightning damage,
(bb) potential for barber chair, and
(cc) foreign objects, nails, wire fence, concrete, etc.

2. **Lean(s)**
Determine side lean from the fall direction, then go 90° adjacent and determine front or back lean. (Note: The side lean may influence the retreat path [escape route] as well as the back cut to be used. Heavy, forward-leaning trees may represent a risk of barber chair.)

3. **Retreat Path/Escape Route** (planned retreat direction)
Select a route that is 45° to the rear of the tree and, when possible, to the opposite side of the natural side lean of the tree.

4. **Notch Plan**
Select and cut a notch (open face, conventional, or Humboldt) that is best suited to allow the tree to fall safely in the desired direction.

5. **Hinge Plan**
Determine the type and characteristics of the hinge. Uncut wood between the notch and back cut is recommended to have a width that is 10 percent of diameter at breast height (DBH) and a hinge length that is 80 percent of the tree's diameter.

6. **Back Cut Plan**
Select and make a felling cut, such as bore cut, stepped cut(s), or level back cut(s); also use assistance, such as wedge(s), work line(s), or machinery. Before making a back cut, give an audible command, such as "Stand Clear," and wait for a response, such as "All Clear."

7. **Retreat**
Use a retreat path (escape route) out to a safe distance. If the tree has not fallen, use work line(s) or machinery in place to start the fall of the tree. Once the tree is on the ground, wait for movement to stop and check for hanging or lodged hazards before approaching.

C.4 Climber Anchorage Selection Guidance

Before beginning the climb, the climber shall inspect the tree and the intended anchorage point to assess load-bearing capacity in relation to the anticipated loads.

1. The tree shall be visually inspected for potential hazards. Loads are borne by the anchor point, the stems that support it, the trunk, and the roots. Failure can occur in any part of the tree that bears the loads, and the climber must carefully inspect the tree to assess its load-bearing capacity at all points between the anchor point and the roots.

2. The load-bearing capacity of an anchor is determined by the inherent wood property of the species and the presence of defects. The defects to analyze at the intended anchor points and branch include, but are not limited to:

- cavities
- cracks
- decay
- dieback
- included bark
- taper

3. The load-bearing capacity is also determined by the diameter of the anchor point. The climber shall take care to select an anchor point of sufficient diameter to reduce the likelihood of failure due to a defect not visible from the ground.

4. The climber shall also consider their weight and actions will affect the loads on the anchor point and branch. The actions to consider include:

(a) whether the applied load of the climber will cause a bending moment or torque on the anchor point or part of the tree.

(b) the climbing system employed. Moving rope systems will create different loads on an anchor than stationary rope systems.

(i) Within stationary rope systems, an anchor will be subject to different loads when used as canopy anchor than when used as the suspension point for a basal anchor system.

Annex D: Additional Resources

(Informative)

D.1 Applicable American National Standards

Boom-Supported Elevating Work Platforms (ANSI/SAIA A92.5-2006 [R2014])

High-Visibility Safety Apparel (ANSI/ISEA 107-2020)

Industrial Head Protection (ANSI/ISEA Z89.1-2014 [R2019])

Ladders - Portable Metal - Safety Requirements (ANSI ASC A14.2-2017)

Ladders - Wood - Safety Requirements With Errata (ANSI ASC A14.1-2007)

Minimum Requirements for Workplace First Aid Kits and Supplies (ANSI/ISEA Z308.1-2021)

Occupational and Educational Personal Eye and Face Protection Devices (ANSI/ISEA Z87.1-2020)

Practices for Respiratory Protection (ANSI/ASSE Z88.2-2015)

Tree, Shrub, and Other Woody Plant Management—Standard Practices [Pruning] (A300 [Part 1]-2017)

Tree, Shrub, and Other Woody Plant Management—Standard Practices [Soil Management a. Modification, b. Fertilization, and c. Drainage] (A300 [Part 2]-2018)

Tree, Shrub, and Other Woody Plant Management—Standard Practices [Supplemental Support Systems] (A300 [Part 3]-2013)

Vehicle-Mounted Elevating and Rotating Aerial Devices (ANSI/SAIA A92.2-2021)

Workplace Walking/Working Surfaces and Their Access; Workplace, Floor, Wall and Roof Openings; Stairs and Guardrail/Handrail Systems (ANSI/ASSE A1264.1-2017)

D.2 Other Applicable Standards

Articulating Boom Cranes (ASME B30.22-2016)

Mobile and Locomotive Cranes (ASME B30.5-2021)

Multiposition Small Engine Exhaust System Fire Ignition Suppression (SAE Standard J335-2020)

Standard Specification for Leg Protection for Chain Saw Users (ASTM F1897-20)

Standard Specifications for Personal Climbing Equipment (ASTM F887-20)

Standard Test Method for Measurement of Cut Resistance to Chainsaw in Lower Body [Legs] Protective Clothing (ASTM F1414-19)

USDA Forest Service Standard for Spark Arresters for Internal Combustion Engines (USDA Forest Service Specification 5100-1d [February 2013])

D.3 Applicable Federal Regulations (Occupational Safety and Health Administration, Federal Motor Carrier Safety Administration, and Federal Highway Administration)

The Control of Hazardous Energy (Lockout/Tagout) (29 CFR 1910.147)

Electric Power Generation, Transmission, and Distribution (29 CFR 1910.269)

Electrical – Safety-Related Work Practices (29 CFR 1910, Subpart S [1910.331–1910.335])

Fall-Arrest Systems (29 CFR 1910, Subpart I [1910.140]

Federal Motor Carrier Safety Regulations; General (49 CFR, Part 390)

Fire (36 CFR 261.52)

Hazard Communication (29 CFR 1910.1200)

Manual on Uniform Traffic Control Devices

(https://mutcd.fhwa.dot.gov/pdfs/2009r1r2r3/pdf_index.htm)

Permit-Required Confined Spaces (29 CFR 1910.146)

Personal Protective Equipment (29 CFR 1910, Subpart I [1910.132–1910.138])

Slings (29 CFR 1910.184)

Traffic Control Devices on Federal-Aid and Other Streets and Highways (23 CFR, Part 655, Subpart F)

D.4 Other Resources

Cordage Institute Rope Standards/The Cordage Institute (www.ropecord.com)

Globally Harmonized System of Classification and Labelling of Chemicals [GHS]

(www.osha.gov/hazcom/global)National Institute for Occupational Safety and Health/Fatality Assessment and Control Evaluation Program (www.cdc.gov/niosh/face)

Occupational Safety and Health Administration/Safety and Health Topics/Tree Care Industry (www.osha.gov/tree-care)

Occupational Safety and Health Administration/Safety and Health Topics/Landscape and Horticultural Services (www.osha.gov/landscaping)

Personal Protective Equipment for the Prevention of Falls from a Height. Low Stretch Kernmantel Ropes (BS EN 1891:1998)

D.5 Associations

International Society of Arboriculture; 270 Peachtree Street NW, Suite 1900, Atlanta, GA 30303 (www.isa-arbor.com)

Tree Care Industry Association, Inc.; N Commercial Street, Suite 201, Manchester, NH 03101 (www.tcia.org)

Annex E: Weight of Green Logs

(Informative)

The green log weight chart found in this annex is one of many charts that estimate the weight of green (living) wood. Green wood has many growth factors besides species; area of the country, local topography, soil nutrients, time of year, and more will affect the weight of the wood. There are also apps for estimating weights of green logs.

How to use the chart:

1. Know the species of the tree you are working with, if the exact species is not known or not listed in the chart then select the species most similar to your tree.

2. Match the diameter of the wood section you are working with, with the closest diameter (in inches) at the top of the chart.

3. Follow species row until it meets the diameter column. The number in the chart is the estimated weight of a 1 ft long, round section of that diameter species of wood.

Example:

Follow **ROW** *Acer rubrum* (red maple) to **COLUMN** 20” in diameter to find **109**.

The 109 is an estimation of the weight in pounds of a 1 ft long, 20” in diameter, red maple round. For a rough estimate of a 4 ft x 20 in diameter log of red maple: 109 x 4 = 436 pounds.

Scientific name	Common name	Weight, pounds per ft³	Weight of a 1 ft section, based on average diameter							
			10″	12″	14″	16″	18″	20″	22″	24″
Abies concolor	white fir	47	25	37	50	66	83	102	124	148
Abies procera	noble fir	29	16	23	31	41	51	63	77	91
Acer rubrum	red maple	50	27	39	53	70	88	109	132	157
Acer saccharinum	silver maple	45	25	35	48	63	79	98	119	141
Acer saccharum	sugar maple	56	31	44	60	78	99	122	148	176
Aesculus hippocastanum	horsechestnut	41	22	32	43	57	72	89	108	129
Alnus rubra	red alder	46	25	36	49	64	81	100	121	144
Betula papyrifera	paper birch	50	27	39	53	70	88	109	132	157
Calocedrus decurrens	incense-cedar	45	25	35	48	63	79	98	119	141
Carya illinoensis	pecan	61	33	48	65	85	108	133	161	192
Carya ovata	shagbark hickory	64	35	50	68	89	113	140	169	201
Celtis occidentalis	hackberry	50	27	39	53	70	88	109	132	157
Diospyros virginiana	persimmon	63	34	49	67	88	111	137	166	198
Eucalyptus camaldulensis	red gum	50	27	39	53	70	88	109	132	157
Fagus spp.	beech	54	29	42	58	75	95	118	142	169
Fraxinus americana	white ash	48	26	38	51	67	85	104	126	150
Fraxinus latifolia	Oregon ash	48	26	38	51	67	85	104	126	150
Fraxinus pennsylvanica	green ash	47	25	37	50	66	83	102	124	148

Gleditsia triacanthos	honeylocust	61	33	48	65	85	108	133	161	192
Juglans nigra	black walnut	58	32	45	62	81	102	126	153	182
Larix spp.	larch	51	28	40	54	71	90	111	135	160
Liquidambar styraciflua	sweetgum	55	30	43	58	77	97	120	145	173
Liriodendron tulipifera	yellow poplar, tuliptree	38	21	30	40	53	67	83	99	199
Melia azedarach	Chinaberry	50	27	39	53	70	88	109	132	157
Nyssa sylvatica	black gum	45	25	35	48	63	79	98	119	141
Picea rubens	red spruce	34	19	27	36	47	60	74	90	106
Picea sitchensis	Sitka spruce	32	17	25	34	45	56	70	84	100
Pinus contorta	lodgepole pine	39	21	30	41	55	69	85	103	122
Pinus elliottii	slash pine	58	32	45	62	81	102	126	153	182
Pinus lambertiana	sugar pine	52	28	41	55	72	92	113	137	163
Pinus monticola	western white pine	36	20	28	38	50	64	78	95	113
Pinus palustris	longleaf pine	55	30	43	58	77	97	120	145	173
Pinus ponderosa	ponderosa pine	46	25	36	49	64	81	100	121	144
Pinus strobus	eastern white pine	36	20	28	38	50	64	78	95	113
Pinus taeda	loblolly pine	53	29	41	56	74	93	116	140	166
Platanus occidentalis	sycamore	52	28	41	55	72	92	113	137	163
Populus spp.	cottonwood	49	27	38	52	68	86	107	129	154
Populus tremuloides	quaking aspen	43	23	34	46	60	76	94	114	135
Prunus serotina	black cherry	45	25	35	48	63	79	98	119	141
Pseudotsuga menziesii	Douglas-fir	39	21	30	41	55	69	85	103	122
Quercus alba	white oak	62	34	48	66	86	109	135	163	194
Quercus coccinea	scarlet oak	64	35	50	68	89	113	140	169	201
Quercus kelloggii	California black oak	66	36	51	70	92	116	144	174	207
Quercus palustris	pin oak	64	35	50	68	89	113	140	169	201
Quercus robur	English oak	52	28	41	55	72	92	113	137	163
Quercus rubra	red oak	63	34	49	67	88	111	137	166	198
Quercus stellata	post oak	63	34	49	67	88	111	137	166	198
Quercus virginiana	live oak	76	41	60	81	106	134	166	200	238
Robinia pseudoacacia	black locust	58	32	45	62	81	102	126	153	182
Salix spp.	willow	32	17	25	34	45	56	70	84	100
Sequoia sempervirens	coast redwood	50	27	39	53	70	88	109	132	157
Taxodium distichum	baldcypress	51	28	40	54	71	90	111	135	160
Thuja plicata	western red cedar	28	15	22	30	39	49	61	74	88
Tilia americana	basswood	42	23	33	45	59	74	92	111	132
Tsuga canadensis	eastern hemlock	49	27	38	52	68	86	107	129	154
Tsuga heterophylla	western hemlock	41	22	32	43	57	72	89	108	129
Ulmus americana	American elm	54	29	42	58	75	95	118	142	169

Annex F: Aerial Rescue Flowchart

(Informative)

Annex development in progress.

Annex G: Hand Signals for Crane Operations

(Informative)

Annex development in progress.

Annex H: Electrical Hazard Abatement

(Informative)

(See Section 4.3.11 of the standard.)

H.1 Abatement

When an arborist cannot safely maintain the applicable minimum approach distance (MAD) from energized electric conductors, or arborist work cannot be safely completed with the line energized, the arborist must stop work on that assignment until an electrical hazard abatement plan is implemented.

An electrical hazard abatement plan may include a request for the utility to deenergize, test, and ground the electric supply lines at the work site to make it as safe as practicable for the arborist to work closer to deenergized conductors than allowed when the conductors are electrically energized. For arborists who are not line-clearance qualified, the hazard abatement plan may require they hire a qualified line-clearance arborist or contractor to perform the work.

H.2 Communication

When an arborist's electrical hazard abatement plan includes a request that the electrical system owner/operator deenergize, test, and ground the electrical conductors, precautions must be taken to ensure clear and thorough communications between the arborist and the onsite, qualified utility employee responsible for deenergizing and grounding the conductors. Failure to effectively communicate and maintain safe work practices could result in severe, potentially fatal, injury.

H.3 General Requirements

1. The electrical system owner/operator has the expertise, responsibility, and authority for deenergizing, testing, grounding, and reenergizing the conductors.

2. Arborist employees shall treat all conductors and equipment as energized and maintain MADs to energized conductors until they have confirmed that the utility has deenergized and tested the line and that grounding is in place to make the electric supply lines as safe as practicable for arborist work.

3. Arborists shall avoid all direct contact with the deenergized conductors because deenergized lines should never be considered 100 percent electrically safe under all conditions.

4. Arborists shall avoid dropping brush/limbs on the deenergized electric supply lines, poles, or equipment.

Sample Procedures

Sequence for working in proximity to deenergized and grounded electrical conductors

1. The arborist supervisor shall request that the designated utility supervisor in charge coordinate communications and actions (i.e., times, locations, and designated contact persons at worksite where deenergizing, testing, and grounding is to apply) between the arborist crew leader and the utility crew leader performing the deenergizing, testing, and grounding.

2. At the worksite, a designated arborist employee in charge will be identified to the designated qualified utility employee in charge of deenergizing, testing, and grounding the conductors.

3. All arborist employees will maintain MADs until the arborist employee in charge has been notified by the qualified utility employee in charge that:

   a. the deenergizing, testing, and grounding has been completed in accordance with the electrical system owner/operator grounding procedures, creating a safety zone for the arborist to perform work; and

   b. the designated arborist employee in charge has visually confirmed, with the guidance of the designated qualified utility employee applying the ground(s), that protective ground(s) have been installed as close as practicable to the line-clearance or arborist work to be performed to prevent hazardous differences in electrical potential.

4. It may be necessary to have the protective ground(s) moved by the utility if the arborist work progresses beyond the original worksite. If the ground(s) must be moved, Steps 1 through 3 must be repeated. The arborist crew leader must be able to visually confirm that protective ground(s) have been installed as required by the utility.

Sequence for reenergizing conductors

1. After completing the line-clearance or arborist work, the designated arborist employee in charge will verify that all arborist employees are outside of the MADs from the electric supply lines. The arborist will then inform the designated qualified utility employee in charge that the work is complete and that arborist employees are outside of the MADs. The qualified utility employee(s) may now reenergize the lines.

2. The arborist employees shall immediately treat the electrical conductors as energized and resume maintaining MADs as specified in Table 4 (for qualified line-clearance arborists), Table 3 (for Electrical Level 3 Arborists), Table 2 (for Electrical Level 2 Arborists), or Table 1 (for Electrical Level 1 Arborists).

Annex I: Insulating Pruning Tools

(Informative)

(From 29 CFR 1910.269 – Electric Power Generation, Transmission, and Distribution)

(j) Insulating Pruning Tools

(1) ***Design of tools.*** Insulating pruning tools shall be designed and constructed to withstand the following minimum tests:

(i) If the tool is made of fiberglass-reinforced plastic (FRP), it shall withstand 100,000 V/ft (328,100 V/m) of length for 5 minutes;

> **Note to paragraph 29 CFR 1910.269 (j)(l)(i):** Live-line tools (insulating pruning tools) using rod and tube that meet ASTM F71l-02 (2007), *Standard Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live Line Tools,* are deemed to comply with paragraph (j)(l) of this section.

(ii) If the tool is made of wood, it shall withstand 75,000 V/ft (246,100 V/m) of length for 3 minutes; or

(iii) The tool shall withstand other tests that the employer can demonstrate are equivalent.

Annex J: Fall-Protection Systems

(Informative)

Annex development in progress.

Annex K: Hierarchy of Controls

(Informative)

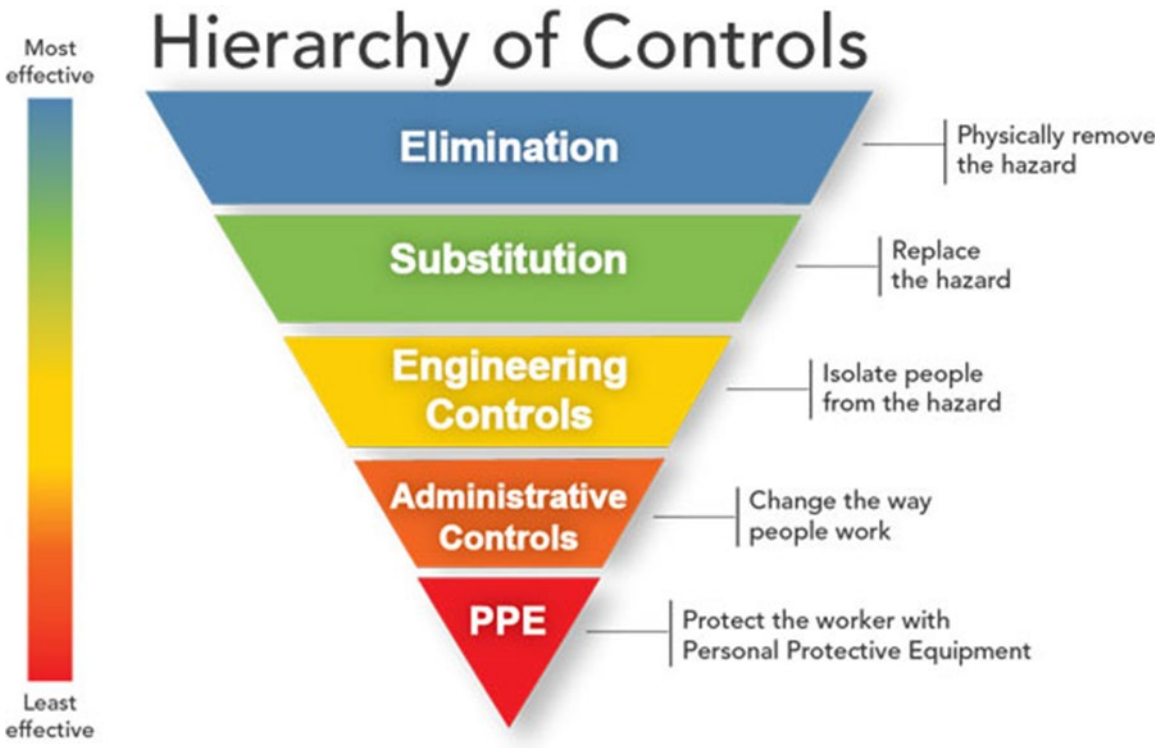


Image from The National Institute for Occupational Safety and Health (NIOSH) website.

https://www.cdc.gov/niosh/topics/hierarchy/default.html