

Cabling and Bracing Standard Proposed Revision

This is an excerpt from the draft version of the ANSI standard for supplemental support systems – cabling and bracing – used in tree care that is currently open for public review. The review period opened Feb. 10 and closes March 27, 2006. The entire proposed revision, along with instructions for submitting comments, can be downloaded on the Web at www.treecareindustry.org/Public/gov_standards_review.htm. Scroll down to “Current Public Review Documents” and click as directed.

BSR A300 Part 3 Draft 1 Version 1, a revision of the American National Standard for Tree Care Operations – Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices (Supplemental Support Systems).

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The Foreword, Scope and Purpose are not included here, but explain what an ANSI standard is, that it is intended as a guide in the drafting of maintenance specifications for public and private authorities, how it should be used, and that this public review document is not intended for trial use.

30 Part 3 – Supplemental Support Systems standards

30.1 Purpose

The purpose of this clause is to provide standards for writing specifications for supplemental support systems.

30.2 Reasons for supplemental support systems

Supplemental support systems are used to provide additional support or limit movement of a tree or tree part.

30.3 Safety

30.3.1 Tree maintenance shall only be performed by an arborist or arborist trainee.

30.3.2 This standard shall not take precedence

over arboricultural safe work practices.

30.3.3 Operations shall comply with applicable Occupational Safety and Health Administration (OSHA) standards, ANSI Z133.1, as well as state and local regulations.

31 Normative references

The following standards contain provisions which, through reference in the text, constitute provisions of this American National Standard. All standards are subject to revision, and parties to agreements based on this American National Standard shall apply the most recent edition of the standards indicated below. (See entire revision for list of references)

32 Definitions

32.1 amon-eye nut: A drop-forged eye nut.

32.2 anchor: A cable to tree attachment.

32.3 anchor-tree: A tree used as an anchor in guying.

32.4 arborist: An individual engaged in the profession of arboriculture who, through experience, education and related training, possesses the competence to provide for, or supervise the management of, trees and other woody ornamentals.

32.5 arborist trainee: An individual undergo-

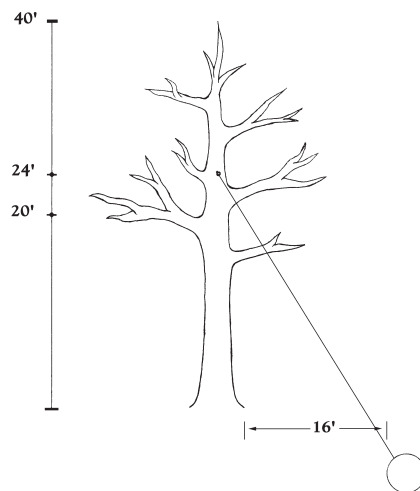


Fig. 33.9.2.1 Tree-to-ground. In this example a point of attachment 24 feet (7.3 m) up the trunk would place the anchors a minimum of 16 feet (4.9 m) away from the base of the tree.

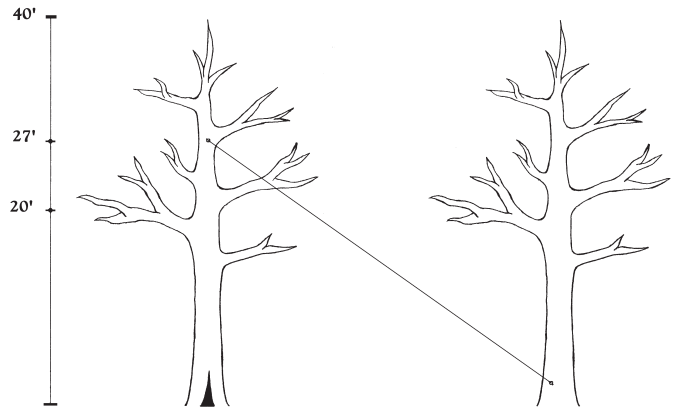


Fig. 33.9.2.2 Tree-to-tree. In this example a point of attachment in the upper half of the supported tree and the lower half of the anchor-tree.

ing on-the-job training to obtain the experience and the competence required to provide for, or supervise the management of, trees and woody ornamentals. Such trainees shall be under the direct supervision of an arborist.

32.6 bond: An electrical connection between an electrically conductive object and a component of a lightning protection system that is intended to significantly reduce potential differences created by lightning currents.

32.7 bracing: The installation of lag-thread screw or threaded-steel rods in limbs, leaders, or trunks to provide supplemental support.

32.8 cable: 1) Zinc coated strand per ASTM A-475 for dead-end grip applications. 2) Wire rope or strand for general applications. 3) Synthetic-fiber rope or synthetic-fiber webbing for general applications.

32.9 cable grip: A mechanical device that temporarily grasps and holds a cable during installation.

32.10 cabling: The installation of a steel wire rope, steel strand, or synthetic-fiber system between leaders, limbs, and branches within a tree.

32.11 compartmentalization: Physiological process that creates the chemical and physical boundaries that act to limit the spread of disease and decay organisms.

32.12 connector clamp: A device meeting ANSI/UL-96 standard, used to bond a conductor to a steel cable.

32.13 dead-end brace: A brace formed by threading a lag-thread screw rod directly into the limb, leader, or trunk, but not through the side opposite the installation.

32.14 dead-end grip: A manufactured wire wrap designed to form a termination in the end

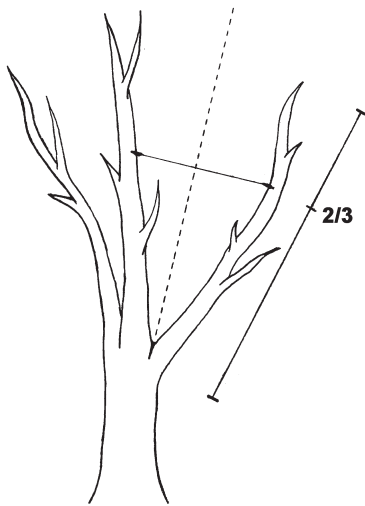


Fig. 33.6.3.2 Correct cable installation.

of 1 x 7, left-hand lay cable that meets the specifications of ASTM A-475 for zinc coated strand.

32.15 dead-end hardware: Anchors or braces that are threaded directly into the tree but not through the side opposite the installation. Dead-end hardware includes but is not limited to: lag hooks, lag eyes, and lag-thread screw rod.

32.16 eye bolt: A drop-forged, closed-eye bolt.

32.17 eye splice: A closed-eye termination formed into common grade cable by bending it back on itself and winding each wire around the cable a minimum of two complete turns.

32.18 ground anchor: A cable to ground attachment.

32.19 guying: The installation of a steel cable or synthetic-fiber cable system between a tree and an external anchor to provide supplemental support.

32.20 lag eye: A lag-thread, drop-forged, closed-eye anchor.

32.21 lag hook (J-hook): A lag-thread, J-shaped anchor.

32.22 lag thread: A coarse screw thread designed for self tapping.

32.23 lag-thread hardware: Anchors or braces with lag-threads. Lag-thread hardware includes, but is not limited to, lag eyes, lag hooks, and lag-thread screw rod.

32.24 lag-thread screw rod: A lag-thread, steel rod used for dead-end and through-brace installations.

32.25 machine thread: A fine screw thread designed for fittings (such as nuts).

32.26 machine-threaded rod: A machine-thread, steel rod used for throughbrace installations.

32.27 peen: The act of bending, rounding or flattening the fastening end(s) of through-hardware for the purpose of preventing a nut from "backing-off."

32.28 prop: Rigid support placed between a trunk, limb, or branch and the ground.

32.29 propping: The installation of a prop.

32.30 shall: As used in this standard, denotes a mandatory requirement.

32.31 should: As used in this standard, denotes an advisory recommendation.

32.32 specifications: A document stating a detailed, measurable plan or proposal for provision of a product or service.

32.33 standards, ANSI A300: Performance parameters established by industry consensus as a rule for the measure of quantity, weight, extent, value, or quality.

32.34 supplemental support system: A system designed to provide additional support or limit movement of a tree or tree part.

32.35 swage: A crimp-type holding device for wire rope.

32.36 swage stop: A device used to seal the end of cable.

32.37 taut: Tightened to the point of eliminating visible slack.

32.38 termination: A device or configuration that secures the end of a cable to the anchor in a cabling or guying installation.

32.39 termination hardware: Hardware used to form a termination. Termination hardware includes, but is not limited to, dead-end grips, thimbles used in eye-splice configurations, and swages.

32.40 thimble: An oblong galvanized or stainless steel fitting with flared margins and an open-ended base.

32.41 through-brace: A brace formed by installing through-hardware into a limb, leader, or trunk completely through the side opposite the installation.

32.42 through-hardware: Anchors or braces that pass completely through the limb, leader, or trunk, secured with nuts and heavy-duty washers. Throughhardware includes but is not limited to: eyebolts, lag-thread screw rod, and threaded-steel rod.

32.43 turnbuckle: A drop-forged, closed-eye device for adjusting tension.

32.44 wedge-type ferrule: A tapered device for terminating and anchoring a cable or strand.

32.45 wire rope clamps: A clamp consisting of a "U" bolt, saddle plate, and fastening nuts.

33 Supplemental support system practices

33.1 Supplemental support system objectives Objectives for supplemental support systems shall be clearly defined prior to installation.

33.2 Tree inspection

33.2.1 A qualified arborist or arborist trainee shall visually inspect each tree before beginning work.

33.2.2 Structural integrity and potential changes

in tree dynamics shall be considered prior to installing a supplemental support system.

33.2.3 If a condition is observed requiring attention beyond the original scope of work, the condition shall be reported to an immediate supervisor, the owner, or the person responsible for authorizing the work.

33.3 Tools and equipment

33.3.1 Climbing spurs shall not be used when climbing trees to install supplemental support systems, except in the case of emergencies, such

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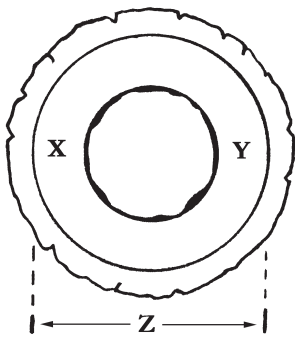


Fig. 33.4.4 Equations for finding the percentage of sound wood.

Symbol Key for Equations:

X = sound wood depth, working side.

Y = sound wood depth, opposite side.

Z = total trunk/branch diameter, bark diameter not included.

Equation for percentage of sound wood for through-bolt applications:

$[(X + Y) \div Z] \times 100 = \% \text{ of sound wood for through-bolt applications.}$

Equation for percentage of sound wood for dead-end applications:

$(X \div Z) \times 100 = \% \text{ of sound wood for dead-end applications.}$

as aerial rescue, or when the tree cannot be climbed safely by other methods.

33.3.2 Equipment and work practices that damage bark, cambium, live palm tissue, or any combination of these, beyond the scope of the work, should be avoided.

33.3.3 Cable grips used to tension the cable shall be designed for use with the type of cable being installed.

33.4 General

33.4.1 System design shall be specified.

33.4.2 When necessary to reach the objective, pruning should be performed prior to installing a supplemental support system. Pruning shall be in accordance with ANSI A300 Part 1 – Pruning.

33.4.3 Prior to installation, the owner or owner’s agent should be notified of the need for periodic inspection by an arborist. Inspections shall be the responsibility of the tree owner and should include supplemental support system: condition; position; cable tension; and the tree’s structural integrity.

33.4.4 Anchors and braces shall not be installed into decayed areas where sound wood is less than 30 percent of the trunk or branch diameter (refer to Fig. 33.4.4).

33.4.5 Steel cables or guys in trees with existing lightning protection conductors, shall be bonded to the lightning protection system. A connector clamp, designed for use in lightning protection systems, shall be used to bond steel cables or guys to the lightning protection system refer to ANSI A300 Part 4 – Lightning Protection Systems.

33.4.6 Supplemental support systems shall be

installed in compliance with minimum distance Table 1 in ANSI Z133.1 for overhead, energized conductors.

33.4.7 Steel hardware shall be corrosion resistant. Synthetic fiber cable systems shall be ultra-violet (UV) light resistant.

33.4.8 Wire rope clamps shall not be used to form terminations in cables larger than 1/8 inch (3 mm).

33.4.9 Treatment of cavities by filling, shall not be considered to provide support.

33.5 Installation practices

33.5.1 Holes should not be drilled closer together than the diameter of the branch or trunk being drilled or 12 inches whichever is less. The diameter of the hole shall not be greater than 1/6 the diameter of the limb, trunk, or branch at the point of installation.

33.5.2 Longitudinal alignment of anchors and/or braces should be avoided.

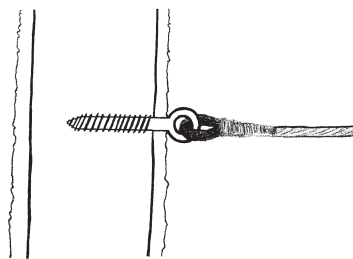


Fig. 33.5.3 Correct cable and hardware alignment.

33.5.3 Anchor(s) shall be installed in alignment with the cable and termination hardware, and not be subjected to side loading (see Fig. 33.5.3).

33.5.4 Synthetic cable systems relying on a loop anchor shall have a slide restraint.

33.5.5 Only one termination shall be attached to an anchor.

33.5.6 Lag-thread hardware shall only be installed in sound wood. The hole for the lag-thread hardware shall be 1/16" to 1/8" (1.5-3 mm) smaller than the diameter of the lag.

33.5.7 Holes for through-hardware should not be drilled greater than 1/8" (3 mm) of the diameter of the hardware being installed.

33.5.8 Lag hooks shall only be used when they can be seated to the full length of the threads. If it is not possible to seat the full length of lag

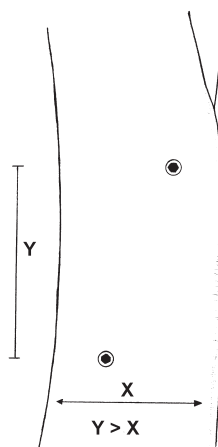


Fig. 33.5.1 Correct brace positioning.

hook threads other hardware shall be selected.

33.5.9 Lag hooks shall be installed to prevent the termination from coming loose. Bark should not be damaged beyond the scope of the work during installation.

33.5.10 Heavy-duty or heat-treated, heavy-duty round steel washers shall be installed between the nut(s) and the wood (see Fig. 38.3).

33.5.11 Washers shall not be countersunk into the wood.

33.5.12 Fasteners for threaded hardware, such as nuts, amon eyes, and turnbuckles, shall be secured to prevent loosening.

33.5.13 Excess portion of the through-hardware shall be removed.

33.5.14 Terminations shall be specified in the system design specifications.

33.5.15 Termination hardware shall be the appropriate size and type for the cable to be installed.

33.5.16 Terminations formed by eye-splice configurations shall incorporate thimbles.

33.5.17 Dead-end grip terminations shall only be used on cable that meets the specifications of ASTM A-475.

33.5.18 Dead-end grip terminations shall incorporate extra heavy-duty wire rope thimbles – Type III, that meet the performance specifications of federal standard FF-T276b.

33.5.19 All hardware within a system shall meet or exceed the minimum strength required to achieve the objective (see Annex A).

33.5.20 Installations shall follow manufacturers’ recommendations. Synthetic cable systems relying on a loop anchor shall not girdle the trunk, limb or branch.

33.6 Cabling

33.6.1 Cabling objectives

Cabling objectives shall be established prior to beginning any cabling operation.

33.6.2 Cabling types

Cabling system specifications should include one or more of the following types:

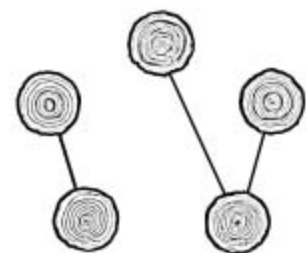


Fig. 33.6.2.1

33.6.2.1 Direct: Direct cabling consists of a single cable between two tree parts (three direct cables shown).

33.6.2.1.1 Location of hardware shall be specified.

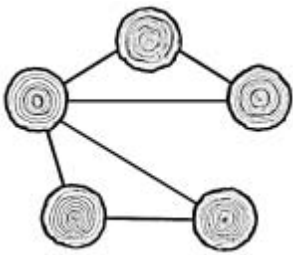


Fig. 33.6.2.2

33.6.2.2 Triangular: Consists of connecting tree parts in combination of threes. This method should be preferred, when maximum support is required (two triangular systems shown).

33.6.2.2.1 Location of hardware shall be specified.

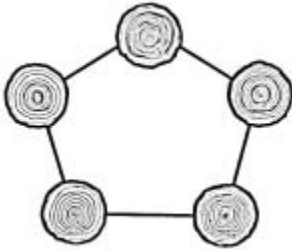


Fig. 33.6.2.3

33.6.2.3 Box: Consists of connecting four or more tree parts in a closed series. This system should be used only when minimal direct support is needed.

33.6.2.3.1 Location of hardware shall be specified.

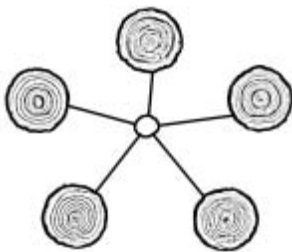


Fig. 33.6.2.4

33.6.2.4 Hub and Spoke: Consists of a center attachment (hub) with spans (spokes) of cable radiating to three or more leaders. Hub and Spoke cabling should only be used when other installation techniques cannot be installed.

33.6.2.4.1 Location of hardware shall be specified.

33.6.3 Cabling installation

33.6.3.1 Steel cables should be taut following installation.

33.6.3.2 Anchor(s) should be installed at or near a point two-thirds (2/3) of the length/height of the limb or leader to be supported, measured from the trunk or (refer to Fig. 33.6.3.2).

33.6.3.3 The correct angle of cable installation should be perpendicular to an imaginary line bisecting the angle between the tree parts being cabled (refer to Fig. 33.6.3.2).

33.6.3.4 If existing cables are to be replaced, they shall not be removed until the new system is installed.

33.7 Bracing

33.7.1 Bracing objectives

Bracing objectives shall be established prior to beginning any bracing operation.

33.7.2 Bracing types

Bracing system specifications should include one or more of the following types:

33.7.2.1 Single: Single bracing consists of one installed rod.

33.7.2.2 Parallel: Parallel bracing consists of two or more rods installed in vertical and directional alignment.

33.7.2.3 Alternating: Alternating bracing consists of two or more rods installed in directional alignment but not in vertical alignment.

33.7.2.4 Crossing: Crossing bracing consists of

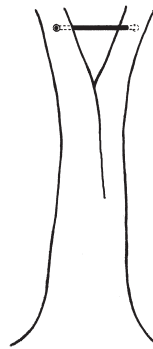


Fig. 33.7.2.1

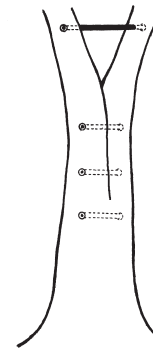


Fig. 33.7.2.2

two or more rods installed in a non-aligned pattern.

33.7.3 Bracing installation

33.7.3.1 A cabling system should be used to provide supplemental support for the limbs forming the crotch being braced.

33.7.3.2 The preferred location for a single rod for a non-split crotch, should be one to two times the branch diameter above the crotch.

33.7.3.3 Brace systems using multiple rods should have at least one rod installed above the crotch.

33.7.3.4 Bracing shall be installed in either a through-brace or dead-end brace configuration.

33.7.3.5 The minimum hardware requirements for braces should be in accordance with the following table:

33.7.3.6 Through-bracing

33.7.3.6.1 Through-braces shall be used when bracing through decayed area/wood or in trees that are poor compartmentalizers or have weak wood characteristics.

33.7.3.6.2 Through braces shall be terminated

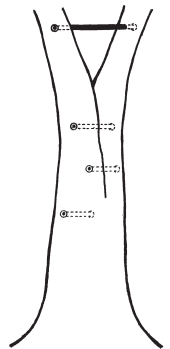


Fig. 33.7.2.3

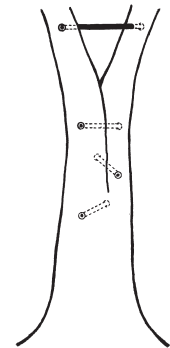


Fig. 33.7.2.4

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Wire Stop	Versus	Traditional Terminal Hardware
1.25 inches	Length	1.5 feet
2.3 oz	Weight	1 lb 11 oz
100% of strand	Strength	Limited to weakest part
No metal to metal rubbing	Wear	Thimble rubs strand & eye
1/16" over strand	Hole size	3/4 inch or more
2	Parts per end	5
2-3 min per end	Installation time	10 min or more per end
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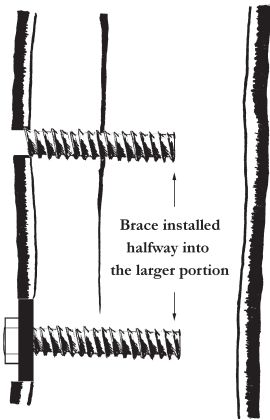


Fig. 33.7.3.7.2 Bracing a split/dead-end brace installation.

with heavy duty washers and nuts.

33.7.3.7 Dead-end bracing

33.7.3.7.1 Dead-end bracing shall be performed with lag-thread screw rod.

33.7.3.7.2 The brace shall be installed completely through the smaller or equal portion and at least halfway into the other portion (see Fig. 33.7.3.7.2).

33.7.3.7.3 The exposed end of the lag-thread screw rod shall be inside the bark or shall be

fastened with a heavy duty or heat-treated washer and a nut (see Fig. 33.7.3.7.2).

33.8 Propping

33.8.1 Propping objectives

Propping objectives shall be established prior to beginning any propping operation.

33.8.2 Propping installation

33.8.2.1 Props shall be of sufficient strength to hold the intended load.

33.8.2.2 Props shall be fastened to the branch in such a manner as to minimize damage and prevent the branch from falling off the prop.

33.8.2.3 Props shall be constructed in a manner so as not to restrict future growth of the branch.

33.8.2.4 Equipment and work practices that damage roots beyond the scope of the work shall be avoided.

33.8.2.5 Props shall be secured to the ground.

33.9 Guying established trees

33.9.1 Guying established trees, objectives

Objectives for guying established trees shall be established prior to beginning any guying operation.

33.9.2 Guying established trees, types

Specifications for guying established trees should include one or more of the following types:

33.9.2.1 Tree-to-ground: Tree-to-ground guying consists of installing at least one cable between a ground anchor and the tree to be guyed.

33.9.2.2 Tree-to-tree: Tree-to-tree guying consists of installing at least one cable between an anchor-tree and the tree to be guyed.

33.9.3 Safety

Public safety shall be considered in all aspects of guying.

33.9.4 Guying installation

33.9.4.1 Hardware shall be installed so that it is in alignment with the angle of pull from the guy.

33.9.4.2 Permanent guys shall be attached to the tree with dead-end hardware or through-hardware.

33.9.4.3 Tree-to-ground guying

33.9.4.3.1 Guys shall be secured to a ground-anchor(s) sufficient to achieve the objective.

33.9.4.3.2 Guys should be attached to the tree at or above a point not less than one-half the height of the tree.

33.9.4.3.3 Ground-anchor(s) should be placed

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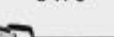
Threaded Stump Cutter



Hodges Stump Cutter



B-11-C



B-1-C



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no closer to the trunk than two-thirds the distance from the ground to the height of the lowest point of attachment in the tree.

33.9.4.4 Tree-to-tree guying

33.9.4.4.1 Anchor-tree(s) shall be inspected for structural integrity.

33.9.4.4.2 Anchor-tree(s) shall have the ability to meet the objective.

33.9.4.4.3 Anchors shall be attached in the upper half of the tree to be guyed and in the lower half of the anchor-tree(s).

33.10 Guying newly installed landscape plants

33.10.1 Guying newly installed landscape plants, objectives

Guying objectives shall be established prior to beginning any guying operation.

33.10.2 Guying installation

33.10.2.1 Guys shall be attached using a method that limits damage to the trunk and branches.

33.10.2.2 A minimum of two guys should be installed at an angle sufficient to support the landscape plant.

33.10.2.3 For trees over 10-inch diameter, guys should be installed in accordance with subclause 33.9.

Diameter at Brace (in inches)	Brace Rod Diameter (in inches)	Minimum number of rods with split or included bark	Minimum number of rods with no apparent split or included bark
<5	1/4	1	1
5-8	3/8	1	1
8-14	1/2	2	1
14-20	5/8	2	1
20-40	3/4	3 min. with one additional for each 8" in excess of 30"	2 min. with one additional for each 8" in excess of 30"
>40	7/8	4 min. with one additional for each 8" in excess of 40"	3 min. with one additional for each 12" in excess of 40"

Table 1: Minimum hardware requirements for bracing trees.

33.10.2.4 Guys shall be secured to a ground anchor(s) sufficient to achieve the objective.

33.10.2.5 Guys should be taut following installation.

33.10.2.6 Guys or other supplemental support systems shall be maintained and be removed when they are no longer needed as part of post planting care practices (see ANSI A300 Part 6 Transplanting, subclause 63.9).

34 Supplemental support system inspection

and maintenance

34.1 Systems should be inspected periodically for wear, corrosion, degradation of hardware and damage to the tree.


34.2 If problems are detected they should be corrected or the system should be repaired, replaced or modified.

Annexes not included here. For the complete revision, visit http://www.treecareindustry.org/Public/gov_standards_review.htm.



Work Snake Safe!

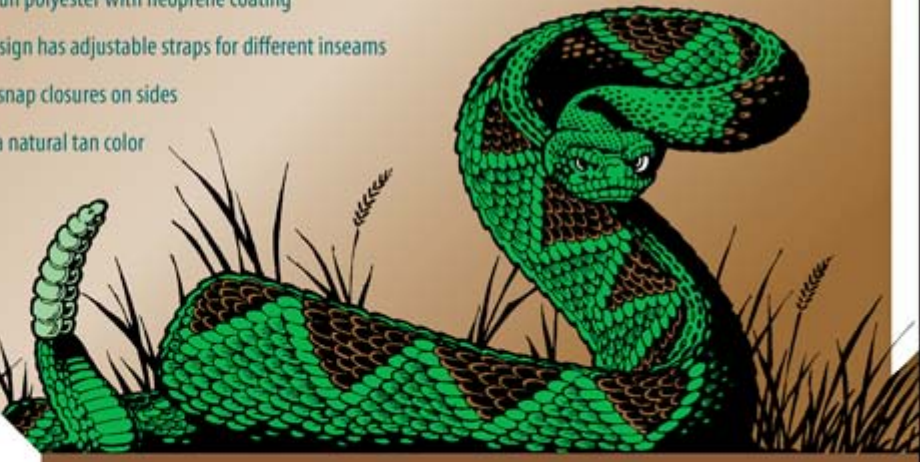
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