American National Standard

for Outdoor Power Equipment –
Grass Trimmers and Brushcutters –
Safety Requirements

ANSI B175.3-2003

Approved American National Standard

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B175.3-2003
Revision of
ANSI B175.3-1997

American National Standard
for Outdoor Power Equipment –

Grass Trimmers and Brushcutters – Safety Requirements

Secretariat

Outdoor Power Equipment Institute

Approved July 9, 2003

American National Standards Institute, Inc.

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Foreword (This foreword is not part of American National Standard ANSI B175.3-2003.)

This standard is the first revision of *American National Standard Grass Trimmers and Brushcutters*, ANSI B175.3-1997. The first edition of this standard was developed under the auspice of the Portable Power Equipment Manufacturers Association (PPEMA) and published in 1997.

In 2002, PPMEA discontinued operations and the Outdoor Power Equipment Institute (OPEI) became the secretariat for this standard since some OPEI member companies manufacture grass trimmers and brushcutters. The present revision of this standard was prepared by the ANSI B175.3 Committee on Trimmers and Brushcutters as part of OPEI's continuing work on standards.

A summary of the principal changes included in this revision is as follows:

- "Convertible unit" in the Scope was clarified.

- The definition for Operator/Cutting Position was modified to account for the possibility of the operator being on the opposite side of the machine depicted in Figure 1.

- Section 6.1, Engine Stopping Device, was modified to include requirements for both blade capable and non-blade capable units.

- Section 7.1, Cutting Attachment Retention, was updated.

- A new section, Section 8, Product Integrity, was added.

- Section 10.3, Vibration Test Conditions, was changed to require the manufacture to test the unit with the cutting attachment that the manufacturer determines will create the highest vibration level.

- Section 13.1.2 (distance between the two handles) was modified and now includes a requirement for on-product labeling if the distance is adjustable to less than ten (10) inches.

- Section 13.2, Barrier(s) and Restrictive Harness(es), was modified to state "a barrier between the operator and cutting attachment…", whereas in the prior version the barrier location was implied.

- Figures 1 and 2 were updated.

Consensus for this standard was achieved by use of the Canvass Method.

There are two annexes in this standard. Annexes A and B are informative and are not considered part of this standard.

Suggestions for improvements to this standard are welcome. They should be sent to the Outdoor Power Equipment Institute, 341 South Patrick Street, Alexandria, VA 22314.

The following organizations recognized as having an interest in the standardization of safety requirements for trimmers and brushcutters were contacted prior to the approval of this revised standard. Inclusion in the list does not necessarily imply that the organization concurred with the submittal of the proposal to ANSI.

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American National Standard
for Outdoor Power Equipment –

Grass Trimmers and Brushcutters – Safety Requirements

1. Scope and Purpose

1.1 Scope

The requirements of this Standard[1] apply to:

a) portable hand-supported gasoline powered grass trimmers[2] intended for use with flexible nonmetallic line, or other types of nonmetallic cutting attachments, and

b) portable, hand-supported, gasoline-powered brushcutters intended for use with cutting blades and other cutting attachments.

NOTE - If a grass trimmer is marketed by the manufacturer as convertible to a brushcutter, then the converted unit shall comply with requirements for brushcutters and vice-versa.

A convertible unit may be marketed as a grass trimmer or a brushcutter without including the devices required for conversion in the packaging, provided the operator manual clearly addresses the need to acquire and use the required conversion devices and the manufacturer makes such devices available as optional equipment.

1.2 Purpose

The purpose of this standard is to establish minimum manufacturer requirements to reduce the risk of injury associated with the use of portable, hand-supported, gasoline-powered grass trimmers and brushcutters.

2 Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this American National Standard. 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 below.

[1)] Metric conversions are shown in brackets and are included for information only.

[2)] Trimmers and Brushcutters with back mounted power units are not covered by this standard.

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ANSI Z87.1-2003, *Practice for Occupational and Educational Eye and Face Protection*
ANSI/ASTM E29-1993 (R1999), *Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications*
IEC 184, *Methods for Specifying the Characteristics of Electro-Mechanical Transducers for Shock and Vibration Management*
IEC 222, *Methods of Specifying the Characteristics of Auxiliary Equipment of Shock and Vibration Measurements*
IEC 61672-1:2002, *Electroacoustics – Sound Level Meters – Part 1: Specifications*
IEC 61672-2:2003, *Electroacoustics – Sound Level Meters – Part 2: Pattern Evaluation Tests*
SAE J335-JUN95, *Multiposition Small Engine Exhaust System Fire Ignition Suppression*

3 Definitions.

3.1 Barrier: A device intended to restrain the operator from moving toward the cutting attachment and vice-versa, and intended to prevent inadvertent operator contact with the cutting attachment. (See Figures 1 and 5.)

3.2 Blade-Capable Units: All brushcutters, and any trimmer that its manufacturer markets as convertible to a brushcutter.

3.3 Blade Retainer: A mechanism that holds the brushcutter blade to the driving member.

3.4 Blade Thrust: The sudden sideways, forward or backward motion of the unit, which may occur when the blade jams or catches on an object such as a sapling or tree stump.

3.5 Brushcutter: Unit using a rotating blade made of metal or plastic intended to cut weed, brush, small trees and similar vegetation. (See Figure 2(a).)

3.6 Choke: A control that is used to enrich the carburetor fuel/air mixture.

3.7 Clutch: A mechanism for connecting and disconnecting a driven member to and from a rotating source of power.

3.8 Cutting Attachment: Any rotating device(s) used to cut vegetation.

3.9 Cutting Attachment Shield: A structure covering a portion of the cutting attachment arc.

3.10 Cutting Blade: A rotating device made of rigid material with cutting edges.

3.11 Drive Shaft: A shaft used to transmit power from the engine to the cutting attachment.

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3.12 Family: A series of units that are identical except for the engine mass and displacement.

3.13 Grass Trimmer: A unit using flexible nonmetallic line(s), string(s), or similar nonmetallic cutting means, such as pivoting blades, intended to cut vegetation. (See Figure 2(b).)

3.14 Hand Supported: A unit that during operation is supported and controlled by the user. A harness may aid in providing support.

3.15 Handle(s): A structure that enables the operator to hold and control the unit during operation.

3.16 Harness: Adjustable strap(s) by which the unit is suspended from the operator, which may or may not include a waist belt.

a) Single Harness: The weight of the unit is distributed through one strap to the operator.

b) Double Harness: Two straps that distribute the load of the unit over both shoulders of the operator.

3.17 May: Indicates a permissive condition.

3.18 Muffler: Device for reducing engine exhaust noise and directing the flow of the exhaust gases.

3.19 Operating/Cutting Position: (See Figure 1.)

NOTE – This standard does not specify the operating/cutting position. The dimensions provided are based on the operator position shown in Figure 1. Should the operating position be on the opposite side as shown in Figure 1, the dimensions referred to would be reversed.

3.20 On/Off Stop Control: A control that allows the engine to run or stop.

3.21 Output Shaft: The shaft to which the cutting attachment is connected.

3.22 Output Shaft Maximum Speed: The speed of the output shaft when the engine is operating at 133% of maximum power speed or at wide open throttle speed, whichever is less. The term "maximum speed" and the ISO (International Standards Organization) term "racing speed" are equivalent.

3.23 Power Head: Power source for the unit.

3.24 Quick Release Mechanism: A device enabling the operator to free him/herself from the unit with a single action in case of emergency.

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3.25 Restrictive Harness: A harness including a waist belt or other protective device designed for the purpose of supporting part of the total unit weight and restricting movement of the harnessed unit toward or away from the operator to the extent allowed by other devices such as barriers. (See Figure 1.)

3.26 Shaft Housing: A structure that encloses and supports the drive shaft and that connects the engine to the cutting attachment.

3.27 Shall: Indicates a mandatory requirement.

3.28 Spark Arrester: A device through which exhaust gases pass to limit the size of glowing particle emissions.

3.29 Speed Limiter: A device that limits the maximum speed of the engine.

3.30 Starter: A mechanism that rotates the engine crankshaft.

3.31 Support Fitting: Element of the unit to which the harness is attached.

3.32 Throttle: A device that adjusts the volume of fuel and air mixture delivered to the combustion chamber of an internal combustion engine.

3.33 Throttle Control: A device activated by the operator to regulate the throttle.

3.34 Throttle Control Latch: A device to temporarily set the throttle in a partially open position to aid in starting the engine.

3.35 Throttle Linkage: A mechanism that transmits motion from the throttle control to the throttle.

3.36 Unit: A complete grass trimmer and/or brushcutter.

3.37 Vegetation: Grass, weeds, brush, saplings or the like.

4 Cutting Attachment Shield

NOTE - The purposes of a shield are to: [1] provide a means for including a cutting off device for controlling flexible line length; [2] indicate to the operator the plane of operation of the cutting attachment; [3] provide the operator with a visual means of determining the cutting edge; [4] reduce the likelihood of operator contact with the cutting attachment; [5] reduce the amount of cutting debris thrown back toward the operator and; [6] elevate the cutting device off the ground during starting. These statements assume that the product is used as intended by the manufacturer. These purposes must be accomplished while maintaining the utility of the product or without increasing the likelihood of removal or modification of the shield.

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4.1 Requirements

4.1.1 All units shall be designed to accept a cutting attachment shield. This shield shall be made available to the consumer at the time of purchase.

4.1.2 When installed in accordance with manufacturer's recommendations, a shield shall remain in the originally installed position when evaluated in accordance with 4.2.

4.1.3 A shield and its mounting shall not crack or break when evaluated in accordance with 4.2.

4.1.4 A brushcutter shield shall meet the dimensional requirements of Figure 3 before and after being evaluated in accordance with 4.2.

4.1.5 A grass trimmer shield shall meet the dimensional requirements of Figure 4 before and after being evaluated in accordance with 4.2.

4.2 Cutting Attachment Shield Test Procedure

4.2.1 Cutting Attachment Shield Integrity Test

a) The shield shall be impacted with a 5.5 lb (2.5 kg) pendulum from a height of 40 in (1000 mm). (See Figure 14.)
b) The unit shall be mounted on a swivel bracket as close to the power head as possible. (See Figure 14.)
c) The pendulum arm mass shall be as light as possible.
d) For metallic shields and/or mounting, tests shall be conducted at temperatures 68 ± 10 degrees F (20 ± 5.6 degrees C).

   For nonmetallic shields and/or mounting, tests shall be conducted at temperatures 104 ± 4 degrees F (40 ± 2 degrees C) and, the shields shall be tested after the unit has been conditioned at a temperature of -13 ± 5 degrees F (-25 ± 3 degrees C) for four hours. This conditioning at -13 ± 5 degrees F (-25 ± 3 degrees C) shall not apply to grass trimmers.

e) Five impact tests shall be conducted at the rear edge and five impacts at the side edge of the same shield at each temperature.

5 Clutches

5.1 Power Disengagement

All blade capable units shall have a clutch that disengages power to the cutting attachment when the engine speed is reduced to the manufacturer's recommended idling speed.

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6 Engine Stopping Device

6.1 Applicability and Location

All units shall be equipped with an engine stopping device that brings the engine to a complete stop. For blade-capable units only, the control for this device shall be so positioned that it can be operated while the machine is being held with both hands, and its operation shall not depend on sustained manual effort. The engine-stopping device for non-blade-capable units may allow sustained manual effort.

6.2 Identification

The purpose and method of operation of the device shall be clearly and durably marked. The color of the control shall contrast to the background.

7 Cutting Attachment

7.1 Retention

When acted upon by the driving torque of the unit, the fastener system for flexible nonmetallic cutting attachments shall be tightened by the driving torque. For all other cutting attachments, retention shall include a fastener system providing tension and a second retention method not acted upon by rotational forces.

7.2 Integrity

All cutting attachments and related fasteners shall not break, crack, fracture, split or separate because of rotational acceleration/deceleration, vibration or impact when fastened in accordance with manufacturer's instructions and when tested in accordance with the Impact Test outlined in 7.2.1 followed by the Spin Test outlined in 7.2.2 using the same cutting attachment.

NOTE 1 - Damage or normal abrasion to flexible nonmetallic line or to any line advancement mechanism that does not separate from the unit as a result of these tests is acceptable.

NOTE 2 - Abrasion similar to normal wear on nonmetallic cutting elements is acceptable.

NOTE 3 - Damage to tooth/teeth at the point of contact may be expected and is not a cause for a test failure.

7.2.1 Impact Test

The cutting attachment shall be mounted to a test unit in accordance with manufacturer's instructions and impacted once pursuant to the methods described in 7.2.1.1 - 7.2.1.4. Cutting attachments that can be mounted on more than one equipment model need only be tested on the unit with greatest mass and on the unit with the highest shaft rotational speed. The equipment unit with the greatest mass and the unit with the highest shaft

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rotational speed may be the same, in which case the impact test on a multi-unit cutting attachment need only be conducted once.

7.2.1.1 The unit shall be suspended freely in an operating position. (See Figure 6.)

7.2.1.2 A vertical positioned fixed mild cold rolled steel rod, for example SAE 1010-1040, 0.95-1.05 in (24-27 mm) in diameter shall be horizontally impacted by the cutting attachment at a minimum approach speed of 40 in/s (1.0 m/s). (See Figure 6.)

7.2.1.3 The test is to be conducted at output shaft maximum speed.

NOTE 1 - For flexible nonmetallic line cutting attachments, line lengths shall not exceed that set by the unit(s) for which the attachment is intended.

NOTE 2 - For flexible nonmetallic line cutting attachments, any supply reels shall be full.

7.2.1.4 The engine shall be switched off after the impact.

7.2.2 Spin Test

After the Impact Test, the cutting attachments shall be spun for 5 minutes at 1.33 times the maximum output shaft speed of all units that the attachment is approved for by the manufacturer.

7.2.2.1 The attachment assembly shall be fastened to the test apparatus in the same manner as it would be on the unit.

7.2.2.2 The attachment assembly shall be tested in the condition remaining after the Impact Test procedure of 7.2.1.

NOTE 1 - Single-piece solid steel blades are exempt from the spin test.

NOTE 2 - Cutting lines on flexible nonmetallic line cutting attachment can be renewed to original length for the Spin Test.

8 Product Integrity

8.1 The shaft, engine, and related fasteners shall not break, crack, fracture, split, or separate because of rotational acceleration/deceleration, vibration, or impact when fastened in accordance with manufacturer's instructions and when impact tested in accordance with the methods described in 7.2.1.1 - 7.2.1.4.

8.2 Each equipment model shall be tested with both the lightest and the heaviest cutting attachments that the manufacturer makes available for that unit. The cutting attachments shall be fastened in accordance with the manufacturer's instructions prior to testing.

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8.3 Equipment units subjected to impact testing for purposes of determining conformity to the cutting attachment integrity provisions of 7.2 may be examined further, without conducting duplicative tests, for purposes of evaluating conformity to the product integrity provisions of Section 8.

9. Sound Levels

9.1 Scope

This section establishes the sound level labeling requirements and test procedures for the products identified in 1.1. The procedure covers operator (required) and 50-ft. bystander (optional) position(s).

9.2 Sound Level Labeling

9.2.1 If the noise level measured at the operator's ear exceeds 90 dB(A), the unit shall be labeled with a requirement for operator hearing protection.

9.2.2 The unit may be clearly and durably marked with the bystander sound level of the unit as determined by 9.8.1(b). If so, the bystander sound level shall be identified as decibels [dB(A)] using simple block characters at least 0.25 in (6 mm) high. The wording "per ANSI B175.3" in 0.08 in (2 mm) minimum height letters shall accompany the numerical noise level.

9.3 Test Values

The values to be measured shall be A-weighted sound pressure levels, in decibels, determined with the frequency weighting "A" and slow response as defined in IEC 61672-1 and 61672-2.

9.4 Test Site

9.4.1 Measurement of Noise in Free Field

a) The test area shall be a flat, open space with natural ground cover not exceeding 3 in (8 cm) in height, and free of any large reflecting surfaces such as signboards or buildings for a minimum distance of 100 ft (30 m) from the unit and microphone.
b) The ambient sound level at the point of measurement (including wind effects) coming from sources other than the unit being tested shall be at least 10 dB(A) lower than the sound level of the unit.
c) Measurements shall be made only when wind gusts are below 12 miles per hour (5.4 m/s).

9.4.2 Measurement of Sound in Sound Room (Alternate Method)

a) An anechoic or semi-anechoic chamber may be used for conducting a sound level test provided the test results do not vary more than ±1 dB(A) from the free field

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test results. If the variation exceeds ±1 dB(A), the correction between the sound room measurement and free field sound measurement shall be applied to the result obtained from the sound room.

b) Sound levels for distances exceeding the dimensions of the chamber, may be calculated from measurements taken in the chamber, provided that sufficient data is available to substantiate such calculations. Artificial grass (e.g., "Astro-Turf") is acceptable as floor covering in the chamber.

9.5 Unit Conditions

9.5.1 Test Conditions

a) The unit shall be evaluated with the cutting attachment the manufacturer determines will yield the highest result.
b) The engine shall be tested warm with the carburetor adjusted in accordance with the manufacturer's recommendations.

9.5.2 Handle Adjustment

9.5.2.1 Unit With Harness

a) Adjust the harness to the size of the operator, and the handles to the required operating position.
b) Position the unit in accordance with Figure 7.

9.5.2.2 Unit Without Harness

a) Adjust the handles and hold the unit in the required operating position.
b) Position the unit in accordance with Figure 8.

9.6 Instrumentation

9.6.1 Calibration

a) Before and after each series of measurements an acoustical calibrator with an accuracy of at least $\pm$0.5 dB(A) shall be applied to the microphone to check the calibration of the entire measuring system at one or more frequencies in the range from 200 to 1000 Hz.
b) The calibrator shall be checked at least once every year to verify that its output is within specifications.
c) In addition, an acoustical and electrical calibration of the instrumentation system over the entire frequency range of interest shall have been conducted within two years of its use.
d) The measuring equipment shall be allowed to reach a steady state (stabilized) temperature before it is calibrated.

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9.6.2 Engine Speed Indicator

a) An engine speed indicator shall be used to check the speed of the engine.
b) It shall have an accuracy of ±3% of measured value.

9.7 Microphone Position (Operator's Ear)

9.7.1 Microphone Position

a) The microphone centerline shall be located 8 in ± 0.8 in (200 mm ± 20 mm) to the side of the center plane of the operator's head, straight out from the ear nearest to the engine. (See Figure 9.)
b) The microphone shall be aimed vertically towards the ground.
c) The operator may attach the microphone to a helmet.

9.7.2 Other Influences

Not more than one person, other than the observer reading the meter and the operator, shall be within 50 ft (15 m) of the unit or microphone, and that person shall be directly behind the observer reading the meter, in line with the microphone and the observer.

9.8 Test Procedure.

9.8.1 General.

a) *Operator's Ear*. Four measurements shall be taken at the operator's ear. The variation of four values shall not be greater than three dB(A). If this variation is exceeded, the test shall be repeated until four consecutive tests fall within a variation of three dB(A). The results and their arithmetic average are to be recorded.
b) *Bystander Position*

    1) Measurements shall be taken at every 45 degrees (a total of 8 different positions) with the microphone 50 ft (15 m) from the operator and 4 ft (1.2 m) above ground. (See Figure 10.) The microphone shall be positioned with its axis of highest sensitivity generally parallel to the ground and pointed toward the trimmer/brushcutter operator. Five readings should be taken at each position at least 5 seconds apart. Each reading shall be an average of 2 seconds duration, minimum. The arithmetic average of the five readings is to be used in the calculation of the reported sound level. If the test data at each position vary more than 3 dB(A), the test shall be repeated until five sequential readings are within 3 dB(A) at each measuring position. If an analog sound level meter is used, the average of the highest and the lowest indicated readings shall be used.
    2) The individual reading the meter shall be at least 8 ft (2.4 m) behind the microphone. Not more than one person other than the individual reading the meter and the operator shall be within 58 ft (17.7 m) of the trimmer/

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brushcutter, and that person shall be directly behind the individual reading the meter, in line with the microphone and the individual reading the meter. All other observers should be no closer that 100 ft (30.5 m) to the trimmer/ brushcutter or microphone.

3) The operator and trimmer/brushcutter shall rotate 360 degrees with respect to the microphone in a fixed position.
4) The reported sound level shall be the arithmetic average of the eight averaged readings taken as provided in Step (1) and rounded to the nearest whole decibel (ANSI/ASTM E29).

c) Measurements of sound pressure levels shall be carried out under operating conditions as described in 9.8.2.
d) The engine speed during the measurements shall be kept within ±200 rpm.

9.8.2 Operating Conditions

9.8.2.1 Units with Flexible Line Attachments

The test shall be conducted without cutting and with a maximum line length in accordance with the manufacturer's recommendation. The engine speed shall be at wide-open throttle.

9.8.2.2 Units with Other Cutting Attachments

The test shall be conducted without cutting. The test shall be conducted at output shaft maximum speed.

9.9 Information to Be Recorded

9.9.1 Unit under Test

a) Description of the unit (including engine displacement, manufacturer, type and serial number, and primary cutting attachment).
b) Other attachments.

9.9.2 Test Environment

a) Describe the test environment.
b) If outdoors, sketch the location of the engine with respect to surrounding terrain, including a physical description of the test environment (the nature of the ground plane shall be described).
c) If indoors, provide a correlation figure between indoor and outdoor measurement.

9.9.3 Instrumentation

a) Equipment used for the measurements, including name, type, serial number and manufacturer.
b) Method used to calibrate the instrumentation system.

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c) Date and place of the most recent calibration of the acoustical calibrator.

9.9.4 Test Data

a) The location of the microphone position (a sketch or photograph may be included, if necessary.)
b) The sound pressure levels of the background noise.
c) Engine speed, measurement values and arithmetic averages. (See Table 1.)
d) Air temperature, wind speed, and barometric pressure.
e) The date and place of the measurements.

Table 1 – Recording Sound Measurement Data

Measuring Position	Individual test reading at each position [dB(A)]					Arithmetic Average [dB(A)] of readings
	1	2	3	4	5	
0°						
45°						
90°						
135°						
180°						
225°						
270°						
315°						
Reported Average of the measuring positions:						

10. Vibration

10.1 Scope

This section establishes the requirements and test procedure for determining vibration levels.

10.2 Requirements

Handle vibration of all units except those intended for occasional use shall meet the following requirement: When tested in accordance with this section, the unit shall be constructed so that the Weighted Acceleration Sum (WAS) from three orthogonal axes for each handle shall not exceed 15 m/s^2.

10.3 Test Conditions

The unit shall be evaluated with the cutting attachment the manufacturer determines will yield the highest vibration level.

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10.3.1 The engine shall be tested warm with the carburetor adjusted in accordance with the manufacturer's recommendations.

10.4 Test Procedure

10.4.1 Instrumentation

10.4.1.1 General

a) Trained personnel shall select the instrumentation and the tests shall be conducted by qualified persons trained in the current technique of vibration measurement and unit operation.
b) Since proper use of all test instrumentation is essential to obtain valid measurements, operating manuals and other literature furnished by the instrument manufacturer shall be consulted for recommended operation of the instruments and of precautions to be observed.

10.4.1.2 Calibration

All vibration-measuring equipment shall be calibrated. Calibration shall be made immediately before and after each test sequence.

10.4.1.3 Frequency Response

The instrumentation for the measurement shall have a uniform frequency response (±2 dB) in terms of acceleration over the whole frequency range of 8 to 1500 Hz. At the reference frequency, 31.5 Hz, the tolerance range shall be ±1 dB. The readings shall be taken using the "slow" response in accordance with IEC 61672-1 and 61672-2.

10.4.1.4 Handle Covering

When a resilient handle covering lies between the handle and vibrating member, the readings of the solid handle system shall be recorded. Measurements over the handle covering may be made if it can be demonstrated that readings comparable to the solid handle readings are obtained.

10.4.2 Hardware

The test instrumentation used shall meet the requirements described in 10.4.2.1 through 10.4.2.4.

10.4.2.1 Accelerometer(s)

a) For each test location, accelerometer(s) weight shall not exceed 25 g including mounting hardware but excluding the cables.

b) Each accelerometer shall meet requirements outlined in IEC 184.

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NOTE - An equivalent requirement is outlined in ANSI S2.11.

c) The cross-axis sensitivity shall be no more than 10 percent of the sensitivity in the axis to be measured.
d) Also, care must be taken when mounting the accelerometer(s) that the transfer function is flat up to 1500 Hz for all three directions.

10.4.2.2. Amplifier

a) The amplifying device and amplitude or level indicator employed shall meet the requirements outlined in IEC 222.

10.4.2.3 Measurement

a) As an alternative to making direct measurements, a magnetic tape recorder, a graphic level recorder, or an indicating meter may be used.
b) An alternate measurement technique can be to use a sampling network to record the continuous measurements as a discrete time series, with appropriate anti-alias filtering.
c) Processing of measurements should be conducted using signal analysis, provided that it meets the requirements outlined in IEC 222 and the SAE J184.

10.4.2.4 Tachometer

A tachometer shall be used to measure the engine speed, in revolutions per minute, accurate to within ±3 percent of the measured value.

10.4.2.5 Filter

a) A frequency filter used to weigh the overall vibration level in each axis is defined in Figure 11.
b) Table 2 gives the attenuation factors for 1/3 octave band center frequencies.
c) Other frequency spectral techniques, filter weighting frequencies that comply with Table 2 guidelines are acceptable.

10.4.3 Accelerometer Location and Mounting

a) The accelerometer(s) shall be rigidly mounted such that the center of gravity of the accelerometer(s) is less than 0.8 in (20 mm) from the outside of the handle grips, and shall be located so as to permit a normal hand position.
b) The accelerometer(s) shall be located as close to the hand as is practical without contacting it.
c) Care shall be taken that the size, shape and mounting of the accelerometer or the accelerometer support do not significantly influence the transfer of vibration to the hand.
d) Preferred location of accelerometer transducers is shown in Figure 12.

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e) The vibration level shall be measured and reported in the directions of the orthogonal coordinate system as shown in Figure 12. Where this procedure cannot be followed, the positions of the accelerometer(s) relative to the hand coordinates shall be reported.

10.5 Unit Operation

a) The unit shall be adjusted for best operation in accordance with the manufacturer's recommendations.
b) For units with flexible line attachments, the engine speed shall be wide-open throttle without cutting and with maximum filament length in accordance with manufacturer's recommendation.
c) For units with other cutting attachments, the engine speed shall be output shaft maximum speed without cutting.
d) Brushcutters shall be equipped with a new cutting attachment.
e) The fuel tank should be between 1/4 and 3/4 full.
f) The unit shall be operated with a normal grip in an upright position in accordance with the manufacturer's recommendations.
g) The test shall be repeated five times.

10.6 Measurements

10.6.1 Measured Quantity

a) The acceleration in the three orthogonal directions shall be measured and processed to form an overall vibration value for each handle, the Weighted Acceleration Sum (WAS).
b) Schematically, the WAS is shown in Figure 13. Mathematically, WAS is the sum of the Root-Mean-Squares (RMS) of the weighted signals from each axis.
c) The WAS can be calculated from frequency spectra of 1/3 octave or 1/1 octave with the weighting factors for the center-frequencies calculated from ISO 5349-1 and 5349-2.
d) Alternatively, the WAS can be calculated from higher resolution FFT Systems where weighting complies with the same standard.
e) The three different acceleration directions may be measured at different times and the engine speed shall be within ±200 rpm.

10.6.2 Results

The results reported shall be the arithmetic average obtained from a minimum of five tests.

10.6.3 Test Data to Be Recorded

a) Geographical location.
b) Date, time, and barometric pressure.
c) Test equipment.

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d) Names of unit operators, technicians, meter readers, and observers.
e) Make, model, and serial number of the unit being tested.
f) Cutting attachments (dimensions).
g) All vibration levels.
h) Engine speeds (RPM) at which readings were taken.
i) Sketch or photograph the location and attachment means of the accelerometers.

Table 2 - Attenuation Factors for 1/3 Octave Band Center Frequencies

Central Frequency 1/3 Octave	**Linear Gain**	**Gain** (dB)
Less than 8 Hz	0	-
8	1	0
10	1	0
12.5	1	0
16	1	0
20	0.8	-2
25	0.63	-4
31.5	0.5	-6
40	0.4	-8
50	0.315	-10
63	0.25	-12
80	0.2	-14
100	0.156	-16
125	0.125	-18
160	0.1	-20
200	0.078	-22
250	0.0625	-24
315	0.05	-26
400	0.039	-28
500	0.03125	-30
630	0.025	-32
800	0.02	-34
1000	0.0156	-36
Greater than 1000 Hz	0	-

11. Hot Surfaces

Hot surfaces such as a muffler shall be guarded or located so that the operator will not inadvertently contact them when starting or operating the unit in accordance with the manufacturer's recommendations.

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12. Exhaust Gases

Exhaust gases shall not be directed toward the operator when the unit is used in accordance with the manufacturer's recommendations.

12.1 Spark-Arresting Mufflers

All trimmers and brushcutters shall be equipped with spark-arresting mufflers meeting the specifications and performance requirements given in SAE J335-JUN95.

13. Handle(s), Barrier(s), and Harness(es).

13.1 Handle(s)

13.1.1 Two handles shall be provided to enable the operator to maintain control of the unit. A shaft grip may be considered a handle. Handles shall have an unobstructed grip length of at least 4 in (100 mm).

13.1.2 The distance between the center of the grip areas on the two handles shall be a minimum of 10 in (250 mm). If this distance is adjustable to less than 10 in (250 mm), the minimum distance shall be indicated on the product.

13.2 Barrier(s) and Restrictive Harness(es)

13.2.1 A brushcutter shall be equipped with a barrier or restrictive harness.

13.2.2 A barrier between the operator and the cutting attachment in the recommended operating position shall project at least 8 in (200 mm) perpendicular from the center of the shaft in a horizontal plane. A handle may be used as a barrier. The barrier shall be positioned as close as practical to the operator. (See Figure 5.)

13.3 Harness(es)

13.3.1 A brushcutter shall be equipped with a harness.

13.3.2 A double shoulder harness shall be provided for all units exceeding a dry weight of 16.5 lb (7.5 kg). The double shoulder harness shall be designed such that the pressure is evenly distributed on both shoulders of the operator. The design of the double shoulder harness shall prevent slipping in any direction.

All double shoulder harnesses and restrictive harnesses shall be equipped with a mechanism for quick release either for the connection between unit and harness or between harness and operator. Either the design of the harness or the use of the quick release mechanism shall assure that the unit can be released quickly from the operator in the event of emergency.

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13.4 Distance to Cutting Attachment

13.4.1 The requirements in 13.4.2 and 13.4.3 shall be verified with the fuel tank half filled.

13.4.2 For brushcutters, the suspension point shall be so adjustable that the machine is freely balanced with the nearest point of the blade 8 in (200 mm) ± 4 in (100 mm) from the ground.

13.4.3 For brushcutters and grass trimmers designed to be partially supported by the ground, the suspension point shall be adjustable so that the ground contact force is not greater than 4.5 lb (20 N).

13.4.4 The horizontal distance from the suspension point to the nearest unguarded point of the cutting attachment, with the unit balanced in accordance with 12.4, shall be at minimum 30 in (750 mm) for units with metallic cutting attachment. (See Figure 15.)

14. Throttle Control

14.1 Applicability

All units shall be equipped with a throttle control that will return the engine to idle after the throttle control is released.

14.2 Self-Releasing

If a throttle control latch is provided, it shall be self-releasing when the throttle control trigger is depressed. In starting mode, the cutting attachment may be powered. The throttle control latch shall be constructed such that two or more independent motions are required to engage the latch.

15. Fuel Tanks and Oil Tanks

15.1 Tank Filler Location and Identification

The fuel tank filler opening and the oil tank filler opening, if provided, shall be located so that they will not be unduly obstructed by the trimmer/brushcutter components. Each cap or opening shall be clearly and durably identified. If only the caps are identified, they shall not be interchangeable.

15.2 Tank Filler Openings

The minimum diameter of the fuel tank filler hole shall be 0.80 in (20 mm). The minimum diameter of the oil tank filler hole, if provided, shall be 0.60 in (15 mm).

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16. Labeling Requirements

16.1 Applicability

All units shall be clearly and durably marked with a label that contains the following wording or other suitable wording. Symbols may be used to provide the information requirements in this section, and shall be explained in the operator's manual(s).

NOTE – ANSI/UL 969, supplemented by a gasoline exposure test, may be used for satisfying the durability requirement.

16.2 **WARNING!** Read the Operator's Manual(s) and follow all warnings and safety instructions. Failure to do so can result in serious injury to the operator and/or bystanders.

16.3 If the unit is not intended to be used with a rigid blade, warn the operator against such use.

16.4 If the unit is intended to be used with a metal blade, warn the operator about "blade thrust."

16.5 Warn the operator of thrown objects such as ricochet.

16.6 Warn the operator to keep bystanders at least 50 ft (15 m) away.

16.7 Warn the operator to wear eye protection that complies with ANSI Z87.1.

16.8 Warn the operator to wear hearing protection as set forth in 9.2.1.

16.9 Show bystander noise level (optional) as specified in 9.2.2.

17. Operator's Manual(s) Instructions

Operating, safety, and maintenance instructions shall be provided with every unit.

17.1 General Information

This manual(s) shall provide sufficient information to enable the operator to assemble and maintain the unit throughout the life of the product.

NOTE - A unit intended for occasional use shall be so identified in the manufacturer's operator's manual(s).

17.1.1 The manual(s) shall explain the consequences of improper maintenance, use of nonconforming replacement components, and the modification or removal of components.

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17.1.2 The operator's manual(s) shall indicate the tasks for which the unit may be used. It shall recommend cutting attachment(s) for the unit. The manual(s) shall also recommend proper cutting techniques, and the materials that can be cut with the unit. If the unit can be used with a blade, the manual(s) shall warn of the hazards of blade thrust and recommended unit configuration for blade use.

17.2 General Instructions

The operator's manual(s) shall provide the warnings and safety instructions listed below, verbatim or suitably paraphrased. These shall be of a form readable and legible and with a letter size of not less than 0.08 in (2.0 mm).

17.2.1 Operator's Manual(s) Content. The information set forth in Section 16 shall also appear in the operator's manual(s).

17.2.2 Physical Condition of Operator. Do not operate this unit when tired, ill or under the influence of alcohol, drugs, or medication.

17.2.3 Clothing Recommendation. Always wear heavy, long pants, boots, gloves**,** and a long-sleeve shirt. Do not wear loose clothing, jewelry, short pants, sandals, or go barefoot. Secure hair so it is above shoulder level.

17.2.4 Condition of Unit before Use. Inspect unit before each use. Replace damaged parts. Check for fuel leaks. Make sure all fasteners are in place and secure. Replace cutting attachment parts that are cracked, chipped, or damaged in any way. Make sure the cutting attachment is properly installed and securely fastened. Be sure the cutting attachment shield is properly attached and in the position recommended by the manufacturer. Use only flexible, nonmetallic line recommended by the manufacturer. Never use, for example, wire or wire-rope, which can break off and become a dangerous projectile.

17.2.5 Proper Stance. The manual(s) shall explain the proper positioning for hands, feet, and the unit during use. It shall explain the proper use of handlebar(s) and harness. Keep firm footing and balance. Do not over-reach. Keep cutting attachment below waist level. Keep all parts of your body away from the rotating cutting attachment and hot surfaces.

17.2.6 Exhaust Gases. Never start or run the unit inside a closed room or building; breathing exhaust fumes can kill.

17.2.7 Fueling. Mix and pour fuel outdoors where there are no sparks and flames. Slowly remove the fuel cap only after stopping the engine. Do not smoke while fueling or mixing fuel. Wipe spilled fuel from the unit. Move at least 10 ft (3 m) away from the fueling source and site before starting engine.

17.2.8 Work Area. Clear the area to be cut before each use. Remove all objects such as rocks, broken glass, nails, wire, or string, which can be thrown or become entangled in

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the cutting attachment. Clear the area of children, bystanders and pets. At a minimum, keep all children, bystanders and pets outside a 50 ft (15 m) radius; outside the 50 ft zone, there is still a risk of injury from thrown objects. Bystanders should be encouraged to wear eye protection.

If you are approached, stop the engine and cutting attachment. In the case of bladed units, there is the added risk of injury to bystanders from being struck with the moving blade in the event of a blade thrust or other unexpected reaction of the saw.

17.2.9 Controlling the Unit. The cutting attachment may be spinning during carburetor adjustments. Wear your protective equipment and observe all safety instructions. For units equipped with a clutch, be sure the cutting attachment stops turning when the engine idles. When the unit is turned off make sure the cutting attachment has stopped before the unit is set down.

17.2.10 Transportation and Storage of the Unit. Provide transportation and long- and short-term storage instructions.

17.3 Additional Requirements for Brushcutters

In addition to applicable requirements of 17.2, brushcutter manuals shall contain the following information, verbatim or suitably paraphrased.

17.3.1 Blade Thrust. Warn the operator of the danger of blade thrust.

- Blade thrust may occur when the spinning blade contacts an object that it does not immediately cut.
- A blade thrust can be violent enough to cause the unit and/or operator to be propelled in any direction, and possibly lose control of the unit.
- Blade thrust can occur without warning if the blade snags, stalls or binds.
- Blade thrust is more likely to occur in areas where it is difficult to see the material being cut.

17.3.2 Condition of Unit before Use. The handles shall be mounted in accordance with the manufacturer's instructions. Do not attach any blade to a unit without proper installation of all required parts. Failure to use the proper parts can cause the blade to fly off and seriously injure the operator and/or bystanders. Discard blades that are bent, warped, cracked, broken or damaged in any way. Use a sharp blade. A dull blade is more likely to snag and thrust.

17.3.3 Blade Maintenance. If a manufacturer indicates an operator may sharpen a metal blade, proper instructions and warnings shall be provided. Wear protective gloves when handling or performing maintenance on the blade.

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17.3.4 Stopping the Unit. A coasting blade can cause injury while it continues to spin after the engine is stopped or throttle trigger is released. Maintain proper control until the blade has completely stopped rotating.

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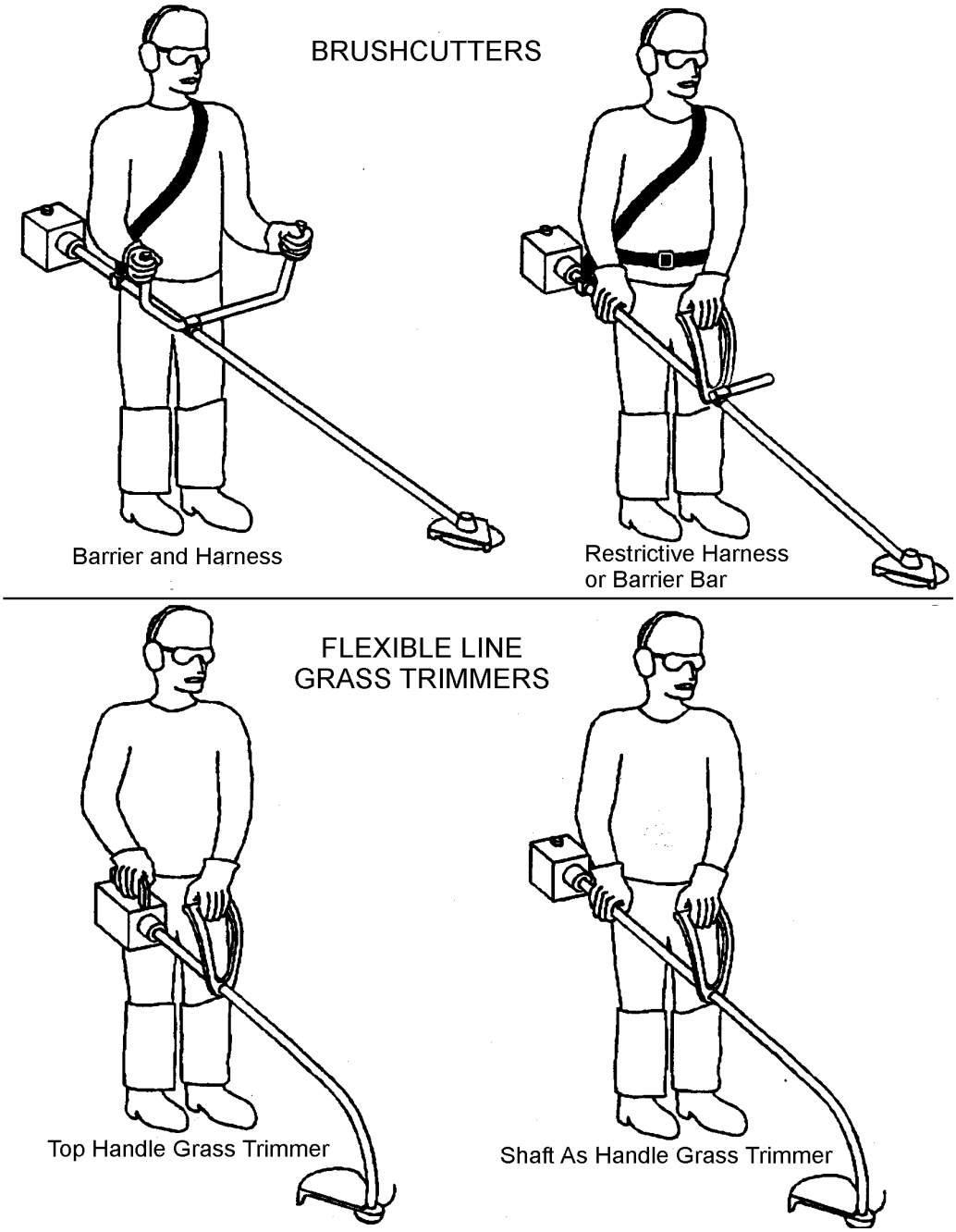
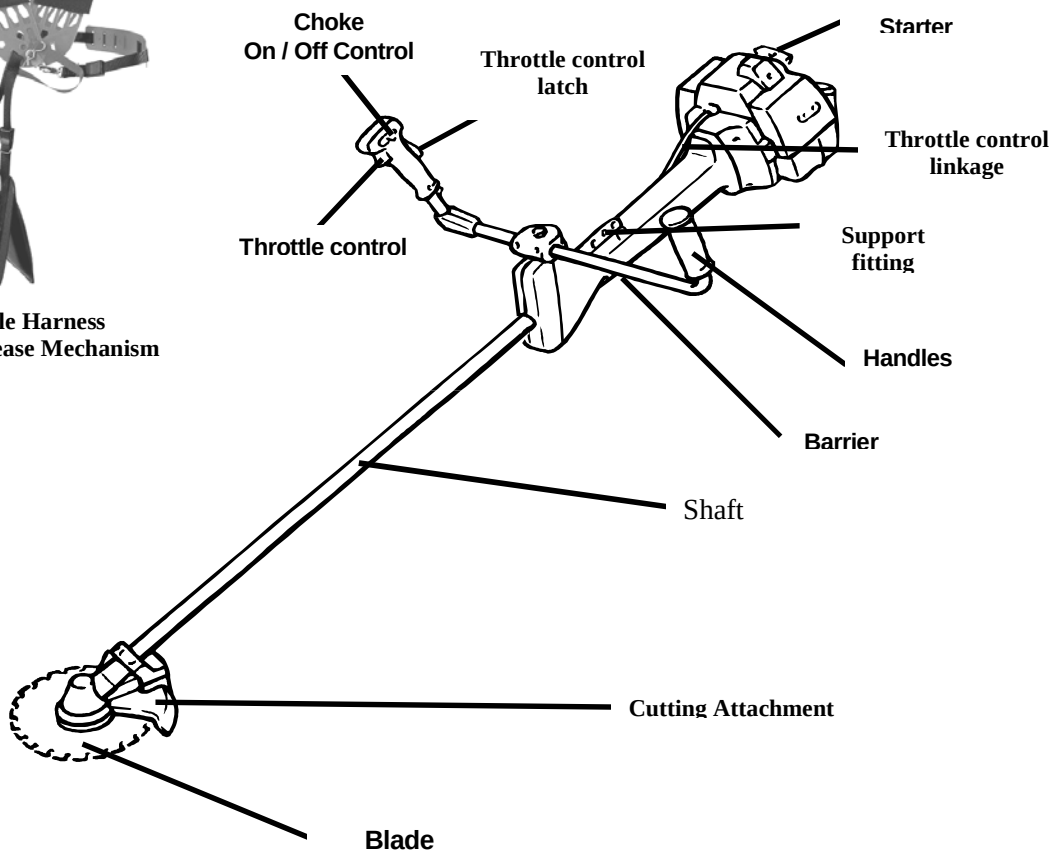


Figure 1 – Operating/Cutting Position

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Double Harness
Quick Release Mechanism



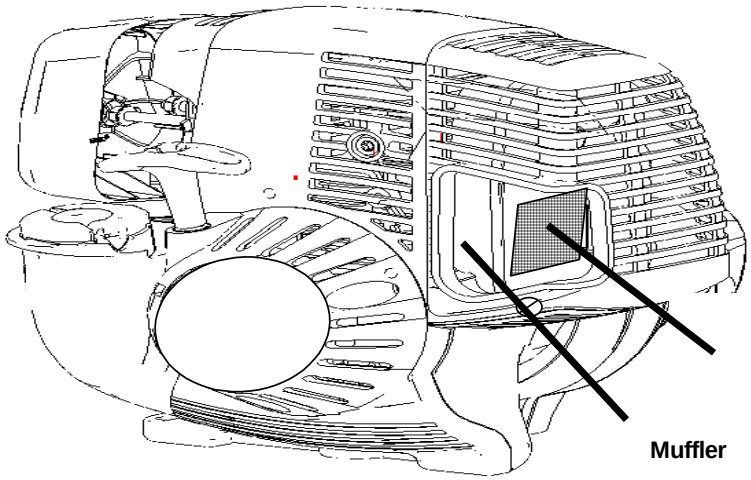


Figure 2(a) - Brushcutter with Nomenclature

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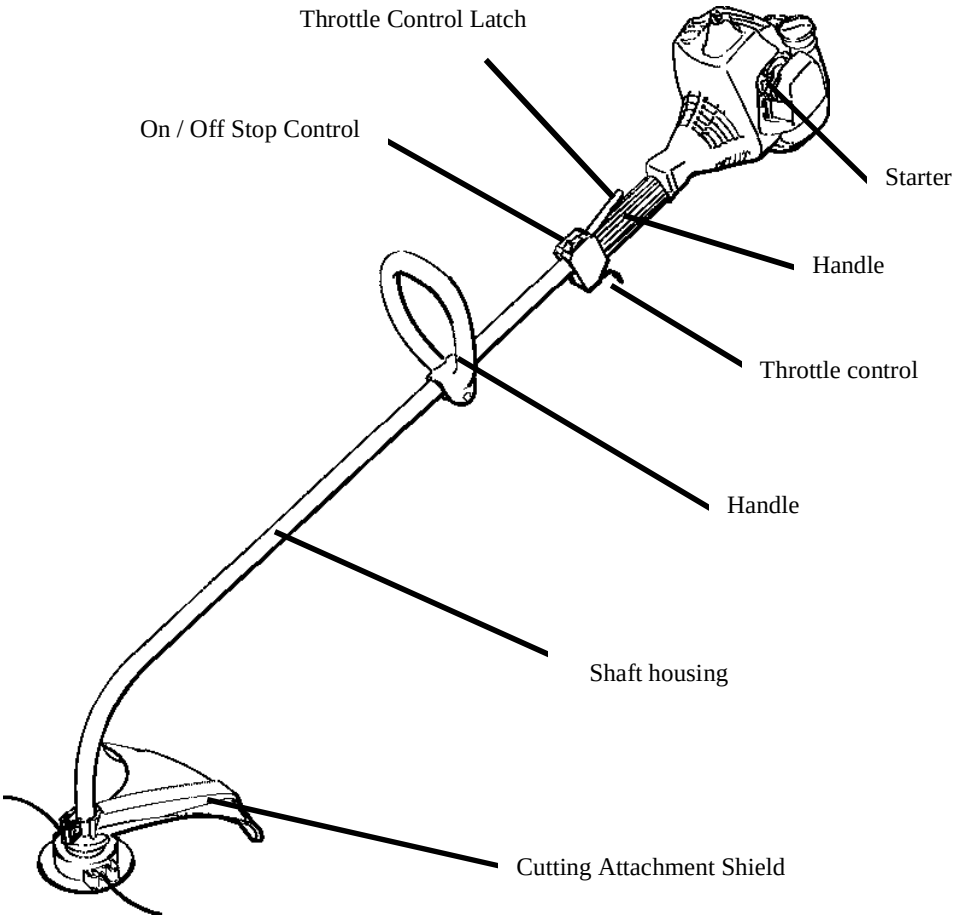


Figure 2(b) - Trimmer with Nomenclature

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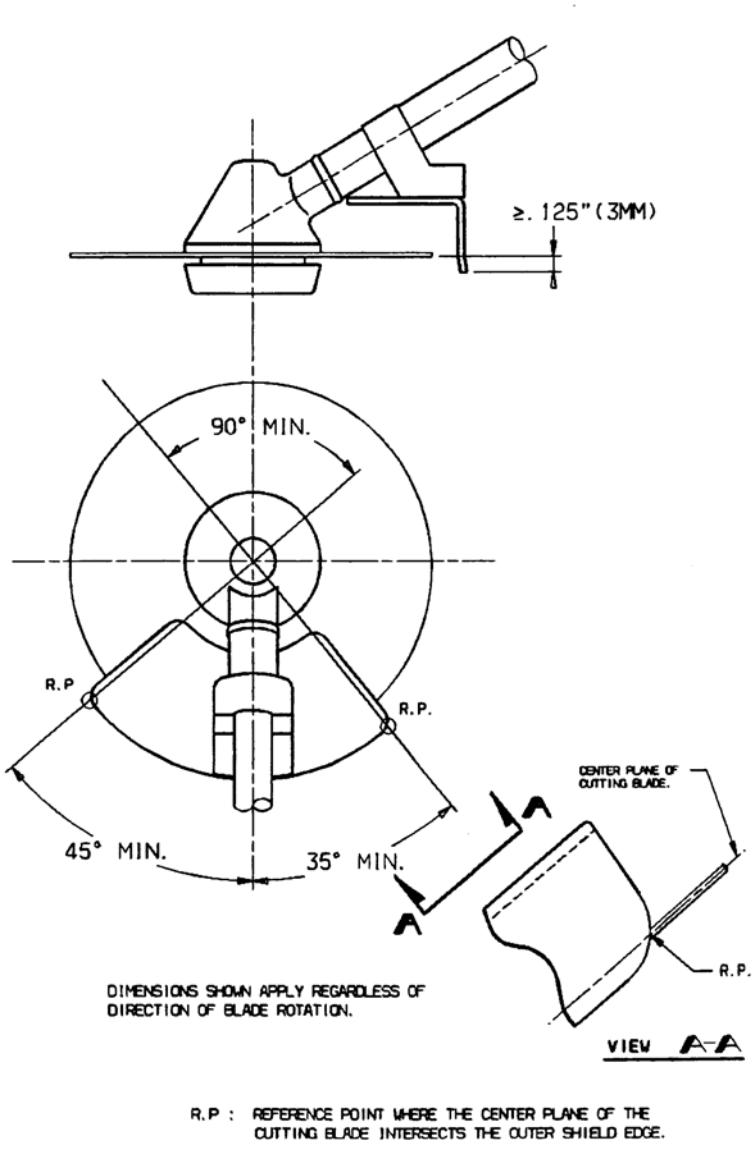


Figure 3 – Brushcutter Shield Dimensions

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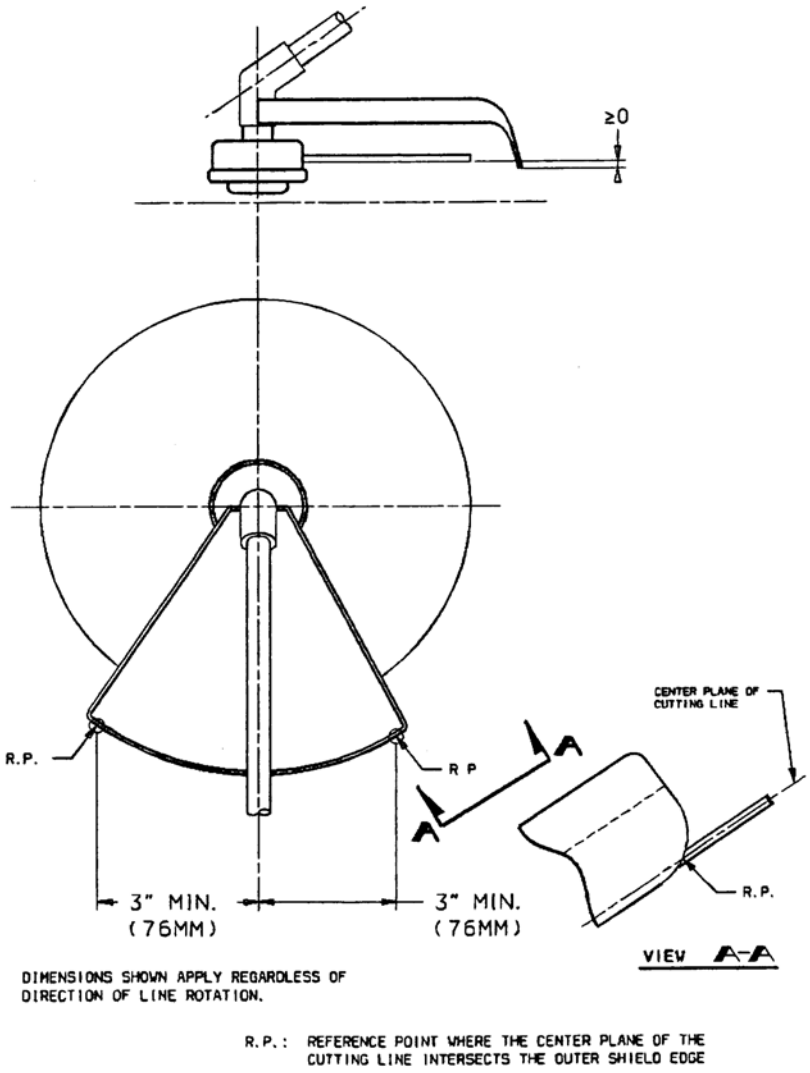


Figure 4 – Grass Trimmer Shield Dimensions

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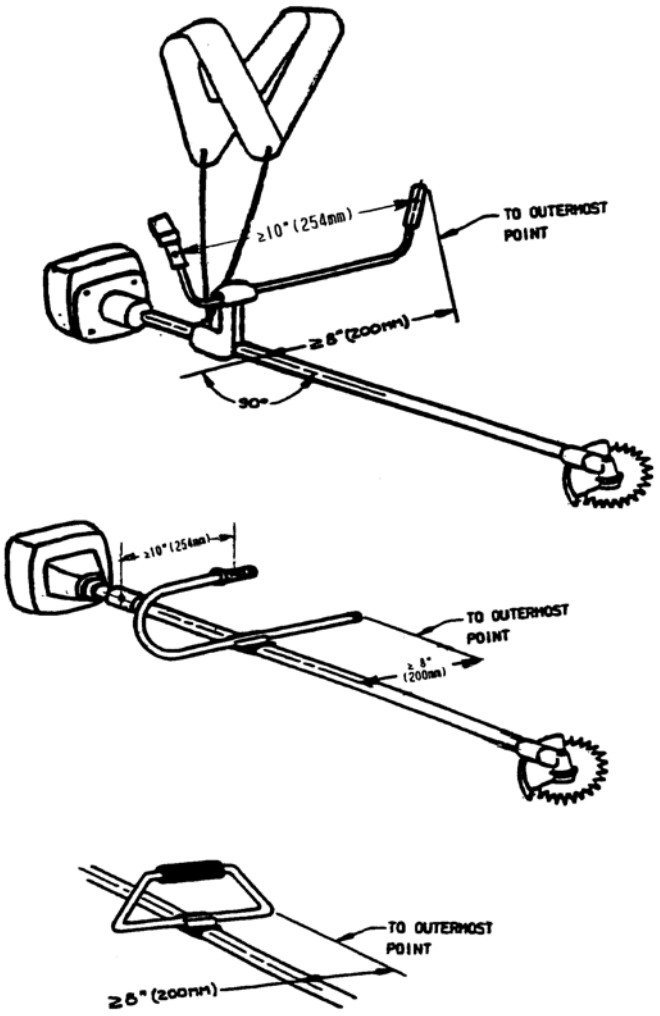


Figure 5 – Barrier Configuration Examples

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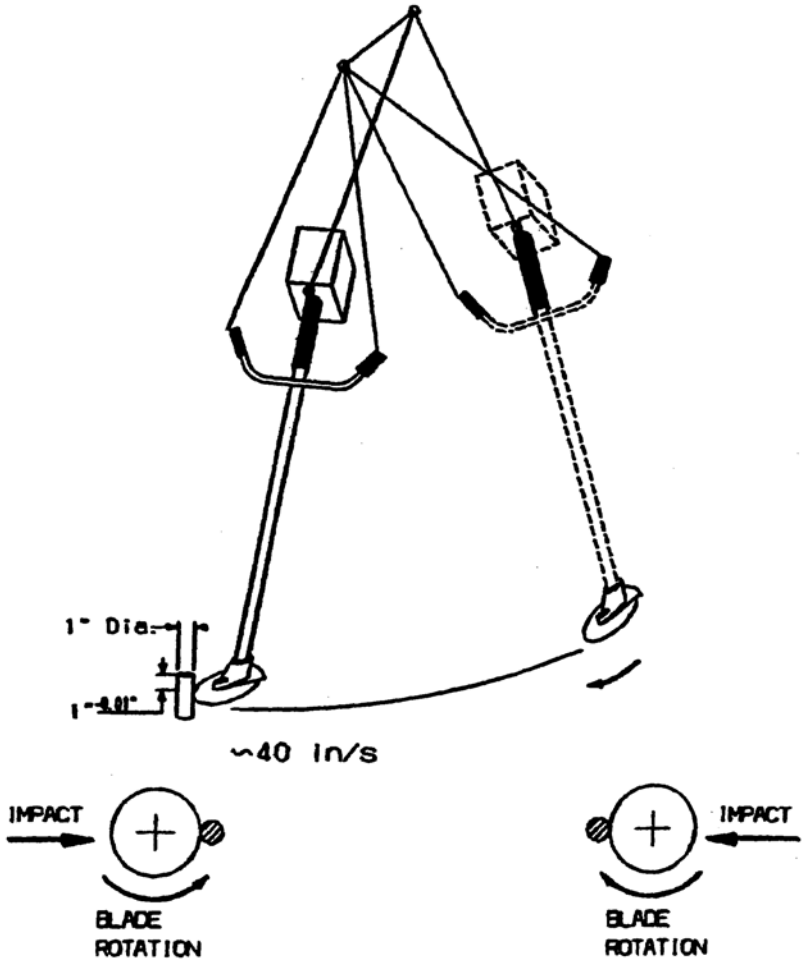


Figure 6 – Impact Test

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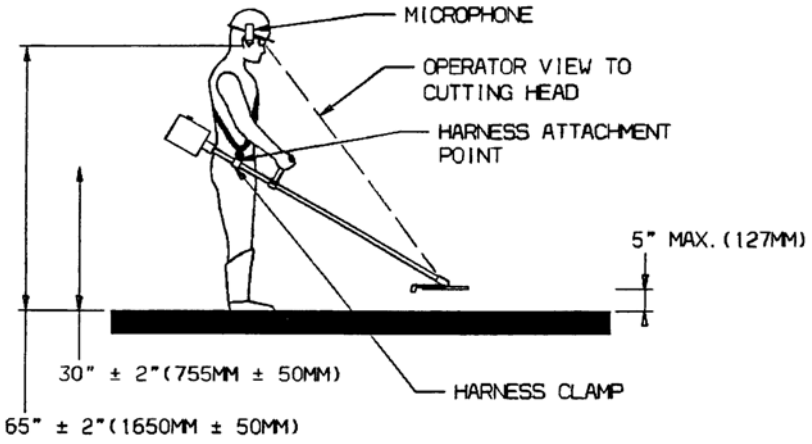


Figure 7 – Unit with Harness

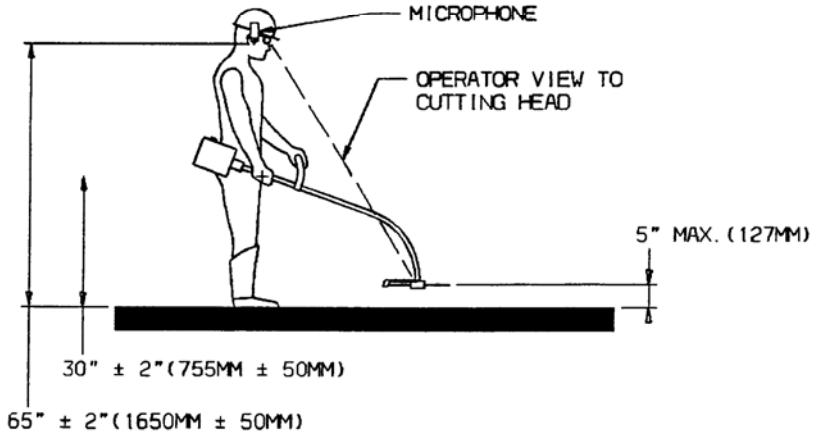


Figure 8 – Unit without Harness

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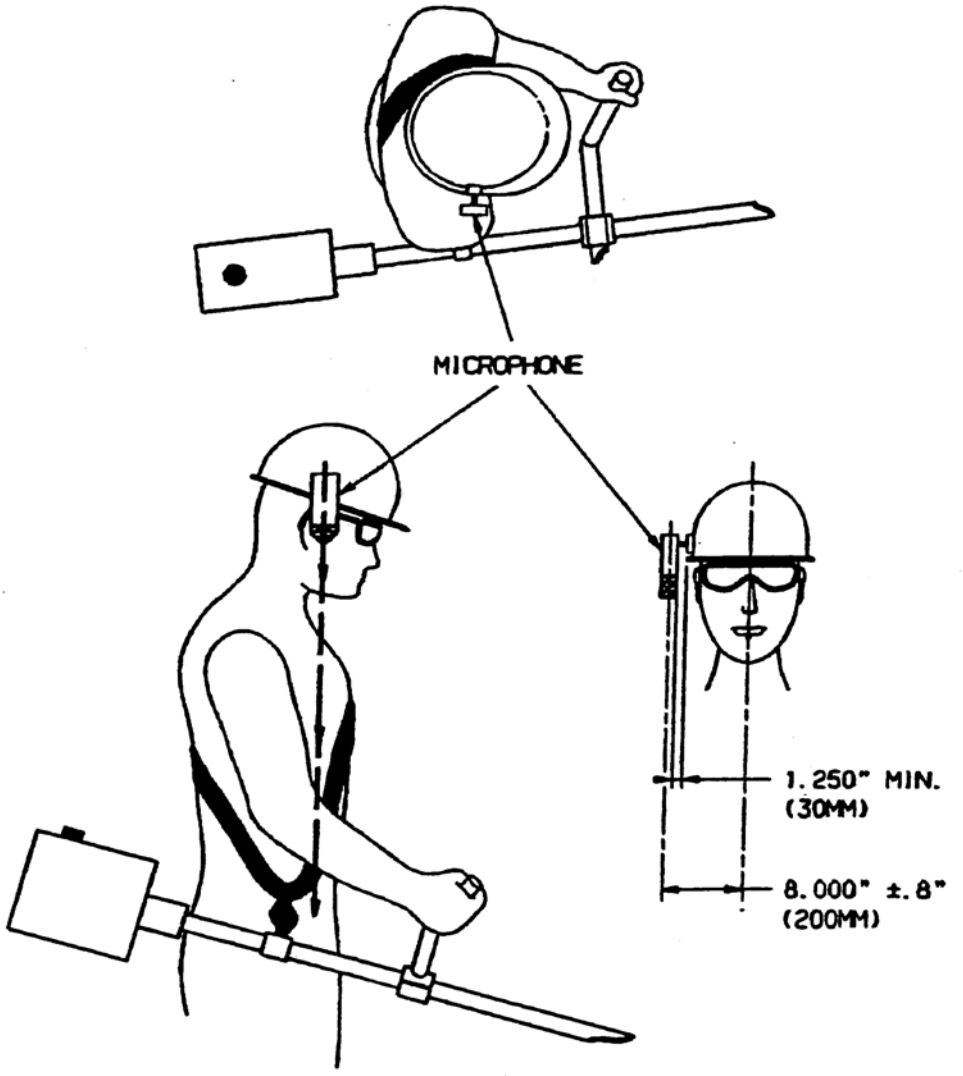


Figure 9 – Microphone Location – Operator's Ear

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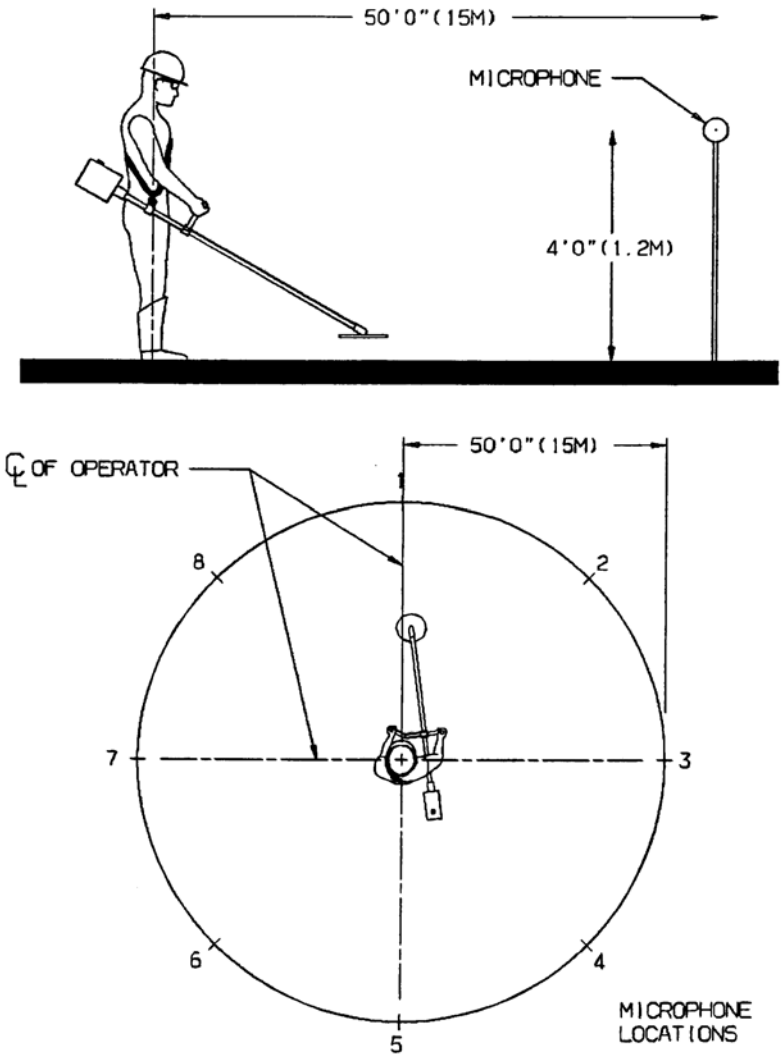


Figure 10 – Microphone Location – Bystander

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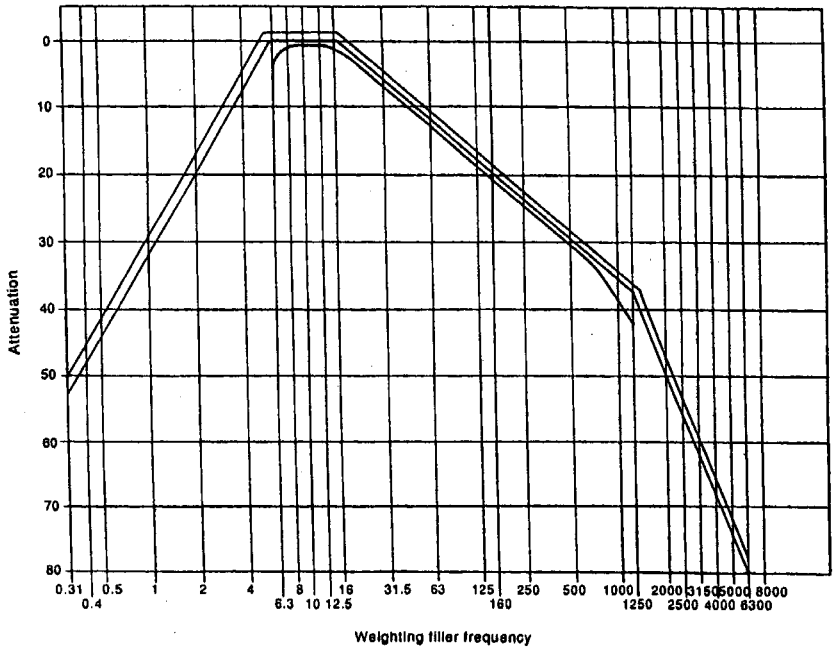


Figure 11 – Weighted Filter Frequency Attenuation Curve

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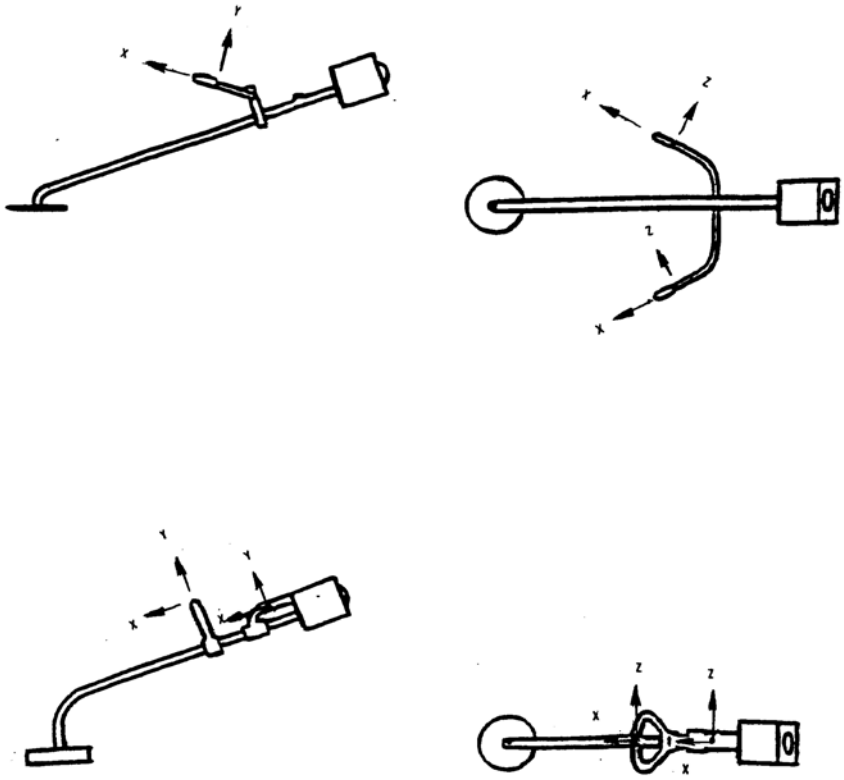


Figure 12 – Typical Accelerometer Locations

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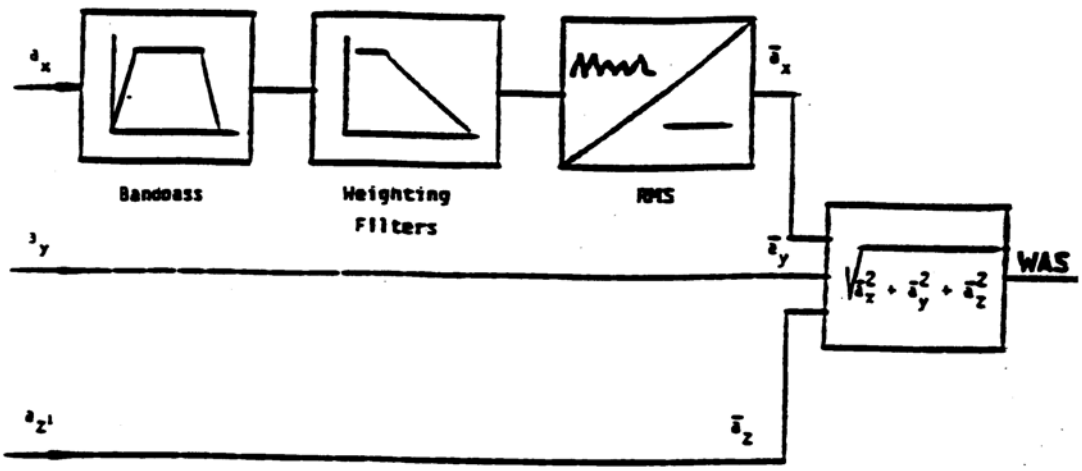


Figure 13 – Weighted Acceleration Sum (WAS)

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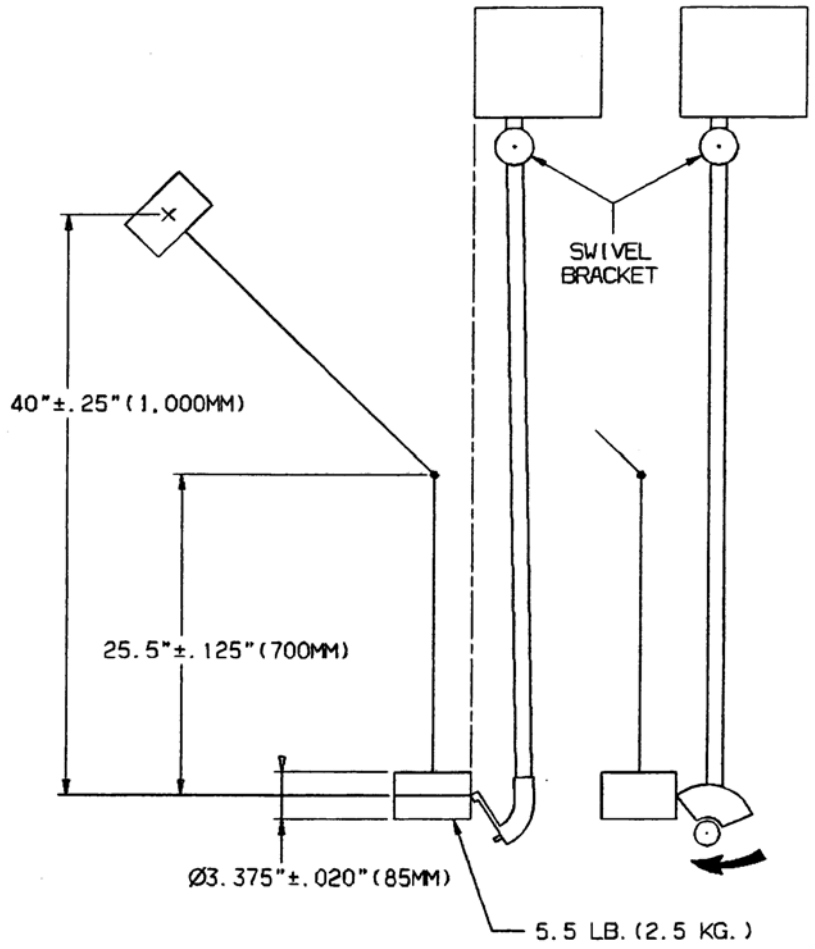


Figure 14 – Cutting Shield Integrity Test

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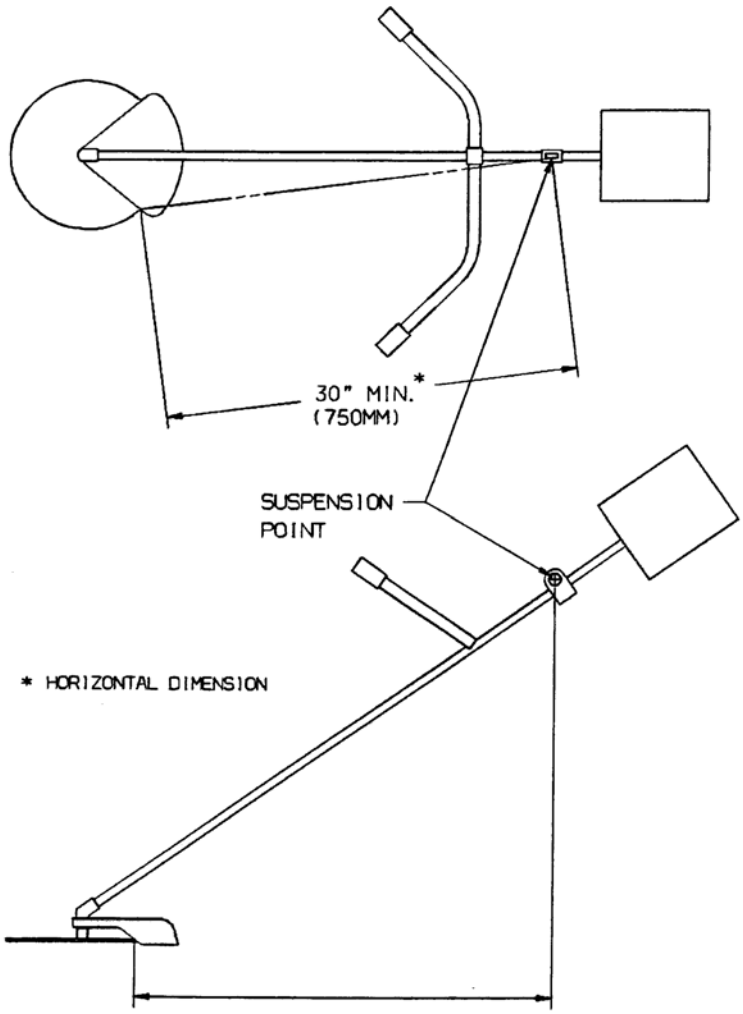


Figure 15 – Minimum Horizontal Distance from Suspension to Cutting Attachment

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Annex A
(informative)

Rationale

3.2 Blade-Capable Units. This definition was added to provide clarification for this term.

6.1 Applicability and Location. This subsection was modified to clarify that all units within the scope of the standard must be equipped with an engine-stopping device that brings the engine to a complete stop, and to clarify location and operational requirements for blade-capable units. Based on evaluation of historical information, a device that requires sustained manual pressure is now allowed for units that are not blade capable.

5.3 (old) Location. This subsection was deleted in its entirety because it has been incorporated into the revised 6.1.

7.2.1 Impact Test. This subsection was modified to clarify applicable test methods and to specify that multi-unit cutting attachments shall be tested on the equipment model with the greatest mass and the model with the greatest rotational speed, i.e., the units for which the greatest effects from the impact test could be expected.

8 to 8.3 Product Integrity. A new Section 8 was added to specify that impact tests be conducted, and product integrity inspections then be made, on each equipment model with the heaviest and the lightest attachments that the manufacturer makes available for that model. Subsequent sections of the standard have been renumbered accordingly.

9.5.1. This subsection was revised to focus on the units from which the greatest effects from the test could be expected.

9.8.1. Additional instructions on performing the sound measure test procedure were included to improve the reliability and repeatability of the test results.

10.3. This subsection was revised to focus on the units from which the greatest effects from the test could be expected.

13.1.2. This subsection was revised to emphasize that the unit's handles should be located so as to enable the operator to maintain control. The revision allows the product manufacturer to determine the actual distance between handles, so long as the operator will be able to control the unit. To provide additional information to the operator, manufacturers are required to indicate on blade-capable units whenever the distance between handles is less than 10 inches.

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17.2.8. Wording was refined to recognize that there is in reality an area of diminishing risk, as opposed to a sharp transition from a region of high risk to one of low risk. It was further clarified that there are two potential risks to which bystanders are exposed when bladed units are in use.

17.3.1. Revised organization of this paragraph for clarity.

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Annex B
(informative)

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