

American National Standard

*for Outdoor Power Equipment –
Internal Combustion Engine-Powered
Handheld and Backpack Blowers
and Blower-Vacuums –
Safety Requirements and
Performance Testing Procedures*





ANSI/OPEI B175.2-2012
Revision and redesignation of
ANSI B175.2-2000 (R2005)
Includes Amendment 1
ANSI/OPEI B175.2-2012/A1-2013

American National Standard
for Outdoor Power Equipment –

**Internal Combustion Engine-Powered
Handheld and Backpack Blowers
and Blower-Vacuums –
Safety Requirements and
Performance Testing Procedures**

Sponsor

Outdoor Power Equipment Institute

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Foreword (This foreword is not part of American National Standard ANSI/OPEI B175.2-2012.)

This standard is a revision of *American National Standard for Power Tools - Hand-Held and Backpack, Gasoline-Engine-Powered Blowers*, ANSI B175.2-2004. The first edition of this standard was developed under the auspices of the Portable Power Equipment Manufacturers Association (PPEMA) and published in 1990.

In 2002, PPMEA discontinued operations and the Outdoor Power Equipment Institute (OPEI) became the secretariat. The present revision of this standard was prepared by the ANSI B175.2 Committee on Gasoline-Powered Backpack and Handheld Blowers.

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

- The scope has been revised (expanded) to establish manufacturer requirements to reduce the risk of injury associated with the use of handheld and backpack, gasoline-powered blowers
- The Definition, Labeling, Operator's Manual and Sound sections have been expanded
- Sections on handles, harnesses, vibration, and performance have been added.

This standard contains four normative annexes, which are considered part of the 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 gasoline-powered blowers 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 –

Internal Combustion Engine-Powered Handheld and Backpack Blowers and Blower-Vacuums – Safety Requirements and Performance Testing Procedures

1 Scope and Purpose

1.1 Scope

The requirements of this standard apply to handheld and backpack internal combustion engine-powered blowers and blower-vacuums.

This standard does not apply to ride-on, towed, or walk-behind units. This standard does not apply to electrically powered units.

This standard shall become effective one year after it is published.

NOTE – The units in this standard are given in metric. English units are included in parenthesis for information only.

1.2 Purpose

The purpose of this standard is to establish manufacturer requirements to reduce the risk of injury associated with the use of handheld and backpack internal combustion engine-powered blowers and blower-vacuums. This standard may also be used to measure bystander sound pressure levels at 15 meters (50 feet).

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.

ANSI/ASSE Z87.1-2003, *Practice for Occupational and Educational Personal Eye and Face Protection Devices*

ANSI/ASTM E29-08, *Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications*

ANSI/UL 969, *Marking and Labeling Systems*

IEC 60068-2-75:1997, *Environmental Testing – Part 2-75: Test Eh: Hammer tests*

IEC 61672-1:2002, *Electroacoustics – Sound Level Meters – Part 1: Specifications*

IEC 61672-2:2003, *Electroacoustics – Sound Level Meters – Part 2: Pattern Evaluation Tests*

ISO 5349-1:2001, *Mechanical Vibration – Measurement and Evaluation of Human Exposure to Hand-Vibration – Part 1: General Requirements*

ISO 5349-2:2001, *Mechanical Vibration – Measurement and Evaluation of Human Exposure to Hand-Vibration – Part 2: Practical Guidance for Measurement at the Workplace*

ISO 22867:2004, *Forestry machinery – Vibration test code for portable hand-held machines with internal combustion engines – Vibration at the handles*

ISO 22868:2011, *Forestry and garden machinery – Noise test code for portable hand-held machines with internal combustion engines – Engineering method (Grade 2 accuracy)*

ISO 1431-1:2004, *Rubber, vulcanized or thermoplastic--Resistance to ozone cracking—Part 1: Static and dynamic strain testing*

SAE J184-NOV98, *Qualifying a Sound Data Acquisition System*

SAE J335-JUN95, *Multiposition Small Engine Exhaust System Fire Ignition Suppression*

40 CFR Part 1065, *Engine Testing Procedures, Subpart H, Engine Fluids, Test Fuels, Analytical Cases and Other Calibration Standards*

Munson, B. R., Young, D. F., and Okiishi, T. H. *Fluid Mechanics*. Wiley, Hoboken, NJ; 1994

3 Definitions

3.1 Back-Pack Powered Blower: blower designed to have the power source carried on the operator's back by means of a harness.

3.2 Back-Pack Powered Vacuum or Blower-Vacuum: vacuum designed to have the power source carried on the operator's back by means of a harness.

- 3.3 Choke:** a control that is used to enrich the carburetor fuel/air mixture.
- 3.4 Debris:** grass, weeds, leaves, paper, dirt, sand, dust or the like. Debris does not include liquid substances.
- 3.5 Debris Collector:** part or combination of parts that provides a means for collecting debris.
- 3.6 Dirty Fan Construction:** a construction where debris being vacuumed comes into contact with the air-moving fan.
- 3.7 Discharge Opening:** gap or opening through which debris or clean air may be discharged.
- 3.8 Guard:** part of the unit or component incorporated to provide protection for the operator. The fan case is considered a guard.
- 3.9 Handheld Blower:** unit supported by hand and possibly assisted by a harness used only for blowing debris.
- 3.10 Handheld Blower-Vacuum:** unit supported by hand and possibly assisted by a harness which may perform as a handheld blower or as a handheld vacuum. Parts may be required to convert a blower to a vacuum and vice-versa.
- 3.11 Handheld Vacuum:** unit supported by hand and possibly assisted by a harness used only to vacuum debris into a debris collector.
- 3.12 Handle(s):** a structure that enables the operator to hold and control the unit.
- 3.13 Harness:** adjustable strap(s) by which the unit is suspended from the operator.
- a) **Single Harness:** the weight of the unit is distributed through one strap to the operator.
 - b) **Double Harness:** two straps that distribute the weight of the unit over both shoulders of the operator.
- 3.14 May:** indicates a permissive condition.
- 3.15 Muffler:** device for reducing engine exhaust noise and directing the flow of the exhaust gases.
- 3.16 Nozzle:** the opening at the end of the blower tube from which the air stream exits.
- 3.17 Normal Use:** normal use includes use, service, or maintenance as defined in the operator's manual(s).

3.18 Operating/Blowing or Vacuuming Position: (See Figure 1.)

NOTE – This standard does not specify the operating/blowing 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.

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

3.20 Power Head: power source for the unit.

3.21 Quick Release Mechanism: a device the operator may activate with one hand in case of emergency.

3.22 Shall: indicates a mandatory requirement.

3.23 Shredder Blade/Device: plastic or metal blade, cutter, string, or the like for reducing vacuumed debris into smaller pieces prior to discharging through the discharge opening. The device may be pivoting or fixed.

3.24 Spark Arrester: a device through which exhaust gases pass to limit the size of particle emissions.

3.25 Speed Limiter: a device that limits the maximum speed of the engine.

3.26 Starter: a system that rotates the engine crankshaft for the purpose of starting.

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

3.28 Throttle Control: a device activated by the operator to regulate the throttle.

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

3.30 Throttle Linkage: a mechanism that transmits motion from the throttle control to the throttle.

3.31 Throttle Setting Control: a manually activated device to set and fix (or release) the throttle setting in a steady position to facilitate operation of the engine over a longer working period.

3.32 Unit: a complete blower or blower-vacuum.

4 Requirements

4.1 Guards

To ensure the safety against contact, power driven components (see 4.1.1) and hot surfaces (see 4.1.2) shall be guarded or located so that the operator will not inadvertently contact them when starting or during normal operation of the unit as described in the operator's manual. The verification of guards shall be carried out on a complete machine assembled in accordance to the operator's manual.

4.1.1 Power Driven Components

Guards of power driven components shall meet criteria by design as specified in 4.2 and criteria by strength and rigidity as specified in 4.3.

The opening or removal of the guards shall require the use of tools, or the unit shall come equipped with an engine shut-off system that will activate when the guard is opened or removed.

4.1.2 Hot Surfaces

Any metallic surface of the machine that has a temperature of over 80°C (176°F), or a plastic part that has a temperature of over 94°C (201°F), shall be considered a hot surface.

NOTE – The exhaust pipe (outlet) is not considered a surface that is intentionally or inadvertently contacted during normal operation. These surfaces may be covered by the requirements of SAE J335.

Guards of hot surfaces shall meet criteria by design as specified in 4.2.

4.2 Probe Test

The probe specified in Figure 8 shall be applied to any opening and if it can be inserted, shall be inserted to a maximum distance of 850 mm using 10 ± 2 Newtons (2.25 ± 0.45 lbf) of force after inserting the probe into the opening. Contact with any moving or hot part is not allowed. The probe shall be manufactured to enable a rotation of $\pm 90^\circ$ about the articulation axis. The movements of the joints of the probe shall be free enough to allow easy articulation as the probe is inserted into the opening.

Access points evaluated shall include the blower intake and discharge. If the pipe(s) can be removed without use of tools and does not have an engine shut-off system, then the pipe shall be removed for the test.

4.3 Guard Strength and Rigidity

The parts of the fan housing and the guards of power driven components, where accessible with the test probe (see 4.2), shall have adequate mechanical strength and be constructed to withstand such rough handling that may be expected in normal use.

When tested in accordance with 4.3.1, no parts of the fan housing shall have become detached and no visible cracks shall have developed.

If there is doubt as to whether a defect has occurred by the application of the preceding blows, this defect is neglected and the group of three blows is applied to the same place on a new sample which shall then withstand the test. If an inner cover is protected by a decorative cover, the test shall be done with the decorative cover removed. Damage to the finish, small dents, and small chips that do not adversely affect the function of the guard are ignored.

4.3.1 Guard Strength and Rigidity Test

The machine is rigidly supported and three blows (in separate locations) are applied with an impact energy of $1.0\text{J} \pm 0.05\text{ J}$ to any point on the guard(s) as identified in 4.3 by means of the spring hammer specified in IEC 60068-2-75. The guard shall withstand these three blows at any location on the guard. The test points selected may be no closer than 51 mm (2 in) to each other. No two points may be at opposite ends of structural ribs in an effort to remove the rib.

To ensure that the machine is rigidly supported, it may be necessary to place it against a solid wall of brick, concrete, or similar material. A sheet of polyamide may be tightly fixed to the wall with care being taken to ensure that there is no appreciable air gap between the sheet and the wall. The sheet shall have a Rockwell hardness of HRB 100 (± 10), a thickness of at least 8 mm (0.31 in) and be sufficiently large to ensure that all parts of the machine are supported.

4.4 Functional Integrity

This section applies only to those units intended to be used or for use as a vacuum.

4.4.1 Functional Integrity Test

The test shall be carried out on all units that can be used or converted to a vacuum. The test is conducted with ceramic prisms that have triangular sides and a prism height of $6.5\text{ mm} \pm 0.8\text{ mm}$ ($0.255 \pm 0.031\text{ in}$) and a mass of $0.43\text{ g} \pm 0.02\text{ g}$ ($0.00095 \pm 0.000044\text{ lb}$). See Figure 3.

1 kg (2.2 lb) of the ceramic prisms shall be placed closely packed together in a single layer on a smooth, flat, hard surface. The unit shall be warmed up and adjusted to the manufacturer's specifications and run at wide-open throttle. The prisms shall be

sucked up as quickly as possible within 30 seconds. The prisms shall be collected in the debris collector. If the unit will not suck up all sample prisms within 30 seconds, the test is void and another unit (original unit may also be used) shall be secured to a table with the vacuum tube perpendicular to the tabletop (with the inlet facing up) where the prisms shall be introduced to the vacuum tube over a period of 30 seconds. The test must follow the same parameters as the normal test procedure in quantity of sample prisms and ingestion time. If the unit has a removable blade/device for shredding, the unit shall be tested with and without the device.

After the ceramic prisms have been ingested, the unit shall be run at wide-open throttle for 30 more seconds before being turned off.

4.4.2 Functional Integrity Test Acceptance

No parts of the unit guards or fan or shredder shall become detached and there shall be no visible holes in the enclosure surrounding moving parts or in the debris collector. Erosion or chipping of the fan or the fan case is not considered a failure. If the enclosure develops a crack, the test shall be repeated twice more on the same unit. If at the conclusion of the additional tests the crack has not developed into a hole, the test is considered a pass.

5 Exhaust Gases

5.1 Exhaust Gas Direction

Exhaust gases shall not be directed toward the operator when the unit is used in the normal operating position(s) as defined by the manufacturer in the operator's manual. See also Figures 1 and 2.

5.2 Spark-Arresting Mufflers

If blowers and blower-vacuums are equipped with or have provisions for spark-arresting mufflers, supplied as an option, they shall meet the specifications and performance requirements in SAE J335.

6 Handles and Controls

6.1 Controls

Controls shall have the function clearly identified. Direction and/or method of operation may be clearly identified by a durable label or mark. Identification of the function of the throttle control and throttle control latch is not required. Detailed instructions on the operation of all the control(s) shall be provided in the operator's manual.

A throttle control and/or a throttle setting control shall be provided. A throttle control latch may be provided as an option.

6.1.1 Throttle Control

If an operator throttle control or a throttle setting control is provided, it shall be positioned so that it can be accessed, operated, and released during operation of the machine. When it is released, the throttle control shall automatically return to the “idle” position unless the throttle control latch or throttle setting control is engaged.

6.1.2 Throttle Control Latch

If a throttle control latch is provided, it shall be such that the latch has to be engaged manually and is automatically released when the throttle control is operated.

6.2 Engine Stopping Device

All units shall have a control for stopping the engine. The engine-stopping device shall not depend upon sustained manual pressure for its operation. The stop position shall be clearly marked. The control shall have a contrasting color against its background.

6.3 Handles

Units shall have at least one handle. The gripping length of this handle shall be at least 100 mm (4 in). For backpack units, a suitable means, such as a handgrip (may be integrated in the support frame or the harness straps), to allow for transport or handling of the unit shall be provided. The gripping length of the control handle shall comprise any length that is straight or curved at a radius of greater than 100 mm (4 in) together with any blend radius but not more than 10 mm (0.4 in) at either or both ends of the gripping surface.

Where appropriate the part of the handle containing the unit controls shall be counted as part of the handle gripping length. Finger grips or similar superimposed profiles shall not affect the method of calculating handle-gripping length.

7 Harnesses

Units with a mass of more than 6 kg (13.2 lbs) weight (without fuel and with empty vacuum bag), shall have at least a single shoulder harness or strap. For vacuum units, the bag strap is considered to be the strap required by this paragraph. A double shoulder harness shall be provided for all units exceeding a weight (without fuel and with empty vacuum bag) of 7.5 kg (16.5 lbs) and for all backpack units regardless of unit weight. The harness shall be adjustable to the size of the operator.

Units having a double shoulder harness shall be supplied with a pad at the points of contact between the unit and the body.

Single shoulder harnesses shall be designed in a way or be equipped with a quick release mechanism, so that the unit can be released quickly from the operator in the event of emergency. Double shoulder harnesses shall always have a quick release mechanism. The quick release mechanism shall only allow separation by deliberate action of the operator.

8 Fuel Tanks, Oil Tanks, and Fuel Lines

8.1 Tank Filler Location and Identification

The fuel tank filler and the oil tank filler openings, if provided, shall be located so that they will not be unduly obstructed by other unit components. Each cap or opening shall be clearly and durably identified.

8.2 Tank Filler Openings

The minimum diameter of the fuel tank filler hole shall be 20 mm (0.80 in). The minimum diameter of the oil tank filler hole, if provided, shall be 15 mm (0.60 in). The design of the caps shall be such that no leakage occurs while the unit is being used at normal operating temperature, in all working positions, and while being transported. The fuel cap shall have a retainer that prevents separation from the unit.

8.3 Fuel Line Integrity

The fuel feed lines used in the unit shall be resistant to fuels, oils and environments as expected for use by the manufacturer and described in the operator's manual. Lines shall be evaluated in accordance with Annex D. The lines shall be routed so that they are not subject to direct abrasion when they are outside of the tank

8.4 Fuel Supply Line Strength and Accessibility

Prior to testing, fully fuel the machine with IE10 (Indolene fuel (General Testing Fuel according to 40CFR1065.710) splash blended with 10% ethanol) and run it for a minimum of 5 minutes to make sure that all fuel lines are wetted, wait for 24 hours to allow the fuel lines to soak. The fuel feed line and the connecting points shall be tested by inserting the probe (see Figure 9) from any opening of the machine and applying a maximum axial force of 40 Newtons (9 lbf). The accessible fuel lines shall not break, leak, or become detached from their fitting or connections during this test. All guards and covers shall be installed for the test. Flexing of the probe is acceptable during the test. The test shall be conducted at room temperature. Verification is by visual inspection.

No fuel line shall become detached from its connecting points, leak, or be damaged by the test. After the test is completed, let the machine run, and check if fuel leakage can be observed.

8.5 Fuel Tank Ventilation

If the fuel system is equipped with a ventilation system, it shall not leak under normal operation. Evaporation through the tank ventilation system is not regarded as leaking.

8.6 Fuel Tank Integrity

The material used in the tank shall be resistant to fuels, oils and environments as expected for use by the manufacturer and described in the operator's manual. Tanks shall be evaluated in accordance with annex D.

8.7 Structural Integrity

No visible tank leakage may occur while holding the product for 30 seconds in each of the 6 orthogonal directions after subjecting test samples to the test described in this section. If the cap loosens during the drop test, it may be retightened before performing the leak test.

8.7.1 General Test Conditions and Requirements

Fill the product's fuel tank half full with a mix of 50% glycol and 50% water. Condition the product at $-5^{\circ}\text{C} \pm 5^{\circ}\text{C}$ ($23^{\circ}\text{F} \pm 9^{\circ}\text{F}$) for a minimum of 6 hours.

Suspend the product in the normal operating position and suspension height as described in 8.7.2.

Within one minute from coming out from the conditioning environment, drop the complete product onto a concrete surface. To collect any liquid that may leak out as a result of the test, concrete slabs placed in a metal tray, in turn placed on the concrete surface, may be used.

8.7.2 Normal Operating Position and Suspension Height

8.7.2.1 Handheld Machines

Normal operating position: Suspend the blower, complete with blower tubes attached, by means of a string attached to the mid-point of the handle.

Normal suspension height: The lower surface of the upper part of the handle shall be 775 mm (30.5 in) above the hard impact surface.

8.7.2.2 Backpack Machines

Normal operating position: Suspend the blower complete with blower tube attachment by means of a string attached to the upper part of the blower so that the contact plane between the backplate/frame and the operator is vertical. Extra support strings may be necessary.

Normal suspension height: The lowest part of the blower (excluding the blower tube) shall be 750 mm (29.5 in) above the hard impact surface.

8.7.3 Test Procedure

8.7.3.1 Equip the product with the shortest/lightest/smallest blower tube normally used according to the operator's manual

Drop the unit from the position and height as described in 8.7.2.

8.7.3.2 Immediately equip the product with the longest/heaviest/largest blower tube (or vacuum tube) normally used according to the operator's manual. Recondition the product for at least one hour and repeat the drop test. If the unit is sold as both a blower and a vacuum, the test shall be performed twice in both configurations. Separate units may be used for each functional mode (vacuum or blower).

NOTE – If only one blower attachment is specified, that one shall be used for two impacts.

9 Sound Levels

9.1 Scope

This section establishes the sound level labeling requirements and test procedures. The procedures cover operator and 15.3-m (50-ft.) bystander position(s).

The unit shall be evaluated with all the standard attachments included with the unit by the manufacturer. The attachments shall be mounted in accordance with the manufacturer's instructions. The highest sound pressure level shall be used as the basis for verification and labeling.

9.2 Requirements

9.2.1 If the sound pressure level at the operator's ear as measured per the procedure specified in Annex A exceeds 85 dB(A), the unit shall be labeled with a requirement for operator hearing protection.

9.2.2 Optionally, the unit may be clearly and durably marked with the bystander sound level of the unit as determined using the procedure specified in Annex A. If it is marked, the sound level shall be identified in decibels [dB (A)] using simple block characters at least 6 mm (0.25 in) high. The wording "per ANSI B175.2" in 2 mm

(0.08 in) minimum-height letters shall accompany the numerical sound pressure level.

10 Vibration

10.1 Scope

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

The unit shall be evaluated with all the standard attachments included with the unit by the manufacturer. The attachments shall be mounted in accordance with the manufacturer's instructions. The highest vibration level shall be used as the reported value.

10.2 Requirements

Handle vibration of all units except those intended for occasional use shall, when tested in accordance with Annex B, have an equivalent total vibration level, $a_{hv,eq}$ not exceeding 10 m/s² (1.02 Gs).

11 Blower Performance

11.1 Scope

The procedures (using the "blow force method") for measuring blower and blower-vacuum blowing performance may be found in Annex C.

11.2 Test Values

The values to be reported shall be measured at the exit of the nozzle(s) supplied with the unit. The values reported shall be the maximum and average velocity in m/s (MPH) and average air volume flow rate in m³/minute (CFM). Values shall be rounded to the nearest whole number.

If the volume flow rate (Q) is included in the operator's manual, it shall be the average volume based on this section. If multiple pipe configurations come standard with the unit, they shall all be measured and the results for each pipe configuration listed in the operator's manual. For blowers that may be used as vacuums, the inlet guard shall be closed and secured for the test.

If the average and/or max velocity (V_p) is included in the operator's manual, it shall be the value based on this clause. If multiple pipe configurations come standard with the unit, they shall all be measured and the results for each pipe configuration listed in the operator's manual.

12 Labeling Requirements

12.1 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 required 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 label durability requirement.

- a) **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.
- b) Warn the operator of thrown or blown objects, dust or other debris.
- c) Warn the operator to wear eye protection that complies with ANSI Z87.1.
- d) Advise the operator to wear hearing protection when required as set forth in 9.2.1.
- e) Show bystander sound pressure level as specified in 9.2.2. (Optional). Sound pressure levels with other attachments may also be marked.

13 Operator's Manual(s) Instructions

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

13.1 General Information

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

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

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

13.1.2 If the unit blowing performance (velocity and volume flow rate) is reported in the manual(s), it shall be in accordance with 11.2 of this standard. Engine power output shall not be used to represent blower performance alone.

13.1.3 The operator's manual(s) shall indicate the tasks for which the unit may be used. It shall recommend attachment(s) for the unit. The manual(s) shall also recommend proper blowing techniques and the materials that can be blown or vacuumed with the unit.

13.2 General Safety Instructions

The operator's manual(s) shall provide the warnings and safety instructions listed below, either verbatim or suitably paraphrased. Pictorial or graphic illustrations may be substituted in lieu of, or used in addition to, the written statements.

13.2.1 Personal Protective Equipment

To reduce the risk of hearing loss associated with sound levels, hearing protection is required. To reduce the risk of injury associated with thrown objects, always wear eye protection. Eye protection should meet the requirements of ANSI Z87.1. To reduce the risk of injury associated with the inhalation of dust, use a face filter mask in dusty conditions.

13.2.2 Physical Condition of Operator

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

13.2.3 Clothing Recommendation

Always wear heavy, long pants, boots, gloves, and a long-sleeve shirt. To reduce the risk of injury associated with objects being drawn into rotating parts, do not wear loose clothing, scarves, jewelry, etc. Secure hair so it is above shoulder level.

13.2.4 Condition of Unit before Use

Inspect unit before each use. Replace damaged parts. Check for fuel leaks. Make sure all visible fasteners are in place and secure. Make sure attachments are properly installed and securely fastened. Be sure guards are properly attached and in the position recommended by the manufacturer.

13.2.5 Proper Stance

The operator's manual(s) shall explain the proper positioning for hands, feet, and the unit during use. It shall explain the proper use of handles and harnesses. Keep firm footing and balance. Do not over-reach. Keep all parts of your body away from hot surfaces.

13.2.6 Exhaust Gases

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

13.2.7 Fueling

Mix and pour fuel outdoors where there are no sparks or 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 3 m (10 ft) away from the fueling source and site before starting engine. Always store gasoline in a container approved for flammable liquids.

13.2.8 Work Area

Clear the area of children, bystanders, and pets. At a minimum, keep all children, bystanders, and pets outside a 15 m (50 ft) radius; outside the 15 m (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.

13.2.9 Work from Ladders or on High Surfaces

The operator's manual should warn that work from ladders or high places (such as roofs) is prohibited and could result in severe injury.

13.2.10 Transportation and Storage of the Unit

The operator's manual should provide transportation and long- and short-term storage instructions.

13.2.11 Service Work

To reduce the risk of injury associated with contacting rotating parts, stop the engine before installing or removing attachments. Do not operate without guards in place. Always disconnect the spark plug before performing maintenance or accessing movable parts.

13.3 Additional Operating Recommendations for Blowers and Blower-Vacuums

13.3.1 Operate power equipment only at reasonable hours--not early in the morning or late at night when people might be disturbed. Comply with times listed in local ordinances.

13.3.2 To reduce sound levels, limit the number of pieces of equipment used at any one time.

13.3.3 Operate blowers at the lowest possible engine speed to do the job.

13.3.4 Use rakes and brooms to loosen debris before blowing.

13.3.5 In dusty conditions, slightly dampen surfaces or use mister attachment when water is available.