UL 1602

STANDARD FOR SAFETY

Gasoline-Engine-Powered, Rigid-Cutting-Member Edgers and Edger-Trimmers

UL Standard for Safety for Gasoline-Engine-Powered, Rigid-Cutting-Member Edgers and Edger-Trimmers, UL 1602

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SUMMARY OF TOPICS

The revision of UL 1602 dated May 19, 2022 is being issued to remove the ANSI logo and approval from the title page.

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UL 1602

Standard for Gasoline-Engine-Powered, Rigid-Cutting-Member Edgers and Edger-Trimmers

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INTRODUCTION

1 Scope

1.1 These requirements cover walk-behind gasoline-engine-powered, ground-supported edgers and edger-trimmers that employ rigid cutting members, the diameter of which is not more than 12 in (305 mm).

1.2 These requirements also cover hand-supported, portable, gasoline-engine-powered edgers having at least one ground-support and employing a rigid cutting member that has a diameter of not more than 12 in (305 mm).

1.3 These requirements do not cover gasoline-powered edgers and edger-trimmers that employ a cutting means:

a) That has a maximum tip-speed of more than 12,000 surface ft/min (3660 surface m/min); or

b) That is made of nonmetallic flexible line.

1.4 These requirements do not cover accessories or attachments provided for the purpose of digging or cutting materials other than earth and grass.

2 Glossary

2.1 BLADE-TIP CIRCLE – The path described by the outermost point of the cutting member as it moves about its axis.

2.2 DEAD-MAN CONTROL – A control that automatically interrupts drive to the cutting member when the actuating force applied by the operator is removed.

2.3 EXPECTED LOADING CONDITION – The stress placed on the product and its components when operated in accordance with the manufacturer's operating instructions.

2.4 GROUND SUPPORT – The means by which the product is maintained in its intended operating position or conveyed during use.

2.5 GROUND-SUPPORTED PRODUCT – A product that, when used as intended by the manufacturer, has at least 50 percent of its weight directly supported by the ground.

2.6 GUIDING HANDLE – The handle of a hand-supported portable edger by which the operator supports the least percentage of product weight. See 2.14.

2.7 HAND-SUPPORTED PORTABLE EDGER – An edger that, when used as intended by the manufacturer, requires the operator to support more than 50 percent of the weight of the product.

2.8 MAXIMUM GOVERNED SPEED – The maximum speed an engine is capable of attaining as limited by a governor or other means, and as set by the manufacturer.

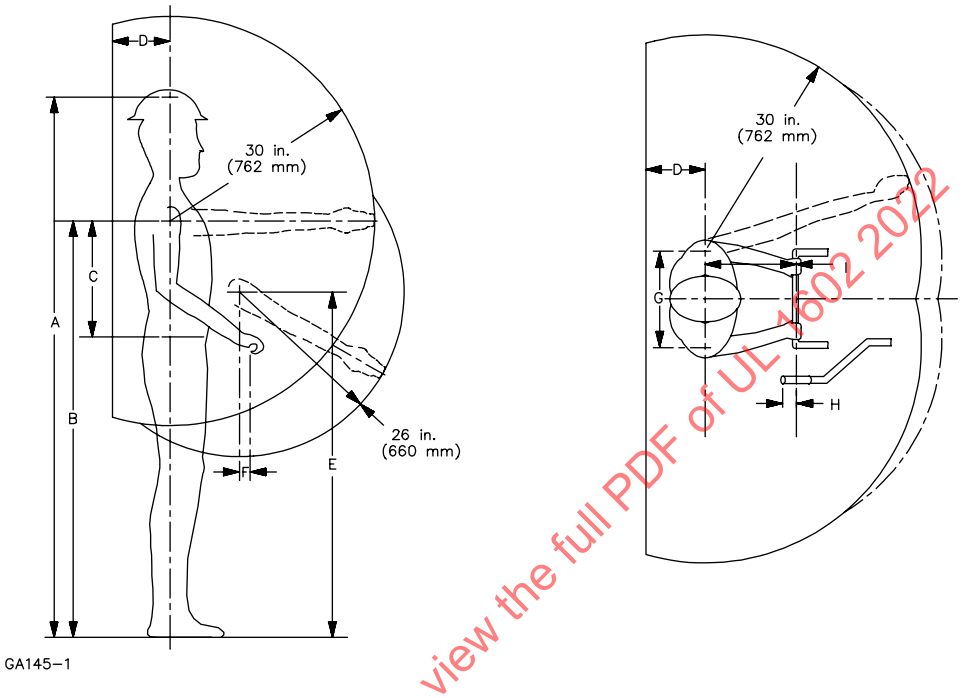
2.9 NORMAL USE AND MAINTENANCE – Those actions performed in application of the product to its intended purposes, or for the product's continued operation, in accordance with the use and care instructions provided by the manufacturer with each product.

2.10 OPERATING CONTROL – Any device necessary for operating the edger or edger-trimmer, such as an engine-starting and-stopping control, a drive-engaging control, and a blade-angle adjustment.

2.11 OPERATOR CONTROL ZONE – The area within which controls are accessible by an operator standing in the operator zone. See Figure 2.1.

Figure 2.1

Operator control zone[a]



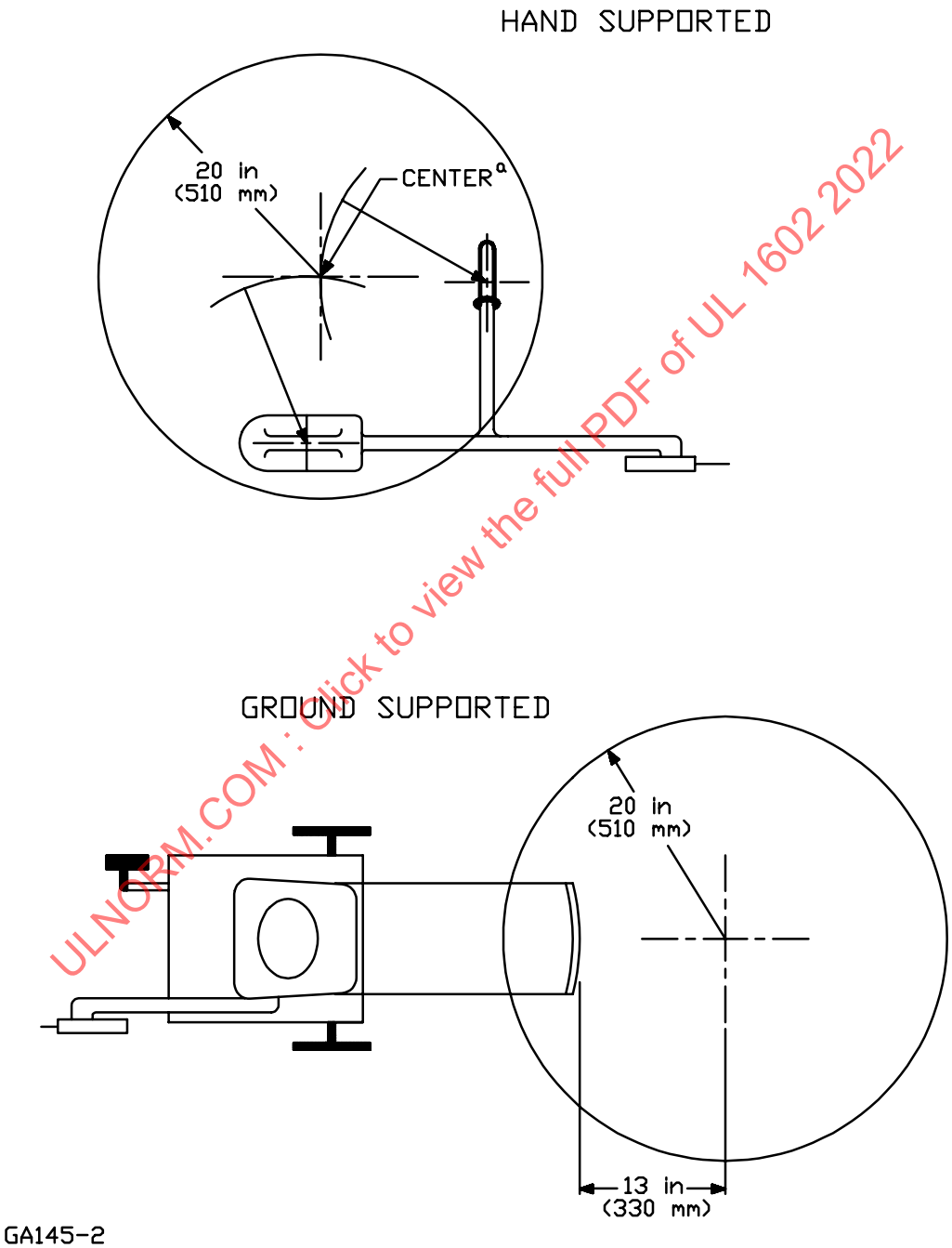
[a] SI values for the dimensions in this figure are:

Dimension	Inches	Millimeters
A	74.0	1880
B	59.0	1500
C	18.7	475
D	10.0	254
E	50.0	1270
F	4.0	102
G	14.0	356
H	2.5	64
I	12.0	305

2.12 OPERATOR ZONE – When the product is performing its intended function, the operator zone is the space occupied by an operator having his hands on the handle or handles and his feet on the ground. See Figure 2.2.

Figure 2.2

Operator zone



[a] The center of the operator zone of a hand-supported portable edger is the point of intersection of two 13 in (330 mm) radius arcs that are drawn, one from each handle, in a plane parallel to the supporting surface. For the purposes of this measurement, the top center of the support handle is to be positioned 33.3 in (846 mm) above the supporting surface.

2.13 RIGHT, RIGHT HAND – LEFT, LEFT HAND – The designation that refers to the orientation of the edger or edger-trimmer when the operator is in the operator zone, facing the intended direction of travel of the product.

2.14 SUPPORT HANDLE – The handle of a hand-supported portable edger by which the operator supports the greatest percentage of product weight. See 2.6.

3 Units of Measurement

3.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

4 Components

4.1 Except as indicated in 4.2, a component of a product covered by this standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

4.2 A component is not required to comply with a specific requirement that:

a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or

b) Is superseded by a requirement in this standard.

4.3 A component shall be used in accordance with its rating established for the intended conditions of use.

4.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

5 Undated References

5.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

CONSTRUCTION

6 General

6.1 Accessories provided or specifically recommended for use by the manufacturer shall be individually evaluated with a product to determine that the product, when used with the accessory as directed by the manufacturer, complies with the requirements in this standard.

7 Cutting Member

7.1 An edger-trimmer shall not employ a cutting member in which the operational plane is adjustable to more than 110 degrees from the horizontal trimming position.

7.2 An edger shall not employ a cutting member in which the operational plane is adjustable to more than 20 degrees from either side of the vertical edging position.

8 Protection Against Corrosion

8.1 Ferrous metal structural parts of the frame, including braces and the handle assembly, shall be protected against corrosion by galvanizing, plating, or a paint coating.

Exception No. 1: Mating surfaces of parts are not required to be protected if paint is applied to all exposed surfaces after assembly, provided such surfaces are not disassembled in normal use and maintenance of the product.

Exception No. 2: Metals that are inherently resistant to corrosion, such as stainless steel and certain alloys of aluminum, are not required to be provided with additional protection against corrosion.

8.2 Ferrous sheet-metal guards over moving parts that are capable of causing injury to persons shall be protected against corrosion by galvanizing, plating, or painting of all surfaces. An external coating of paint is not prohibited from being applied over galvanizing or plating.

9 Fuel Tank

9.1 A fuel tank shall provide for filling from a safety can that complies with the requirements in the Standard for Metal Safety Cans, UL 30, or the equivalent.

9.2 A fill opening of a fuel tank shall have a minimum inside diameter of 0.72 in (18 mm).

9.3 Strengthening ribs or depressions in ferrous-metal fuel tanks that are capable of trapping water on the tank top shall not be more than 1/16 in (1.6 mm) deep.

9.4 A metal fuel tank shall be made of terneplate steel, aluminized steel, galvanized steel, aluminum, or zinc alloy (see 9.5) or shall be provided with an inorganic coating on the inside and outside surfaces that provides equivalent protection against corrosion.

9.5 A metal fuel tank is not prohibited from being made of materials other than those mentioned in 9.4. The materials of such a fuel tank shall be galvanically compatible and shall be provided with protection against corrosion equivalent to the protection provided by the metals mentioned in 9.4. If the corrosion resistance properties of the metal are not known, a sample shall be subjected to the corrosion test described in 25.2.1 – 25.2.3 to determine whether it meets the intent of this requirement.

9.6 A nonmetallic fuel tank, and a fuel tank constructed of nonmetallic and metallic materials in combination shall be resistant to the effects of:

a) Reference Fuel C (ASTM D471, Standard Test Method for Rubber Property – Effect of Liquids);

b) Heat aging;

c) Low temperature; and

d) Ultraviolet light if the nonmetallic surface is exposed to ultraviolet light during intended use.

Resistance to the effects of (a) – (d) is to be determined by the requirements in 25.3.1 – 25.6.3. See 9.7.

9.7 If a nonmetallic tank is provided with an exterior coating of paint for protection against ultraviolet light exposure, the paint will be investigated to determine whether it meets the intent of these requirements. Factors to be used in the investigation are:

a) Effectiveness of the paint in providing protection against ultraviolet light;

b) Permanence and adherence of the paint in service; and

c) Adverse effect of the paint on the plastic.

10 Fuel Line

10.1 A flexible fuel line shall comply with the SAE Standard J30, Standard for Fuel and Oil Hoses.

10.2 A rigid fuel line shall be steel or seamless annealed copper tubing or the equivalent. Copper tubing shall have a wall thickness of 0.032 plus 0.000 minus 0.003 in (0.81 plus 0.00 minus 0.08 mm). Steel tubing shall have a wall thickness of 0.028 plus 0.000 minus 0.003 in (0.71 plus 0.00 minus 0.08 mm) and shall have a corrosion-resistant exterior coating equivalent to that afforded by paint.

11 Ignition Cable

11.1 Ignition cable provided with a product shall comply with the requirements for SAE Standard J2031, High-Tension Ignition Cable.

11.2 If a product is not provided with either a dead-man control that opens the ignition circuit or a centrifugal clutch, then the cable connection to the spark plug shall be readily accessible without the use of a tool.

PROTECTION AGAINST RISK OF INJURY TO PERSONS

12 General

12.1 A product shall be completely assembled before being shipped from the factory, unless all of the following conditions are met:

a) Other than as provided in 12.2, all parts required for assembly and all parts necessary for the manufacturer's intended operation of the product are provided in one carton;

b) Intended assembly is accomplished without introducing a risk of fire, electric shock, or injury to persons;

c) Clear and detailed assembly instructions are provided; and

d) The product is marked in accordance with 27.3, if shipped with a required guard that is detached.

12.2 A product is not prohibited from being shipped from the factory in two cartons if the following conditions are met:

a) All parts for assembly that are necessary for the product to comply with the requirements in this standard are provided in the two cartons;

b) Intended assembly is accomplished without introducing a risk of fire, electric shock, or injury to persons;

c) Clear and detailed assembly instructions are provided in both cartons; and

d) The product and its shipping containers are marked in accordance with 26.4.

12.3 A product shall:

a) Be provided with at least three ground supports arranged in a triangular configuration in all operational modes (curb attachments are not ground-supporting means); or

b) When tested as described in 12.4, not tip over on the side opposite the cutting member and expose the rotating cutting member to operator contact.

Exception: A product having a dead-man control the cutting member of which has a stopping time of 3 seconds or less is not required to comply with this requirement.

12.4 For the test mentioned in 12.3(b), a product is to be placed on a horizontal concrete surface, and started and adjusted to operate at the maximum cutting-member speed specified by the manufacturer. The product is then to be released and left unattended.

12.5 Edges, projections, and corners of a product that are exposed to contact by the user in normal use and maintenance shall be smooth and rounded, and not sufficiently sharp to constitute a risk of cut-type injury to persons, when judged in accordance with the Standard for Test for Sharpness of Edges on Equipment, UL 1439.

13 Enclosures and Guards

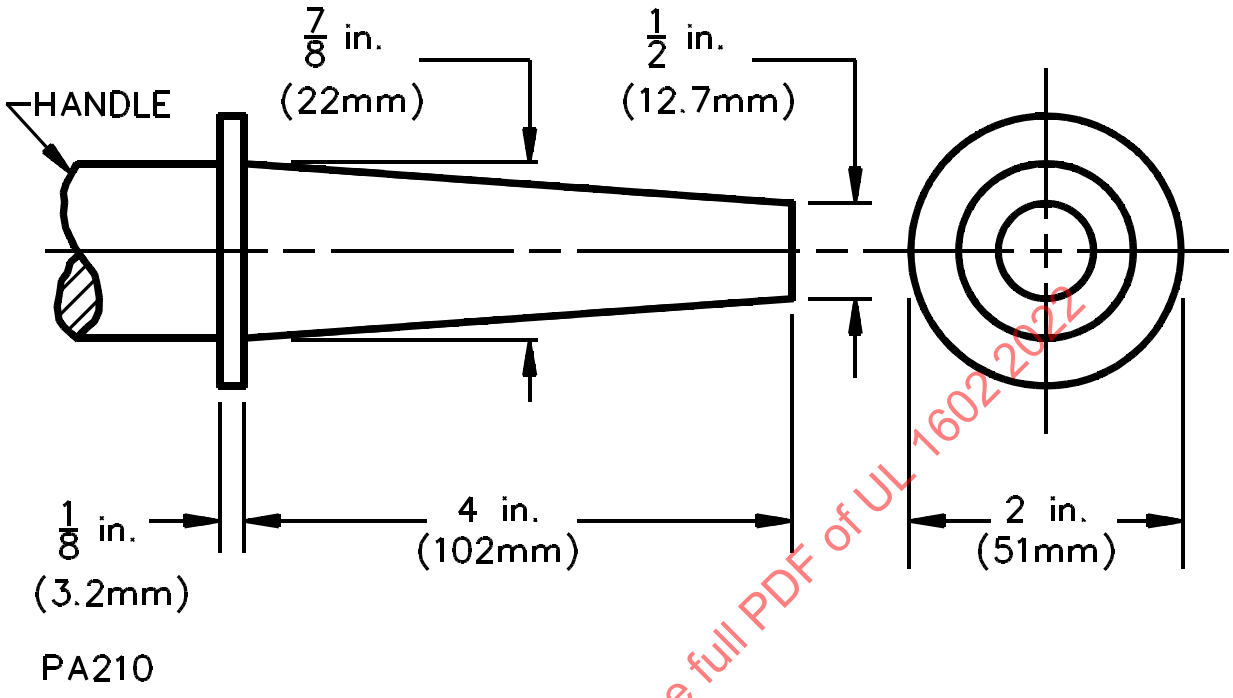
13.1 To reduce the risk of injury to the operator, pulleys and cutting members shall be provided with guards or enclosures that are attached so that they are not to be removed without a tool.

Exception: Rope starter pulleys are not required to be provided with guards or enclosures.

13.2 A guard or deflector shall be provided at each exposed pulley to reduce the risk of a hand or finger being caught between the pulley and belt on the side of the pulley where it is capable of being caught and drawn in. Such a guard or deflector shall not allow the probe illustrated in Figure 13.1 to contact the pulley or the pinch point of the pulley (point where the belt enters the pulley) when the probe is applied as described in 13.3.

Figure 13.1

Finger probe



13.3 The probe mentioned in 13.2 is to be applied perpendicular to the plane of the pulley, and to any potential depth with a force of 1 lb (4.4 N) or less.

13.4 An opening in a guard or enclosure of a gear or chain on a ground-supported product and of a hand-supported portable edger shall not allow the probe illustrated in Figure 13.1 to contact a moving part that presents a risk of injury to persons when applied as described in 13.5. See 21.3.

13.5 The probe mentioned in 13.4 is to be applied to any potential depth through an opening with a force of 1 lb (4.4 N) or less, and is to be rotated and positioned in all angles while inserted in the opening.

13.6 A product for which the distance D measured between the rearmost portion of the blade-tip circle (in any operational mode) and the foremost portion of the handle (as illustrated in Figure 13.2) is less than 16 in (406 mm) and a portable edger shall be provided with a guard, supplemented by other parts of the product as necessary, such that when tested as described in 13.7 and 13.8, the foot probe illustrated in Figure 13.3 is not able to be made to contact the cutting member in any operational mode.

Figure 13.2

Distance between rear of rotating cutting member and foremost portion of handle

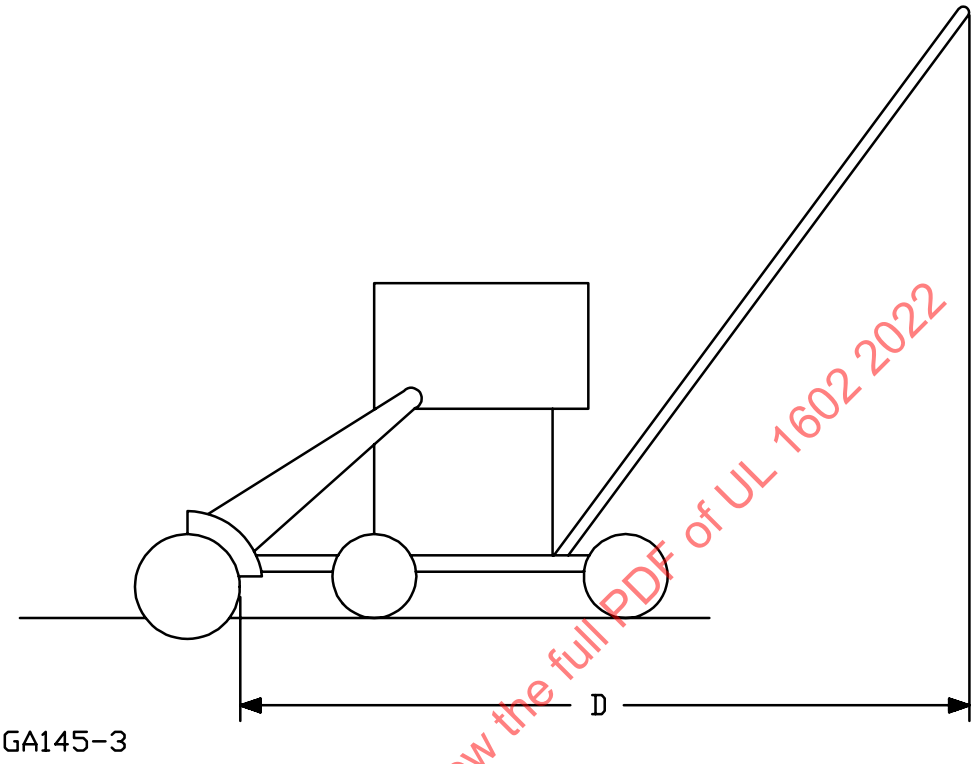
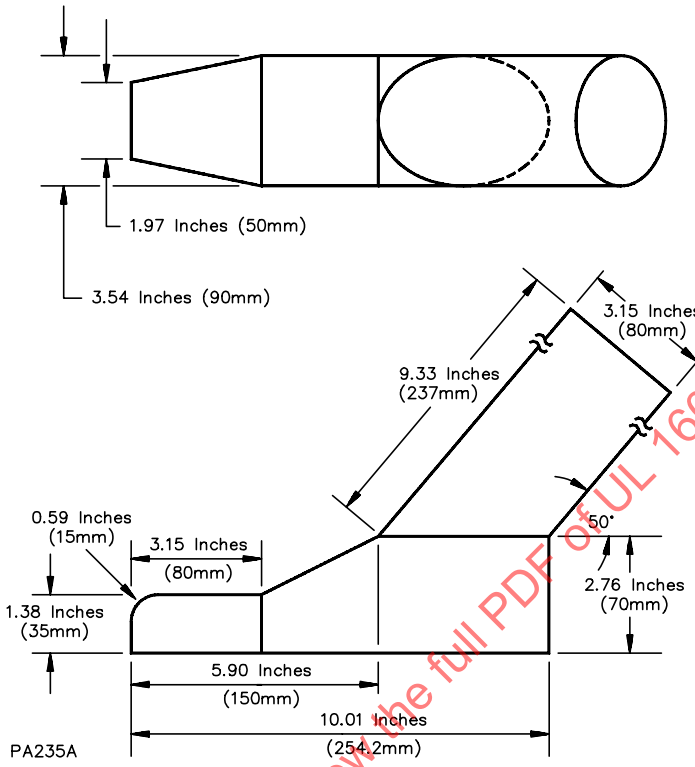


Figure 13.3

Foot probe



13.7 The foot-contact probe test is to be conducted with the product adjusted as follows:

a) A ground-supported product is to be placed on a smooth, level surface.

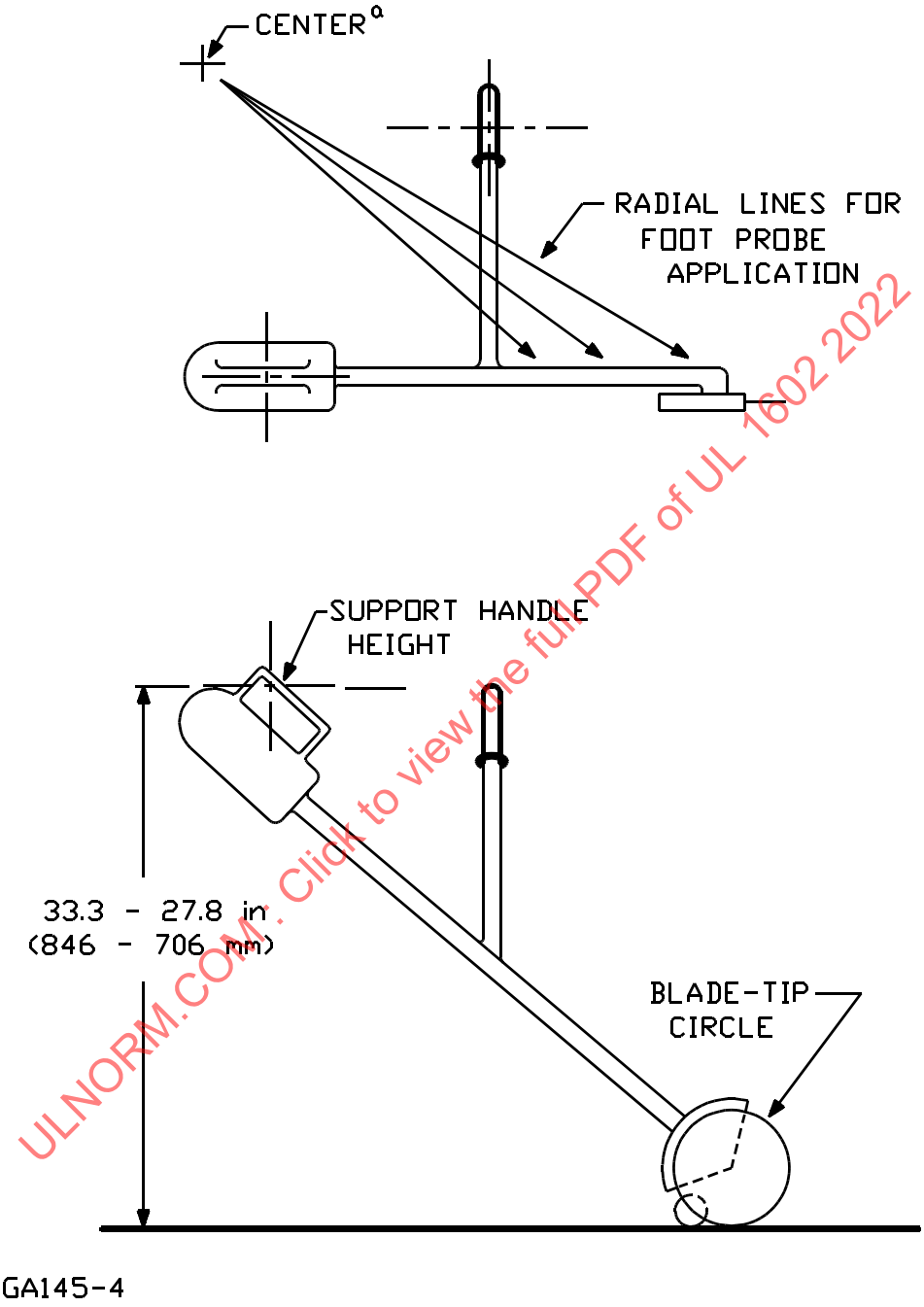
b) A hand-supported portable edger is to be placed on a smooth, level surface with the top center of the support handle alternately positioned at a height of 27.8 in (706 mm) and 33.3 in (846 mm) (see Figure 13.4), and with the guiding handle in all positions of adjustment.

c) The product is to be adjusted to the wheel height setting that will result in the most severe test conditions.

d) The cutting member is to be adjusted so that the blade-tip circle is tangent to the supporting surface.

Figure 13.4

Foot contact test specifications for hand-supported portable edgers



[a] Center of operator zone as specified in Figure 2.2.

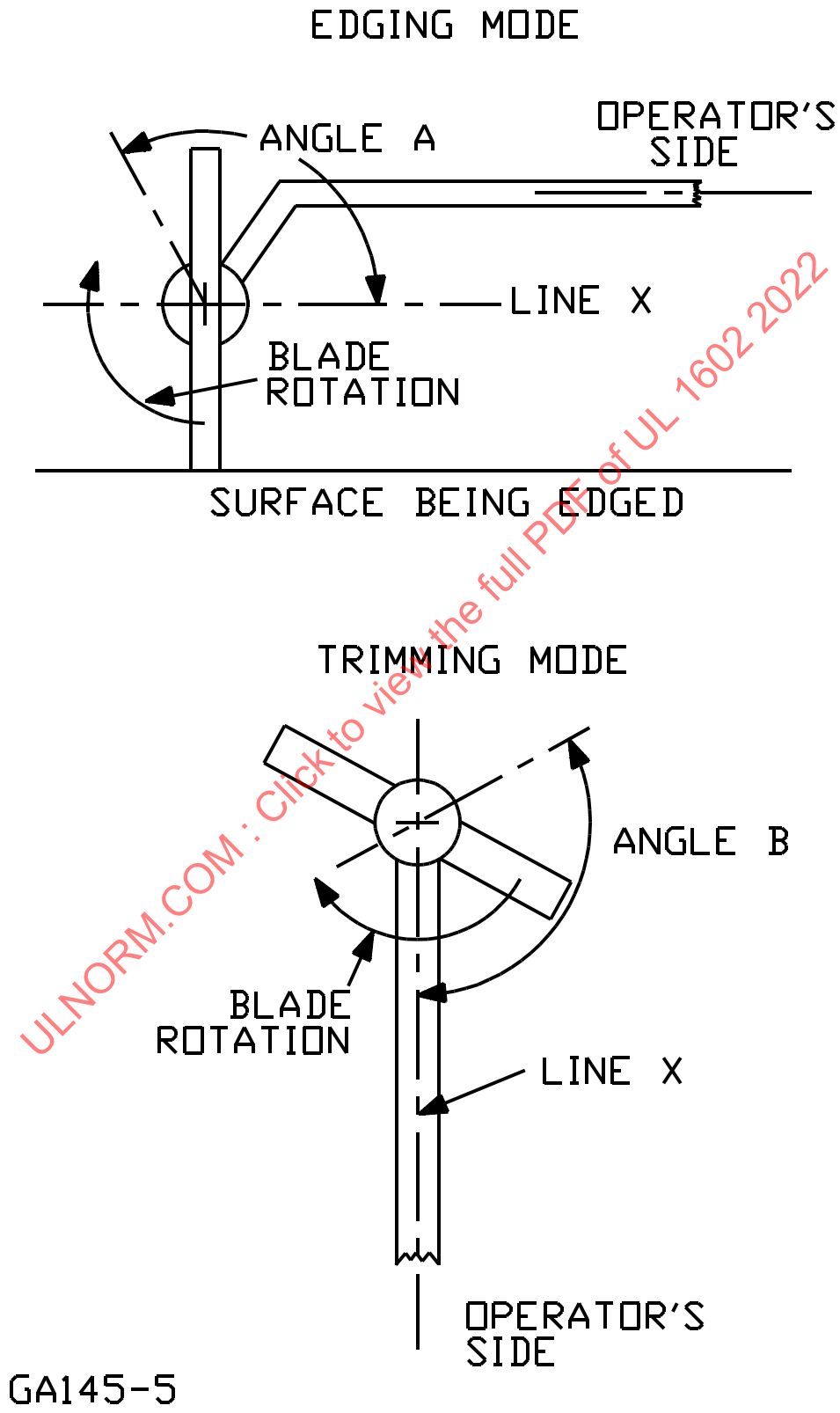
13.8 For a ground-supported product, the foot probe mentioned in 13.6 is to be applied at any angle on the operator's side, and moved forward in a direction parallel to the plane of the blade in the edging mode. For a hand-supported portable edger, the foot probe is to be applied at any angle along any radial line that passes through the center of the operator zone (see Figure 13.4). For all products, the sole of the foot probe is to be maintained parallel to the supporting surface during the test.

13.9 A product shall be provided with a guard or guarding, which is not prohibited from being transparent, that blocks the operator's direct line of sight to the cutting member. The operator's line of sight to the cutting member is to be determined under the conditions described in 13.7 (except that a ground-supported product provided with a handle adjustment is to be adjusted to the most severe position), and is to be taken at any point within 10 in (254 mm) of either side of the center of the operator zone and at any height 55 – 70 in (1400 – 1780 mm) above the supporting surface. The guard or guarding shall block the operator's direct line of sight to the cutting member when the cutting member is rotating toward the operator within the 135 degree arc illustrated in Figure 13.5. Angle A of Figure 13.5 describes the 135 degree arc for a product in the edging mode; Angle B describes the 135 degree arc for a product in the trimming mode. For bevel modes of operation, the 135 degree arc is revolved about the line parallel to the product's intended direction of travel that also passes through the cutting member's axis of rotation (line X of Figure 13.5).

Exception: A product is not required to be provided with a guard or guarding if the maximum cutting-member tip speed is not more than 430 surface ft/min (131 surface m/min).

Figure 13.5

Area for line-of-sight guarding

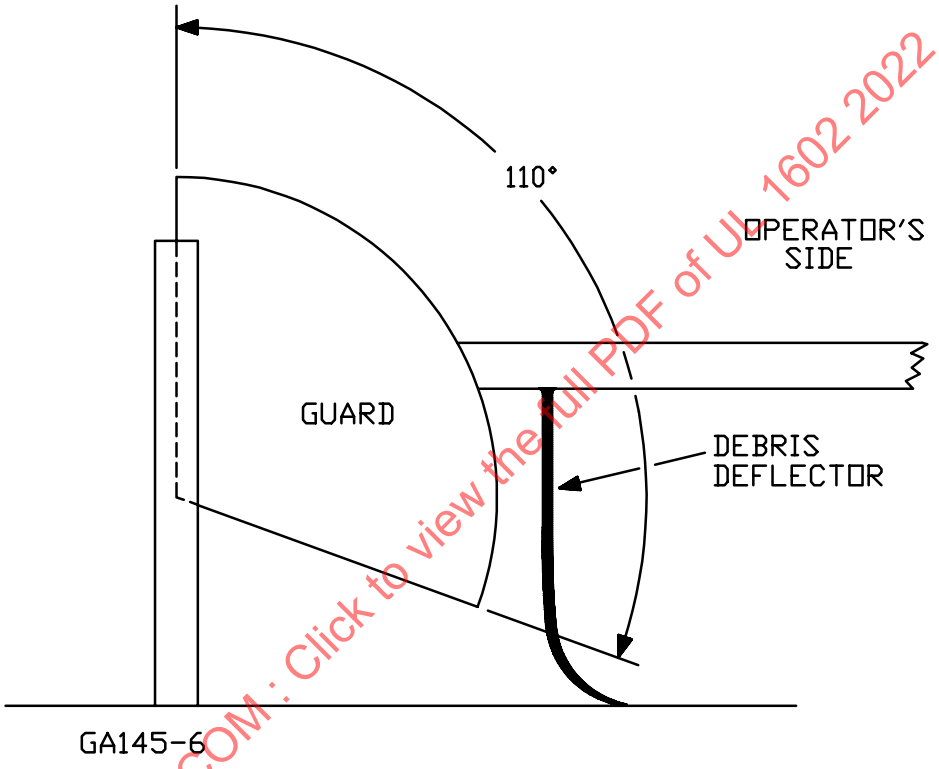


13.10 A product in the edging mode shall be provided with a permanent guard as described in 13.11. A debris deflector constructed of flexible material and having the dimensions described in 13.12 shall also be included if discharge is toward the operator. See Figure 13.6.

Exception: A product that has a maximum cutting-member tip speed of not more than 430 surface ft/min (131 surface m/min) is not required to be provided with a guard.

Figure 13.6

Cutting-member guard and debris deflector for edging mode



13.11 The guard required by 13.10 shall provide a minimum of 110 degrees of guarding, measured:

a) At the cutting-means axis of rotation;

b) With the product height adjusted so that the cutting means, when vertical, is tangent to the surface being edged; and

c) From a vertical line that passes through the cutting means axis of rotation towards the operator's side.

If the guard is adjustable, the guard shall provide the minimum 110 degrees of guarding in any position of adjustment.

13.12 The debris deflector required by 13.10 shall not be less than 4 in (102 mm) wide, measured perpendicular to the intended direction of travel of the product, from the outside lip of the blade guard toward the inside. The debris deflector shall trail on the ground when the product height is adjusted so that the cutting means, when vertical, is tangent to the surface being edged. The debris deflector shall:

a) Have a minimum height equal to the lowest portion of the permanent blade guard;

b) Not contact the blade in any operational mode; and

c) Be located behind the blade guard.

13.13 The cutting-member guard required by 13.10 shall extend perpendicularly beyond the cutting plane, and shall not include any openings in the top or rear sections facing the operator's side.

14 Rotating Parts

14.1 A user-removable rotating part, such as a cutting member, shall be assembled so that the direction of rotation tends to tighten the means used to hold the rotating part in place.

15 Handles

15.1 A ground-supported product shall be provided with a handle, handles, or other means for guiding the product.

15.2 A hand-supported portable edger shall be provided with two separate handles, one for support and one for guiding. See 21.3. The handles shall:

a) Be fixed in position, except that the guiding handle is not prohibited from being vertically adjustable through a distance of not more than 12 in (305 mm);

b) Serve as a barrier between the operator and the cutting member in all positions of adjustment; and

c) Be located so that the distance between the rearmost portion of the blade-tip circle and the foremost portion of the handle barrier is at least 16 in (406 mm), measured in a horizontal plane.

For the purposes of this requirement, the foremost portion of the handle barrier is the point where the handle intersects a radial line drawn from the center of the operator zone to the rearmost portion of the blade-tip circle.

15.3 A handle or handle-supporting structure of a ground-supported product shall not break or become disengaged from the product when tested as described in 15.4.

15.4 The product is to be positioned on a horizontal supporting surface and restrained from movement at the wheels. A static force of 50 lbs (222 N) is to be applied for 1 minute to the rearward part of the handle on the longitudinal centerline of the handle in a direction toward the front of the product and parallel to the supporting surface.

16 Controls

16.1 For a pull-cord or recoil-spring starter mechanism, the direction of pull as specified by the manufacturer shall be away from other parts of the product, such as the frame or handle.

16.2 A product shall be provided with either:

a) A cutting-member clutch mechanism that disengages drive to the cutting member before the lowest part of the cutting member is raised more than 3 in (76.2 mm) above ground level; or

b) A dead-man control that disengages drive to the cutting member when the actuating mechanism is released.

If the product is provided with a clutch mechanism, there shall be no provision for locking the cutting member at a height where it is completely above ground level with the drive engaged.

16.3 A shutoff control shall be provided to stop the engine. The shutoff control shall be fitted with a stopping device, which brings the tool to a complete stop and does not depend on sustained manual effort to operate the stopping device.

16.4 A means to prevent starting of the engine shall be provided if a one-touch stop device is provided, and the means shall require deliberate action by the operator to permit the engine to start up. A one-touch stop switch shall be used only with a pull-cord starter mechanism. See 31.5.

16.5 Either the actuating mechanism of a cutting-member clutch, if provided, or the engine shutoff control shall be located in the operator control zone. See Figure 2.1.

16.6 A product having a cutting-member disengagement control that is not located within the operator control zone (see Figure 2.1) shall have:

a) The cutting-member-depth control, engine shutoff, and engine choke located within the operator control zone (see 16.6); and

b) The starting means located on the side opposite the cutting means.

16.7 When tested as described in 16.8, a cutting member shall not retain sufficient force to break a 3/8 in (9.5 mm) diameter wooden dowel, after actuation of the:

a) Engine shutoff;

b) Cutting-member disengagement control; or

c) Dead-man control.

Only a control located in the operator control zone shall be investigated to determine compliance with this requirement. If all controls are located in the operator control zone, they shall be individually investigated to determine compliance.

16.8 To determine compliance with the requirement in 16.6, a product is to be operated at no-load and maximum governed speed in an ambient temperature between 50° and 104°F (10° and 40°C). After 30 minutes, the engine shutoff or cutting-member disengagement control is to be actuated. Five seconds after actuation of the control for a ground-supported product, and three seconds after actuation for a hand-supported portable edger, a 3/8-in (9.5-mm) diameter wooden dowel, held rigidly 6 in (152 mm) from the tip, is to be inserted perpendicular to and within 1/2 in (12.7 mm) of the outside tip of the cutting member.

17 Overspeed Protection

17.1 The engine shall be provided with a means of limiting engine speed such as a governor or basic engine construction.

18 Engine Exhaust

18.1 The engine exhaust shall discharge at an angle not more than 15 degrees above the horizontal.

19 Hot Surfaces

19.1 The engine shall be provided with shielding, guarding, or insulation as necessary so that when the product is tested as described in 19.2, no surfaces required to be contacted by the operator during starting, stopping, or normal operation of the product (in accordance with the manufacturer's operating instructions) will attain a temperature of more than 150°F (65.6°C).

19.2 A product is to be operated at no-load and maximum governed speed in an ambient temperature between 50° and 104°F (10° and 40°C). After 30 minutes, with the engine still running, temperatures are to be measured as described in 19.3 – 19.5.

19.3 Temperatures are to be measured by thermocouples consisting of wires not larger than 24 AWG (0.21 mm^2) and not smaller than 30 AWG (0.05 mm^2). The thermocouples and related instruments shall be accurate and calibrated. The thermocouple wire is to conform to the requirements for special tolerances thermocouples as listed in the Tolerances on Initial Values of EMF versus Temperature tables in the Standard Specification and Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples, ANSI/ASTM E230/E230M.

19.4 A thermocouple junction and adjacent thermocouple lead wire are to be in thermal contact with the surface of the material, the temperature of which is being measured. In most cases, thermal contact will result from securely taping or cementing the thermocouple in place. However, if a metal surface is involved, brazing or soldering the thermocouples to the metal is not prohibited from being done.

19.5 Whenever referee temperature measurements are necessary, thermocouples consisting of 30 AWG (0.05 mm^2) iron and constantan wires and a potentiometer type of indicating instrument are to be employed.

20 Fuel Tank

20.1 If the fuel-line connection to the fuel tank leaks, the leakage shall not contact:

a) Any surface on which exhaust gas is able to directly impinge;

b) Any surface capable of attaining a temperature of 800°F (427°C) or more during intended operation; and

c) Any uninsulated high-voltage component.

20.2 A product constructed such that the fuel tank to fuel cap seal is submerged, partially or completely, during intended use or storage shall be tested as described in 20.3. As a result of the test, the threads of the tank and the cap shall not be stripped, and the assembly shall not be otherwise damaged such that leakage of fuel occurs.

20.3 A cap for a fuel tank is to be screwed on (until the cap bottoms on the tank) and off the fuel tank a total of ten times. After this conditioning, the cap is to be screwed on and tightened with a torque of 10 lb-in (1.13 N·m) and held for 1 minute.

21 Impact Test

21.1 The guard or guarding that is described in 13.11 provided for the cutting means, and any mounting means provided for such guarding, shall withstand the ball-impact test described in 21.2 without cracking such that the function of the part is affected. If the guard or mounting means is made of nonmetallic material, the ball-impact test is to be performed on the sample or samples that have been conditioned as described in 21.5.

21.2 The ball-impact test is to be conducted using a 2-in (50.8-mm) diameter smooth steel sphere weighing 1.18 lbs (0.535 kg). If the component being tested has potential to be struck from above, the sphere is to be allowed to fall vertically from rest to strike the component. Otherwise, the sphere is to be suspended by a cord and allowed to fall from rest as a pendulum to strike the component. In either case, the vertical travel of the sphere is to be 51 in (1295 mm).

21.3 A hand-supported portable edger shall be subjected to the impact test described in 21.4. If the enclosure or handles are made of nonmetallic material, the samples are to be conditioned as described in 21.5 before being subjected to the impact test. As a result of the test, the product shall not break, crack, rupture, or show other adverse effects such that:

a) The enclosure no longer complies with the requirements in 13.4 and 13.5; or

b) The function of either of the handles is affected.

21.4 With reference to 21.3, the product is to be dropped twice on each handle, and on the enclosure with the long axis horizontal, through a distance of 3 ft (914 mm) to strike a concrete surface. In the tests, three different samples are not prohibited from being used, one for each set of impacts.

21.5 The conditioning required by 21.1 and 21.3 is to consist of placing the product in an air-oven for 7 hours at a uniform temperature not less than 18°F (10°C) higher than the maximum operating temperature of the material measured under normal operating conditions, and not less than 158°F (70°C). The conditioned samples are not to be tested until they have returned to room temperature. See 21.6.

21.6 Upon removal from the oven mentioned in 21.5 and before being subjected to the impact test, no sample shall show cracking or other deleterious effects from the oven conditioning, nor shall any sample show distortion sufficient to impede the intended use of the product.

PERFORMANCE

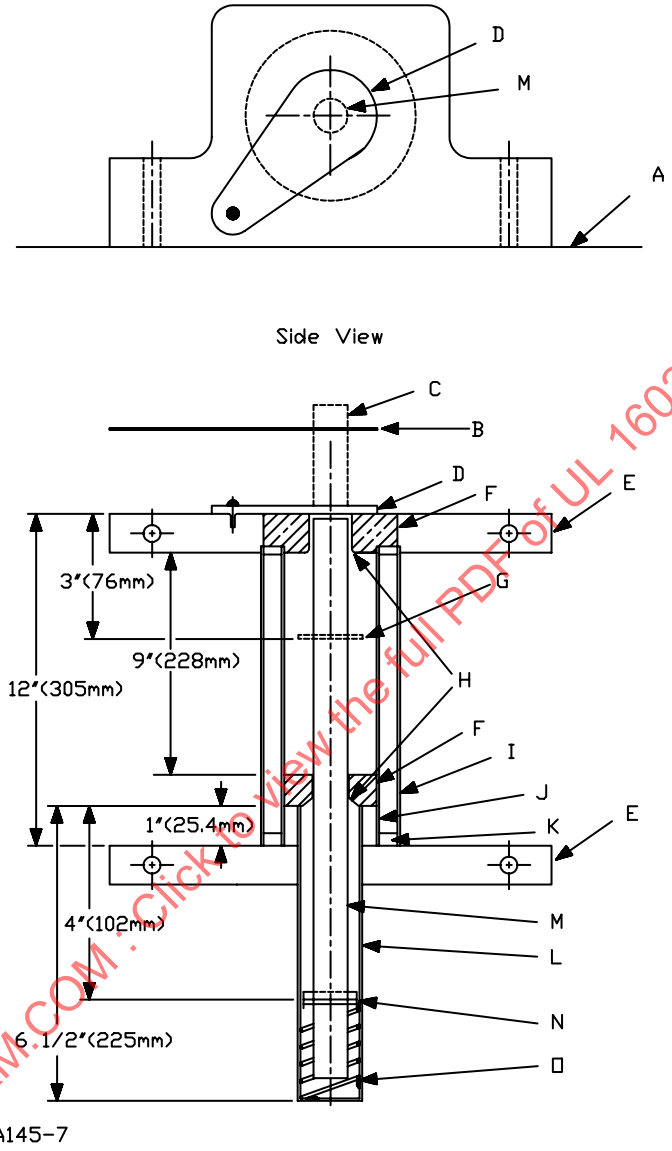
22 Sudden Impact Test

22.1 No part of the product shall break, loosen, or deform in a manner that introduces a risk of injury to a person as a result of the test described in 22.2.

22.2 The product is to be positioned and operated at a maximum governed speed over or parallel to the test fixture illustrated in Figure 22.1. The test fixture is to be secured by resilient restraints. The cutting member is to be positioned so that, when the rod is inserted into the rotating cutting member, the portion of the cutting member within 2 in (50.5 mm) of the tip will strike the exposed portion of the rod.

Figure 22.1

Typical sudden-impact test fixture



A. Floor level

B. Blade height

C. Release position of rod

D. Remote control release

E. 1-in (25.4 mm) plate

F. 1-in (25.4 mm) thick hardened steel bushing, 1-1/8-in (28.6-mm) diameter hole in center

G. Pin

H. Chamfer

I. 4-in (102-mm) pipe

J. 3-in (76-mm) pipe

K. Spacer

L. 2-in (51-mm) pipe

M. 1-in (25.4-mm) diameter SAE 1117 steel rod

N. Pin and washer

O. Compression spring

23 Noise Level Test

23.1 The noise level from a product shall not exceed 100 decibels on the A scale with the microphone located 66 in (1676 mm) above the ground, and 10 in (254 mm) to the right and left of the center of the operator zone.

23.2 Measurements of sound level are to be made with instrumentation conforming with the International Electrotechnical Commission Recommendation for Sound Level Meters, IEC 123. The test is to be performed in accordance with the following:

a) An operator is to be at the product control when readings are taken.

b) The microphone is to be mounted independent of the equipment and operator.

c) The sound-level meter is to be set on slow response.

d) The test site is to be a flat, open space free from any large reflecting surfaces, such as sign boards, buildings, or hillsides located within 100 ft (30.5 m) of the product being tested. The surface of the test area shall be grass, approximately 2 in high.

e) Ambient sound level, including wind, is to be at least 10 decibels below that of the product being tested.

f) The product is to be operated in a stationary position at maximum governed speed and at no load.

24 Out-of-Balance Test

24.1 If a part of the product fractures, breaks, loosens, or deforms when subjected to the tests described in 24.2 and 24.3, the product shall still comply with the other requirements in this standard.

24.2 The product is to be unbalanced by adding material to one end of the cutting member which will cause the product to attain an unbalance of U in-ounces when operated at maximum speed. The magnitude of unbalance (U) in inch-ounces is to be calculated from the equation $U = L^3/618$ in which L is the diameter of the blade-tip circle in inches.

24.3 The product is to be operated in the unbalanced condition described in 24.2 for 1 hour or until it ceases to function.

25 Fuel Tank Tests

25.1 Overfill test

25.1.1 When tested as described in 25.1.2, overflow fuel from the fuel tank:

a) Shall not collect on the product other than in strengthening ribs as described in 9.3; and

b) Shall not come in contact with:

1) Any surface on which exhaust gas is able to directly impinge;

2) Any surface attaining a temperature of 800°F (427°C) or more during intended operation; or

3) Any uninsulated part of the spark plug cable assembly.

25.1.2 The product is to be placed on a horizontal concrete surface. The fuel tank is then to be overfilled by 5 oz (142 g) of liquid within 5 seconds, introduced at the rate of 1 oz (28.9 g) per second. The test liquid is to be nonflammable and approximately the same viscosity as the fuel intended to be used in the product.

25.2 Corrosion test

25.2.1 A metal fuel tank, the corrosion resistance properties of which are not known, shall be tested for 1800 hours as described in 25.2.2 and 25.2.3. See 9.5.

25.2.2 The metallic specimen is to be supported vertically and exposed to salt spray (fog) as specified by the test method for Standard Practice for Operating Salt Spray (Fog) Apparatus, ASTM B117. The apparatus used for salt-spray exposure is to consist of a fog chamber, of which the internal dimensions are 48 in (1220 mm) long, 30 in (760 mm) wide, and 36 in (915 mm) high. The chamber is to have a salt solution reservoir, a supply of conditioned compressed air, a dispersing tower for producing a salt fog, specimen supports, provision for heating the chamber, and necessary means of control. The dispersion tower is to be located in the center of the chamber and is to be supplied with salt solution and with warmed, humidified air at a pressure of 17 to 19 psig (115 to 130 kPa), so as to disperse the salt solution in the form of a fine mist or fog throughout the interior of the chamber. The temperature within the chamber is to be maintained at 95 plus 2 minus 3°F (35 plus 1 minus 1.5°C). Condensate accumulation on the cover of the chamber is not to drop on the specimens, and drops of the solution that fall from the specimens are not to be recirculated, and are to be removed through a drain located in the floor of the chamber.

25.2.3 The salt solution is to consist of 5 percent by weight of common salt (sodium chloride) and distilled water. The pH value of this solution as collected after spraying in the test apparatus is to be between 6.5 and 7.2, and the specific gravity between 1.026 and 1.040 at 91.0 ±1.8°F (35.0 ±1.0°C).

25.3 Reference fuel C

25.3.1 There shall be no evidence of softening or other deterioration after a fuel tank filled to capacity with ASTM Reference Fuel C has been maintained at a temperature of 69.8°F (21.0°C) or higher for 30 days.

25.4 Heat aging test

25.4.1 The tensile strength of specimens of a nonmetallic fuel tank that have been subjected to accelerated aging in accordance with 25.4.2 shall not be less than 70 percent of that obtained on unaged specimens of the tank.

25.4.2 Type I specimens are to be cut from a tank and tested in accordance with the test method of the Standard Test Method for Tensile Properties of Plastics, ASTM D638. The specimens are to be prepared for this test by:

a) Aging the specimens in a forced-draft air-oven for 1440 hours at 189° ±2°F (87° ±1°C); and

b) Conditioning the specimens in an ambient of 73° ±2°F (23° ±2°C) and 50 % relative humidity for at least 24 hours.

25.5 Low temperature test

25.5.1 When tested as described in 25.5.2 and 25.5.3:

a) A fuel tank shall not leak; and

b) The mountings for the fuel tank shall not break or deform.

25.5.2 The fuel tank is to be filled to capacity with 75 percent glycol and 25 percent water by volume, and the fill cap is to be secured in position. The product is then to be placed in a cold chamber maintained at minus 22° ±5°F (minus 30° ±3°C) for 24 hours. The product is then to be removed from the cold chamber, and subjected to the ball-impact test described in 25.5.3 within 1 minute after removal from the chamber.

25.5.3 The ball-impact test is to be conducted using a 2-in (50.8-mm) diameter smooth, steel sphere weighing 1.18 lbs (0.535 kg). If the component being tested has potential to be struck from above, the sphere is to be allowed to fall vertically from rest to strike the component. Otherwise, the sphere is to be suspended by a cord and allowed to fall from rest as a pendulum to strike the component. In either case, the vertical travel of the sphere is to be 51 in (1295 mm).

25.6 Ultraviolet light test

25.6.1 A nonmetallic fuel tank that is exposed to ultraviolet light (unpainted or not otherwise provided with a protective coating) during intended operation shall be conditioned for 720 hours as described in 25.6.2 and 25.6.3. As a result of the conditioning, the tensile strength of specimens cut from the fuel tank shall not be less than 70 percent of that obtained on unexposed specimens. See 9.7.

25.6.2 The ultraviolet light is to be obtained from two stationary enclosed carbon-arc lamps. The arc of each lamp is to be formed between two vertical carbon electrodes that are 1/2 in (12.7 mm) in diameter, and located at the center of a revolvable vertical metal cylinder. The metal cylinder is to be 31 in (785 mm) in diameter and 17-3/4 in (450 mm) in height. Each arc is to be enclosed with a No. 9200-PX clear Pyrex-glass globe. The specimens are to be mounted vertically on the inside of the revolvable cylinder facing the lamps. The cylinder is to be continuously revolved around the stationary lamps at 1 revolution per minute. A system of nozzles is to be provided so that each specimen, in turn, is sprayed with water as the cylinder revolves. Each operating cycle is to consist of exposing each specimen to the light and water spray for 3 minutes and to the light only for 17 minutes. The air temperature within the revolving cylinder of the apparatus during operation is to be 140 ±9°F (60 ±5°C).

25.6.3 After exposure to the ultraviolet light and water as described in 25.6.2, the tank specimens are to be conditioned for at least 24 hours at 73 ±5°F (23 ±4°C) and 50-% relative humidity.

MARKING

26 General

26.1 A required marking shall be legible and readily visible, and shall be molded, die-stamped, paint-stenciled, stamped or etched on metal, or indelibly stamped on pressure-sensitive labels secured by adhesive. Pressure-sensitive labels secured by adhesive shall comply with the requirements in the Standard for Marking and Labeling Systems, UL 969, or the Consumer Turf Care Equipment Walk-Behind Mowers and Ride-on Machines with Mowers Safety Specifications, ANSI B71.1.

26.2 A product shall be marked with the:

a) Manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product is identified (See 26.3);

b) Catalog number or equivalent (other than as noted in 26.6); and

c) Date of manufacture (See 26.4).

26.3 When the manufacturer's identification is in a traceable code, the product shall be identified by the brand or trademark owned by the private labeler.