

	SURFACE VEHICLE STANDARD	SAE J2258 DEC2010
		Issued 1996-01 Revised 2010-12
		Superseding J2258 DEC2003
(R) Light Utility Vehicles		

RATIONALE

The revisions to SAE J2258 are intended to achieve consistency with other SAE standards and procedures, to make the test results more repeatable and quantitative, and to incorporate improvements in test procedures and data analysis.

The primary changes and the reasons for them are listed as follows:

- a. Added the Table of Contents

Reason: To make sections easier to access

- b. Revised Scope to include 40.23 km/h (25 mph) and to exclude Go-Karts, Fun-Karts, and Dune Buggies.

Reason: Clarity

- c. Reviewed normative references and deleted those not used, revised references as necessary, and added references

Reason: To insure applicability and to include new references.

- d. Revised definition of Charged Battery (3.1.3.8), and added definition of Light Utility Vehicle (3.1.3.12b) and Off Highway (3.1.3.15b).

Reason: Clarity.

- e. Revised (7.3.6.3) references and requirements for seat restraints.

Reason: To insure that seat restraints tested are representative of revised references and intended loading.

- f. Revised Figure 2B and relabeled as Figures 3A and 3B.

Reason: To clarify the intent of the standard to eliminate the possibility of a different test procedures being used.

- g. Revised Reflex Reflectors (7.6.6) to include two rear mounted reflectors.

Reason: To aid in vehicle identification and location.

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- h. Revised the test load placement procedures by adding (7.7.3.d.(1), (2), and (3) and eliminating Figure 3.

Reason: For clarity and to define load placement in cargo areas with and without sides

- i. Revised Service Braking (7.9.2.a.5) to include operator only and G.V.W. vehicle configurations, added (7.2.9.b.3, .4, and .5) to test conditions, and added maximum stop distance to Equation 1 and 2.

Reason: To define the two loading conditions needed for testing, to record data for Fade Testing, to not allow wheel "lock-up", to address regenerative braking, and limit stopping distance.

- j. Revised Service Brake Fade by adding (7.9.3.b.2) procedure and the Option 2 (Multiple Stop) procedure.

Reason: To provide an alternative procedure that does not require special equipment and test conditions.

FOREWORD

This Standard has been formulated with the SAE as sponsor in accordance with the accepted practice and procedures of the SAE and the following scope. Establishment of the requirements relating to the elements of design, operation, and maintenance; also, the standardization relating to principal dimensions to facilitate test methods and test procedures of Light Utility Vehicles.

One purpose of the document is to serve as a guide to governmental authorities having jurisdiction over subjects within the scope of the document. It is expected, however, that the document will find a major application in industry, serving as a guide to manufacturers, purchasers, and operators of the equipment.

If adopted for governmental use, references to other national standards may be changed to refer to the corresponding governmental regulations. A second purpose of this standard is to provide design and performance requirements to aid in minimizing accidents and injuries associated with the operation and maintenance of Light Utility Vehicles.

The use of light utility vehicles is subject to certain hazards that cannot be eliminated by mechanical means, but only by the exercise of intelligence, care, and common sense. It is therefore essential to have competent and careful operators, who are not physically or mentally impaired, thoroughly trained in the safe operation of the equipment and the handling of the loads. It is recommended that the operator be capable of obtaining a valid motor vehicle operator's license. Serious hazards include, but are not limited to, hillside operation, overloading, instability of the load, oversize loads, poor maintenance, and using equipment for a purpose for which it was not intended or designed.

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1. SCOPE

This SAE Standard defines requirements relating to the elements of design, operation, and maintenance of light utility vehicles. The safety specifications in this document apply to any self-propelled, operator-controlled, off-highway vehicle 1829 mm (72 in) or less in overall width, exclusive of added accessories and attachments, operable on three or more wheels, primarily intended to transport material loads or people, with a gross vehicle weight of 2500 kg (5500 lb) or less, and a maximum design speed less than or equal to 40.23 km/h (25 mph).

This document is not intended to cover Go-Karts (ASTM F2007-07a), Fun-Karts (ASTM F2011-02e1), Dune Buggies, and all terrain vehicles (ATVs) complying with ANSI/SVIA 1.

1.1 Purpose and Effective Date

The purpose of this document is to promote safety in the design, application, operation, and maintenance of light utility vehicles. This document may be used as a guide by governmental authorities desiring to formulate safety rules and regulations. This document is also intended for voluntary use by others associated with manufacturing or utilizing light utility vehicles.

1.2 Effective Date

The effective date for this document is the date of publication.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. The following publications and standards contain provisions, which through reference in this text constitute provisions of this SAE Standard. At the time of publication of this standard, the contents of the published editions of the indicated references were recognized as being valid and applicable. All standards are subject to revision, and parties are encouraged to investigate the possibility of applying the most recent editions of the standards referenced below. The latest issue of SAE Publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J114	Seat Belt Hardware Webbing Abrasion Performance Requirements
SAE J115	Safety Signs
SAE J140	Seat Belt Hardware Test Procedures
SAE J141	Seat Belt Hardware Performance Requirements
SAE J268	Rear View Mirrors - Motorcycles
SAE J339	Seat Belt Hardware Webbing Abrasion Test Procedure
SAE J383	Motor Vehicle Seat Belt Anchorages - Design Recommendations
SAE J384	Motor Vehicle Seat Belt Anchorages - Test Procedure
SAE J585	Tail Lamps (Rear Position Lamps) for Use on Motor Vehicles Less than 2032 mm in Overall Width

SAE J586	Stop Lamps for Use on Motor Vehicles Less than 2032 mm in Overall Width
SAE J588	Turn Signal Lamps for Use on Motor Vehicles Less than 2032 mm in Overall Width
SAE J592	Sidemarkers Lamps for Use on Road Vehicles Less than 2032 mm in Overall Width
SAE J594	Reflex Reflectors
SAE J843	Brake System Road Test Code—Passenger Car and Light-Duty Truck
SAE J1718	Measurement of Hydrogen Gas Emission from Battery-Powered Passenger Cars and Light Trucks During Battery Charging

2.1.2 ACGIH Publication

Available from American Conference of Governmental Industrial Hygienists, 1330 Kemper Meadow Drive, Cincinnati, OH 45240, Tel: 513-742-2020, www.acgih.org.

2003 TLVs® and BEIs® ACGIH® Publication #0103, ISBN: 1-882417-49-6

2.1.3 ANSI Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ANSI Z535.4 Product Safety Signs and Labels

2.1.4 ISO Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ISO 1044	Industrial Trucks - Lead Acid Traction Batteries for Electric Trucks - Preferred Voltages
ISO 3287	Powered Industrial Trucks, Control Symbols
ISO 3864	Graphical Symbols, Safety Colours and Safety Signs
ISO 3691	Powered Industrial Trucks - Safety Code
ISO 11684	Tractors, Machinery for Agriculture and Forestry, Powered Lawn and Garden Equipment - Safety Signs and Hazard Pictorials

2.1.5 NASA Publication

Available from National Technical Information Service, 5285 Port Royal Road., Springfield, VA 22161, Tel: 703-605-6000, www.ntis.gov.

Man-Systems Integration Standards, Volume I, Section 3, ANTHROPOMETRY AND BIOMECHANICS
<http://msis.jsc.nasa.gov/sections/section03.htm>

2.1.6 NFPA Publications

Available from National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471, Tel: 617-770-3000, www.nfpa.org.

NFPA 30 Flammable and Combustible Liquids Code

NFPA 58 Storage and Handling of Liquefied Petroleum Gases

NFPA 505 Fire Safety & Standard for Powered Industrial Trucks-Type Designations, Areas of Use, Maintenance and Operation

2.1.7 SVIA Publication

Available from Specialty Vehicle Industry of America, 2 Jenner Street, Suite 150, Irvine, CA 92618-3812, Tel: 949-727-3727, www.svia.org.

SVIA 1 Four Wheel All Terrain Vehicles- Equipment, Configuration, and Performance

2.1.8 Underwriters Laboratories Publications

Available from Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096, Tel: 847-272-8800, www.ul.com.

UL 558 Standard for Industrial Trucks, Internal Combustion Engine-Powered

UL 583 Standard for Electric-Battery-Powered Industrial Trucks

3. PART I - INTERPRETATION, TERMS AND DEFINITIONS FOR LIGHT UTILITY VEHICLES

3.1 Interpretation and Definitions

3.1.1 Mandatory and Advisory Rules

To carry out the provisions of this document, the word shall is to be understood as mandatory and the word should as recommended.

3.1.2 Terms

For purposes of this document, the term vehicle shall mean light utility vehicle.

3.1.3 Definitions

3.1.3.1 Accelerator

A device that controls the speed of a vehicle.

3.1.3.2 Accessory

Light utility manufacturer approved device installation on a vehicle (i.e., tire chains, lights, canopy, cab, etc.) to enhance its utility or appearance (exclusive of attachment).

3.1.3.3 Approved Vehicle

A vehicle that is listed or approved for fire safety purposes for the intended use by a nationally recognized testing laboratory (e.g., Underwriters Laboratories; Factory Mutual Engineering Corp.) using nationally recognized testing standards.

3.1.3.4 Attachment

Components designed primarily to perform a specific task and for mounting on a specific machine, utilizing the machine's power and control system. These attachments may be detachable, but are not intended to be universally adaptable to other machines (i.e., top dresser, spreader, etc.).

3.1.3.5 Battery - Electric Vehicle

An electric vehicle in which the power source is a storage battery(s).

3.1.3.6 Body Restraint

A hand hold or combination hand hold/hip restraint, anchored securely to the body or seat platform of the vehicle creating a barrier to help prevent an occupant from sliding outside of the vehicle.

3.1.3.7 Center of Gravity (of Test Load)

That point at which the load mass is concentrated. It is located horizontally in the center of the load-bearing surface, and vertically by its distance above the load-bearing surface.

3.1.3.8 Charged Battery

Charging of vehicle batteries shall be in accordance with the requirements of the vehicle/battery supplier as stated in the Owner/Operators manual.

3.1.3.9 Controlling Party

The person(s) or organization(s) responsible for the operation and maintenance of a vehicle.

3.1.3.10 Electric Vehicle

A vehicle in which the principal energy is transmitted from power sources to motor(s) in the form of electricity.

3.1.3.11 Gross Vehicle Weight (GVW)

Maximum stated weight including operating weight, material load, personnel, options, accessories, and attachments.

3.1.3.12 Hand Hold

A readily accessible device mounted securely to the vehicle that can be encircled by the fingers of one hand for the purpose of holding on. A hand hold can also function as a body restraint.

3.1.3.13 Light Utility Vehicle

Any self-propelled, operator-controlled, off-highway vehicle 1829 mm (72 in) or less in overall width, exclusive of added accessories and attachments, operable on three or more wheels, primarily intended to transport material loads or people, with a gross vehicle weight of 2500 kg (5500 lb) or less, and a maximum design speed less than or equal to 40.23 km/h (25 mph)

3.1.3.14 Material Load

Weight and dimension of material to be carried, excluding personnel.

3.1.3.15 Occupant Protective Structure

A structure that provides a crush protective environment for the occupants in the event of a vehicle tip-over (rotation of 90 degrees or more about the vehicle's lateral or longitudinal axis) or roll-over (rotation of 180 degrees or more about the vehicle's lateral or longitudinal axis)

3.1.3.16 Occupant Protective System

The occupant protective structure, seat belt assemblies, and may include passive restraints.

3.1.3.17 Off Highway

Not required to comply with FMVSS

3.1.3.18 Off Road

Un-improved terrain. Surfaces which may or may not be modified by the elimination of obstructions and depressions, but not necessarily having a compaction resistance suitable to support motorized vehicles.

3.1.3.19 Operating (Curb) Weight

Weight of vehicle with full fuel load, without material load or personnel load.

3.1.3.20 Operator

Trained and authorized person who controls any function of the light utility vehicle.

3.1.3.21 Operator's Seat

The seat located directly behind the steering controls.

3.1.3.22 Options

Selectable components necessary to complete vehicle assembly (i.e., tires, batteries, etc.).

3.1.3.23 Parking Brake

A device to prevent the movement of a stationary vehicle.

3.1.3.24 Rated Capacity

The total weight of material load and personnel load for a vehicle. The total personnel load for personnel vehicles.

3.1.3.25 Service Brake

A device designed to bring a moving vehicle to a stop.

3.1.3.26 Test Load

Weight that can be added to the vehicle when combined with operating weight and those accessories and options that create the least stable condition not to exceed GVW.

- a. $GVW = FIXED + VARIABLE$
- b. $FIXED = \text{Vehicle operating weight} + \text{Operator weight}$
- c. $VARIABLE = (\text{Passenger} + \text{Option} + \text{Accessory}) \text{ weight(s)} + \text{Load weight(s)}$

3.1.3.27 Test Vehicle

Unless otherwise stated, the test vehicle shall conform to the Manufacturer's specifications for optimum performance. All optional and accessory items offered by the manufacturer shall be considered in performing each test, which shall be conducted with optional and accessory items installed, or not installed, so as to create the most severe test conditions.

3.1.3.28 Travel Control

Devices that control the speed, braking, forward, and reverse direction of the vehicle.

4. PART II - FOR THE CONTROLLING PARTY

See Appendix B.

5. OPERATING SAFETY RULES AND PRACTICES

See Appendix B.

6. MAINTENANCE PRACTICES

See Appendix B.

7. PART III - FOR THE MANUFACTURER - DESIGN AND CONSTRUCTION STANDARDS

7.1 Introduction

7.1.1 Part III sets forth safety standards for vehicles at the time of manufacture.

7.2 Nameplates, Markings, and Instructions

7.2.1 On every vehicle, the manufacturer shall install permanent marking(s), with the following information:

- a. Serial Number
- b. Approximate operating weight of the vehicle without accessories or attachments in kilograms (kg), pounds (lb), or both
- c. Designation of compliance with the mandatory requirements of this document
- d. Type designation if in conformance with ANSI/NFPA 505 and either ANSI/UL 583 or ANSI/UL 558
- e. Gross vehicle weight (G.V.W.)

- 7.2.2 Where applicable, marking authorized by an appropriate nationally recognized testing laboratory may be installed on approved vehicles.
- 7.2.3 On battery-electric vehicles, the nameplate shall also show:
- The minimum and maximum service weights of battery (s) and tray if used.
 - Nominal voltage for which the vehicle is designed. For recommended voltages, see ISO 1044.
- 7.2.4 For batteries in a lift-out tray with total combined service weight of batteries and tray exceeding 45 kg (100 lb) or, the maximum combined weight of the batteries and tray shall be legibly identified on the battery tray near the lifting means with the information shown in Figure 1.

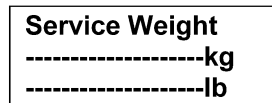


FIGURE 1 - MARKING FOR LIFT-OUT BATTERY TRAY

- 7.2.5 Each vehicle shall be supplied with a vehicle operator's manual furnished by the manufacturer. This manual shall contain instructions for setup, assembly, safe and proper operation, and routine service (separate set-up and assembly manuals are acceptable). Operator's Manuals should include, but not be limited to, information contained in Sections 4, 5, and 6 where applicable.
- 7.2.6 Product Safety Signs and Labels should be used for hazard identification in accordance with either ANSI Z535.4, ISO 3864, ISO 11684 or SAE J115.
- 7.2.7 Universal symbols for operator controls and other displays should be in accordance with ISO 3287.
- 7.3 General Requirements
- 7.3.1 The operator and passengers, in the normal operating position, shall be protected from parts of the vehicle that represent a hazard.
- 7.3.2 Vehicles shall be provided with seat(s) and body restraints (see 7.3.4) for each intended rider position.
- 7.3.3 Operator and passenger stations shall accommodate the 5th to 95th percentile man, as per the National Aeronautics and Space Administration (NASA) publication, and shall be within the plan view outline of the vehicle.
- 7.3.4 A handhold shall be provided for the operator and each passenger. A steering wheel or two-hand tiller shall be considered a handhold for the operator. A handhold shall be provided for each additional intended passenger and placed in such a manner that when grasping the handhold, the occupant's hands shall be within the plan view outline of the vehicle.
- 7.3.5 The operator and passengers in the normal operating position shall be protected from particles thrown by the tires and wheels.
- 7.3.6 Occupant Protective Systems (OPS)
- 7.3.6.1 Occupant Protective Structures and seat belt assemblies shall be provided with Light Utility Vehicles that can be so configured and loaded per the manufacturer's recommendations such that the maximum operation speed (as determined per 7.7) and the lateral stability (as determined per 7.8) fall within the area defined on Figure 2 as "OPS Required".

- 7.3.6.2 Seat belts shall not be installed on Light Utility Vehicles unless they have Occupant Protection Structures.
- 7.3.6.3 Light Utility Vehicles fitted with seat belt assemblies shall conform to the following standards: SAE J114, SAE J140, SAE J141, and SAE J339. Seat belt geometry should conform to SAE J383, and use the test procedures of SAE J384 with the load requirements of 7.3.6.4.
- 7.3.6.4 Each seat belt anchorage shall be capable of withstanding a static tensile force of 2224 N (494 lb) at 45 degrees to the horizontal. Where suspension seats are used, the seat belt assemblies shall accommodate the ride motion of the occupants. If seat belt assemblies are attached to the seats, the seat mounting shall be capable of withstanding this force, plus a force equal to four times the force of gravity, on the mass of all applicable seat components applied 45 degrees to the horizontal in a forward and upward direction.
- 7.3.6.5 Occupant Protection Structures shall meet the requirements of Roof Crush Resistance as stated in the following sections.

7.3.6.5.1 Requirements

A test device as described in 7.3.6.5.2 shall not move more than 127 mm (5 in), measured in accordance with 7.3.6.5.3.4, when it is used to apply a force of 1.5 times the unloaded vehicle weight of the vehicle or 2268 kg (5000 lb) whichever is less, to either side of the forward edge of the vehicle's roof in accordance with the procedures of 7.3.6.5.3. Both the left and right front portions of the vehicle's roof structure shall be capable of meeting the requirements, but a particular vehicle need not meet further requirements after being tested at one location.

7.3.6.5.2 Test Device

The test device is a rigid unyielding block with its lower surface formed as a flat rectangle 762 mm x 1829 mm (30 in x 72 in).

7.3.6.5.3 Test Procedure

Each vehicle shall be capable of meeting the requirements of 7.3.6.5.1 when tested in accordance with the following procedure.

- 7.3.6.5.3.1 Place the chassis frame of the vehicle on a rigid horizontal surface, fix the vehicle rigidly in position, close all windows, close and lock all doors, and secure any convertible top or removable roof structure in place over the passenger compartment.
- 7.3.6.5.3.2 Orient the test device as shown in Figure 3A and 3B, so that:
- Its longitudinal axis is at a forward angle (side view) of 5 degrees below the horizontal, and is parallel to the vertical plane through the vehicle's longitudinal centerline;
 - Its lateral axis is at a lateral outboard angle, in front view projection, of 25 degrees below the horizontal;
 - Its lower surface is tangent to the surface of the vehicle; and
 - The initial contact point, or center of the initial contact area, is on the longitudinal centerline of the lower surface of the test device and 254 mm (10 in) from the forward-most point of that centerline.

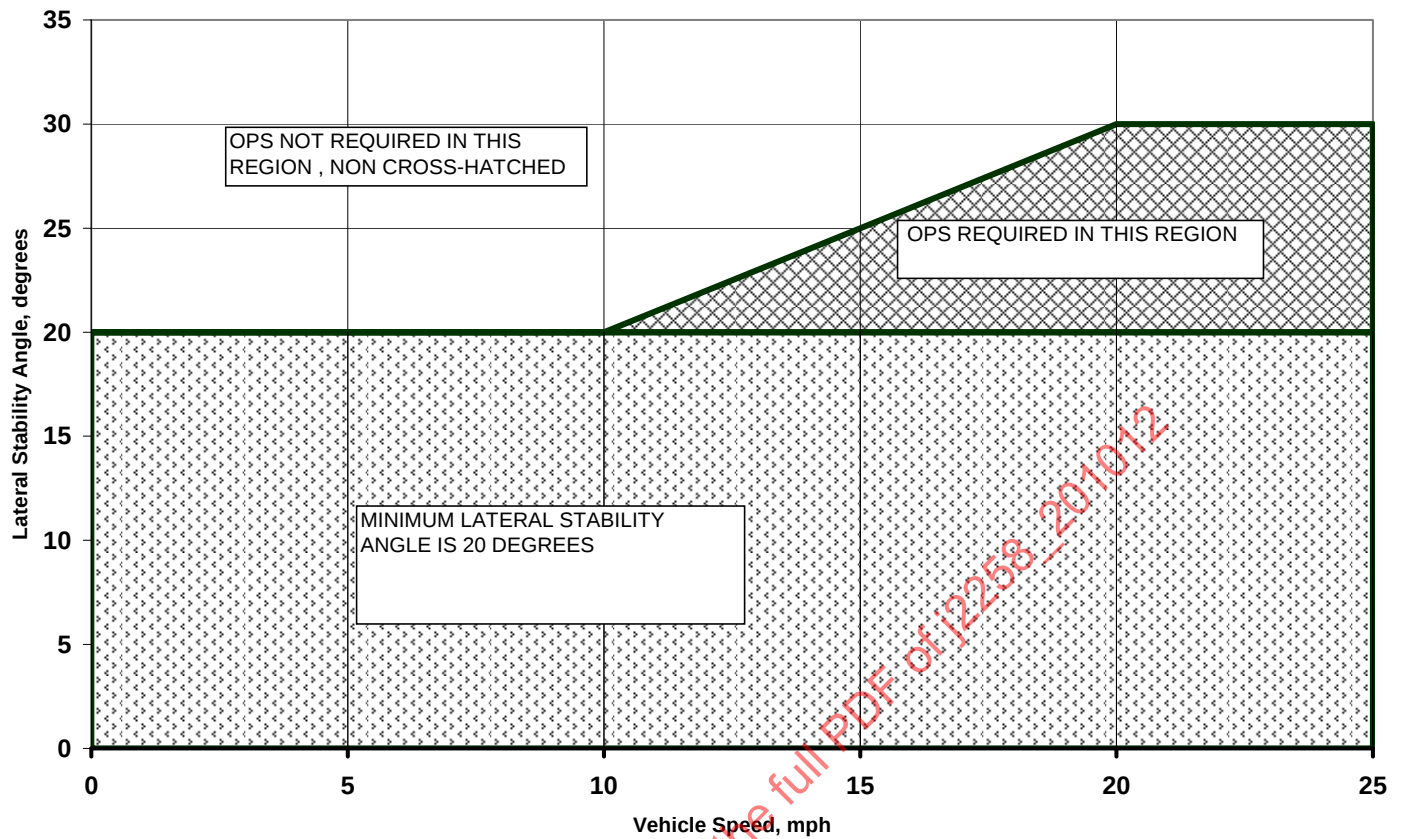


FIGURE 2 - VEHICLE LATERAL STABILITY VERSUS SPEED

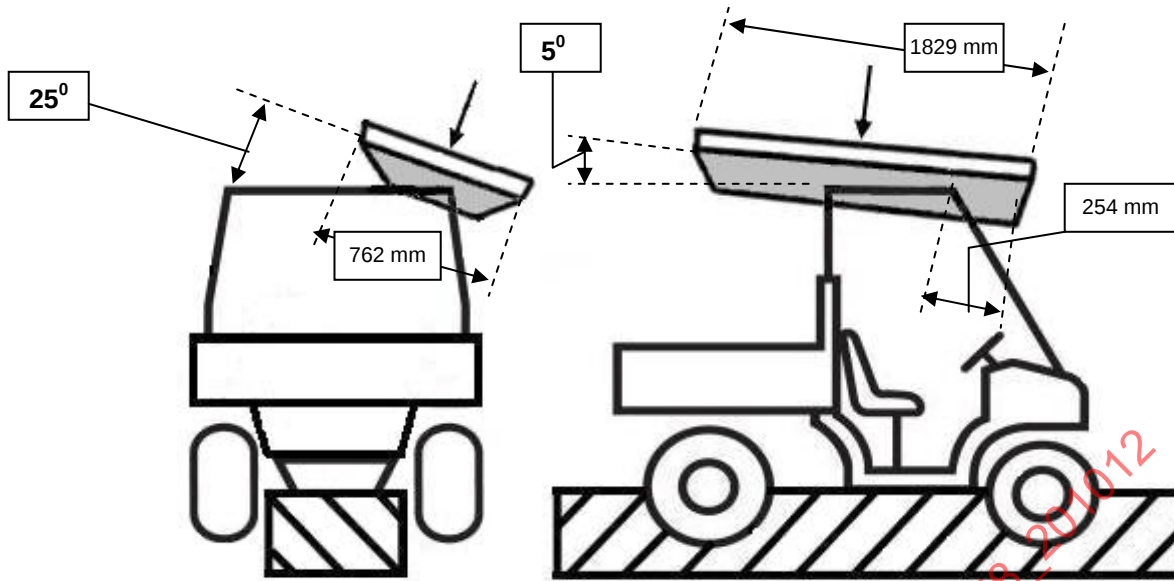


FIGURE 3A - REAR VIEW, BLOCK ON RIGHT SIDE FIGURE 3B - RIGHT SIDE, BLOCK ON LEFT SIDE

FIGURE 3 - TEST DEVICE FOR OPERATOR PROTECTIVE STRUCTURE

7.3.6.5.3.3 Apply force in a downward direction perpendicular to the lower surface of the test device at a rate of not more than one-half inch per second until reaching a force of 1.5 times the unloaded vehicle weight of the tested vehicle or 2268 kg (5000 lb), whichever is less. Complete the test within 120 s. Guide the test device so that throughout the test it moves, without rotation, in a straight line with its lower surface oriented as specified in 7.3.6.5.3.2a through 7.3.6.5.3.2d.

7.3.6.5.3.4 Measure the distance that the test device moves, i.e., the distance between the original location of the lower surface of the test device and its location as the force level specified in 7.3.6.5.3.3 is reached.

7.4 Steering

7.4.1 Vehicles employing a hand wheel or a horizontal lever (horizontal motion) or a tiller bar for steering control shall have such controls designed so the vehicle will respond as follows when moving in a forward direction: movement of the steering control in a clockwise direction shall steer the vehicle to the operator's right.

7.4.2 All steering controls shall be confined within the plan view outline of the vehicle or provided with guards that protect against injury to the operator and passengers during movement of the controls.

7.5 Controls

7.5.1 Vehicle speed control shall increase speed when moving the control downward or forward or both.

7.5.2 Service brakes, if foot operated, shall be energized by moving the control downward or forward or both. Hand-operated service brakes shall be energized by moving control upward, or rearward, or both.

7.5.3 If a single foot pedal controls both acceleration and deceleration, depressing the pedal shall increase speed and releasing the pedal shall decrease speed.

7.5.4 A device shall be provided to prevent unauthorized operation of the vehicle.

7.5.5 Direction control shall be clearly and durably marked indicating forward and reverse directions.

7.5.6 A parking brake shall be provided.

7.5.7 Control pedals and control platforms shall have skid resistant surfaces.

7.6 Lighting and Marking

7.6.1 Head Lamps

If so equipped, two (2) headlamps shall be mounted on the front of the vehicle and disposed symmetrically about the centerline and separated as far apart as practicable. They should be mounted no less than 381 mm (15 in) no more than 1270 mm (50 in) above the ground. It is recommended that each lamp be a single low beam or high/low beam and comply with the requirements of either Table 1 or 2. Alternative head lamp configurations that provide lighting equivalent to two (2) of the aforementioned head lamps will be acceptable. Provision may be made for the lamps to be adjusted.

7.6.2 Beam Aim for Photometry

A head lamp unit that has both high beam and low beam shall be aimed by positioning the high intensity zone of the high beam at 1/2 degree down-vertical. The beam shall be centered by photoelectrically balancing the points, 6 degrees left and 6 degrees right. The lamp shall comply with Tables 1 and 2.

A head lamp unit having only a single beam shall be aimed with the top cut-off of the beam at horizontal and centered by balancing the points 6 degree left and 6 degree right. The lamp shall comply with Table 2.

TABLE 1 - UPPER BEAM

Test Point (degrees)	Intensity (cd)
H-V	2000 min
1/2 degree D-V	5000 min
1/2 degree D- 3 degree R - 3 degree L	3000 min
1/2 degree D- 6 degree R - 6 degree L	1000 min
2 degree D-V	2500 min
3 degree D-V	1500 min
3 degree D- 6 degree R- 6 degree L	750 min
4 degree D-V	5000 min

TABLE 2 - LOWER BEAM

Test Point (degrees)	Intensity (cd)
1/2 degree V - and above	2000 max
2 degree D-V	3000 min
3 degree D- 4 degree R- 4 degree L	1500 min
3 degree D- 6 degree R- 6 degree L	750

7.6.3 Tail Lamps

If so equipped, tail lamp(s) should be mounted on the rear of the vehicle. If two (2) tail lamps are used, they shall be disposed symmetrically about the centerline and as far apart as practicable. They should be mounted no less than 381 mm (15 in) nor more than 1524 mm (60 in) above the ground. Tail lamps shall be illuminated when the headlamps are energized. Each lamp should comply with the requirements of SAE J585.

7.6.4 Stop Lamps

If so equipped, stop lamp(s) should be mounted on the rear of the vehicle. If two (2) stop lamps are used, they shall be disposed symmetrically about the centerline of the vehicle. They should be mounted no less than 381 mm (15 in) nor more than 1524 mm (60 in) above the ground. The stop lamps shall be illuminated by activation of the vehicle service brake. A stop lamp may be combined optically with the tail lamp, and it should comply with requirements of SAE J586.

7.6.5 Turn Signals

If so equipped, turn signal lamps should be mounted on the vehicle as follows: two (2) facing to the rear and two (2) facing to the front and as far from the longitudinal centerline of the vehicle as practicable. They should be mounted no less than 381 mm (15 in) or more than 1524 mm (60 in) from the ground. A turn signal lamp may be combined optically with the tail lamp and should comply with the requirements of SAE J588.

7.6.6 Reflex Reflectors

If so equipped, Reflex reflectors should be mounted on the vehicle as follows: two (2) yellow, mounted (one on each side) as far forward as practicable; two (2) red, mounted (one on each side) as far rearward as practicable, and two (2) red, mounted on the rear, as far from the vehicle centerline as practicable. They should be mounted no less than 381 mm (15 in) nor more than 1524 mm (60 in) from the ground. Each reflex reflector should comply with the requirements of SAE J594.

7.6.7 Side Marker Lamps

If so equipped, side marker lamps, should be mounted on each side of the vehicle, one (1) yellow as far forward as practicable and one (1) red, as far rearward as practicable. They should be mounted no less than 381 mm (15 in) nor more than 1524 mm (60 in) from the ground. Each side marker lamp should comply with the requirements of SAE J592.

7.6.8 Horn

If so equipped, the horn activating switch should be mounted so it can be easily activated with a minimum movement of the operator's hand or foot. The horn shall produce a minimum sound level of 93 dBA as measured by a sound level/power meter located at a distance of 7 m in front of, and on the longitudinal centerline of, the vehicle at a height of 1 m.

7.6.9 Mirrors

If so equipped, exterior mirrors should incorporate the requirements of SAE J268.

7.7 Speed Tests

7.7.1 Test Conditions

- a. Horizontally flat surface, 1.0% grade (0.6 degrees) maximum
- b. Straight course
- c. Concrete or asphalt surface of sufficient track length to allow the test vehicle to reach maximum speed before measurements begin
- d. Concrete or asphalt surface that is dry and free from loose material or surface contamination with a minimum coefficient of friction of 0.8 between tire and surface
- e. The test vehicle shall be loaded with one operator weighing no less than 77 kg (170 lb) or more than 82 kg (180 lb)

7.7.2 Test Procedure

The vehicle shall be operated in one direction of travel on the test course and then the other. The results shall then be averaged.

NOTE: The vehicle direction of travel selection means must not be changed during the test.

7.7.3 Test Acceptance

The maximum average speed from 7.7.2 shall be less than or equal to 40.23 km/h (25 mph).

7.8 Stability Tests

7.8.1 General Test Conditions and Requirements

- a. A test platform shall be rigid, flat, and constructed to be an adjustable slope, single plane (tilt table) with a surface finish providing a minimum of 1.0 coefficient of friction. The platform surface shall be large enough to support all wheels of the vehicle to be tested.
- b. Tire inflation on all wheels shall be in accordance with the vehicle manufacturer's minimum specifications or recommendations.
- c. Prior to the addition of test loads, the vehicle to be tested shall be readied to reflect its operating weight and shall include all options and accessory items which, when installed, will decrease the stability of the vehicle.
- d. The test loads shall be placed on each load bed of the vehicle, and secured thereto such that each center of gravity is directly above the geometric center of its load bed. The vehicle shall be weighted in such a manner as to not exceed the manufacturer's stated gross vehicle weight..
 1. A test load shall be placed on each cargo area of the vehicle, and secured in such a manner that each test load's CG is directly above the geometric center of its cargo area when the vehicle is on a level surface. The total cargo capacity shall be proportionally distributed among designated cargo areas but shall not exceed individual area cargo capacities.
 2. The minimum height of the CG of the load in the cargo bed shall be 127 mm (5 in) or one-half the distance from the cargo bed floor to the highest point of the tailgate in the closed position, whichever is greater. If the cargo bed has no tailgate, the CG height of the load will be the greater of 127 mm (5 in) or one-half the distance from the cargo bed floor to the highest point on the cargo bed sides. For cargo beds without sides, the minimum height of the CG of the load shall be 127 mm (5 in) above the flat load surface.

3. For racks and other cargo areas with sides and a cargo load capacity exceeding 22.7 kg (50 lb), the minimum height of the CG of the load shall be 127 mm (5 in) or one-half the distance from the load surface to the highest point of the rack or cargo area sides, whichever is greater. For cargo racks or other cargo areas without sides, the minimum height of the CG of the load shall be 127 mm (5 in) above the rack or flat load surface.
- e. A weight, no less than 90 kg (200 lb) or more than 95 kg (211 lb) shall be secured to each seat, representing the operator and each passenger that will decrease the stability of the vehicle. If seats are adjustable, they shall be adjusted to that position representing the least stable condition of stability in each test. The center of gravity of the weight(s) is to be 152 mm (6 in) above the lowest point of the operator supporting surface and 254 mm (10 in) forward of the seat back. If a seat back is not used, then 254 mm (10 in) will be measured from the position of the back of a person when seated normally.

7.8.2 Lateral Stability Test

a. Test Conditions

1. The position of the vehicle on the test platform shall be maintained by parking brakes or similar means, but not by use of wheel chocks.
2. Stability determination and measurements shall be taken under static conditions.

b. Test Procedure - The vehicle with test loads in place shall be put on the tilt platform in accordance with Figures 4 or 5 (depending on type and number of supporting wheels).

1. The steerable wheels of the machine shall be placed to simulate the least stable condition. The machine shall be so positioned on the tilt table that a line through the center of the footprint of the two lowest tires will be parallel to the tilt axis of the table. The machine shall be tested with its left side downhill and again with its right side downhill.
2. The stability of the vehicle shall be determined directly by tilting the platform to the stability angle determined from Figure 2.
3. Tilt platform back to level.
4. Recheck the vehicle test condition and position of all loads to ensure that they still conform to the test requirements.
5. Recheck the tire inflation of all tires to ensure that they still conform to the test requirements.

The test is to be conducted with one side of the vehicle facing the platform tilt axis and repeated with the other side facing the platform tilt axis.

c. Test Acceptance - Acceptance of the lateral stability test shall require that at least one of the supporting tire or tires on the uphill side remain in contact with the surface or the vehicle slides. Failure shall have occurred when all the vehicle's uphill tires lift off the platform.

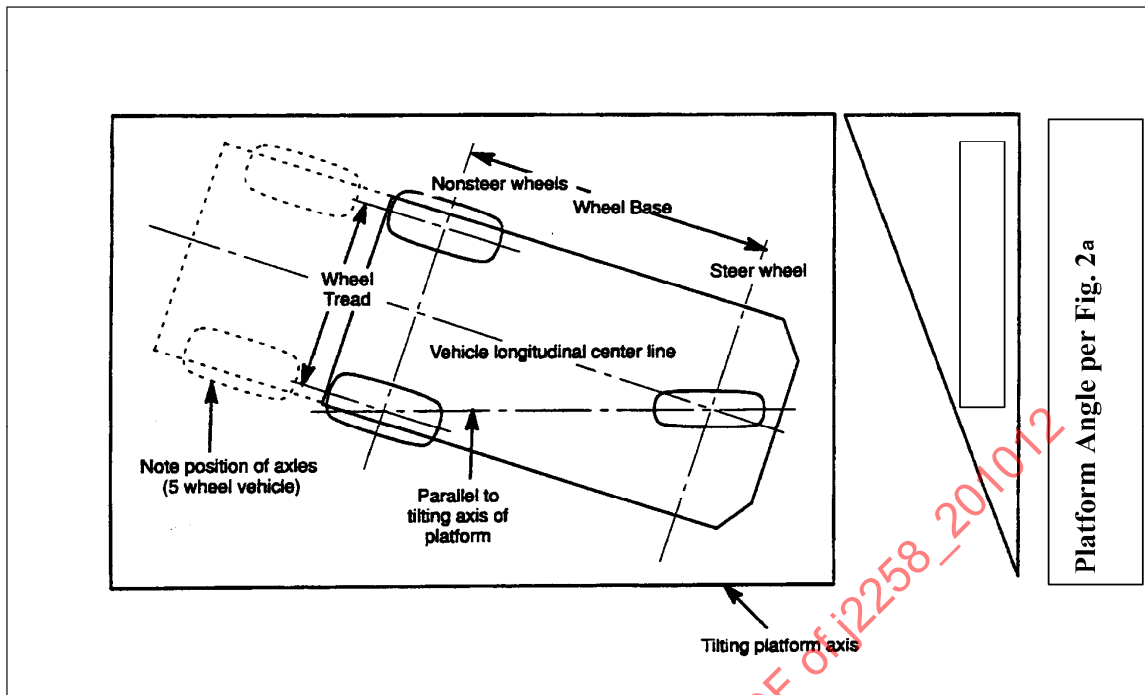


FIGURE 4 - VEHICLE PLACEMENT ON LATERAL TILTING PLATFORM

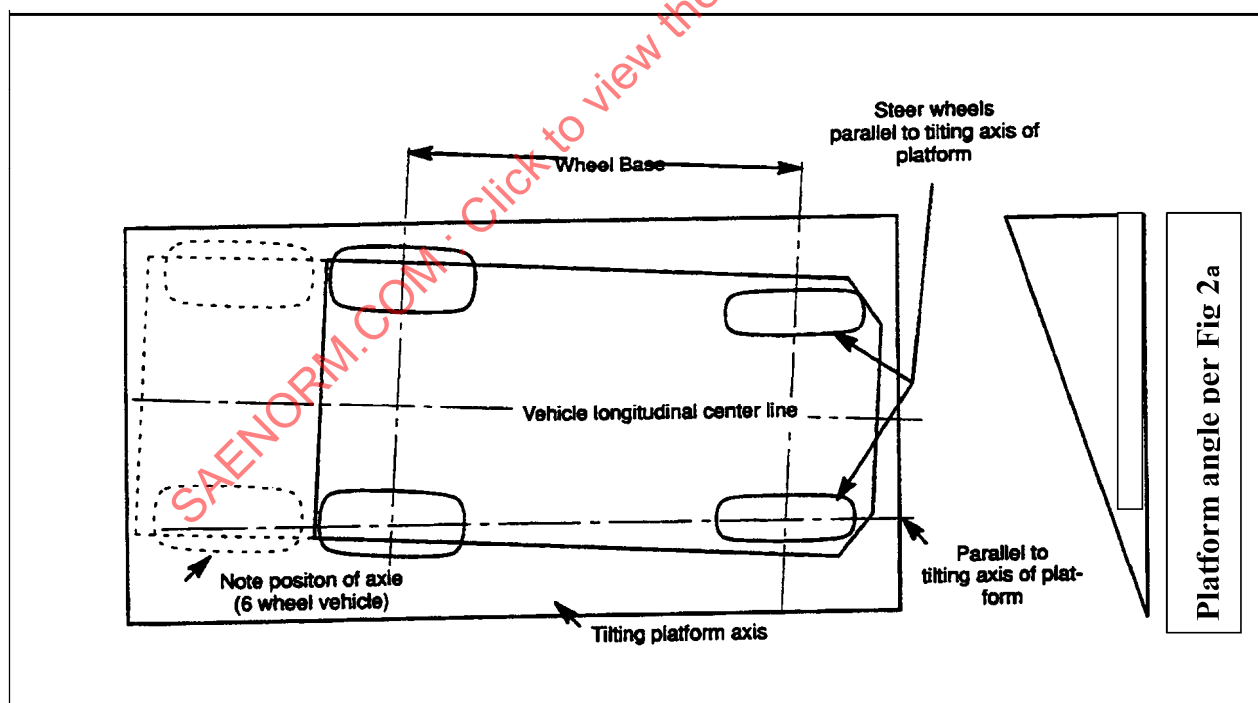


FIGURE 5 - VEHICLE PLACEMENT ON LATERAL TILTING PLATFORM

7.8.3 Longitudinal Stability Tests

a. Test Conditions

1. The position of the vehicle on the test platform shall be maintained by locking all braked wheels, but not by use of wheel chocks.
2. Stability determination and measurements shall be taken under static conditions.

b. Downgrade Test

1. Test Procedure - The loaded vehicle shall be placed on the tilting platform such that the longitudinal centerline is perpendicular to the platform tilt axis (see Figure 6). The forward end of the vehicle will be facing the platform tilt axis. Tilt the platform to a 46.6% (25 degrees) gradient and repeat items listed in 7.8.2. (b) (3), (4), (5).
2. Test Acceptance - The vehicle will have failed the test when all wheels uphill from the vehicle pivot axis lift off when tested in accordance with the previous standards or the vehicle slides.

- c. Upgrade Test - Same as 7.8.3. (b) (1) and (2) except that the rear end of the vehicle will be facing the platform axis of tilt (see Figure 7).

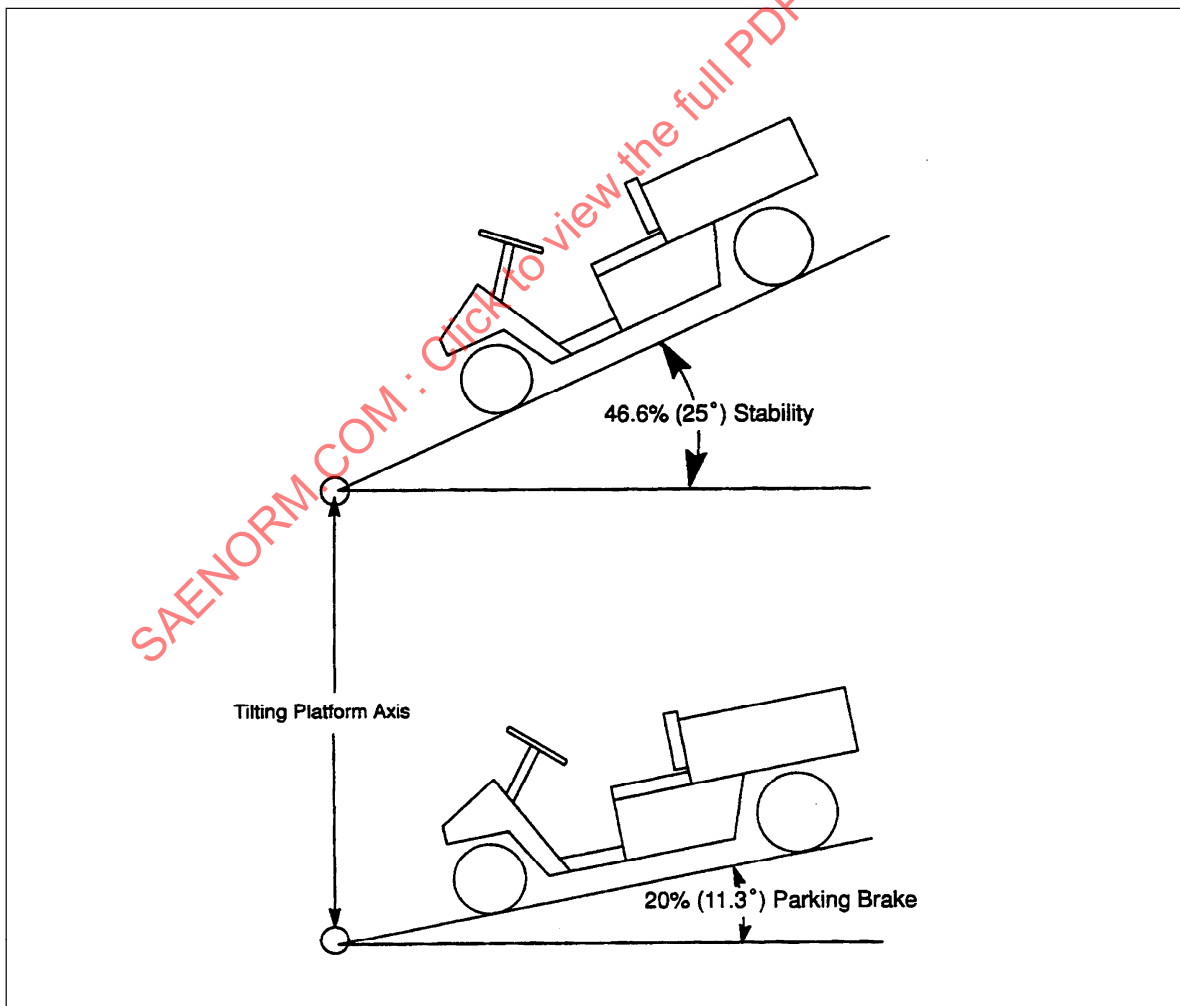


FIGURE 6 - VEHICLE PLACEMENT, LONGITUDINAL PLATFORM DOWNHILL INDICATED

7.9 Brakes

7.9.1 System Proof Load Test

A proof load indicated by (a), (b), or (c), shall be applied to the center of the pedal, lever, or grip for a minimum of 5 min. There shall be no permanent deformation nor breakage of brake system components.

- a. Foot Pedal = 1125 N (250 lb) minimum
- b. Hand Lever = 675 N (150 lb) minimum
- c. Hand Grip (Squeeze) = 450 N (100 lb) minimum

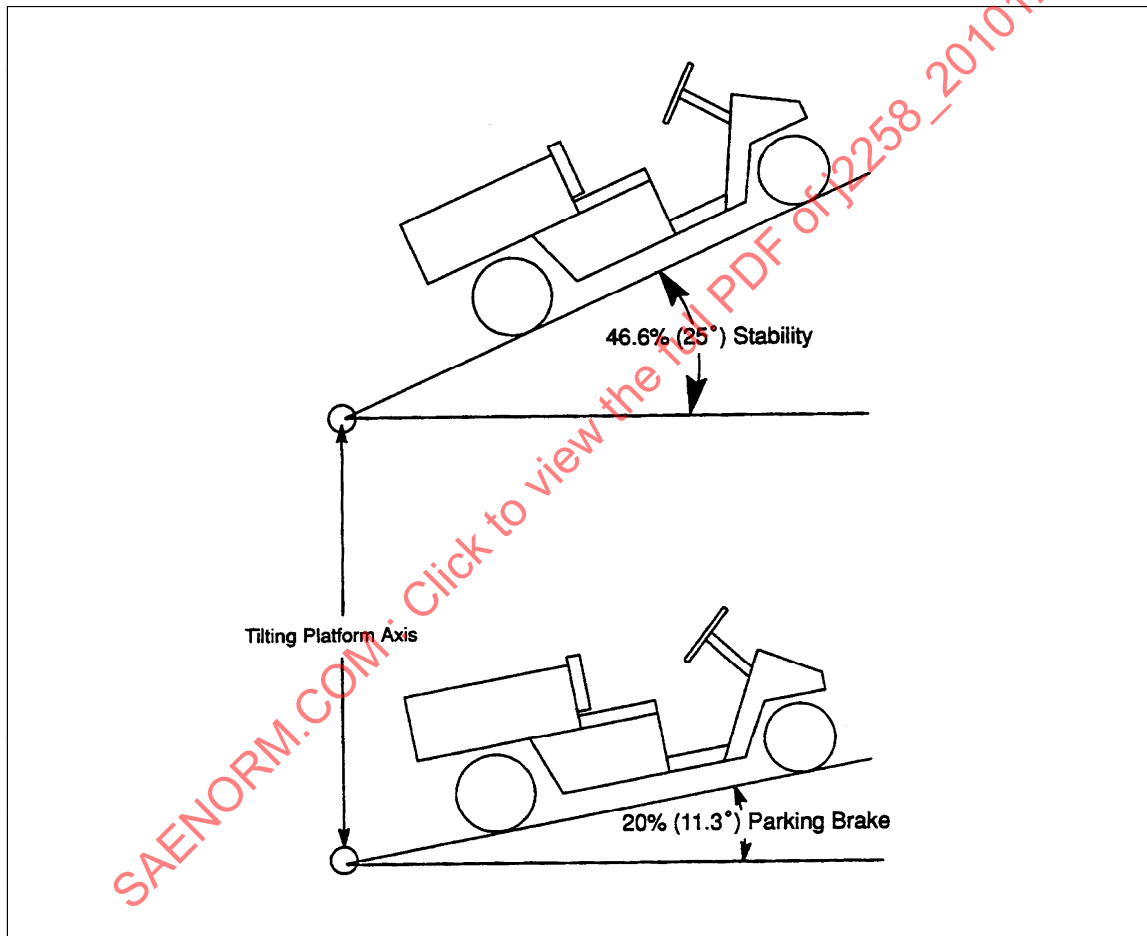


FIGURE 7 - VEHICLE PLACEMENT, LONGITUDINAL PLATFORM, UPHILL INDICATED

7.9.2 Service Brake Performance

a. Test conditions shall be as follows:

1. Horizontally flat surface, 1.0% grade (0.6 degrees) maximum.
2. Straight course.
3. Concrete or asphalt surface that is dry and free from loose material or surface contamination with a minimum coefficient of friction of 0.8 between tires and surface.
4. Sufficient track length to allow the vehicle to reach maximum speed (except for 7.9.3 Option 1) before measurements begin.
5. The vehicle shall be configured and loaded with operator only (weighing no less than 77 kg (170 lb) or more than 82 kg (180 lb)), and with Gross Vehicle Weight.
6. Burnishing brakes is permissible following the manufacturer's approved procedure.

b. Test Procedure - The test shall be conducted as follows:

1. The test vehicle shall be operated at its maximum speed attainable in the configuration providing the most severe conditions for braking as identified in 7.9.2.a.5, and the brake(s) then applied with a foot pedal force no more than 555 N (125 lb), applied to the center of the service brake pedal.
2. For hand grip (squeeze) operated brakes, the application force, applied at the midpoint of the lever, shall not exceed 225 N (50 lb).
3. Record the brake application force from 7.9.2 b. 1 or 2, for use in 7.9.3, Service Brake Fade, Option 2
4. Braked wheels must not stop rotation (no lock-up) during the test.

c. Test Acceptance - The test vehicle shall stop the following distances from the point of application of the brake(s) in the forward direction per the formula:

$$\begin{aligned}\text{Stopping Distance (in meters)} &= 0.015V^2 \text{ (V in km/h, vehicle speed)} \\ \text{(in feet)} &= 0.125V^2 \text{ (V in mph)} \quad (65 \text{ ft maximum}) \quad (\text{Eq. 1})\end{aligned}$$

The test vehicle shall stop from the point of application of the brake(s) in the reverse direction according to the formula:

$$\begin{aligned}\text{Stopping Distance (in meters)} &= 0.018V^2 \text{ (V in km/h)} \\ \text{(in feet)} &= 0.150V^2 \text{ (V in mph)} \quad (60 \text{ ft maximum}) \quad (\text{Eq. 2})\end{aligned}$$

7.9.3 Service Brake Fade, Option 1

- a. Test Conditions - They shall be the same as given in 7.9.2 and the test vehicle shall be towed in the forward direction with brake(s) applied to produce a drag load determined by the following formula:

$$\begin{aligned}\text{Drag load} &= \text{free rolling towing force} + (0.342) \times \text{loaded vehicle weight} \\ \text{DL} &= \text{frtf} + (0.342) \times \text{lvw}\end{aligned}\quad (\text{Eq. 3})$$

This drag load shall be maintained within $\pm 15\%$ for 61 m (200 ft). Towed vehicle speed shall be between 40% and 50% of maximum level ground vehicle speed.

- b. Test Procedure - The test shall be conducted as follows:

1. The test vehicle shall be operated at its maximum speed and the brake(s) then applied with a foot pedal force no more than 555 N (125 lb), applied to the center of the service brake pedal. For hand grip (squeeze) operated brakes, the application force at the midpoint of the lever shall not exceed 225 N (50 lb).
2. The braking test must begin as soon as possible. Accelerate the vehicle as rapidly as possible to the braking test speed and make a final stop.

- c. Test Acceptance - The test vehicle shall stop the following distances from the point of application of the brake(s) in the forward direction per the formula:

$$\begin{aligned}\text{Stopping Distance (in meters)} &= 0.018V^2 \text{ (V in km/h)} \\ \text{(in feet)} &= 0.150V^2 \text{ (V in mph)}\end{aligned}\quad (\text{Eq. 4})$$

7.9.4 Service Brake Fade, Option 2

- a. Test Conditions - They shall be the same as given in 7.9.2.

- b. Test Procedure.

1. All ten required stops shall be made by applying only the service brakes. The test procedure shall be as follows:
 - (a) Burnish the service brakes according to the procedure recommended by the manufacturer.
 - (b) Adjust the brakes according to the manufacturer's recommendation.
 - (c) The braking test speed is the maximum loaded forward speed of the vehicle as determined by 7.7.3.
 - (d) Accelerate the vehicle to the braking test speed. Measure the speed immediately before the service brakes are applied.
2. Apply the service brake using a minimum application force from 7.9.2 b. 3, without exceeding the maximum brake application force as defined in 7.9.2.b. Braked wheels must not stop rotation (no lock-up) during the test.
3. Repeat step 7.9.3.Option 2.b.1.(d) to perform nine (9) required stops within 9 min, with no more than 1 min between stops.
 - (a) Accelerate the vehicle as rapidly as possible to no less than 90% of the braking test speed.
4. The final test run (stop number 10) shall begin as soon as possible after completion of the last of the nine (9) stops. No changes or adjustments to the service-brake system are permitted.
 - (a) Accelerate the vehicle as rapidly as possible to the braking test speed and make a final stop.

- c. Test Acceptance For the final stop, the test vehicle shall demonstrate

$$\begin{aligned}\text{Stopping Distance (in meters)} &= 0.018V^2 \text{ (V in km/h)} \\ \text{(in feet)} &= 0.150V^2 \text{ (V in mph)}\end{aligned}$$

7.9.5 Service Brake Fade Recovery

- a. Test Conditions - They shall be the same as given in 7.9.2.
- b. Test Procedure - The service brake test described in 7.9.2 (b) shall be repeated after cooling the brakes to ambient temperature.
- c. Test Acceptance - They shall be the same as given in 7.9.2 (c).

7.9.6 Parking Brake

- a. Test shall be conducted with application force as per (1), (2), or (3):
1. Foot - 555 N (125 lb) maximum
 2. Hand Lever - 333 N (75 lb) maximum
 3. Hand Grip (Squeeze) - 225 N (50 lb) maximum
- b. Test Conditions
1. The vehicle shall be configured and loaded such that it creates the most severe conditions; this could be less than maximum gross vehicle weight.
 2. The test vehicle shall be positioned on an inclined plane having a 20% (11.3 degree) grade with a minimum coefficient of friction of 1.0 between tires and surface, with its longitudinal centerline perpendicular to the pivot axis of the inclined plane.
- c. Test Procedure - With the parking brake(s) engaged, the vehicle shall be positioned with its:
1. Front end on the downhill side (see Figure 6).
 2. Rear end on the downhill side (see Figure 7).
- d. Test Acceptance - The parking brake(s) shall hold the vehicle on the inclined plane having a 20% (11.3 degree) grade. Vehicle shall not move more than 76 mm (3 in) in 1 h.

8. NOTES

8.1 Marginal Indicia

A change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

APPENDIX A - GLOSSARY OF COMMONLY USED WORDS AND PHRASES

Accelerator - A device that controls the speed of a vehicle.

Accessory - Light utility manufacturer approved device installation on a vehicle (i.e., tire chains, lights, canopy, cab, etc.) to enhance its utility or appearance (exclusive of attachment).

Approved Vehicle - A vehicle that is listed or approved for fire safety purposes for the intended use by a nationally recognized testing laboratory (e.g., Underwriters Laboratories; Factory Mutual Engineering Corp.) using nationally recognized testing standards.

Attachment - Components designed primarily to perform a specific task and for mounting on a specific machine, utilizing the machine's power and control system. These attachments may be detachable, but are not intended to be universally adaptable to other machines (i.e., top dresser, spreader, etc.).

Battery-Electric Vehicle - An electric vehicle in which the power source is a storage battery(s).

Body Restraint - A hand hold or combination hand hold/hip restraint, anchored securely to the body or seat platform of the vehicle creating a barrier to help prevent an occupant from sliding outside of the vehicle.

Center of Gravity (of Test Load) - That point at which the load mass is concentrated. It is located horizontally in the center of the load bearing surface, and vertically by its distance above the load bearing surface.

Charged Battery - Charging of vehicle batteries shall be in accordance with the requirements of the vehicle/battery supplier as stated in the Owner/Operators manual.

Controlling Party - The person(s) or organization(s) responsible for the operation and maintenance of a vehicle.

Electric Vehicle - A vehicle in which the principal energy is transmitted from power sources to motor(s) in the form of electricity.

Gross Vehicle Weight (GVW) - Maximum stated weight including operating weight, material load, personnel, options, accessories, and attachments.

Hand Hold - A readily accessible device mounted securely to the vehicle that can be encircled by the fingers of one hand for the purpose of holding on.

Material Load - Weight and dimension of material to be carried, excluding personnel.

Occupant Protective Structure - A structure that provides a crush protective environment for the occupants in the event of a vehicle tip-over (rotation of 90 degrees or more about the vehicle's lateral or longitudinal axis) or roll-over (rotation of 180 degrees or more about the vehicle's lateral or longitudinal axis)

Occupant Protective System - The occupant protective structure, seat belt assemblies, and may include passive restraints.

Off Highway - Not required to comply with FMVSS

Operating (Curb) Weight - Weight of vehicle with full fuel load, without material load or personnel load.

Operator - Trained and authorized person who controls any function of the light utility vehicle.

Operator's Seat - The seat located directly behind the steering controls.

Options - Selectable components necessary to complete vehicle assembly (i.e., tires, batteries, etc.).