

Submitted for recognition as an American National Standard

## LIGHT UTILITY VEHICLES

**Foreword**—This Document has not changed other than to put it into the new SAE Technical Standards Board format.

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 safety 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.

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.

**1. Scope**—This SAE Standard defines safety 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 1828 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 2268 kg (5000 lb) or less, and a maximum design speed less than 40 km/h (25 mph).

**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.

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This document shall become effective 1 year after date of issuance. Part III applies only to light utility vehicles manufactured after the effective date.

### 2. References

**2.1 Applicable Publications**—The following publications form a part of this specification to the extent specified herein. The latest issue of SAE Publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J115—Safety Signs

SAE J843—Brake System Road Test Code—Passenger Car and Light-Duty Truck

2.1.2 ACGIH PUBLICATION—Available from American Conference of Governmental Industrial Hygienists, 6500 Glenway Building, D5, Cincinnati, OH 45211.

Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment

2.1.3 ANSI PUBLICATIONS—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ANSI/NFPA 30-1990—Flammable and Combustible Liquids Code

ANSI/NFPA 58-1992—Storage and Handling of Liquefied Petroleum Gases

ANSI/NFPA 505-1992—Fire Safety & Standard for Powered Industrial Trucks—Type Designations, Areas of Use, Maintenance and Operation

ANSI Z535.3-1991—Criteria for Safety Symbols

ANSI Z535.4-1991—Product Safety Signs and Labels

ANSI/UL 558 (latest revision)—Standard for Safety for Internal-Combustion-Engine-Powered Industrial Trucks

ANSI/UL 583 (latest revision)—Standard for Safety for Electronic-Battery-Powered Industrial Trucks

2.1.4 ISO PUBLICATIONS—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ISO 1044-1993—Industrial Trucks - Lead Acid Traction Batteries for Electric Trucks - Preferred Voltages

ISO 3287-1978—Powered Industrial Trucks, Control Symbols

ISO 3691-1980—Powered Industrial Trucks - Safety Code

ISO/DIS11684-1993—Tractors, Machinery for Agriculture and Forestry, Powered Lawn and Garden Equipment - Safety Signs and Hazard Pictorials

2.1.5 NASA PUBLICATION—Available from NASA RP-1024 (N79-11734), National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161.

Anthropometric Sourcebook, Vol. 1, Anthropology for Designers

### 3. Part I—Safety Standard for Light Utility Vehicles

#### 3.1 Interpretation

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*.

#### 4. Part II—For the Controlling Party

##### 4.1 Maintenance and Operations

###### 4.1.1 INTRODUCTION

4.1.1.1 Like other machines, light utility vehicles can cause injury if improperly used or maintained. Part II contains broad safety practices applicable to vehicle operations. Before operation, the controlling party shall follow such additional specific safety practices as may reasonably be required for safe operation.

4.1.1.2 *Safety Survey*—The controlling party shall perform a safety survey of their premises periodically, and as conditions warrant, identify areas where vehicles should not be operated and to identify possible hazards.

- a. *Steep Grade*—In areas where steep grades exist, vehicle operation should be restricted to the designated vehicle's pathways where possible, and shall be identified with a suitable warning giving the following information: "Warning, steep grade, descend slowly with brake applied."
- b. *Wet Areas*—Wet areas could cause a vehicle to lose traction and could affect steering, stability and braking.
- c. *Sharp Turns, Blind Corners, Bridge Approaches*—Sharp turns, blind spots, bridge approaches, and other potentially hazardous areas shall be identified with a suitable warning to the operator of the nature of the hazard and stating the proper precautions to be taken to avoid the hazard.
- d. *Loose Terrain*—Loose terrain could cause a vehicle to lose traction and could affect steering, stability, and braking.

4.1.1.3 *Utility Vehicle/Pedestrian Interference Areas*—Areas where pedestrian and vehicle traffic could interfere should be avoided by rerouting the vehicle or the pedestrian traffic to eliminate the interference. If elimination of the interference is not possible or is highly impractical, signs shall be erected warning pedestrians and vehicle operators of traffic conditions and to use caution.

4.1.1.4 The controlling party shall train vehicle operators to adhere strictly to the operating instructions stated in vehicle operator's manual and those additional operating instructions provided by controlling party.

4.1.1.5 The controlling party shall survey specific operating conditions and environment, establish safety practices, and train vehicle operators to comply with these practices.

###### 4.1.2 STABILITY

4.1.2.1 Experience has shown that vehicles which comply with the provisions stated in 7.7 are stable when properly operated in accordance with specific safety rules and practices established to meet actual operating terrain and conditions. However, improper operation, faulty maintenance, or poor housekeeping may contribute to a condition of instability and defeat the purpose of the standard. Some conditions which could affect stability are failure of the operator to follow safety practices, surface conditions, grade, speed, loading, braking, turning, improper loads, towing, attachments, dynamic forces, and the judgment exercised by the vehicle operator.

###### 4.1.3 NAMEPLATES, MARKINGS, CAPACITY, AND MODIFICATIONS

4.1.3.1 The controlling party shall maintain in a legible condition all nameplates, warnings, and instructions which are supplied by the vehicle manufacturer.

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- 4.1.3.2 The controlling party shall not perform any modification or addition which affects capacity or safe operation, or make any change not in accordance with the vehicle manual(s) without the vehicle manufacturer's prior written authorization. Where authorized modifications have been made, the controlling party shall ensure that capacity, operation, warning, and maintenance instruction plates, tags, or decals are changed accordingly.
- 4.1.3.3 As required under 4.1.3.1 or 4.1.3.2, the vehicle manufacturer shall be contacted to secure new nameplates, warnings, or instructions which shall then be affixed in their proper place on the vehicle.
- 4.1.4 FUEL HANDLING
- 4.1.4.1 The controlling party shall supervise the handling of liquid fuels (when used) to be certain that it is in accordance with appropriate sections of ANSI/NFPA 505 and ANSI/NFPA 30 or as required by local ordinance.
- 4.1.4.2 The controlling party shall supervise the handling of liquefied petroleum gas fuels (when used) to be certain it is in accordance with appropriate sections of ANSI/NFPA 505 and ANSI/NFPA 58 or as required by local ordinance.
- 4.1.5 CHARGING STORAGE BATTERIES
- 4.1.5.1 The controlling party shall require battery-charging procedures to be in accordance with appropriate sections of ANSI/NFPA 505, ISO 3691, or local ordinance and meet any other requirements such as OSHA.
- 4.1.5.2 The controlling party shall periodically review procedures to be certain that appropriate sections of ANSI/NFPA 505 or local ordinance and OSHA are strictly complied with, and shall familiarize vehicle operators with it.
- 4.1.6 LIGHTING FOR OPERATING AREAS
- 4.1.6.1 The controlling party, in accordance with his responsibility to survey the environment and operating conditions, shall determine if the vehicle requires lights and, if so, shall equip the vehicle with appropriate lights in accordance with the vehicle manufacturer's recommendations.
- 4.1.7 WARNING DEVICE(S)
- 4.1.7.1 The controlling party shall make periodic inspections of the vehicle to be certain that the sound-producing and visual device(s), if so equipped, are maintained in good operating conditioning condition.
- 4.1.7.2 The controlling party shall determine if operating conditions require the vehicle to be equipped with additional sound-producing and/or visual devices compatible with the vehicle manufacturer's recommendations, and be responsible for providing and maintaining such devices, in accordance with the vehicle manufacturer's recommendations.
- 4.1.8 SAFETY INTERLOCKS
- 4.1.8.1 The controlling party shall make periodic inspections of the vehicle to be certain that the safety interlock system, if so equipped, is operating properly.

## **5. Operating Safety Rules and Practices**

### **5.1 Operator Qualifications**

5.1.1 Only persons who are trained in the proper operation of the vehicle shall be authorized to operate the vehicle. Operators shall be qualified as to visual, auditory, physical, and mental ability to safely operate the vehicle according to Section 5 and all other applicable parts of this document and vehicle operator's manual.

### **5.2 Operator's Training**

5.2.1 The controlling party shall develop and conduct an operator training program.

5.2.2 Successful completion of the operator training program by the operator shall be required before operation of the vehicle. The program shall be presented in its entirety to all new operators and not condensed for those claiming previous experience.

5.2.3 The controlling party should include, as a minimum, in the operator training program the following:

- a. Instructional material provided by the vehicle manufacturer, including vehicle operator's manual
- b. Emphasis on safety of passengers, vehicle operator, and other persons
- c. Safe loading practice, including securing material loads
- d. General safety rules contained within this document and the additional specific rules determined by the controlling party in accordance with this document, and why they were formulated
- e. Introduction of equipment, control locations, and functions, and explanation of how they work when used properly and the consequences of improper use; explanation of surface conditions, grade, and other conditions of the environment which could affect vehicle operation
- f. Operator competency evaluations

### **5.3 Operator Responsibility**

5.3.1 Read and follow operator's manual.

5.3.2 Do not operate vehicle under the influence of drugs or alcohol.

5.3.3 Safeguard the pedestrians at all times. Do not drive vehicle in a manner that could endanger other persons.

5.3.4 Riding on the vehicle by persons other than the operator is authorized only on seat(s) provided by the vehicle manufacturer. All parts of each person's body shall remain within the plan view outline of the vehicle while the vehicle is in motion.

5.3.5 When a vehicle is to be left unattended, stop vehicle, apply the parking brake, turn off the control or ignition circuit, and remove the key if provided. Block the wheels if vehicle is on an incline.

5.3.6 Maintain a safe distance from potential hazards.

5.3.7 Use only approved vehicles in hazardous locations, as defined in the appropriate safety standards.

5.3.8 Report all accidents involving personnel, building structures, and equipment.

5.3.9 Do not add to, or modify, the vehicle.

5.3.10 Slow down or stop, as conditions dictate, and activate a sound-producing warning device, if so equipped, at intersections and when visibility is obstructed at other locations.

- 5.3.11 Ascend or descend grades slowly, avoid turning if possible; normally travel straight up and down.
- 5.3.12 Under all travel conditions, operate vehicle at speeds that will permit it to be brought to a stop in a safe manner.
- 5.3.13 Use caution and slow down when approaching or on wet or slippery surfaces, loose or unfamiliar terrain.
- 5.3.14 Avoid sudden starts, stops, turns, or direction reversals so as not to shift the load, endanger passengers, or lose control of the vehicle.
- 5.3.15 Do not operate vehicle in a dangerous manner, such as stunt driving or horseplay.
- 5.3.16 Avoid running over loose objects, potholes, and bumps.

#### **5.4 Loading**

- 5.4.1 Refer to operator's manual for loading instructions.
- 5.4.2 Transport only stable and safely arranged loads secured to prevent movement. Avoid loads which cannot be centered.
- 5.4.3 Transport only loads within the gross vehicle weight capacity.
- 5.4.4 Avoid material loads exceeding the physical dimensions of the vehicle or as specified by the vehicle manufacturer.

#### **5.5 Operator Care of Light Utility Vehicles**

- 5.5.1 Follow operator's manual.
- 5.5.2 At the beginning of each operating period during which the vehicle will be used, the operator shall check the vehicle condition and inspect the tires, warning devices, safety interlocks, lights, battery(s), fuel system, speed and directional controllers, brakes, and steering mechanism. If the vehicle is found to be in need of repair, or in any way unsafe, the matter shall be reported immediately to the controlling party and the vehicle shall not be operated until it has been restored to safe operating condition.
- 5.5.3 If during operation the vehicle becomes unsafe in any way, the matter shall be reported immediately to the controlling party, and the vehicle shall not be operated until it has been restored to safe operating condition.
- 5.5.4 Repairs and adjustments shall only be performed by specifically trained and authorized persons.

### **6. Maintenance Practices**

#### **6.1 Maintenance Procedures**

- 6.1.1 Maintenance and inspection of all vehicles shall be performed in conformance with the vehicle manufacturer's recommendations and the following practices, if applicable. Only trained and authorized personnel shall be permitted to maintain, repair, adjust, and inspect vehicles.
  - a. A scheduled preventive maintenance, lubrication, and inspection system shall be followed.
  - b. Before undertaking maintenance or repair, follow the vehicle manufacturer's recommendations for immobilizing the vehicle.
  - c. Chock wheels and block chassis before working underneath it.

- d. Before disconnecting any part of the fuel system of a gasoline-powered vehicle, be sure shutoff valve, if so equipped, is closed, and run engine until fuel system is depleted, engine stops running, and is allowed to cool. Before disconnecting any part of the engine fuel system of a diesel-powered vehicle, be sure shutoff valve, if so equipped, is closed, following vehicle manufacturer's recommended practice.
- e. Before disconnecting any part of the fuel system of LP/CNG powered vehicles, close the fuel cylinder valve and run the engine until fuel in the system is depleted, the engine stops running, and is allowed to cool.
- f. Disconnect battery(s).
- g. Operation to check performance of the vehicle shall be conducted in an authorized area where suitable conditions exist, free of vehicular and pedestrian traffic.
- h. Before returning the vehicle to service, follow the vehicle manufacturer's recommended procedures.
- i. Avoid fire hazards and have fire protection equipment present in the work area. Do not use an open flame to check level or leakage of fuel, battery electrolyte, or coolant.
- j. Properly ventilate the work area in accordance with applicable regulations or local ordinances.
- k. Handle fuel cylinders carefully. Physical damage, such as dents, scrapes, or gouges, may dangerously weaken cylinders and make them unsafe for use.
- l. Brake mechanisms, steering mechanisms, speed and directional control mechanisms, warning devices, electrical systems, governors, guards, exhaust system, and safety devices shall be inspected regularly and maintained in accordance with the vehicle manufacturer's recommended procedures.
- m. Vehicles or devices designed and approved for hazardous area operation shall be inspected to ensure that maintenance preserves the original approved operating features.
- n. Fuel systems shall be checked for leaks and condition of parts. If a leak is found, action shall be taken to prevent the use of the vehicle until the cause of the leak has been repaired.
- o. The vehicle manufacturer's capacity, operation, and maintenance instruction plates, tags, and safety labels shall be maintained in legible condition.
- p. Batteries, motors, speed and directional controllers, limit switches, protective devices, electrical conductors/insulators, and connections shall be inspected and maintained in accordance with vehicle manufacturer's recommended procedures.
- q. Vehicles shall be kept in a clean condition to minimize fire hazards and facilitate the detection of components needing service.
- r. Hydraulic systems, if so equipped, shall be checked for leaks and condition of parts. Keep body and hands away from pin hole leaks or nozzles that eject hydraulic fluid under high pressure. Use paper or cardboard, not hands, to search for leaks.
- s. Modifications and additions which affect capacity and safe machine operation shall not be performed without vehicle manufacturer's prior written authorization. Where authorized modifications have been made, the controlling party shall ensure that capacity, operation, warning, and maintenance instruction plates, tags, and safety labels are changed accordingly.
- t. Care shall be taken to ensure that all replacement parts are interchangeable with the original parts and of a specification at least equal to that provided in the original equipment.

## **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 a durable, corrosion-resistant nameplate, legibly inscribed with the following minimum information:
  - a. Vehicle model or serial number, or both
  - 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
- 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:
  - a. Vehicle weight without battery (batteries).
  - b. The maximum service weights of battery (s) and tray to be used.
  - c. 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 an 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).
- 7.2.6 Universal symbols for operator's control and safety symbols in accordance with SAE J115, ISO 3287, ISO 11684, ANSI Z535.3, and ANSI Z535.4, should be used for control and hazard identification.

**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, "Anthropometric Sourcebook, Vol. I, Anthropometry for Designers," 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.

#### 7.4 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 Travel Controls

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

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

7.5.3 If a single foot pedal controls both acceleration and braking, depressing the pedal shall increase speed and releasing the pedal shall apply brakes.

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 Speed Tests

##### 7.6.1 TEST CONDITIONS

- a. Horizontally flat surface, 0.5% grade (0.3 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)

7.6.2 TESTS—The vehicle shall be operated in one direction of travel and then the other. The results shall then be averaged.

7.6.3 TEST ACCEPTANCE—The maximum average speed from 7.6.2 shall be less than 40 km/h (25 mph).

## 7.7 Stability Tests

### 7.7.1 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. In the case that the vehicle is equipped with a vehicle manufacturer's approved accessory other than a load bed, the vehicle shall be weighted in such a manner as to simulate the least stable condition and not to exceed the manufacturer's stated gross vehicle weight. The minimum height for each test load shall be determined by Figure 2.
- e. A  $95 \text{ kg} \pm 5 \text{ kg}$  ( $209 \text{ lb} \pm 11 \text{ lb}$ ) weight shall be secured to each seat, representing the operator and each passenger as specified. 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 150 mm (6 in) above the lowest point of the operator supporting surface and 250 mm (9.8 in) forward of the seat back. If a seat back is not used, then 250 mm (9.8 in) will be measured from the position of the back of a person when seated normally.

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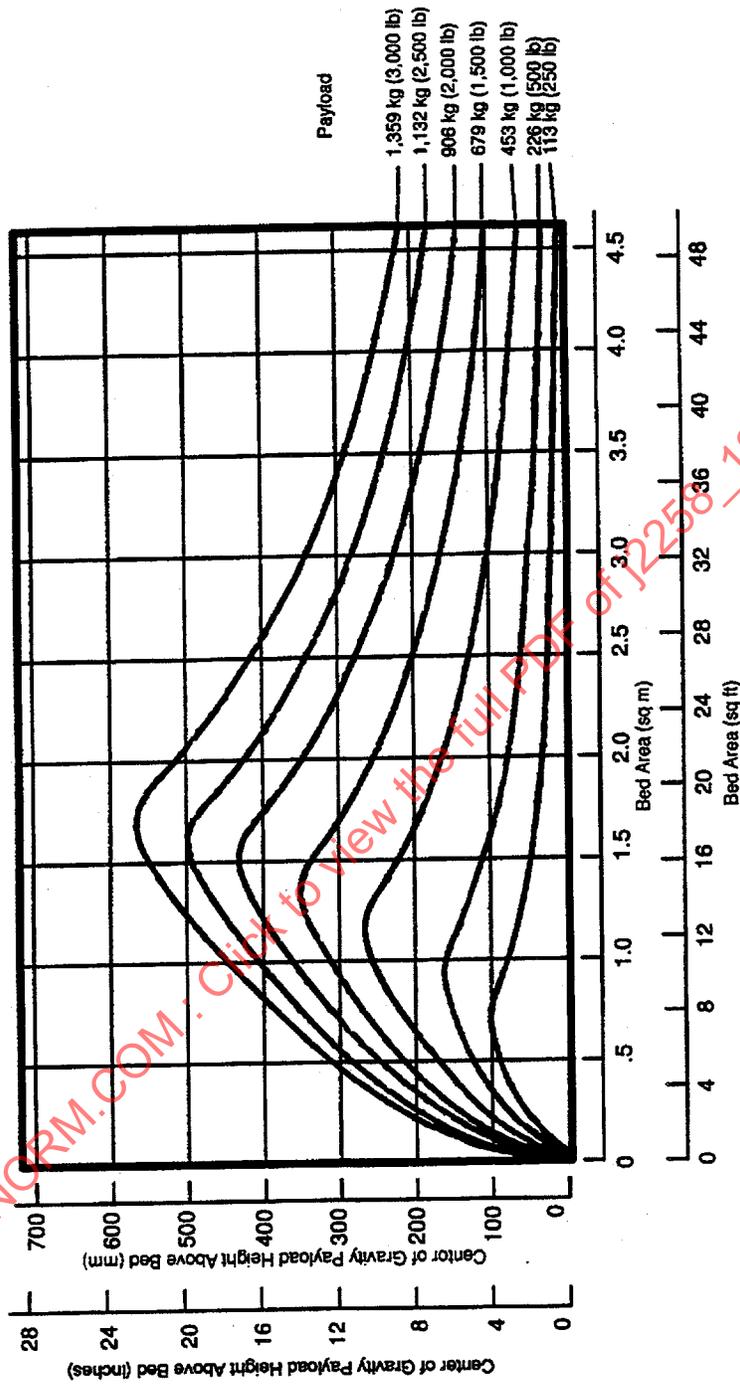


FIGURE 2—CENTER OF GRAVITY PAYLOAD HEIGHT ABOVE BED

7.7.2 LATERAL STABILITY TEST

a. Requirements

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. Procedure—The vehicle with test loads in place shall be put on the tilt platform in accordance with Figures 3 or 4 (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 36.4% grade (20 degrees).
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.

c. 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.

d. 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.

7.7.3 LONGITUDINAL STABILITY TESTS

a. Requirements

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. 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 5). 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 7.7.2. (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 7.7.3. (b) (1) and (2) except that the rear end of the vehicle will be facing the platform axis of tilt (See Figure 6).

7.8 Brakes

7.8.1 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

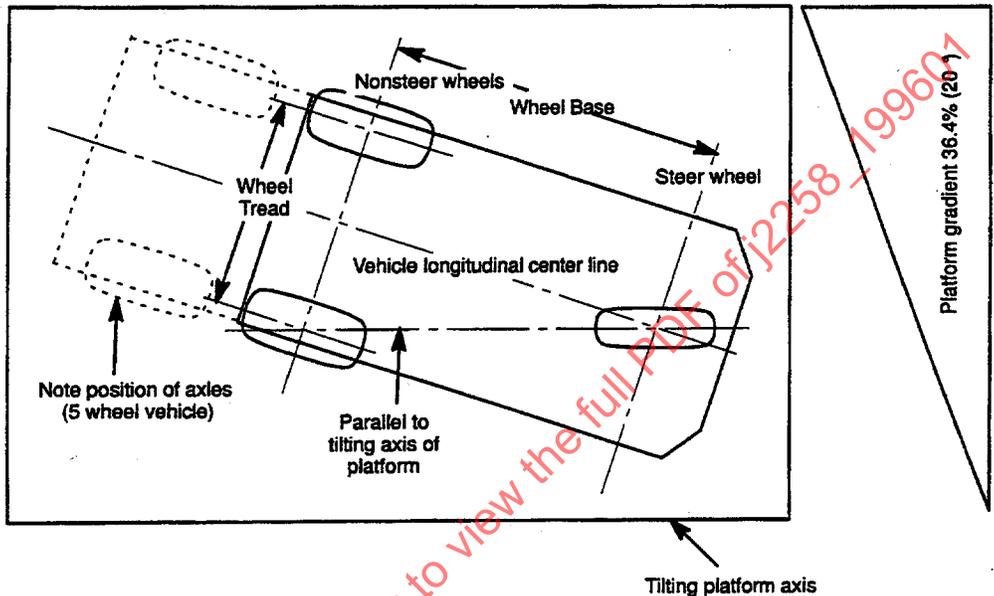


FIGURE 3—CARRIER PLACEMENT ON LATERAL TILTING PLATFORM (THREE- AND FIVE-WHEEL)

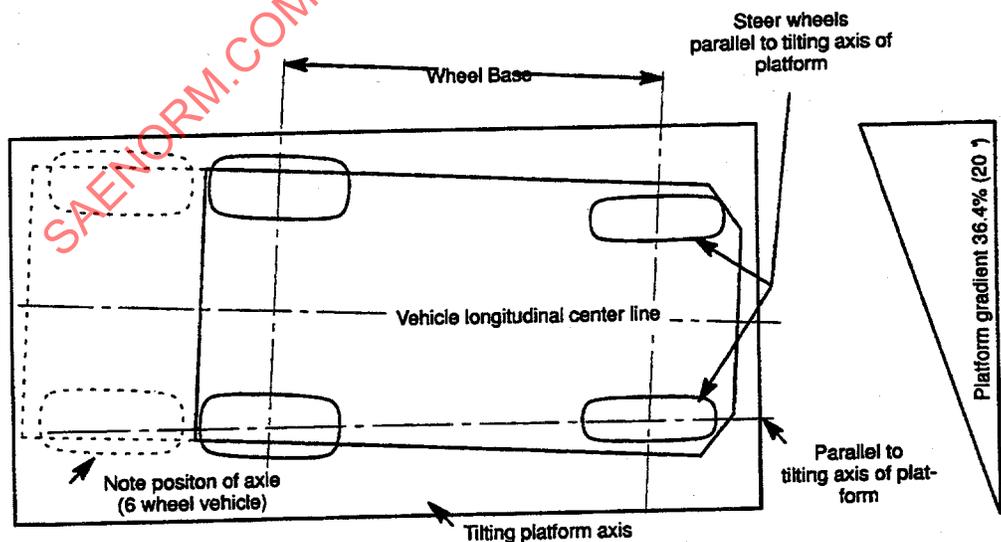


FIGURE 4—CARRIER PLACEMENT ON LATERAL TILTING PLATFORM (FOUR-WHEEL AND SIX-WHEEL UNEQUAL TREAD WIDTH)

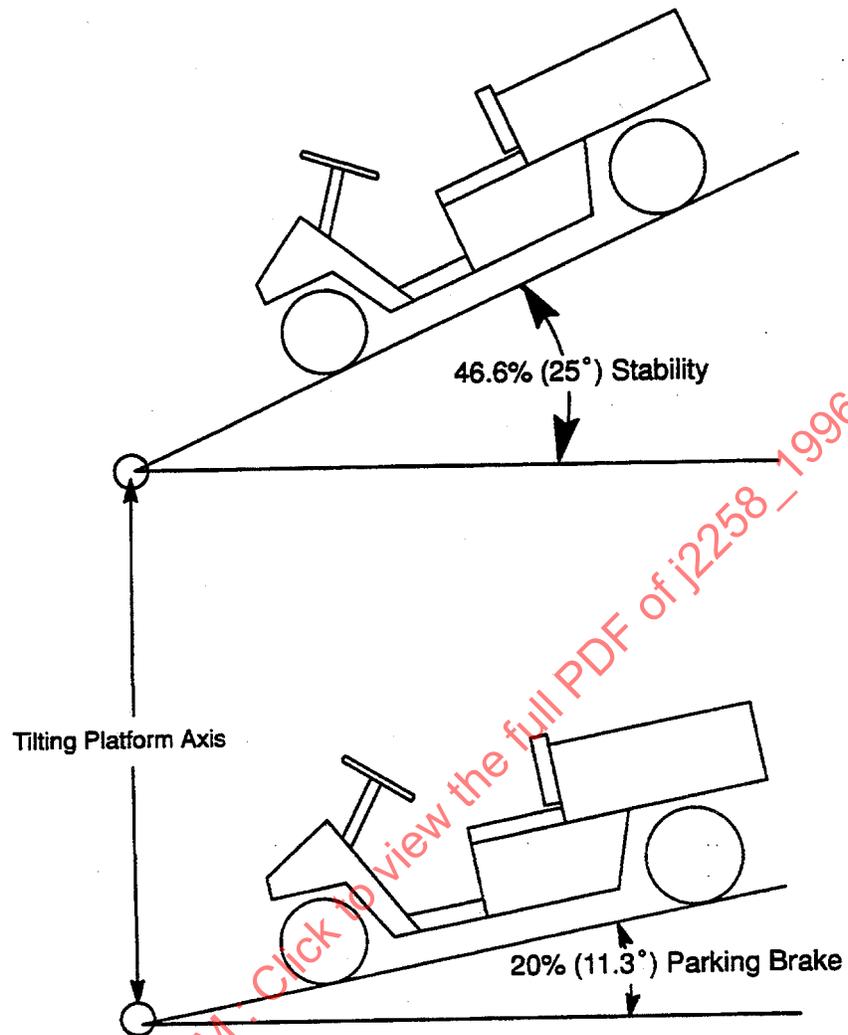


FIGURE 5—CARRIER PLACEMENT ON LONGITUDINAL PLATFORM (DOWNGRADE POSITION INDICATED)

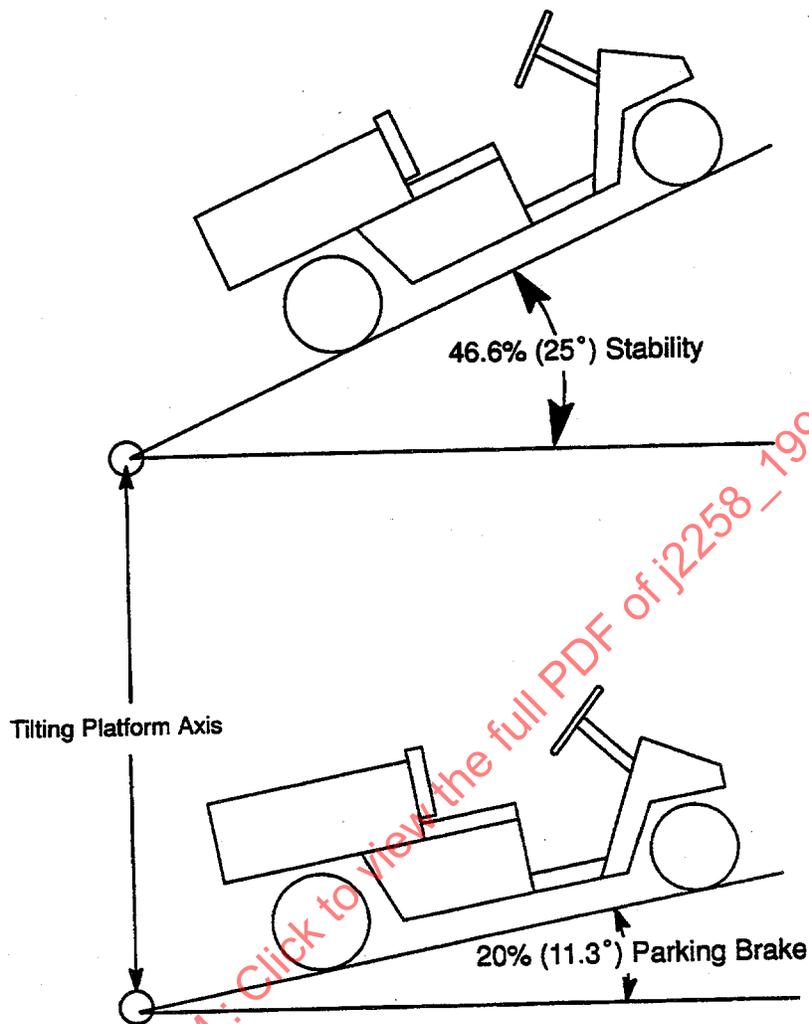


FIGURE 6—CARRIER PLACEMENT ON LONGITUDINAL PLATFORM (UPGRADE POSITION INDICATED)

### 7.8.2 SERVICE BRAKE PERFORMANCE

a. Test conditions shall be as follows:

1. Horizontally flat surface, 0.5% grade (0.3 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 before measurements begin.
5. The vehicle shall be configured and loaded such that it creates the most severe braking conditions which could be at less than gross vehicle weight.
6. Burnishing brakes is permissible following the manufacturer's approved procedure.

b. 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, applied at the midpoint of the lever, shall not exceed 225 N (50 lb).

- 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:

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

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

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

### 7.8.3 SERVICE BRAKE FADE

- a. Test Conditions—The test vehicle shall be towed in the forward direction with brake(s) applied to produce a drag load determined by the following formula:

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

This drag load shall be maintained within  $\pm 15\%$  for 152.2 m (500 ft). Towed vehicle speed shall be between 50% and 100% of maximum level ground vehicle speed.

- b. Test—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. This test shall be performed before the brake linings have cooled more than 14 °C (25 °F) from the maximum temperature, as measured per SAE J843d, obtained during the tow period.
- 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:

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

### 7.8.4 SERVICE BRAKE FADE RECOVERY

- a. Test Conditions—They shall be the same as given in 7.8.2.
- b. Test—The service brake test described in 7.8.3 (b) shall be repeated after cooling the brakes to ambient temperature.
- c. Test Acceptance—They shall be the same as given in 7.8.2 (c).

### 7.8.5 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