

American National Standard

*for Golf Cars –
Safety and Performance Specifications*



ANSI/OPEI
Z130.1-2020
Revision and
redesignation of
(ANSI/ILTV Z130.1-2012)

American National Standard for Golf Cars – Safety and Performance Specifications

Sponsor

Outdoor Power Equipment Institute

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American National Standard

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Foreword (This foreword is not part of American National Standard ANSI/OPEI Z130.1-2020.)

This is the seventh edition (sixth revision) of *American National Standard for Golf Cars - Safety and Performance Specifications*, ANSI/ILTVA Z130.1-2012. The first edition of the standard was published in 1979. The first through sixth editions were developed under the auspices of the International Light Transportation Vehicle Association (ILTVA). This revision was prepared by the OPEI Z130.1 / Z135 Golf Car and PTV Committee, as part of OPEI's continuing work on standards.

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

- Several definitions were added or revised;
- The vehicle identification number requirements were revised;
- Safety warnings were revised to specify warnings for both occupants and operators;
- Previous fuel system requirements were replaced with the requirement to comply with ANSI/OPEI B71.10.

The standard contains no normative annex and one informative annex.

Suggestions for improvement of the standard are welcome. They should be sent to the Outdoor Power Equipment Institute, 1605 King Street, Alexandria, VA, 22314, or via e-mail to info@opei.org.

Consensus for this standard was developed by use of the Canvass Method, as well as through public consultation in *ANSI Standards Action*.

The persons listed below were recognized as having an interest in the standardization of golf cars and were included on the consensus body. Additional stakeholders were recognized as having an interest, however OPEI was unable to make contact with these stakeholders, or they declined to participate. Inclusion in this list does not necessarily imply that all organizations concurred with the submittal of the proposed standard to ANSI.

Geoff Stewart, P.E., C.R.E., Chairman
(Club Car, LLC)

Z130.1-2020 Consensus Body

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American National Standard

for Golf Cars – Safety and Performance Specifications

PART I INTRODUCTION

1 Scope and purpose

1.1 Scope

This standard provides safety and performance specifications relating to golf cars, driven by electric motors or internal combustion engines specifically intended for and used on golf courses for transporting golfers and their equipment.

This standard does not apply to:

- Personal Transport Vehicles (PTVs), which are covered by ANSI/OPEI Z135 (formerly ANSI/ILTV Z135);
- autonomous vehicles;
- hybrid electric vehicles (powered by a combination of an internal combustion engine and a battery with an electric motor);
- vehicles designed for the transportation of persons with disabilities.

The effective implementation date of this standard shall be two (2) years after the publication date and shall apply to all products built after that date. Newly manufactured golf cars may also comply with the requirements of this standards any time after the publication date.

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

1.2 Purpose

The purpose of this standard is to promote safety in the design, manufacture, maintenance and operation of golf cars. This standard may be used as a guide by regulatory authorities desiring to formulate safety rules and regulations. This standard is also intended for voluntary use by others associated with manufacturing, maintaining or utilizing golf cars.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this American National Standard. At the time of publication of this standard, the editions indicated were valid. However, all publications and standards are subject to revision and obsolescence. Accordingly, users are encouraged to investigate the possibility of applying the most recent editions of the standards referenced herein.

ANSI Z535.1, *Safety Colors*

ANSI Z535.3, *Criteria for Safety Symbols*

ANSI Z535.4, *Product Safety Signs and Labels*

ANSI/NFPA 30, *Flammable and Combustible Liquids Code*

ANSI/NFPA 58, *Storage and Handling of Liquefied Petroleum Gases*

ANSI/OPEI B71.10, *Off-Road Ground-Supported Outdoor Power Equipment – Gasoline Fuel Systems – Performance Specifications and Test Procedures*

ISO 3864, *Graphic Symbols – Safety colours and safety signs – Part 1: Design principals for safety signs and safety markings*

NASA-STD-3000, *Revision B, July 2003, Man-Systems Integration Standards, Volume I, Section 3, ANTHROPOMETRY AND BIOMECHANICS*¹

US Environmental Protection Agency Urban Dynamometer Drive Cycle (UDDS)

SAE J1718, *Measurement of Hydrogen Gas Emission from Battery-Powered Passenger Car and Light Trucks during Battery Charging*

SAE ICS 1000, *Recreational Off-Road Vehicle Product Identification Numbering System*

SAE J1163, *Determining Seat Index Point*

3 Definitions

For purposes of this standard, the following definitions apply:

- 3.1 accessory:** A manufacturer-approved device installed on the golf car to enhance its usability and functionality.
- 3.2 adequate clearance:** The clearance necessary to avoid damage to components during use.
- 3.3 authorized persons:** Persons determined by the controlling party to be knowledgeable about golf cars and capable of operating them for their intended use consistent with these safety standards and regulatory authority rules governing golf car operation.
- 3.4 golf car braking system:** A system used to slow, prevent, or stop the movement of the golf car.
- 3.5 center of gravity of the test load:** The point at which the load mass is concentrated, located horizontally in the center of the load-bearing surface and vertically by its distance above the surface.
- 3.6 controlling party:** The person responsible for the management and maintenance of a golf car.
- 3.7 fire hazard:** Any condition that presents the possibility of creating a fire by ignition of a combustible material.
- 3.8 fire protection equipment:** Equipment used to prevent, control or extinguish a fire in accordance with state and local fire protection codes.
- 3.9 fuel system:** All tanks, lines, hoses, pumps, filters, connections, caps, fittings and other components necessary to store and carry fuel from the fuel tank to the engine.
- 3.10 fully charged batteries:** A battery or battery set that has been charged using the manufacturer's approved charger and charging algorithm where the charging cycle

¹ Available from National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161.

terminated normally, and that can achieve over 80% state of rated ampere-hour capacity at 27°C (80.6 °F).

- 3.11 **golf bag test weight:** A cylinder approximately 914 mm (36 inches) long, approximately 254 mm (10 inches) in diameter, and weighing 23 kg (50 lb) plus or minus 2%, with the center of gravity at the geometric center of the cylinder.
- 3.12 **golf car:** A vehicle used to convey a person or persons and equipment to play the game of golf in an area designated as a golf course.
- 3.13 **hand hold:** A device connected to the vehicle that can be encircled by the fingers of one hand for the purpose of improving personal stability.
- 3.14 **hip restraint:** A device, anchored securely to the golf car, creating a barrier or impediment to help keep the occupant within the golf car.
- 3.15 **insulated tools:** Those tools that are covered with a non-conducting material to prevent an inadvertent electrical short circuit and to protect the user from the dangers of electrical shock.
- 3.16 **newly manufactured:** Either a completely new vehicle or a vehicle modified to meet the definition of a golf car where it did not do so prior to the modification.
- 3.17 **occupant:** Any person occupying the golf car.
- 3.18 **occupant test weight:** A test weight approximately 305 mm (12 in) square and weighing 91 kg (200 lb) \pm 2% with the center of gravity at the geometric center of the weight. The vertical height of the test weight center of gravity should be between 125 mm (5 in) and 177.8 mm (7 in).
- 3.19 **operator:** An occupant controlling the operation of the golf car from the operator's seat.
- 3.20 **operator seat:** The seat located directly behind the steering wheel.
- 3.21 **parking brake:** A device that, when properly engaged, prevents movement of the parked vehicle.
- 3.22 **PIN:** A 17-digit Product Identification Number for off-road recreation vehicles governed by the Society of Automotive Engineers.
- 3.23 **regulatory authority:** The person(s) establishing the rules for use of golf cars.
- 3.24 **reverse warning device:** A sound-producing device to alert of reverse or pending reverse operation.
- 3.25 **roll-over:** A rotation of the golf car of at least 90° along the longitudinal axis in any direction from its normal upright position.
- 3.26 **service brake:** The primary braking system of the golf car used to reduce the speed or stop movement of the golf car.
- 3.27 **shall:** Indicates a mandatory requirement.
- 3.28 **should:** Indicates a permissive condition (a recommendation).
- 3.29 **speed control device:** An actuator used by the operator to vary or fix the rate of travel of the golf car.
- 3.30 **stopping distance:** The distance traveled between the point of service brake application and where the golf car comes to rest.
- 3.31 **test vehicle:** A golf car used for testing which conforms 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.

3.32 tilting platform: A platform that is rigid, flat and constructed to be a single plane, with adjustable slope.

3.33 wiring system assemblies: All wires, terminals, and connectors required to conduct electrical current to the motor, starter/generator or any other electrical devices.

PART II: MAINTENANCE AND OPERATIONS

The safety information contained in Part II is intended to enable the controlling party to implement a golf car safety program.

It is recommended that Part II be reprinted in the manufacturer's operation and service manuals to encourage safe operation and practices at the controlling party's facility.

4 General safety practices

4.1 Introduction

Like other vehicles, improper use or maintenance of golf cars may result in personal injury or death. This Part II contains broad safety practices recommended for safe golf car operations. Before operation, the controlling party should establish such additional specific safety practices as may be reasonably required for safe operations, for the intended use of the vehicle and applicable environment.

Golf cars that comply with the provisions stated in Part III of this standard are reasonably safe when properly operated in accordance with the safety and operation warnings affixed to every golf car. The safe operation is enhanced when the golf cars are operated within a specific set of operation instructions, safety rules and practices established to meet actual operating terrain and conditions.

4.2 Safety survey

The controlling party shall perform a safety survey of its premises periodically, and as conditions warrant, identify areas where possible hazards exist and golf cars should not be operated. See, for example, 4.2.1. See also *ILTVA Golf Course Safety Guidelines* and *ILTVA Golf Car Storage Facility Safety Guidelines* (available at www.opei.org or by e-mail request to info@opei.org).

4.2.1 Grades

Excessive speed while descending grades adversely affects the stability of the golf car and its ability to stop. In areas where hazardous grades exist, golf car operations should be restricted to designated golf car paths and roads where possible. Hazardous grades shall be identified with a suitable warning at a point preceding the initiation of the slope for example, "Warning, steep hill, slow down now". All slopes should generally be considered potentially hazardous especially when a turn occurs on the down slope or the slope exceeds 10% (6°) on an unpaved surface or 20% (11°) on a paved surface. Avoid parking on steep hills. Provide flat surface parking areas adjacent to golf car paths on steep grades.

4.2.2 Slippery terrain

Extreme caution should be used when driving on slippery terrain. For example, wet grassy areas or ice may cause a golf car to lose traction and may adversely affect operator control. Slippery surfaces should be chained or roped off to prevent golf car operations or be identified by a suitable warning that golf cars should not be operated in those areas. Additionally, if wet conditions are or become prevalent, consider limiting golf car operation to paved paths.

4.2.3 Turns

All turns shall be negotiated at a reduced speed. Approach turns with caution particularly on grades. Negotiating a turn can affect the stability and control of a golf car, causing loads and passengers to shift. Potentially hazardous areas shall be closed off to prevent golf car operations or 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. Avoid improperly banked curves to prevent negative super elevation.

4.2.4 Loose terrain

Extreme caution shall be used when driving in areas of loose terrain. For example, loose terrain, or sand or gravel, can cause a golf car to lose traction and may affect steering, braking and stability. Areas of loose terrain shall be repaired if possible, or closed off to prevent golf car operation or identified by a suitable warning that golf cars should not be operated in those areas

4.2.5 Golf car/pedestrian interaction areas

Areas where golf cars could or do interact with pedestrians, bicycles, or motor vehicles, should be avoided, if possible. If avoidance of the interaction is not possible or is highly impractical, warning signs shall be erected. Additionally, convex mirrors, barriers, lighting or other measures may be used in these areas.

4.3 Modifications

Modifications made to golf cars that are not approved by the original equipment manufacturer may adversely affect the safe operation and performance of the vehicle. For modifications made by a party other than the original equipment manufacturer, the controlling party shall (i) arrange for the modification to be designed, tested and implemented by an engineer expert in golf cars and their safety; (ii) maintain a permanent record of the design test(s) and implementation of the modification; (iii) make appropriate changes to the capacity, plate(s), decals, and operation and maintenance manuals; and (iv) affix a permanent and readily visible label on the golf car stating the golf car has been modified with the date of the modification and the name of the organization that accomplished the modification. The controlling party shall not perform, or allow to be performed, any modification or addition to the vehicle that affects capacity or safe operation, or make any change not in accordance with the original equipment manufacturer's operations and service manuals, without the original equipment manufacturer's prior written authorization.

Whether or not modifications have been authorized by the original equipment manufacturer, if modifications are made, the controlling party making the modifications becomes the original equipment manufacturer of the modified vehicle and has the responsibility to ensure that capacity, operation, warning, maintenance instruction plates, tags, and/or decals are changed accordingly.

5 Maintenance

5.1 Introduction

Golf cars may become hazardous if maintenance is neglected or improperly performed. Proper maintenance shall be performed by trained personnel in accordance with the manufacturer's recommendations.

5.2 Preventive maintenance

A regularly scheduled inspection and preventive maintenance program in accordance with the manufacturer's recommendations should be established. Such a program will be a valuable tool in providing the golf car operator with a safe, properly operating golf car.

5.2.1 Personnel

Only qualified, trained and authorized personnel shall be permitted to inspect, adjust and maintain golf cars.

5.2.2 Parts and materials

Manufacturer's recommended replacement parts and materials should be used.

5.2.3 Maintenance and repair safety procedures

All repair and maintenance shall be performed in accordance with the manufacturer's recommended maintenance and safety procedures as outlined in the manufacturer's operation and service manuals. For example:

- a) Each vehicle should be removed from service if repair or maintenance is needed;
- b) Follow manufacturer's instructions for immobilizing golf car before beginning any maintenance;
- c) Block chassis before working underneath golf car;
- d) Before disconnecting any part of the fuel system, drain the system and turn all valves to the "off" position to prevent leakage or accumulation of flammable fuels;
- e) Avoid fire hazards and have fire protection equipment available;
- f) Before performing any maintenance on an electric golf car, disconnect the electrical system in accordance with the manufacturer's instructions;
- g) Use only properly insulated tools when performing maintenance;
- h) Periodically inspect and maintain braking system, steering mechanisms, warning devices, governors, safety decals and all other safety devices and maintain them in a safe operating condition. Do not modify these devices unless instructed to do so by the manufacturer;
- i) After each maintenance or repair, have the golf car driven by qualified and trained personnel to ensure proper operation and adjustment; perform validation checks in an area that is free of vehicular and pedestrian traffic;
- j) Record all work performed in a maintenance record log by date, name of person performing maintenance and type of maintenance. The controlling party should periodically inspect maintenance log to ensure accuracy and completeness of entries.

5.2.4 Safety labels

The controlling party shall maintain in a legible condition all **Danger**, **Warning**, and **Caution** labels (collectively and individually "safety labels"), nameplates, serial numbers, and instructions that are supplied by the manufacturer.

The manufacturer shall be contacted to secure new nameplates, warnings, or safety labels, as necessary, which shall be affixed in their proper place on the golf car as designated in the owner's manual.

6 Fuels handling and storage/battery charging

6.1 Ventilation

Maintenance and storage areas shall be properly ventilated to avoid fire hazards in accordance with applicable fire codes and ordinances.

Ventilation for internal combustion engine golf cars shall be provided to remove flammable vapors, fumes and other flammable materials. Consult applicable fire codes for specific levels of ventilation.

Because of the highly volatile nature of hydrogen gas and its propensity to rise and accumulate at the ceiling in pockets, ventilation for electric-powered golf cars shall be provided to remove the accumulation of flammable hydrogen gas emitted during the charging process. The controlling party shall consult applicable fire and safety codes for the specific ventilation levels required. See the *ILTV Golf Car Safety Storage Guidelines* (available at www.opei.org or by e-mail request to info@opei.org) and SAE J1718, *Measurement of Hydrogen Gas Emission from Battery-Powered Passenger Car and Light Truck during Battery Charging*.

6.2 Battery charging facilities

The controlling party shall require battery changing and charging facilities and procedures to be in accordance with applicable ordinances or regulations.

6.3 Fuel storage

The controlling party shall supervise the storage and handling of liquid fuels in accordance with ANSI/NFPA 30.

Storage and handling of liquefied petroleum gas fuels shall be in accordance with ANSI/NFPA 58.

6.4 Auditing

The controlling party shall periodically inspect charging and storage areas or facilities and review procedures to be certain that the requirements in this clause are being followed.

7 Operating safety rules and practices (Operator and passenger qualifications)

It is recommended that only authorized persons who are qualified by the controlling party be allowed to operate a golf car. Qualifications may include training, proof of insurance, minimum age requirement or other appropriate standards or regulatory requirements.

The controlling party shall display the golf car manufacturer's operation and safety instructions and the golf course safety rules in a conspicuous place near the golf car rental area or pick-up area, or on each golf car, or both. It is also recommended that the warning "Do not operate golf car when under the influence of alcohol or drugs, or when distracted" be posted in a conspicuous location.

It is the responsibility of the operator to ensure that all occupants comply with the safety warnings.

PART III: MANUFACTURER'S REQUIREMENTS

8 General requirements

8.1 Identification Number

- 8.1.1 The manufacturer shall legibly inscribe a unique serial number on every golf car. It shall be on the main frame of the vehicle or a location that is not typically removed or separated from the main frame of the vehicle. It shall be in a location protected from debris and damage.
- 8.1.2 The primary location of the serial number shall be described in the Owners or Instructional Manual.
- 8.1.3 At the option of the manufacturer, the manufacturer may also attach a PIN that conforms to SAE ICS-1000. The PIN may serve as the serial number.
- 8.1.4 The serial number, PIN (if used) and manufacturer's name shall also be displayed on the steering column of the vehicle or in the vicinity of the steering column if installation on the steering column is not practical.

8.2 Safety warnings

8.2.1 General

8.2.1.1 Operator warnings

Safety labels shall be affixed to the golf car and shall be available to the field of the operator's vision. The safety labels shall conform to ANSI Z535.1, Z535.3, and Z535.4 or ISO 3864 and convey the following minimum information:

- Use the signal word "**Warning**," "**Caution**," or "**Danger**" as applicable;
- Operate from driver's seat by authorized persons only and only in designated areas;
- This vehicle is restricted to _____ occupants (manufacturer to specify the number of occupants);
- Do not operate the vehicle until all occupants are fully seated;
- Remain fully seated and hold on when in motion;
- Keep entire body inside vehicle;
- Drive slowly in turns;
- Drive slowly straight up and down slopes;
- Set parking brake before leaving vehicle;
- Place vehicle control in "Neutral," if so equipped, and turn main power "off" when not in use; and
- Do not operate golf car when under the influence of alcohol or drugs, or when distracted.

8.2.1.2 Occupant warnings

Safety labels shall be affixed to the golf car and shall be available to the field of the occupants' vision. The safety labels shall conform to ANSI Z535.1, Z535.3, and Z535.4 or ISO 3864 and convey the following minimum information:

- Use the signal word "**Warning**," "**Caution**," or "**Danger**" as applicable;
- This vehicle is restricted to _____ occupants (manufacturer to specify the number of occupants);
- Remain fully seated and hold on when in motion;
- Keep entire body inside vehicle; and
- Do not occupy golf car when under the influence of alcohol or drugs, or when distracted.

8.2.2 Nameplates, markings, safety warnings and operating instructions

On every vehicle, the manufacturer shall inscribe a permanent, durable, corrosion-resistant nameplate or marking with the unique serial number, manufacturer name, model name/code, date code and contact information.

On every electric vehicle, the manufacturer shall inscribe a permanent, durable, corrosion-resistant nameplate or marking with the nominal system voltage and load capacity.

On every internal combustion engine-powered vehicle, the manufacturer shall inscribe a permanent, durable, corrosion-resistant nameplate or marking with the fuel type and load capacity.

On every vehicle, the manufacturer should inscribe the tire size, tire rating, and recommended tire pressure.

Legible safety warnings and operating instructions shall be affixed to the vehicle and shall be sufficiently durable to resist environmental stresses.

8.3 Instructional manuals

Each manufacturer shall make available manuals that provide:

- Operating instructions; and
- A schedule of the required maintenance and storage, as appropriate, and information as provided in Part II.

Manufacturers shall make replacement manuals available for a minimum of 10 years after the vehicle manufacture date.

8.4 Operational controls

The controls shall be visible to and accessible by the operator from the designated operator's position.

8.4.1 Steering mechanism

When traveling in a forward direction, rotating the steering wheel in a clockwise direction shall cause the golf car to turn to the right and when rotated in a counterclockwise direction, the golf car shall turn to the left, when viewed from the operator's seat.

8.4.2 Foot-operated controls

Foot-operated controls shall include a slip-resistant surface.

8.4.2.1 Speed control devices

Speed control devices shall require force to be activated.

8.4.2.2 Service brake control

The service brake pedal or control shall be located in a conventional manner for right-foot or hand operation.

8.4.3 Parking brake

A parking brake shall be provided.

8.4.4 Directional control (forward and reverse)

The operational position of the forward and reverse control(s) shall be clearly marked.

8.4.5 Reverse warning device

Every golf car shall be equipped with a reverse warning device capable of 60 dBA minimum at the operator's ear level and functional at all times when the directional control is in the reverse position.

8.4.6 Main power switch

The golf car shall be provided with a main power switch. When the switch is in the "Off" position, or the key or other device that activates the switch is removed, the motive power circuit shall be inoperative. If the switch uses a key, it shall be removable only in the "Off" position.

8.5 General configuration

8.5.1 Adequate leg room shall be provided. "Adequate leg room" is that which will accommodate persons falling in the 5% to 95% male range of the appropriate measurements contained in NASA-STD-3000.

8.5.2 The golf car shall provide a seating arrangement, including a seat back for each intended occupant.

8.5.3 A hand hold shall be provided for each intended occupant seating position. A steering wheel may function as a hand hold for the operator. A hip restraint may function as a hand hold.

8.5.4 A hip restraint shall be provided for each intended outermost occupant seating position. The profile view of the hip restraint shall encompass the triangular area defined by the SIP point as specified in SAE J1163 and two restraint reference points defined in this clause. On the passenger side, the first restraint reference point shall be 88.9 mm (3.5 in) vertically (A) above the SIP point and the second reference point shall be 152.4 mm (6.0 in) horizontally (B) forward of the SIP point. On the driver side, the first restraint reference point shall be 38.1 mm (1.5 in) vertically (A) above the SIP point and the second reference point shall be 50.8 mm (2.0 in) horizontally (B) forward of the SIP point. See Figure 1. For seats where the SIP measurement fixture does not interface with the seat back, the manufacturer shall increase the height of the fixture to allow for interface of the fixture and seat back.

8.5.5 Surfaces normally exposed to occupants or bystanders shall be free of sharp edges and projections.

8.5.6 The floor area shall have a slip-resistant surface or shape.

8.5.7 All hazardous parts shall be identified, shielded, or located in such a position as to avoid inadvertent contact with the occupants or bystanders.

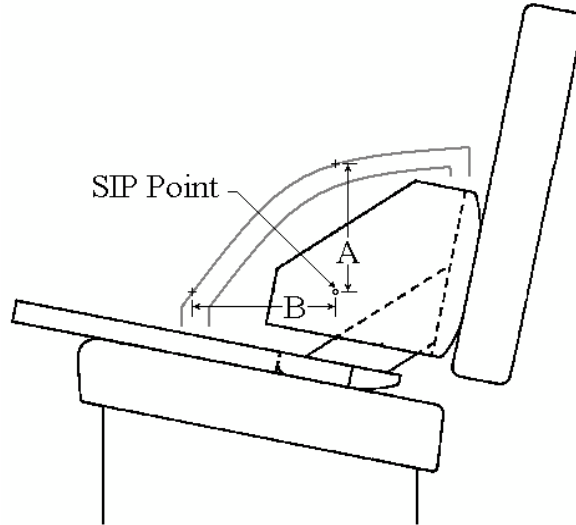


Figure 1 – First and second restraint reference points

8.6 Mechanical performance

8.6.1 Maximum golf car speed

8.6.1.1 Test conditions

Test conditions shall be as follows:

- Horizontally level surface, 1.0% grade (0.6°) maximum;
- Straight course;
- Concrete or asphalt surface of sufficient track length to allow the test vehicle to reach maximum steady state speed before measurements begin;
- Concrete or asphalt surface that is dry and free from loose material or surface contamination with a coefficient of static friction between tire and surface sufficient to prevent wheel slippage;
- Test vehicle shall be loaded with one operator and ballast, if necessary, with a combined weight of no less than 77 kg (170 lb) or more than 91 kg (200 lb);
- The test vehicle shall be configured in accordance with manufacturer's recommendations to achieve maximum speed;
- Electric vehicles shall have fully charged batteries.

8.6.1.2 Test

The test vehicle shall be operated with the directional control in forward at maximum speed under the conditions stated in 8.6.1.1. This test shall be first run forward in one direction and subsequently run forward in the opposite direction (within 30 minutes), along the level surface, and the maximum steady state speed achieved in both runs shall be averaged.

8.6.1.3 Test acceptance

The average speed shall be less than 24 km/h (15 mi/h).

8.6.2 Maximum vehicle acceleration

8.6.2.1 Test conditions

Test conditions shall be as stated in 8.6.1.1.

8.6.2.2 Test

The test vehicle shall be accelerated at maximum rate from stop position to maximum speed, under the conditions stated in 8.6.1.1. This test shall be run in one direction and the opposite direction along the flat surface (within 30 minutes), and the results of both runs shall be averaged.

8.6.2.3 Test acceptance

Test vehicle peak acceleration rate shall not exceed 0.5 g, i.e., 4.9 m/s^2 (16 ft/s^2) for intervals exceeding 0.2 seconds.

8.6.3 Static stability

The test vehicle shall be configured in accordance with manufacturer's recommendations to achieve the most severe conditions for stability including manufacturer-approved accessories.

8.6.3.1 Longitudinal stability**8.6.3.1.1 Test conditions**

Test conditions shall be as follows:

- A tilting platform shall be used;
- The tilting platform shall have a friction surface that achieves a coefficient of friction of one (1.0) minimum;
- The tilting platform surface shall be large enough to support all tires of the test vehicle;
- An occupant test weight shall be secured to the centerline of each intended seat, representing the operator and each passenger as specified. See Figure 2. If seats are adjustable, they shall be adjusted to that position representing the least stable condition to stability in each test. The center of gravity of the weight is to be 152 mm (6 in) above the lowest point of the operator- or passenger-supporting surface and 254 mm (10 in) ahead of the seat back; and
- The golf bag test weight(s) shall be mounted as intended for service.

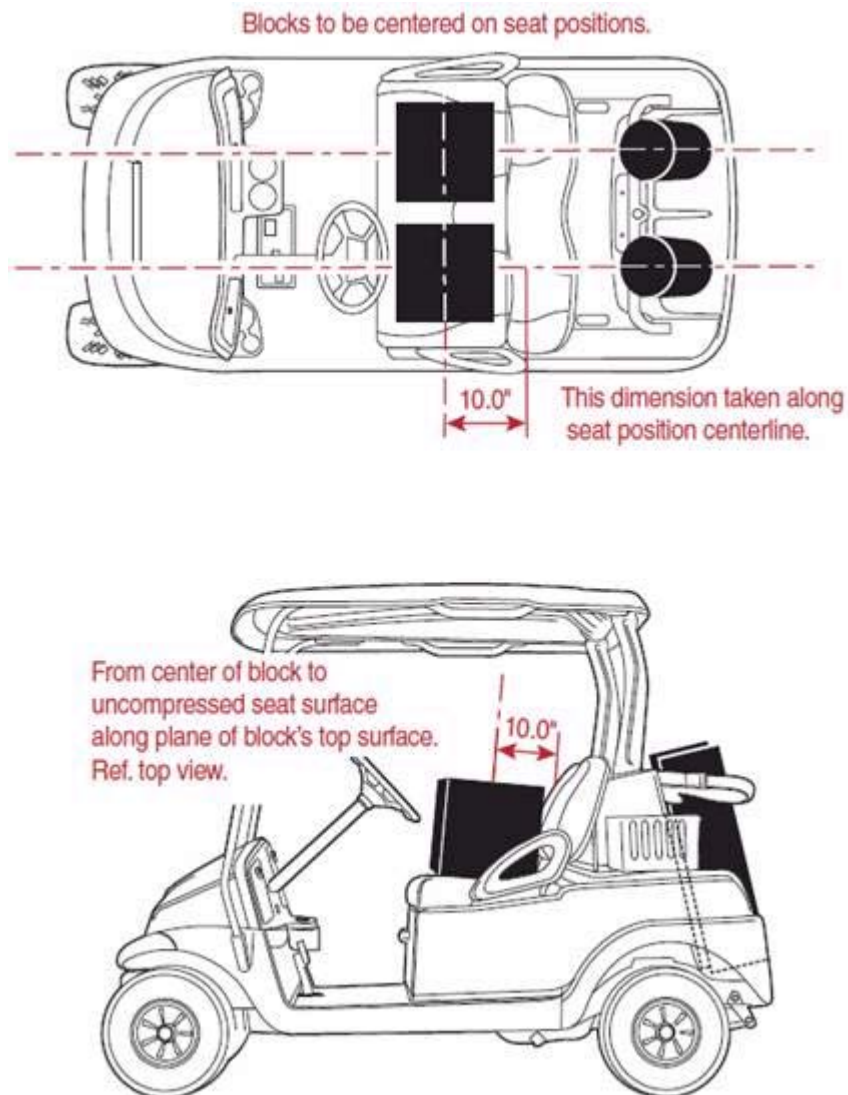


Figure 2 – Positioning of occupant test weights

8.6.3.1.2 Test

The test vehicle shall be supported by all tires, with the braking wheels locked, on an adjustable tilting platform of no less than 58% grade (30°) to the horizontal (see Figure 3). The test vehicle shall be positioned on the tilting platform with its longitudinal centerline perpendicular to the intersection line of the tilting platform and the horizontal plane in each of the following orientations:

- Front end on the downhill side;
- Rear end on the downhill side.

8.6.3.1.3 Test acceptance

Acceptance of the longitudinal stability test shall require that the supporting tires on the uphill side remain in contact with the surface or that the golf car slides under test conditions expressed in 8.6.3.1.2. Failure shall have occurred when all of the golf car's uphill tires lift off the platform before the platform exceeds the stability angle determined from Figure 3.

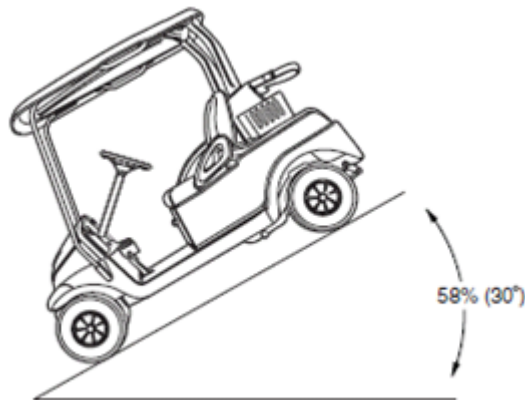


Figure 3 – Longitudinal test position

8.6.3.2 Lateral stability

8.6.3.2.1 Test conditions

Test conditions shall be the same as given in 8.6.3.1.1.

8.6.3.2.2 Test

The test shall be conducted as follows:

- a) The position of the test vehicle on the tilting platform shall be maintained by the parking brake;
- b) The vehicle with test load shall be placed on the tilting platform in accordance with Figure 4;
- c) The steerable tires of the test vehicle shall be positioned (Figure 4) such that a line from the center of contact of the lower rear tire to the center of contact of the steerable tire nearest to the tilting platform axis is parallel to the tilting axis of the platform;
- d) The steerable tires on the test vehicle shall be turned to be parallel to the tilting axis of the platform. The steering wheel may be restrained to prevent wheel movement during the test;
- e) The stability of the test vehicle shall be determined directly by tilting the platform to a 40% grade (21.80°).

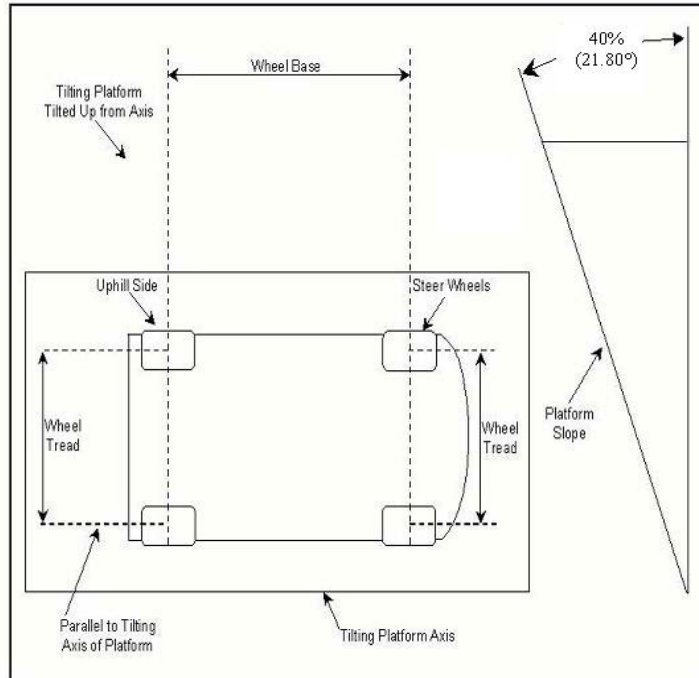


Figure 4 – Vehicle placement on lateral tilting platform (four wheel)

8.6.3.2.3 Test acceptance

Acceptance of the lateral stability test shall require that the supporting tires on the uphill side remain in contact with the surface, or that the vehicle slides under the test conditions expressed in 8.6.3.1.1. Failure shall have occurred when both of the vehicle's uphill tires lift off the platform before the platform exceeds the stability angle determined from Figure 4.

8.6.4 Brake systems

8.6.4.1 Service brake performance

8.6.4.1.1 Test conditions

Test conditions shall be the same as in 8.6.1.1, except that in addition to the operator, the vehicle shall be loaded with the equivalent test weights in their respective designated positions as prescribed in 9.6.3.1.1 and the coefficient of friction shall be between 0.8 and 1.1 as determined by the following procedure:

- a) The test vehicle shall be loaded as specified in 8.6.3.1.1;
- b) The static weight on the braked tires shall be measured;
- c) The test vehicle shall be placed on the surface to be used in the braking tests;
- d) The front of the test vehicle shall be connected to a tow vehicle provided with a means for measuring the tow force;
- e) The test vehicle's brake shall be engaged such that the braked tires do not roll when the vehicle is towed;
- f) The test vehicle shall be pulled forward by the tow vehicle until it moves at least 254 mm (10 in) forward and the maximum tow force shall be recorded. The measurement shall be repeated for a total of three trials;
- g) The average of the three maximum tow forces shall be taken;

- h) If the average maximum tow force divided by the total weight on the braked tires is less than 0.8 or greater than 1.1, then the braking tests may not be run;
- i) The same service brake components shall be used for all tests.

8.6.4.1.2 Test

The test shall be conducted as follows:

- a) A constant load of 1112 N (250 lbf) shall be applied perpendicular to the geometric center of the brake pedal pad in the direction of application for a minimum of 5 minutes;
- b) After release of force on brake pedal, the test vehicle shall be run to its maximum operating speed and the brake then applied with a foot pedal force of no more than 556 N (125 lbf) when applied to the center of the service brake pedal.
- c) Burnished brakes are permissible following the manufacturer's approved procedure.

8.6.4.1.3 Test acceptance

There should be no permanent deformation of any component in the braking system after the application of the 1112 N (250 lbf) proof load.

The average deceleration of the test vehicle from the point of brake application to the point the vehicle comes to rest, shall be at a minimum of 0.33g.

Alternatively, the test vehicle shall stop within a distance from the point of brake application per the formula:

$$\begin{aligned} \text{Stopping Distance} \quad (\text{in meters}) &= 0.012V^2 \quad (V \text{ in km / h}) \\ (\text{in feet}) &= 0.100V^2 \quad (V \text{ in mi / h}) \end{aligned}$$

8.6.4.2 Service brake fade

8.6.4.2.1 Test conditions

The test condition shall be the same as given in 8.6.4.1.1. The test vehicle shall be towed in the forward direction with the brake applied to produce a drag load determined by the following formula:

$$\text{Drag load} = \text{TFfr} + (0.342) \text{TVW},$$

where:

TFfr = towing force; free rolling;

TVW = test vehicle weight;

0.342 = downhill component of a 20° slope.

This drag load shall be maintained within 15% for 150 m (500 ft). The towing speed shall be between 40 and 50 percent of maximum level ground speed.

8.6.4.2.2 Test

The test shall be conducted as follows:

- a) The test vehicle shall be operated at maximum operating speed; the brake shall then be applied with a foot pedal force not to exceed 556 N (125 lbf) applied to the center of the brake pedal;
- b) For vehicles equipped with friction brakes, this test shall be performed before the brake linings have cooled more than 14°C (25°F) from the maximum temperature obtained during the tow period;
- c) Prior to test performance, burnished brakes are permissible;
- d) For vehicles equipped with alternative braking systems there shall be no adjustment or servicing of the brake system during the test. Test shall be performed with fully charged batteries.

8.6.4.2.3 Test acceptance

The average deceleration of the test vehicle from the point of brake application to the point the vehicle comes to rest, shall be at a minimum of 0.28 g. Vehicles with regenerative braking shall pass this test, irrespective of battery state of charge.

Alternatively, the test vehicle shall stop within a distance from the point of brake application per the formula:

$$\begin{aligned} \text{Stopping Distance} & \quad (\text{in meters}) = 0.0144V^2 \quad (V \text{ in km / h}) \\ & \quad (\text{in feet}) = 0.120V^2 \quad (V \text{ in mi / h}) \end{aligned}$$

8.6.4.3 Service brake fade recovery

8.6.4.3.1 Test conditions

The test conditions shall be the same as those given in 8.6.4.1.1.

8.6.4.3.2 Test

The service brake test described in 8.6.4.1.2 shall be repeated after the braking system returns to ambient temperature.

8.6.4.3.3 Test acceptance

The test acceptance shall be the same as set forth in 8.6.4.1.3.

8.6.4.4 Parking brake

8.6.4.4.1 Test conditions

Test conditions shall be as follows:

- The test vehicle shall be loaded as specified in 8.6.3.1.1;
- The test vehicle shall be positioned on a 30% grade (16.7°) with its longitudinal centerline perpendicular to the intersection line of the 30% grade surface and the horizontal plane.

8.6.4.4.2 Test

With a maximum 556 N (125 lbf) force applied to the pedal to engage the parking brake or with a maximum 334 N (75 lbf) force applied to a hand-operated lever brake, the vehicle shall be positioned with its:

- Front end on the downhill side;
- Rear end on the downhill side.

8.6.4.4.3 Test acceptance

The vehicle shall not move more than 76 mm (3 in) in 1 hour.

8.7 Battery installation**8.7.1 Ventilation**

The battery or batteries shall be located to minimize accumulation of battery gases within the vehicle.

9 Electric-powered golf cars**9.1 Wiring systems****9.1.1 Grounding**

Wiring system assemblies, including accessories, options or field-installed items, shall not be grounded to the vehicle chassis.

9.1.2 Routing

Wiring system assemblies shall be routed and contained within the golf car in such a manner as to provide adequate clearance to prevent damage from vibration, abrasion or heat-generating components and to avoid obstacles or projections that the vehicle may encounter during normal operation.

9.1.3 General

The wiring system shall have adequate capacity for the expected electrical loads.

9.1.4 System voltage

Adequate guarding shall be provided to prevent exposure to nominal system voltages above 60V DC or 30V AC.

9.2 Heat-generating components

Heat-generating components shall be mounted and contained within the golf car in such a manner as to prevent injury to occupants and damage to other vehicle components.

9.2.1 Test conditions

A test vehicle with fully charged batteries shall be set up and locked in such a manner as to prevent movement of the vehicle or rotation of the vehicle traction tires when the accelerator control is set at its maximum speed position.

Tests may be conducted indoors or in a covered area protected against the direct rays of the sun. Wind velocity in the test area shall not exceed an average of 8 km/h (5 mi/h). The temperature of the ambient air shall not be less than 19°C (65°F) or more than 30°C (86°F), and shall not vary more than 5.5°C (10°F) between maximum and minimum throughout the test period.

9.2.2 Test

The test shall be conducted as follows:

- a) Power shall be applied to the drive motor by means of the speed control device being set at the maximum speed position and held for 10 seconds;
- b) Immediately afterwards, the accelerator shall be placed at twenty percent (20%) of full pedal stroke past the point the system is energized and held for 30 minutes.

9.2.3 Test acceptance

There shall be no incidents of fire and all electrical components shall remain contained within the test vehicle.

Any heat transfer through the test vehicle shall not produce an external surface temperature accessible to persons outside or on the vehicle in excess of 60°C (140°F) on metal surfaces and 85°C (185°F) on nonmetal surfaces.

9.3 Chargers for vehicles

Chargers shall comply with UL, IEC, CSA, or other required national or applicable safety certifications.

The vehicle drive system shall not be operable when the charger system is connected to the vehicle from an external power source.

9.4 Impact containment

9.4.1 Test conditions

Test conditions shall be as follows:

- Where applicable, remove acid from discharged lead acid batteries and rinse with water to minimize acid-related accidents during testing. Refill cells with water. If batteries other than lead acid are used, precautionary measures should be taken to minimize potential hazards.
- Horizontally flat surface, 1.0% grade (0.8°) maximum;
- Straight course;
- Sufficient track length to allow test vehicles to reach average maximum speed as specified in 8.6.1.3;
- An unyielding, flat concrete or steel barrier with sufficient strength to fully resist the impact of the test vehicle at the test speed. The barrier shall be wider than the vehicle.

9.4.2 Test

A test vehicle shall be propelled into the barrier at maximum speed in the forward direction and at maximum speed in the reverse direction.

9.4.3 Test acceptance

The battery or batteries shall not become a projectile that presents a hazard to the occupants.

9.5 Roll-over containment

9.5.1 Test conditions

Test conditions shall be as follows;

- Where applicable, remove acid from discharged batteries and rinse with water to minimize acid-related accidents during testing. Refill cells with water. If batteries other than lead acid are used, precautionary measures should be taken to minimize potential hazards;
- The test shall be conducted on a concrete or asphalt surface.

9.5.2 Test

The test vehicle shall be tilted by elevating one side up to the point just past the point of neutral stability and released so the test vehicle completes at least one quarter revolution (90°) in a lateral direction on its own accord. The test shall be repeated in the opposite lateral direction. Either the same vehicle or a different vehicle may be tested for each direction.

9.5.3 Test acceptance

After each test, the battery or batteries and their contents shall be contained within the test vehicle battery compartment. Leakage from battery vent system, if present, is permissible.

10 Internal combustion powered vehicles

10.1 Wiring systems

10.1.1 Grounding

Wiring systems assemblies may be grounded to the golf car chassis, providing the electrical system is twelve (12) volts nominal or less.

10.1.2 Routing

Wiring system assemblies shall be routed and contained within the golf car in such a manner as to provide adequate clearance from heat-generating components and to avoid obstacles or projections that the vehicle may encounter during normal operation.

10.2 Heat-generating components

Heat-generating components shall be mounted and contained within the golf car in such a manner as to prevent injury to occupants and damage to other golf car components.

10.2.1 Test conditions

Test conditions shall be as follows:

- Tests may be conducted indoors or in a covered area protected against the direct rays of the sun. Wind velocity in the test area shall not exceed an average of 8 km/h (5 mi/h). The temperature of the ambient air shall not be less than 18°C (65°F) or more than 30°C (86°F), and shall not vary more than 5.5°C (10°F) between maximum and minimum throughout the test period;
- Operating temperatures measured at any one time shall be related to the ambient temperature of the air at the same time and location;
- The test vehicle weight (TVW) shall be such that it creates the most severe conditions;
- The test vehicle shall be configured in accordance with manufacturer's recommendations to achieve the most severe conditions for heat including manufacturer-approved accessories.

10.2.2 Test

The test shall be conducted as follows:

- a) Operate the test vehicle to obtain steady state engine oil temperature. Steady state may be achieved by operating the test vehicle for one cycle of the UDDS. Steady state may also be achieved by driving the vehicle for a minimum of 30 minutes on flat ground with stops at least every 200 yards until the engine oil temperature does not fluctuate more than 5% over a 5-minute period;
- b) Immediately operate for 183 m (200 yards) under steady load. Steady load is defined by the following formula:

$$\text{Steady load} = \text{TFfr} + (0.342) \text{TVW}$$

where:

TFfr = towing force; free rolling;

TVW = test vehicle weight;

0.342 = downhill component of a 20° slope.

- c) Stop the vehicle and record temperature measurements on the surfaces described in 10.2.3 until temperature rise has reached the peak point. Peak point shall be considered achieved when the temperature begins to diminish.

10.2.3 Test acceptance

Any heat transferred through the test vehicle shall not produce an external surface temperature accessible to persons outside or on the vehicle in excess of 60°C (140°F) on metal surfaces or 85°C (185°F) on nonmetal surfaces.

10.3 Fuel systems

10.3.1 General

Fuel systems shall comply with the requirements of ANSI/OPEI B71.10.

10.3.2 Fuel shut-off

Fuel systems shall have a fuel shut-off mechanism between the tank and engine. An electronic fuel injector may serve as a fuel shut-off mechanism.

10.3.3 Impact containment

10.3.3.1 Test conditions

Test conditions shall be as follows:

- Horizontally flat surface, 1.0% grade (0.8°) maximum;
- Straight course;
- Sufficient track length to allow test vehicles to reach maximum speed as specified in 8.6.1.3;
- An unyielding, flat concrete or steel barrier with sufficient strength to fully resist the impact of the test vehicle at maximum speed;
- Fuel tank and battery(s) shall be filled to recommended capacity with water.

10.3.3.2 Test

A test vehicle shall be propelled into the barrier at maximum speed in the forward direction and at maximum speed in the reverse direction.

10.3.3.3 Test acceptance

The fuel tank shall be contained within the test vehicle and maintain its integrity.

10.3.4 Roll-over containment

10.3.4.1 Test conditions

Test conditions shall be as follows:

- The fuel tank and battery(ies) shall be filled to recommended capacity with water;
- The test shall be conducted on a concrete or asphalt surface.

10.3.4.2 Test

The test vehicle shall be tilted by elevating one side up to the point just past the point of neutral stability and released so the test vehicle completes at least one quarter turn (90°) in a lateral direction on its own accord. The test shall be repeated in the opposite lateral direction. Either the same vehicle or a different vehicle may be tested for each direction.

10.3.4.3 Test acceptance

After each test, the fuel tank shall be contained within the test vehicle and maintain its integrity.

Annex A
(informative)

Bibliography

ILTVA Golf Course Safety Guidelines²

ILTVA Golf Car Storage Facility Safety Guidelines²

² Available at www.opei.org or by e-mail request to info@opei.org.