AEROSPACE INFORMATION REPORT

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Superseding AIR1375C

Minimum Safety Requirements for Special Purpose Airline Ground Support Equipment

RATIONALE

Despite several attempts to revise this document it has not been possible to do it as the resources and the needed expertise were not available in the AGE-2C committee. Intent of the committee for a future revision would be to make a major update and harmonisation with EN 1915-1 and ISO 6966-2 standards. Therefore, until the time comes when such revision can be done, the document is put in the "Stabilized" category.

STABILIZED NOTICE

This document has been declared "Stabilized" by the SAE AGE-2C Vehicle Maintenance and Aircraft Servicing Committee. This document should be considered as non-current and used for historic purposes only. Until a document revision is done, the reader is advised to use current references like: EN 1915-1 and ISO 6966-2.

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1. SCOPE:

This document applies to special purpose equipment which is used in the ground handling, servicing, and maintenance of transport aircraft. Fixed airport facilities and equipment covered under other sections of Part 1910 of Code of Federal Regulations (OSHA) are excluded from the scope of this document.

1.1 Purpose:

This document identifies minimum safety requirements for special purpose aircraft ground equipment. It is intended to be used as a resource for determination of design requirements for this type of equipment.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1 SAE Publications:

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

ARP1247	General Requirements for Aerospace Ground Support Equipment Motorized and Nonmotorized
ARP1328	Aircraft Ground Support Equipment Vehicle Stability Analysis
AIR1558	Interface Protective Devices - Ground Equipment to Aircraft
ARP1838	Pictograms for Ground Support Equipment
J377	Performance of Vehicle Traffic Horns, Standard

2.2 ANSI Publications:

Available from ANSI, 11 West 42nd Street, New York, NY 10038-8002.

ANSI A92.7	Safety Requirements for Airline Ground Support Vehicle - Mounted Vertical Lift Devices

2.3 ISO Publications:

Available from International Organization for Standardization, Case Postale 56, CH-1211 Geneve 20, Switzerland.

ISO 6966 Aircraft - Basic Requirements for Aircraft Loading Equipment
ISO 11995 Aircraft - Stability Requirement for Loading and Servicing Equipment

2.4 IATA Publications:

Available from Publications Assistant, International Air Transport Association, 2000 Peel Street, Montreal, Quebec, Canada H3A 2R4.

Airport Handling Manual
AHM 913 Basic Safety Requirements for Aircraft Ground Support Equipment

2.5 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

Code of Federal Regulations, Title 49, Part 571 - Federal Motor Vehicle Safety Standards (FMVSS)

Code of Federal Regulations, Title 29, Part 1910 - Occupational Safety and Health Administration (OSHA)

3. DEFINITIONS:

3.1 BOOTED FOOT is the foot of an operator sheathed appropriately for protection of the operator from normal job hazards and environmental weather conditions.

3.2 DEADMAN is a control design such that continuous, deliberate pressure on the control is necessary for activation and continuous operation, and such that relief of that pressure will cause control deactivation.

3.3 ELEVATED WORKING SURFACE is any platform or area, 4 ft or more above the next lowest working surface, on or in which an employee may be located in the performance of his/her working duties.

3.4 EQUIPMENT is any and all units, not an aircraft element, but mobile or semi-mobile, motorized or portable; intended or used as a means of providing access to aircraft; intended or used as an aid to an aircraft ground support activity, at or in the vicinity of an aircraft.

3.5 FMVSS refers to the Federal Motor Vehicle Safety Standard.

3.6 FUNCTIONAL means capable of servicing the purpose for which it was designed.

3.7 GLOVED HAND is the hand of an operator sheathed appropriately for dexterity and protection of the hand from normal job hazards and environmental weather conditions.

3.8 GUARDRAIL is a barrier erected along exposed edges of elevated work surface to prevent falls of persons.

3.9 HANDRAIL is a member supported on a stairway or ramp, to furnish persons with a handhold.

3.10 HIGHWAY USAGE is the operation of equipment on a public street or road such that state motor vehicles licensing of the vehicle is required.

3.11 HYDROSTATIC DRIVE means a vehicle has a hydrostatic transmission as opposed to a drive shaft and differential and where the oil is pumped from the hydraulic pump on the engine or electric motor directly to the hydraulic motor on the driven axle or wheels. The oil returns directly to the pump instead of going through a reservoir.

3.12 OPERATIONAL means the ability to perform intended function.

3.13 RISE is the vertical distance from the top of one tread to the top of the next higher tread.

3.14 RUNG is a ladder cross-member for use as a horizontal foot/hand hold.

3.15 SHALL is a term used to stress maximum advisability, and to qualify a provision as the minimum acceptable.

3.16 SHOULD is a term qualifying a provision as advisable but not critical.

3.17 STABILITY means the ability of remaining in the designed position and attitude.

3.18 STEP is a horizontal flat surface member of a stair, ladder, or a single foothold between two levels, capable of accepting a working load.

3.19 STEP WIDTH is the distance between the handrails of a stair or ladder, inside to inside.

3.20 TOE BOARD is a vertical barrier erected along exposed edges of elevated work surfaces to prevent materials from falling.

3.21 TREAD DEPTH is the horizontal distance from front tread facing edge to the riser or rear edge of the tread.

3.22 UNIT is any piece of equipment; or a coupled equipment set.

3.23 VEHICLE is any piece of mobile equipment which is self-propelled and capable of carrying the operator.

4. SAFETY REQUIREMENTS:

4.1 Inherent Safety:

Considerable importance is attached to having equipment into which the essential safety aspects have been incorporated as part of the basic design. It is particularly necessary when designing aircraft handling equipment to take into account the adverse conditions which frequently prevail in ramp areas, e.g., congested vehicle movement, exposure to rain, wind, jet blast, night operation, noise from aircraft and other vehicles, and difficult communications.

4.1.1 Design of equipment shall be such that safety features are inherent in the equipment. Materials, workmanship, and methods of fabrication shall be of high standard.

4.1.2 All equipment or any component thereof, the failure of which could be hazardous, shall be designed to be fail-safe.

4.2 Personnel Working Surfaces, Stairs, and Ladders:

4.2.1 Personnel work platforms, walkways, stairs, ramps, ladder rungs, cleats or treads shall have a high traction surface of nonslip material and be self-draining.

4.2.2 Personnel work platforms, walkways, and stairs shall have adequate handrail and/or guardrail protection. See local codes.

4.2.3 Handrails shall be provided on all stairs. The handrail height in relation to the stair tread shall be constant with a minimum height of 76 cm (30 in) and a maximum height of 107 cm (42 in).

4.2.4 Ladder side rails shall extend a minimum of 100 cm (40 in) above a landing or working surface unless it creates an unavoidable obstruction.

4.2.5 Where vertical grab bars are provided, a minimum hand clearance of 6.4 cm (2.5 in) shall be maintained.

4.2.6 Stair angles of incline shall not be less than 20° nor more than 75°.

4.2.7 Stair treads shall be provided with a rise of not more than 30.5 cm (12 in). Tread rise shall be constant throughout the entire length of the stair above the first step from ground level or a platform.

4.2.8 Stair treads shall provide a usable depth of not less than 18 cm (7 in). Tread depths must remain constant throughout the entire length of the stair except when broken by a landing.

4.2.9 Where ladders are used for access, the incline angle shall not be less than 75° with a maximum of 90°.

4.2.10 A minimum 41 cm (16 in) clear width shall be provided between the side rails of a ladder.

4.2.11 Equal spacing between ladder rungs above the first rung shall be maintained with a maximum spacing of 30.5 cm (12 in).

4.2.12 Where steps are used on ladders, they shall be provided with a minimum depth of 3.8 cm (1.5 in). Where rungs are used, the minimum diameter shall be 1.9 cm (0.75 in).

4.2.13 If adjustable overlapping ladders are installed, there shall be a minimum of 15.2 cm (6 in) clearance between them.

4.2.14 Where off-set ladders are used, the side rails and rungs must be carried to a minimum of 1.07 m (3.5 ft) above the beginning of the next section unless it creates an unavoidable obstruction.

4.2.15 Off-set ladders shall have a maximum step over distance of 46 cm (18 in).

4.2.16 A minimum 17.8 cm (7 in) horizontal clearance shall be maintained between a ladder and any obstruction behind the ladder.

4.2.17 Ladder rungs shall be designed to support a minimum working load equivalent to a mass of 1112 N (250 lb). The number and position of additional concentrated live-load units of 1112 N (250 lb) each, as determined from anticipated usage of said ladder rung, shall be considered in the design.

4.2.18 Stair treads, landings, and working surfaces shall be designed to support a minimum uniformly distributed working load of 3000 N/m^2 (63 lb/ft^2), as well as a concentrated load of 1375 N (309 lb) applied at any point on the surface of the platform. The above loads are to be applied separately.

4.2.19 Access ramps to cargo compartments of wide-body aircraft or other working areas of equivalent height shall have a minimum of one handrail provided.

4.3 Hoisting/Lifting Equipment:

4.3.1 Elevating devices shall be protected against uncontrolled movement or actuation in the event of a power source failure of any type (i.e., hydraulic, electrical, pneumatic, or engine).

4.3.2 Hydraulic lift cylinders shall have pilot operated check or counter-balance valves connected directly to their base fittings to prevent accidental lowering in the event of failure of any line in the system.

4.3.3 The maximum capacity of all hoisting equipment shall be displayed in a location that is readily visible.

4.3.4 A safe means of lowering or disconnecting the device shall be provided in the event of a malfunction.

4.4 Stability:

4.4.1 Self-propelled type units equipped with power actuated stabilizers shall have an operator warning device to indicate when the stabilizers are not in the stowed position or an interlock to prevent driving the unit with the stabilizers or outriggers deployed.

4.4.2 Lift type units exposed to blast and wind shall be stable when exposed to wind blast up to 75 km/h (40 knots) without cautions and/or restrictions, and 120 km/h (65 knots) with adequate precautions and/or restrictions. Refer to AIR1328 and ISO 11995.

4.4.3 The stability criteria outlined in 4.4.2 shall determine at which point during elevation the stabilizing devices will be necessary. A safety interlock device shall be provided to ensure this elevation is not exceeded unless stabilizing devices are extended and/or engaged.

4.4.4 Retraction of the stabilizing device shall not be possible under normal or emergency conditions until the unit has been lowered to within the stability requirements outlined in 4.4.2.

4.4.5 Stabilizer activating devices shall be located so as not to expose the operator to personal injury.

4.4.6 Emergency stabilizer-raising controls shall be provided and shall be located so as not to expose the operator to injury.

4.4.7 Stabilizer ground contact pads shall have the outside edges radiused a minimum of 0.6 cm (0.25 in) and shall be smooth.

4.4.8 Stability devices that extend beyond the vehicle profile shall be painted yellow or illuminated. Stabilizer pads shall be painted red.

4.4.9 The stabilizers shall not collapse in the case of a system failure. If hydraulically operated, stabilizers shall have pilot operated check valve(s).

4.5 Functional/Operational Controls:

4.5.1 Functional and operational controls, for the purpose of this document, are those controls specifically designed for aircraft support usage, and exclude those designed into the basic unit such as steering, brakes, etc.

4.5.2 Units equipped with an automatic transmission shall have the transmission shift sequence conforming to FMVSS 102. If the transmission shift lever is steering column mounted or operates in a transverse vertical plane, the shift positions should be P, R, N, D, L, in a clockwise direction while seated in the operator's seat. If the shift lever operates in a longitudinal vertical plane, the shift pattern should be P, R, N, D, L, going from the front of the vehicle to the rear while seated in the operator's seat.

4.5.3 Transmission shift selector shall be located in an ergonometrically acceptable manner.

4.5.4 While it is recommended for safety purposes that the directional control (forward and reverse) lever on hydrostatically or electric motor driven ramp equipment move in the direction of travel, the opposite situation is commonly found in practice. Therefore, this equipment should be designed to facilitate easy change of directional control by the end user if a different forward/reverse control movement is desired.

4.5.5 Controls and warning lights shall be grouped and located so as to be convenient to the operator from his/her normal operating station(s). Where there is more than one station, interlocks should be provided at each station to render inoperative the controls of all other stations.

4.5.6 Instruments and controls exposed to the weather shall be of a weatherproof type and shall be protected from snow and ice accumulations.

4.5.7 Controls shall be identified with permanently affixed and nonfading placards. Contrast shall be sharp and in large enough letters or symbols to be easily read from operator's position, indicating the function and direction of the motion of the control. The use of pictograms is preferred (see ARP1838).

4.5.8 All operational controls shall move in the direction of travel for the function which they control and shall be of the deadman type, unless the control is set to achieve a function to permit the users to accomplish another task. In this case, such set controls shall be detented or similarly locked into the operating position to prevent inadvertent deactivation or reversing. Such controls shall be readily available to the operator(s). Operating controls only used in emergencies need not meet this requirement.

4.5.9 Hand and foot controls shall be sized and spaced to provide easy operation with a gloved hand and/or booted foot dependent on the control. Consideration shall be given to environmental weather conditions in which the unit will operate.

4.5.10 Clutch, foot brake, accelerator, and functional foot controls shall be a minimum size of 5 cm x 8 cm (2 in x 3 in) and be provided with a nonslip surface material.

4.5.11 Foot operated driver controls should be in the following sequence from left to right from the operator's position as applicable: parking brake, clutch, foot brake, and accelerator.

4.5.12 No more than 10 daN (22 lb of force) shall be required to actuate any hand control. No more than 30 daN (66 lb of force) shall be required to actuate any foot pedal control.

4.5.13 Controls and controlling circuits shall be designed in such a manner that failure within a control or its circuitry will not introduce an unsafe operating condition.

4.5.14 Conventional automotive driving controls shall be used where possible.

4.5.15 On-off switches shall be "ON" in the UP position or away from the operator if mounted in a horizontal plane.

4.5.16 A vehicle, while stationary and operating a functional device that requires the engine to operate above idle speed, shall be equipped with an interlock to insure that power cannot be transmitted to the drive wheels.

4.5.17 Power steering shall be provided on all vehicles with a steering axle load of 40,000 N (9000 lb) or more.

4.5.18 Emergency engine stop button(s) (red mushroom type) shall be provided. These should be installed at convenient positions on the unit to enable immediate shutdown in the event of an emergency. The location and number should be specified by the purchaser.

4.5.19 For self-propelled vehicles, it shall not be possible to start the engine unless the shifting lever is in the neutral or park position.

4.5.20 Positive, nonjerking slow speed is required for the final positioning of a unit/vehicle with respect to the aircraft.

4.6 Cab and Operator's Compartment:

4.6.1 Seats shall be provided with a backrest of no less than 33 cm (13 in) high.

4.6.2 In enclosed cab vehicles, a clearance of not less than 89 cm (35 in) shall be provided between the top of the seat cushion and the cab roof.

4.6.3 On open cab vehicles with passenger seat(s), a hip guard shall be provided on the outside edge of the outside seat(s) with a minimum height of 8 cm (3 in) above the seat surface.

4.6.4 Foot supports, such as a floor rest, shall be provided for all seat positions.

4.6.5 Seat belts shall be required on vehicles licensed for highway usage.

4.6.6 The following controls, if provided, shall be grouped and located so as to be convenient to the operator's reach:

a. Steering
b. Horn
c. Transmission
d. Ignition
e. Head lamps
f. Turn signal
g. Windshield wiping system
h. Windshield washing system
i. Manual choke
j. Driver's sun visor
k. Secondary brake system
l. Cab heater or defroster/defogger or both
m. Intercom

4.6.7 Configuration and location of operational controls shall be in a manner to minimize the possibility of inadvertent operation.

4.7 Visibility:

4.7.1 Vehicle operators shall have clear and unimpaired visibility when operating the unit. Mirrors shall be provided where necessary.

4.7.2 All glass shall be of a safety or tempered type and shall provide maximum visibility based upon the functional requirements of the unit.

4.7.3 Any vehicle equipped with a windshield shall be provided with a powered windshield wiper giving a wipe area of not less than 60% of the glazed area. A sun visor of suitable size shall be provided. Overhead view panels should also be fitted with wiping mechanisms.

4.7.4 Vehicles licensed for highway usage shall be equipped with windshield washer device.

4.7.5 On enclosed-cab equipped vehicles, the windshield shall be provided with a defogger and/or defroster.

4.7.6 Units singular or in train that exceed 2.44 m (8 ft) total length shall be provided with reflective devices on both sides and the rear. These reflective devices shall be installed to provide the optimum reflective angle.

4.8 Warning and Directional Indication:

4.8.1 An audible warning device which meets the requirements of J377 shall be provided for self-propelled vehicles. The horn shall be supplied with a control button located in the center of the steering wheel or operator's most suitable position(s).

4.8.2 A reverse warning horn, or other audible device, should be provided on vehicles with a restricted view to the rear. That device will sound when the directional control lever is set to the reverse direction, and white reverse light(s), which shall be installed on the rear portion of the unit, shall come on.

4.8.3 Automatic audible and/or flashing personnel warning for movement of lift platform shall be provided.

4.8.4 Directional indicating lights should be provided on self-propelled vehicles at the four corners of the unit and should be easily controlled by the driver.

4.9 Illumination:

4.9.1 Motorized self-propelled vehicles shall be equipped with a minimum of two headlights and two combination stop/tail lights.

4.9.2 A vehicle operating in the aircraft taxi-way or runway areas shall be equipped with an amber or red flasher or beacon type light on its highest or most noticeable position.

4.9.3 All instruments and control panels exclusive of driving control panels shall be lighted to a level of 54 lx (5 fc), and shall not produce a glare to the operator.

4.10 Fuel Systems:

4.10.1 Fuel lines shall be located and secured with a minimum of 5 cm (2 in) clearance to exhaust and electrical system components.

4.10.2 Fuel tanks and lines shall be located and installed so that any overflow during filling, or any leakage from the tank, lines or fittings, will not impinge on the engine, exhaust, electrical system or other ignition sources, nor enter the operator's compartment. Consideration should be given to preventing spilled fuel making working or access surfaces slippery.

4.10.3 Fuel tanks shall be located to minimize damage in the event of a collision.

4.10.4 Fuel lines shall be constructed of steel tubing. Flexible fuel line may be used in locations to absorb vibration and prevent fatigue failures.

4.10.5 A visible permanent marking shall be located adjacent to the fuel filler opening indicating the type of fuel to be used. The filler cap shall be color coded to indicate the appropriate fuel in accordance with ARP1247.

4.11 Electrical:

4.11.1 Wiring shall be grouped in cable or harness form and shall be routed to provide maximum protection from abrasion, road splash, grease, oil, fuel, and excessive heat.

4.11.2 Electrical buttons, switches, etc. shall be suitably waterproofed.

4.12 Hydraulic and Pneumatic:

4.12.1 Relief valves shall be installed in all systems subject to significant pressure spikes in excess of the rated working pressure of each system component.

4.12.2 System pressures shall be kept as low as possible, consistent with practical and economic design.