The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE RECOMMENDED PRACTICE

ARP5140

Issued 1997-04

Submitted for recognition as an American National Standard

DESIGN CRITERIA FOR LIFTS USED TO BOARD PASSENGERS WITH MOBILITY IMPAIRMENTS ONTO AIRCRAFT WITH DOORSILL HEIGHTS OF 144 in OR LESS

FOREWORD

This document is intended to establish minimum standards, and provide a recommendation for the design and manufacture of passenger boarding devices which will permit safe operation while minimizing aircraft damage and personnel safety hazards associated with commercial aircraft boarding operations.

The boarding devices described in this document are intended to be used for assisting wheelchair passengers and passengers with disabilities onto and off of propeller and jet propelled aircraft with doorsill heights to a maximum of 144 in.

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1. SCOPE:

This SAE Aerospace Recommended Practice (ARP) outlines the design and functional requirements for aircraft passenger lifts, operated manually and self-propelled. The primary function of the lift described in this document is to act as an elevator between ground level and aircraft doorsills to a maximum of 144 in.

2. REFERENCES:

2.1 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.

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

SAE Handbook - Latest revision

ARP1247B	General Requirements for Aerospace Ground Equipment, Motorized and Nonmotorized
ARP1328	Aircraft Ground Support Equipment Vehicle Stability Analysis
AIR1375	Minimum Safety Requirements for Special Purpose Airline Ground Support Equipment
AIR1558	Interface Protective Devices - Ground Equipment to Aircraft
ARP1817	Battery Industrial, Lead Acid Type, For Use in Electric Powered Ground Support Equipment
ARP1892	Electrical Connectors for Use in Battery Powered Ground Support Equipment
AS4828	Technical Manual Development for Ground Support Equipment

2.1.2 FAA Publications: Available from FAA, 800 Independence Avenue, SW, Washington, DC 20591.

FAA AC150/5220-21	Guide Specification for Lifts Used to Board Airline Passengers With Mobility Impairments

2.1.3 OSHA Publications: Available from OSHA, 200 Constitution Ave., NW, Washington, DC 20210.

OSHA Safety and Health Standards 29 CFR 1910

2.1.4 IATA Publications: Available from IATA, IATA Bldg., 2000 Peel St., Montreal Quebec, Canada H3A 2R4.

IATA AHM 979 Functional Specification for an Incapacitated Passenger Loading Device for Commuter Type Aircraft

2.1.5 Other References:

Measure of Man, Human Factors in Design, H. D. Dreyfuss

Division of Industrial Safety and Industrial Safety Codes applicable in the state of manufacture

3. GENERAL REQUIREMENTS:

3.1 Operational Environment:

The lift shall not be affected by wind, sand, grit, rain, snow and ice, deicing fluids, and other normally encountered airport ramp conditions. The entire lift shall operate satisfactorily under temperature ranges from -40 to +140 °F.

4. FUNCTIONAL AND DESIGN REQUIREMENTS:

4.1 Functions:

The lift must perform the following functions while maintaining a safe distance from the aircraft.

4.1.1 Ground Level: The lift must provide a means for boarding wheelchair passengers and other passengers with mobility impairments onto the lift at ground level.

4.1.2 Elevating: Elevate the passenger and attendant to the aircraft doorsill.

4.1.3 Transfer: Provide a means of transferring the wheelchair passenger between the aircraft and the lift platform.

4.1.4 Protection: The unit must provide protection for the passenger and attendant from injury, as well as protecting the aircraft from damage.

4.1.5 Ramp Drive Speed: The unit must be capable of moving between airport gate areas and terminals at a maximum speed that is safe for the passenger, the attendant/operator, and the aircraft. While approaching the aircraft, the unit should be limited to a maximum speed of 1.5 mph. The unit must be towable to 15 mph.

4.2 Design Standards:

4.2.1 Capacity: The platform shall have a minimum capacity of 660 lb.

4.2.2 Primary Platform: This is considered any surface traversed by the passenger and attendant in boarding the aircraft.

4.2.3 Nonskid: All platform surfaces shall have nonskid surface.

4.2.4 Bridge Platform: This platform is the transitional platform that bridges the area between the aircraft and the primary platform. It shall be designed so as not to damage the aircraft. It may rest on the aircraft doorsill but shall not attach to the aircraft.

4.2.5 Railings: The platform shall be equipped with rigid protective railings or other barriers. Spaces between the barrier members and between the aircraft and the barriers shall be sufficiently small to prevent personnel injury and provide a feeling of confidence to the passenger and attendant.

4.2.6 Locks: The platform shall include a system to immobilize each wheelchair it is designed to transport. The system shall be easily operated by the attendant or equipment operator.

The unit must have a system to immobilize it during the time that it is mated to the aircraft doorsill and passengers are enplaning or deplaning the aircraft.

4.2.7 Platform Width: The interior width of the platform shall be compatible with the boarding chair to be used and the aircraft being serviced.

4.2.8 Ascent/Descent Rate: The rate shall not exceed 3 in/s.

4.2.9 The time required to deploy the lift upon arrival at the passenger loading area or the aircraft shall be less than 1 min.

4.2.10 Enplaning/Deplaning Time: The time required to convey a passenger onto the lift and to the aircraft doorsill shall be 2 min or less. The time to deplane a passenger to ground level shall also be 2 min or less.

4.2.11 Stability: The lift shall be capable of safe operation in the fully raised position with winds of 80 mph. The unit shall withstand winds of 90 mph full raised without tipping over.

4.2.12 Stress: The lift shall have a safety factor of 3:1 to the yield strength of the materials used.

4.2.13 Push/Pull Force: The lift shall be designed to allow positioning by one person on a dry concrete or asphalt surface with push/pull forces not exceeding 60 lb.

4.3 Hydraulic System:

a. Load path: Raising and lowering of the lift shall be accomplished by one person and through the use of one or more hydraulic cylinders, powered by an electric motor or engine driven pump. The system must incorporate a fail-safe hydraulic and/or mechanical device to prevent lowering in the event of component failure. An emergency lowering system must be available.

4.3.1 Shut-off: A shut-off valve must be incorporated in the hydraulic supply line between the reservoir and pump or filter.

4.3.2 Reservoir: The hydraulic reservoir shall incorporate baffles, sump drain, clean-out cover, and level indicator.

4.3.3 Hydraulic Fluid: The system shall use Mobil DTE-13 hydraulic fluid or equal. Type of fluid shall be stenciled on the reservoir in 2 in yellow letters.

4.3.4 Hoses and Lines: All fixed hydraulic lines shall be stainless steel. All flexible lines shall be of high quality fluid resistant material. All lines shall be supported and protected from chafing and binding. Flexible lines are to be used only when absolutely necessary. All lines and hoses near the engine exhaust system shall be shielded.

4.3.5 Filter: There shall be a full flow 10 µm absolute hydraulic filter rated at twice pump capacity in the return to tank line. The filter shall be equipped with a condition indicator.

4.4 Electrical System:

4.4.1 Wiring: All wiring shall be adequately sized, fused, and weatherproof. Wiring shall be secured to prevent damage due to rubbing and snow/ice buildup. All circuits shall be color or number coded which is to be reflected on electrical diagrams.

4.4.2 Switches: All switches shall be weatherproof and shielded from weather. Proximity switches are to be used wherever possible where exposure to moisture and freezing can be expected.

4.4.3 Lighting: Lighting shall be a minimum of 1.5 cp to illuminate the platform and access ramps.

4.4.4 Battery: Electric powered units should be supplied with a 12 V system using deep cycle batteries capable of lighting the platform and ramps for a minimum of 3 h without recharging the batteries. The system is to be equipped with a 30 min timer that turns the lights off.

4.4.5 Battery Charging System: Electrically powered units are to be equipped with a 110 V built-in charging system. The charger is to be variable output type that will recharge the batteries in less than 8 h, but will not cause the batteries to gas if the charger remains on for longer periods. A 50 ft cord is to be supplied with storage on the unit.

4.5 Towbar:

The unit shall be equipped with a permanently attached towbar or tow hooks mounted to the unit on the side away from the aircraft.

4.6 Stability:

The unit is to be equipped with a stabilizing system for passenger/attendant safety while the unit is mated to the aircraft doorsill. Solid or foam filled wheels and/or stabilizers are recommended.

4.7 Aircraft Compatibility:

4.7.1 Design Considerations: The lift must be capable of being operated with built-in aircraft stairs deployed when necessary.

4.7.2 The following aircraft factors are to be considered in the design of the lift:

a. Aircraft doorsill height, width, and location
b. Aircraft floor slope
c. Aircraft components adjacent to the door such as wings, tail, fairings, engine, and propeller
d. Aircraft stairs and handrails
e. Vertical movement of the door during enplaning/deplaning

5. PROPULSION SYSTEM:

The unit may be driven by electric motor or internal combustion engine.

5.1 Internal combustion engine units with automatic transmissions or hydrostatic drive.

5.1.1 Oil Filter: A full flow type engine filter shall be provided.

5.1.2 Starter and Battery: Starter, battery, and battery cables shall be of sufficient size to easily crank a cold soaked engine at -25 °F.

5.1.3 Alternator: A heavy-duty 12 V alternator shall be provided capable of supplying full electric load at the recommended engine idle speed.

5.1.4 Interlocks: Safety interlocks shall be provided so that the engine cannot be started unless the transmission is in the neutral position; the throttle cannot be advanced except with the gas pedal unless the transmission is in the neutral position; the starter cannot be engaged while the engine is running; the unit cannot be driven with stabilizers deployed (if so equipped).

5.1.5 Antifreeze: Antifreeze shall be installed in the radiator to protect the engine down to -25 °F.

5.1.6 Engine Fan: A fan, if used, shall be protected so that personnel cannot come into contact with the blades.

5.1.7 Cold Weather Starting: Diesel engines shall be equipped with cold weather starting aids.

5.1.8 Fuel Tank: A fuel tank of sufficient capacity for 8 h of continuous operation shall be provided. The fuel cap shall be a Protecto Seal type, with the spark arrestor screen removed.

5.2 Electric drive units shall be powered by a common industrial battery pack, utilizing a SCR or equivalent electronic controller.

5.2.1 Battery voltage shall reflect the best design for duty cycle, lift speed, and minimum current losses.

5.2.2 Battery Location: The location and installation of the battery must provide the capability to be serviced and recharged while installed on the lift.

5.2.3 Battery Charger: See 4.4.5

5.2.3.1 Charger Cable: It shall not be possible to drive the unit away with the cable plugged into the power source.

5.2.4 Duty Cycle: The electrical system shall be designed to a duty cycle of not less than 3 h of actual and lift time.

5.2.5 Instrumentation: Instrumentation shall include a battery discharge indicator and hourmeter. The battery discharge indicator shall incorporate a red flashing low battery warning light and give an audible warning when the battery is 80% discharged. The hourmeter shall register lift operating time.

5.2.6 Accessory System: A separate 12 V DC accessory system using chassis ground to accommodate standard automotive equipment shall be provided. The chassis ground shall be isolated from the main battery negative by at least 500,000 Ω resistance. The preferred method to provide the 12 V system is through a DC to DC converter with or without a 12 V storage battery.

5.2.7 NEMA Standards: The SCR controller, DC-DC converter, and associated electronic equipment shall be enclosed in a sealed compartment with Type 4 NEMA standards or better. All peripheral electrical or electronic components that cannot be contained in this compartment must be waterproof and heavy-duty construction.

5.2.8 Shielding: The electrical/electronic systems shall incorporate proper shielding, filtering, etc., if necessary to insure electromagnetic compatibility with all communication and navigation frequencies in and around the airport ramp areas.

6. CHASSIS:

6.1 Suspension:

The suspension system shall be adequate to prevent the chassis bottoming under normal operating conditions with a full rated load.

6.2 Steering:

The steering effort shall not require more than 20 ft-lb torque as measured from the circumference of the steering wheel if so equipped.

6.3 Service Brakes:

The vehicle shall have a braking system that will stop the unit in number of feet equal to its speed in mph on dry, level pavement.