



AEROSPACE RECOMMENDED PRACTICE

ARP1247™

REV. E

Issued 1972-04
Revised 2018-02

Superseding ARP1247D

(R) Aircraft Ground Support Equipment – General Requirements

RATIONALE

Revised to harmonize with European and International Standards in order to progress towards global GSE standardization.

TABLE OF CONTENTS

1.	SCOPE.....	3
2.	REFERENCES.....	3
2.1	Applicable Documents	3
2.1.1	SAE Publications.....	3
2.1.2	ANSI Accredited Publications	4
2.1.3	U.S. Military Specifications and Standards	4
2.2	Other Publications.....	5
3.	REQUIREMENTS	6
3.1	Performance.....	6
3.2	Operability	6
3.3	Reliability	6
3.4	Maintenance Requirements	6
3.4.1	Maintainability	6
3.4.2	Maintenance Cycle.....	7
3.4.3	Service and Access.....	7
3.5	Total Life	8
3.6	Environmental	8
3.7	Transportability.....	8
3.8	Safety	9
3.9	Personnel Safety.....	9
3.10	Equipment Safety.....	11
3.11	Noise and Vibration.....	12
3.12	Equipment Definition	13
3.13	Design and Construction.....	13
3.14	Aircraft Docking Protection	30
3.15	Operating Speeds	32
3.16	Control Panels and Displays.....	32

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2018 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER:
Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
<http://www.sae.org>

SAE WEB ADDRESS:

Full document details: SAE ARP1247E

SAE values your input. To provide feedback on this Technical Report, please visit <http://standards.sae.org/ARP1247E>

Documents
Document Sharing Hub

4.	QUALITY ASSURANCE PROVISIONS.....	32
4.1	Preliminary Qualification Tests	32
4.2	Formal Qualification Tests	32
4.3	Inspection.....	32
4.4	Analyses.....	33
4.5	Demonstrations	33
4.6	Tests.....	33
4.7	Reliability Test and Analysis	34
5.	INSTRUCTIONS FOR SHIPMENT	34
6.	DEFINITIONS AND ABBREVIATIONS.....	34
7.	DETAILS FOR CONTRACTUAL NEGOTIATIONS	34
8.	NOTES	36
8.1	Revision Indicator.....	36
Table 1	Maximum allowable flow velocity	16
Table 2	Traveling speeds.....	22
Table 3	Braking distances.....	22

1. SCOPE

This SAE Aerospace Recommended Practice (ARP) outlines the basic general design requirements for ground support equipment used in the civil air transport industry. It is intended to assist in standardizing requirements for various configurations of equipment. For procurement of equipment, sections of this document should be specified with due consideration of the functional and environmental requirements of the equipment, and to the relative cost of satisfying those requirements.

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 the 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 International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J10	Automotive and Off-Highway Air Brake Reservoir Performance and Identification Requirements – Truck and Bus
SAE J377	Vehicular Traffic Sound Signaling Devices (Horns)
SAE J512	Automotive Tube Fittings
SAE J514	Hydraulic Tube Fittings
SAE J517	Hydraulic Hose
SAE J524	Seamless Low-Carbon Steel Tubing Annealed for Bending and Flaring
SAE J533	Flares for Tubing
SAE J537	Storage Batteries
SAE J561	Electrical Terminals – Eyelet and Spade Type
SAE J844	Nonmetallic Air Brake System Tubing
SAE J858	Electrical Terminals Blade Type
SAE J919	Sound Measurement – Off-Road Work Machines – Operator – Singular Type
SAE J928	Electrical Terminals – Pin and Receptacle Type
SAE J1127	Low Voltage Battery Cable
SAE J1128	Low Voltage Primary Cable
SAE J1401	Road Vehicle – Hydraulic Brake Hose Assemblies for Use With Nonpetroleum-Base Hydraulic Fluids
SAE J1402	Automotive Air Brake Hose and Hose Assemblies

SAE J1403	Vacuum Brake Hose
SAE J1703	Motor Vehicle Brake Fluid
SAE J2031	High Tension Ignition Cable
AIR6133	Design and Safety Criteria for Passenger Boarding Stairways
ARP1052	Selection Criteria for Internal Combustion Engines Used in Ground Support Equipment
ARP1328	Aircraft Ground Support Equipment - Wind Stability Determination
ARP1330	Welding of Structures for Ground Support Equipment
AIR1336	Vehicle Electric Systems
AIR1375	Minimum Safety Requirements for Special Purpose Airline Ground Support Equipment
ARP1558	Aircraft Interface Protective Devices
ARP1838	Pictograms for Ground Support Equipment
ARP1801	Measurement of Exterior Sound Level of Specialized Aircraft Ground Support Equipment

2.1.2 ANSI Accredited Publications

Copies of these documents are available online at <http://webstore.ansi.org/>.

ANSI B56.1 Safety Standard for Powered Industrial Trucks

ANSI A92.7 Airline Ground Support Vehicle – Mounted Vertical Lift Devices

2.1.3 U.S. Military Specifications and Standards

Copies of these documents are available at <http://quicksearch.dla.mil>.

MIL-STD-461 Electromagnetic Interference Characteristics Requirements for Equipment

MIL-STD-1472 Human Engineering Design Criteria for Military Systems, Equipment, and Facilities

MIL-DTL-3950 Switch, Toggle, General Specification for

A-A-870 Antifreeze, Ethylene Glycol, Inhibited

Various Standards – United States Public Health Service Standards, Code of Federal Regulations

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

Code of Federal Regulations Title 49, Part 393 - Parts and Accessories Necessary for Safe Operation

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

2.2 Other Publications

2.2.1 Available from American Welding Society, www.aws.org.

American Welding Society – Applicable chapters/sections of welding codes

2.2.2 Available from American Society of Mechanical Engineers, www.asme.org.

Section VIII – ASME Unfired Pressure Vessel Code

2.2.3 Available from Airlines for America (A4A), 1301 Pennsylvania Ave NW, Suite 1100, Washington DC 20004, Tel. 202-626-4000, www.airlines.org.

ATA Spec. 101 – Specification for Ground Equipment Technical Data

2.2.4 Available from the Official Journal of the European Union, <http://eur-lex.europa.eu>.

E.U. Machinery Directive (Directive 2006/42/EC of 17 May 2006)

NOTE: For intended GSE operation in Europe, E.U. Machinery Directive requirements apply. They can be met by complying with the general requirements of the EN 1915 Parts as well as requirements specific to each GSE type covered by EN 12312-1 to -20 standards. ISO 6966-1 and 6966-2 provide general requirements common to ARP1247 and the ENs for worldwide application. However, they are not sufficient to ensure compliance with the E.U. Machinery Directive.

E.U. Low Voltage Directive (LVD) (Directive 2014/35/EU of 26 February 2014)

2.2.5 Available from Comité Européen de Normalisation, Avenue Marnix 17, B-1000 Brussels, Belgium, or the European national standardization institutes, members of C.E.N.:

EN 1915-1:2011 – Aircraft ground support equipment – General requirements – Part 1: Basic safety requirements

EN 1915-2:2001 – Aircraft ground support equipment – General requirements – Part 2: Stability and strength requirements, calculations and test methods

EN 1915-3:2004 – Aircraft ground support equipment - General requirements – Part 3: Vibration measurement methods and reduction

EN 1915-4:2005 – Aircraft ground support equipment – General requirements - Part 4: Noise measurement methods and reduction

2.2.6 Available in the U.S. from ANSI, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, <http://webstore.ansi.org>. Abroad, from the national standardization institutions, or ISO, 1, chemin de la Voie Creuse, Case postale 56, CH-1211 Geneva 20, Switzerland, Tel: +41 22 749 01 11, www.iso.org:

ISO 2328 – Fork-lift trucks – Hook-on type fork arms and fork arm carriages – Mounting dimensions

ISO 6966-1:2005 – Aircraft ground equipment – Basic requirements – Part 1: General requirements

ISO 6966-2:2014 – Aircraft ground equipment – Basic requirements – Part 2: Safety requirements

ISO 10254:2016 – Air cargo and ground equipment – Vocabulary (E, F, G)

ISO 11532:2017 – Aircraft ground equipment – Graphic symbols

ISO 11995:1996 – Aircraft – Stability requirements for loading and servicing equipment

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

NFPA Standard No. 70, National Electrical Code

NFPA No. 505 – Standard for the Use, Maintenance and Operation of Industrial Trucks. Fire Safety for Powered Industrial Trucks

2.2.8 Available from CFTMA, Caster & Floor Trucks Manufacturer's Association, www.mhi.org:

ANSI CFTMA – Performance Standard for Casters and Wheels

2.2.9 Available from International Air Transport Association (IATA), Publications Assistant, 800 Place Victoria, P.O. Box 113, Montréal, Québec H4Z 1M1, Canada, www.iata.org.

Airport Handling Manual AHM 910, Basic Requirements for Aircraft Ground Support Equipment

Airport Handling Manual AHM 911, Ground Support Equipment Requirements for Compatibility with Aircraft ULD

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

Airport Handling Manual AHM 916, Basic Requirements for Towing Vehicle Interface (Hitch)

3. REQUIREMENTS

3.1 Performance

The equipment, properly maintained, shall be designed to perform its intended function for its "Total Life" period (see 3.5).

3.2 Operability

3.2.1 The equipment shall be designed for continuous operation at rated load for the period indicated in a functional specification provided by the purchaser as a controlling document herein referred to as a "controlling specification."

3.2.2 The equipment shall operate satisfactorily at any angle up to 5 degrees (0.0873 rad., 8.7 %). In the event that this requirement imposes significant design constraints, the manufacturer shall define and propose a design suitable for the intended application.

3.3 Reliability

The equipment and its accessories shall be designed and constructed with reliability of operation a primary consideration. The minimum reliability design requirement is that the equipment be designed to operate between periodic preventive maintenance periods of 200 operating hours or 8 weeks, whichever occurs first. The above interval does not apply to components in those cases where the component manufacturer recommends more frequent maintenance intervals. (For the purpose of this document, normal servicing of fuel, oil, tire pressure, battery, and water are not considered preventive maintenance.)

3.4 Maintenance Requirements

3.4.1 Maintainability

3.4.1.1 Access to any part of the equipment for light or heavy maintenance shall be possible, and means provided to ensure safety of personnel proceeding with a maintenance operation. Such means may be external, and in this case shall be specified in the manufacturer's documentation.

3.4.1.2 Places on which maintenance personnel may need to stand shall be protected by guard-rails if they present a risk of falling from a height exceeding 3 ft (1.0 m). If not necessary in equipment operation, such guard-rails may be flexible in order to be more easily stowed, or removeable for workshop storage, installation, and use.

3.4.1.3 Foldable or external maintenance supports painted in a safety colour shall be provided to secure raised platform(s) or other lifting element(s) in order to protect maintenance personnel working underneath against the risk of lowering.

3.4.2 Maintenance Cycle

The recommended maintenance cycle shall be specified in the manufacturer's documentation. The systematic preventive maintenance intervals, excluding normal servicing, shall be at least 200 operating hours. Up to 400 operating hours, or more if achievable, intervals are preferred. Heavy maintenance is recommended to take place on a yearly basis, i.e., typically at 1500 – 2500 operating hours intervals or more.

3.4.3 Service and Access

3.4.3.1 Equipment components and systems requiring routine and frequent inspection and maintenance shall be readily accessible. Suitable access doors or removable enclosures shall be provided for this purpose.

3.4.3.2 Access doors, covers, and protective guards shall be designed for quick removal or opening. Access holes in protective guards for lubrication are acceptable only when lubrication is required on intervals exceeding twice annually but shall be held to a minimum quantity and the minimum size required for the pressurized fitting only. Access doors, panels, and protective guards shall be designed for quick opening or removal by personnel wearing arctic gloves or mittens, using standard mechanics tools.

3.4.3.3 Access panels and doors normally used during aircraft servicing shall be designed to structurally withstand wind blasts up to 75 mph (120 km.h⁻¹) in both open and closed position.

3.4.3.4 Access panels shall be hinged, pinned, etc., to prevent loss from the unit. Large panels of over 4 feet (1.219 m) in both height and width which are normally removed only for heavy maintenance, i.e., major component overhaul or removal, may be designed to be removed from the equipment when hinging or pinning is not practical.

3.4.3.5 All hinged doors shall be provided with devices to secure them in the open and closed positions such that they will not be blown by jet blast or ambient winds. Stops or bumpers shall be installed so that the doors (or stops), do not mark or scratch the paint work. Where possible, at least 8 inches (203 mm) of clearance above the ground shall exist when any door is open.

3.4.3.6 Major assemblies and components shall be capable of being disconnected and removed from the equipment without the necessity for extensive disassembly of other components. Standard automotive practice is acceptable.

3.4.3.7 Parts requiring removal for replacement, service, or maintenance shall be fastened with removable fasteners or latching devices.

3.4.3.8 Weight of removable enclosures, or replaceable units, designed for one-man handling must be less than 30 pounds (14 kg). Units exceeding 30 pounds (14 kg) to a maximum of 80 pounds (36 kg) must be designed for two-man handling.

3.4.3.9 All components that exceed 80 pounds (36 kg), or that exceed 30 pounds (14 kg) if only one man has access to the unit for handling, shall have provisions for attaching lifting or handling devices such as slings, hoists, or forklift tines. The minimum design safety factor of such provisions, based on the ultimate strength of the material shall be 5 to 1.

3.4.3.10 Any vital, unattached parts such as tractor hitch pins and lock pins which might otherwise be easily lost shall be secured to the equipment with cable or chain of durable size and material.

3.4.3.11 Pressure lubrication fittings shall be provided at all points where heavy loads, close tolerance, relative rotary or linear motion of parts occurs. This will normally include pivots, guides, bearings, and journals except sealed ball and roller bearings. Where access to the fittings is difficult, they shall be brought to a common lubrication panel.

- 3.4.3.12 Fastener heads and nuts shall be provided with adequate clearance for wrenches and drivers.
- 3.4.3.13 A means of positively securing lift devices at a convenient height for service and access shall be provided with each unit.
- 3.4.3.14 On lift types of equipment, the manufacturer shall provide alternate means of raising the hoist in event of failure of the primary power source if any components that could cause failure are not accessible while the hoist is in the down position.
- 3.4.3.15 On lift bed types of equipment a means shall be provided for a mechanic to raise and lower the hoist while working at ground level.
- 3.4.3.16 Chain and belt drives shall have provisions for adjusting the tension to the manufacturer's specified value. A positive means to hold the adjustment shall be provided.

3.5 Total Life

"Total Life" is defined to be the hours of use from time of delivery of the equipment to the using activity until its identity is destroyed by classifying it as salvage and/or subject to cannibalization. The "Total Life" for which the equipment is designed, assuming it is used and maintained in accordance with the manufacturer's recommendation, shall be specified.

3.6 Environmental

- 3.6.1 The entire unit shall be designed and equipped to start easily and operate satisfactorily under temperature conditions ranging from -20 to +123 °F (-29 to +52 °C) with 100% RH after soaking at either of the stated temperature extremes for 24 hours. For vehicles to be routinely operated at higher and/or lower temperatures, applicable operating temperature limits should be specified in the procurement document.

NOTE temperature conditions ranging from -40 to +140 °F (-40 to +60 °C) are optional, and can be necessary for equipment intended to be operated in extreme climatic conditions.

- 3.6.2 The equipment shall be designed to operate satisfactorily after exposure to the following sequence of conditions.

- a. 4 hours soak at +20 °F (-6.7 °C)
- b. Thorough wetting of the exterior of the equipment with a fine spray of +40 °F (4.4 °C) water
- c. 4 hours soak at +20 °F (-6.7 °C)

- 3.6.3 The equipment and all its components shall be designed to operate satisfactorily after 6 hours exposure to heavy rainfall (0.30 in/h) (7.6 mm/h) driven by a 25 mph (40 km.h⁻¹) wind in any horizontal direction.
- 3.6.4 Components shall be protected from mechanical, electrical, and corrosion damage and impairment of operation due to rain, snow, ice, sand, grit, and deicing fluids.
- 3.6.5 Operators' compartments shall be designed to preclude excessive temperature from heat sources such as engine and exhaust system. Insulation and ventilation shall be provided, if necessary, to limit compartment temperatures in any operational mode, to a maximum of 100 °F (37.8 °C) on a calm, 85 °F (29.4 °C), full sunlight day.

3.7 Transportability

- 3.7.1 The unit shall be designed for over-the-road unrestricted transportation insofar as possible. The manufacturer shall identify any constraints applicable to transportation or shipment of the unit or any subassemblies.

- 3.7.2 Units required, as outlined in the controlling specification, to operate on public highways or to be capable of being licensed for use on public highways shall meet the requirements of Chapter V – National Highway Safety Bureau, Department of Transportation, Title 49 of the Code Federal Regulations in effect on the date of manufacture. The unit shall be manufactured in a manner and equipped to be capable of operation in accordance with Part 393, subparts A, B, C, D, E, and G of Chapter III – Federal Highway Administration, Department of Transportation, Title 49 of the Code of Federal Regulations.
- 3.7.3 Units which may be licensed to operate on public highways shall have the minimum capability to accelerate on a level surface, from 0 to 40 mph (0 to 65 km/h) within 60 seconds with full payload.
- 3.7.4 Suitable lifting points shall be provided on the equipment. When forklift tineways are used, they shall be installed in compliance with ISO 2328. When slings are used, the sling attachment points shall be of adequate strength and clearly marked, and the approximate centre of gravity (C.G.) location of the equipment should be indicated.

3.8 Safety

- 3.8.1 It shall be the responsibility of the manufacturer to ensure that the equipment contains all the safety features required to protect the equipment, the operator(s), the load, and the aircraft serviced, in accordance with AIR1375 and Title 29 CFR Part 1910 - Occupational Safety and Health Standards (OSHA).
- 3.8.2 Powered Industrial Trucks (as defined by Section 1910.178 of OSHA) shall meet the design and construction requirements established in ANSI B56.1, Part II. In the event of conflict between this document and B56.1, Part II, B56.1 shall apply.
- 3.8.3 Vehicles equipped with vertical lift devices shall meet the design and construction requirements established in ANSI A92.7. In the event of conflict between this document and A92.7, A92.7 shall apply.
- 3.8.4 The essential safety aspects must be incorporated as part of the basic design (design to safety), and take into account the adverse conditions which frequently prevail in airport ramp areas, e.g. congested vehicle movement, exposure to weather, night operation, noise from aircraft and other vehicles, and difficult communications.
- 3.8.5 Design to safety should be based on a specific comprehensive risk assessment for each type of aircraft GSE, to be conducted by the manufacturer. The retained design should be commensurate with the results of the risk assessment, as well as take into account, if applicable, each area of potential safety concern listed in this ARP.
- 3.8.6 Design should aim at providing intrinsically safe equipment, i.e. where potentially unsafe occurrences are prevented by basic design features such as equipment and components geometry, layout, or mode of operation, minimizing inasmuch as feasible the necessity to use additive safety devices or circuits. Where such additional devices or circuits dedicated to safety purposes cannot be avoided, risk assessment shall include an evaluation of any potential drawbacks or unforeseen additional hazards resulting from this addition.
- 3.8.7 Any component, the failure of which could be hazardous, shall be designed to be fail-safe, or, where impractical, duplicated. In the event of duplication, each of the duplicated components shall separately be capable of safely performing its function in the event of its alternate's failure.

3.9 Personnel Safety

- 3.9.1 Unless specifically excluded by the purchasing agreement, a windshield shall be provided on all motorized vehicles designed for operation at speeds above 5 mph (8.1 km.h⁻¹). Powered windshield wipers shall be provided on all motorized vehicles which are equipped with a windshield. A powered wiper shall also be provided on any rearview window of each motorized vehicle required to approach aircraft in a reverse direction. Wiper motors and mechanical linkage must be protected against damage with wipers in a stalled condition. Window washing and wiping systems shall conform to FMVSS No. 104. "Windshield Wiping and Washing Systems". Unless otherwise stated in the specification, washing systems need not be provided on vehicles not equipped for highway travel.
- 3.9.2 On units where rear vision is restricted, outside mirrors shall be provided on each side of the cab as specified by the controlling specification. The mirrors shall be adequately braced to preclude accidental loss of adjustment or visual distortion due to vibration of vehicle. If specified, the mirror(s) shall have down vision capability.

- 3.9.3 An electric horn which meets the requirements of SAE J377 shall be provided. The horn shall be supplied with control button located in the center of the steering wheel.
- 3.9.4 Control pedals shall be designed and located to permit safe operation if heavy overshoes are worn by the operator. Spacing between the brake pedal and accelerator shall follow standard automotive industry practice. In no case shall they be located so that the accelerator can be depressed accidentally while applying the brakes with a booted foot. The use of pedal surface material which inhibits "slippage" of shoes when wet is required.
- 3.9.5 A crash barrier which, when rigidly supported in a horizontal position, is capable of withstanding the impact of a 100 pound (45 kg) solid hardwood cube (or equivalent) dropped at random from a distance of 5 feet (1.5 m) 10 times, without fracture or permanent deflection exceeding 0.75 inch (1.9 cm) shall be installed on each vehicle designed to carry loose cargo to prevent injuring the operator with such cargo in the event of a collision.
- 3.9.6 Where required, heat shields or guards shall be installed to protect personnel operating the equipment or performing routine periodic maintenance on the equipment against accidental contact with exposed parts which are subject to high operating temperatures. This does not apply to exhaust systems in commercial vehicle engine compartments. Warning devices shall be added where applicable.
- 3.9.7 Suitable guards shall be provided for all moving parts located where operating personnel may make accidental contact with them. In general, standard automotive practice is acceptable. Warning decals shall be added where applicable.
- 3.9.8 Vehicles shall have the operator and adjacent front seat positions equipped with seat belts conforming to FMVSS No. 207, "Seating Systems"; No. 208, "Occupant Crash Protection"; and No. 209, "Seat Belt Assemblies".
- 3.9.9 Exposure of operating and maintenance personnel to electric shock hazards shall be minimized by the provision of suitable interlocks, grounding means, or protective devices.
- 3.9.10 Guards or enclosures shall be provided for all exposed portions of electrical equipment.
- 3.9.11 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).
- 3.9.11.1 Hydraulic lift cylinders shall have pilot operated check or counterbalance valves connected directly to their base fittings to prevent accidental lowering in the event of failure of any line in the system.
- 3.9.11.2 Electrical or pneumatic lifts shall be equipped with brakes to lock the system in the event of power failure or malfunction.
- 3.9.11.3 An emergency lowering system, operationally independent of the prime power source and operable from the ground, shall be provided on all lift units.
- 3.9.11.4 The location of emergency lowering controls must be easily identified and shall be located so as not to create a potential hazard to the operator or equipment during operation.
- 3.9.12 All pinch and shear points, sharp edges and protruding objects must be eliminated wherever possible and practical. If elimination is not possible, adequate guarding must be achieved to prevent injury and/or damage exposure.
- 3.9.13 Push/pull forces required to move other than control handles and access doors shall be limited to 60 pounds (27.2 kg) when the operator is standing upright.
- 3.9.14 Stairs, ladders, scaffolds, platforms, etc., shall comply with the applicable OSHA requirements.
- 3.9.15 Stairs used by the general public for access to and from the aircraft shall take into account AIR6133.
- 3.9.16 Where practical and possible, access to work areas shall be provided by means of a protected lift platform or stairs. Ladders shall be used only where use of stair is not practical and possible. In this case, telescoping ladders, elements of which move in relation to each other, shall be used only where the use of fixed ladders is not possible.

- 3.9.17 Stair risers, treads and stair and ladder angles shall conform to OSHA promulgated standards and documents for Industrial Operations. Critical angles shall be avoided where practical and possible.
- 3.9.18 Steps and ladder rungs shall be of open, nonskid material.
- 3.9.19 Non-slip surfaces shall be provided in all areas where personnel will be required to walk or work during normal operations.
- 3.9.20 Serrated grating panels may be used where personnel will not be required to kneel or sit, and smoother surfaces are not required for rolling of casters. Protection shall be provided to prevent objects from falling on personnel and moving parts below such platforms.
- 3.9.20.1 Smoother nonslip materials shall be installed on personnel work areas as required by the operation. Abrasive impregnated aluminum or steel plate, adhesive applied abrasive sheet or painted on abrasive coatings shall be used only as approved by the purchaser.
- 3.9.21 Handrails and/or cages shall be installed on all stairs, ladders, and platforms when required by OSHA regulations. Removable railings shall be avoided where practical and possible. Removable railings shall be positively retained on the unit.
- 3.9.22 Working surfaces with removable handrails shall incorporate provisions for the attachment of personnel safety harnesses.
- 3.9.23 Equipment having an effect on public health, such as food or drinking water or lavatory service equipment, shall comply with and be certified by the United States Department of Health, Education, and Welfare.
- 3.9.24 No component, door, stair, towbar, or other item whose weight is balanced by a spring device shall be erected upward under the sole effect of the spring if the locking device fails.
- 3.9.25 Vehicles using pneumatic tires on split rim wheels shall have nuts and bolt heads on hardware securing the split rims together painted bright red. A warning placard shall be placed in the immediate vicinity of all wheel wells that shall warn the operator of potentially dangerous conditions and the red painted hardware is not to be loosened or removed when an inflated tire is mounted. Personnel injury and equipment damage may ensue.

3.10 Equipment Safety

- 3.10.1 If required, the type, location, and color of reflecting devices will be specified by the controlling specification.
- 3.10.2 Consideration should be given for protection of lamps and reflectors against damage if dictated by normal design practice, i.e., likelihood of damage.
- 3.10.3 Non-marking cushion devices shall be installed on all equipment intended to be used in direct contact with or close proximity to aircraft to prevent damage to the aircraft. Such cushion devices shall be at least tubular or "D" section rubber bumpers of suitable length with an outside diameter and wall thickness as specified by the controlling specification (see ARP1558 and 3.14 for aircraft protection).
- 3.10.4 All components and systems shall be fail-safe wherever practical.
- 3.10.5 Powered mobile equipment shall be designed with operator visibility a primary consideration.
- 3.10.6 All lift device mobility and/or positioning controls shall be of the "deadman" type.
- 3.10.7 Relief valves shall be provided in all hydraulic and pneumatic systems to prevent sustained pressures in excess of rated working pressure.
- 3.10.8 If required, the type, size, and location of fire extinguisher(s) will be stipulated in the controlling specification.
- 3.10.9 If stabilizers, outriggers, or spring lockouts are used, the following shall be provided:

