



AEROSPACE RECOMMENDED PRACTICE

ARP1804™

REV. B

Issued 1983-04
Revised 2017-06
Reaffirmed 2022-03

Superseding ARP1804A

Electric Baggage/Cargo Tractor

RATIONALE

Minor update to accommodate 24 VDC auxiliary electrical systems and integrated drive axles. References to specific paragraphs in related SAE documents were removed as they could change in revisions of those documents.

1. SCOPE

This SAE Aerospace Recommended Practice (ARP) outlines the design and performance requirements for a battery-powered electric tow tractor for the handling of baggage or cargo trailers in airline service. The use of "shall" in this document indicates a mandatory requirement. The use of "should" indicates a recommendation or that which is advised but not required.

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, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AIR1316	Airline Tow Tractor - Baggage/Cargo Factors for Design Consideration
AIR1375	Minimum Safety Requirements for Special Purpose Airline Ground Support Equipment
AIR1898	Maintenance of Batteries and Battery Charging and Servicing Facilities
ARP1247	Aircraft Ground Support Equipment - General Requirements
ARP1328	Aircraft Ground Support Equipment Vehicle - Wind Stability Determination
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

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SAE WEB ADDRESS:

Full document details: SAE ARP1804B

For more information on this standard, visit
<https://www.sae.org/standards/content/ARP1804B/>

Documents
Document Sharing Hub

AS4828	Technical Manual Requirements for Ground Support Equipment
SAE J163	Low Tension Wiring and Cable Terminals and Splice Clips
SAE J377	Vehicular Traffic Sound Signaling Devices (Horns)
SAE J551-1	Performance Levels and Methods of Measurement of Electromagnetic Compatibility of Vehicles, Boats (up to 15 m), and Machines (16.6 Hz to 18 GHz)
SAE J551-12	Vehicle Electromagnetic Immunity - On-Board Transmitter Simulation
SAE J561	Electrical Terminals - Eyelet and Spade Type
SAE J858	Electrical Terminals Blade Type
SAE J1127	Low Voltage Battery Cable
SAE J1128	Low Voltage Primary Cable
SAE J1654	Unshielded High Voltage Primary Cable
SAE J1673	High Voltage Automotive Wiring Assembly Design
SAE J1690	Flashers
SAE J1742	Connections for High Voltage On-Board Vehicle Electrical Wiring Harnesses - Test Methods and General Performance Requirements

2.2 ANSI Accredited Publications

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

ASME/ANSI B56.9 Safety Standard for Operator Controlled Industrial Tow Tractors

ANSI/NEMA No. 250 Enclosures for Electrical Equipment (1000 Volts Maximum)

2.3 CiA Publications

Available from CAN in Automation, AM Weichselgarten 26, DE-91058 Erlangen (Germany).

CiA Standard 418 CANOpen: Device Profile for Battery Modules

CiA Standard 419 CANOpen: Device Profile for Battery Charger

2.4 EN Publications

Available from CEN, Comité Européen de Normalisation, Avenue Marnix 17, B-1000 Brussels, Belgium, www.cen.eu or any European national standardization institutes, members of C.E.N.

EN12312-15 Aircraft Ground Support Equipment - Specific Requirements - Part 15: Baggage and Equipment Tractors (considered mandatory in the European Union in application of its Machinery Directive)

2.5 IATA Publications

Available from International Air Transport Association, Publications Assistant, 800 Place Victoria, P.O. Box 113, Montreal, Quebec H4Z 1M1, Canada, Tel: 1-514-874-0202, www.iata.org.

AHM 916 Basic Requirements for Ground Support Equipment Towing Interface

AHM 968 Functional Specification for Ramp Equipment Tractors

2.6 National Fire Protection Agency Publications

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

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

2.7 UL Publications

Available from UL, 333 Pfingsten Road, Northbrook, IL 60062-2096, Tel: 847-272-8800, www.ul.com.

UL 583 Electric-Battery-Powered Industrial Trucks

2.8 U.S. Government

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

MIL-STD-461E Electromagnetic Interference Characteristic Requirements for Equipment

3. DESIGN REQUIREMENTS

3.1 The tractor shall comply with all performance requirements over the full range of environmental factors specified in ARP1247.

3.2 The tractor shall comply with the requirements of ARP1328.

3.3 Electrical System

The electrical system shall consist of an appropriate size and type of traction battery pack powering a compatible electric motor(s) through an electronic controller(s) to produce smooth acceleration and operation. Traction battery voltage should reflect the best design for duty cycle, vehicle speed, tractive effort and minimum current losses. The traction battery charger shall be appropriately selected to properly charge the traction battery and meet the requirements of the particular application.

3.3.1 Traction Battery

3.3.1.1 The traction battery should comply with the requirements of ARP1817. A single battery should be provided of size and capacity to satisfy performance and accessory requirements. Operational characteristics should also be considered when selecting the proper battery, such as the average amp-hour draw, any non-gassing requirements, available maintenance personnel and facilities. The vehicle manufacturer shall provide the battery manufacturer's specifications, including the 1-hour and 3-hour discharge rating of the traction battery (in ampere-hours), and shall specify the operating time (in hours) which the battery will support, assuming the vehicle is operating continuously at 6.2 mph (10 kph) with a 14-ton dolly.

3.3.1.2 Means of restraining the traction battery in the lateral and longitudinal directions shall be provided.

- 3.3.1.3 Vehicle manufacturer should supply battery manufacturers recommended traction battery charging algorithm.
- 3.3.1.4 Vehicle manufacturer should supply traction battery maintenance requirements.
- 3.3.1.5 Vehicle manufacturer shall indicate the depth of discharge below which the traction battery should not be discharged.
- 3.3.1.6 The traction battery shall be protected by a cover, which can support one load of 250 pounds, applied to any 1 ft² (10.5 kg to any 1 m²) of the cover.
- 3.3.1.7 The traction battery and traction battery compartment shall be designed such that electrolyte from the battery is captured in an auxiliary tray or the battery tray and not allowed to drain onto the ground, corrode parts of the tractor, create acid paths for current to flow to the chassis.
- 3.3.1.8 Battery cable connectors shall be located such that they create no danger of igniting gases expelled during battery charging. The location should also be convenient for charging while not subject to damage during battery removal or installation.
- 3.3.1.9 Manufacturer shall supply an MSDS for the battery and any materials used in the tractor that would not typically be found in an automotive shop.

3.3.2 Propulsion System

- 3.3.2.1 The electronic controller(s) and motor(s) shall be sized for the application and shall limit maximum battery discharge as specified in 3.3.1.5 to prevent degradation of battery life and abrupt loss of tractor operability. Such limit shall be adjustable, repeatable, and accurate within 10% battery state of charge.
- 3.3.2.2 All wiring and components used in the high voltage propulsion system shall be of a “two-wire” design (battery negative above chassis ground) and sized in compliance with SAE J1673.
- 3.3.2.3 Vehicles shall not contain exposed conductors, terminals, contact blocks or devices of any type that create the potential for personnel to be exposed to greater than 60 V (nominal battery voltage) (the distinction between low voltage and high voltage, as specified in SAE J1127). Access to any high voltage components shall require the removal of at least one bolt, screw, cover, or latch. Devices considered to be high voltage components shall be clearly marked as HIGH VOLTAGE. These markings should be installed at any point the voltage can be accessed by the end user. Additionally, cable and wire marking shall consist of orange wire and/or orange sleeves as required by SAE J1127.
- 3.3.2.4 All HIGH VOLTAGE (>60 V) cable shall comply with the requirements of SAE J1654. All low voltage cable shall comply with the requirements of SAE J1127 or SAE J1128 as applicable.
- 3.3.2.5 HIGH VOLTAGE (>60 V) connectors should utilize locking devices, shall be keyed to prevent mis-connection and should be moisture proof. HIGH VOLTAGE (>60 V) connectors should comply with the requirements of SAE J1742.
- 3.3.2.6 The tractor may utilize a single speed or multi-speed automatic or a continuously variable transmission. An alternative design may incorporate an integrated axle such as used in material handling equipment.
- 3.3.2.7 A propulsion power system operating at greater than 60 V shall be considered HIGH VOLTAGE and shall be isolated from the vehicle chassis such that leakage current does not exceed 20 mA with the battery connected.
- 3.3.2.8 An arrangement for the controller to increase braking by changing motor field current (called “plugging” or “regenerative braking”) shall be offered. Maximum regenerative braking settings shall be adjustable such that maximum current returning to the traction battery pack can be set to avoid potential damage to traction battery pack or electrical components.
- 3.3.2.9 If a DC traction motor is used, the motor should be accessible for brush inspection without having to remove the battery.