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AEROSPACE RECOMMENDED PRACTICE

ARP 1836

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Revised

AIRCRAFT CARGO CONVEYOR - BATTERY POWERED

1. SCOPE: This Recommended Practice outlines the functional and design requirements for a battery powered, self propelled belt conveyor for handling baggage and cargo at aircraft bulk cargo holds.

2. APPLICABLE DOCUMENTS: The following documents shall become a part of this Recommended Practice.

2.1 SAE ARP 1247: General Requirements for Aerospace Powered Mobile Ground Support Equipment.

2.2 SAE ARP 1328: Aircraft Ground Support Equipment Vehicle Stability Analysis.

2.3 SAE ARP 1892: Electrical Connectors for Use In Battery Powered Ground Support Equipment.

2.4 SAE ARP 1817: Batteries for Battery Powered Ground Support Equipment.

2.5 SAE ARP 1816: Charger for Battery Powered Ground Support Equipment.

2.6 SAE AIR 1838: Pictograms for Ground Support Equipment.

2.7 SAE AIR 1375: Minimum Safety Requirements for Special Purpose Airline Ground Support Equipment.

2.8 SAE AIR 1558: Interface Protective Devices - Ground Equipment to Aircraft.

2.9 IATA Airport Handling Manual, Section 9, AHM 942 International Air Transport Association, 2000 Peel Street, Montreal, Quebec, Canada H3A 2R4.

2.10 SAE ARP 1838: Pictograms for Ground Support Equipment.

3. DESIGN REQUIREMENTS: Design, systems, hardware and material used in the manufacture of the conveyor must meet automotive standards and good industry practices. The loader shall be designed for easy access to those areas that require frequent checks for servicing.

REAFFIRMED

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3.1 Physical Characteristics:

3.1.1 Overall dimensions of the conveyor shall be within 347 in. (8.7 m) long and 80 in. (2.1 m) wide.

Overall height should be kept as low as possible consistent with good operation, safety and ground clearance.

3.1.2 The loader must be capable of servicing all commercial aircraft cargo compartments. This requires a range of travel of the forward end of the conveyor of 38 in. (.97 m) in the conveyor full down position to 145 in. (3.7 m) in the full up position while the rear of the conveyor is not more than 30 in. (0.76 m) off the ground. The rear of the conveyor shall have a range of 20 in. (0.51 m) to 70 in. (1.8 m).

3.1.3 The turning radius as measured from the outside corner of the vehicle shall not be greater than 25 ft. (7.6 m).

3.1.4 The following characteristics shall be met under normal operating conditions and loads:

Approach Angle:	16° (0.28 rad.) minimum.
Ramp Breakover Angle:	10° (0.18 rad.) minimum.
Departure Angle:	10° (0.18 rad.) minimum.

3.1.5 The belt shall be 24 in. (0.61 m) wide. Usable conveyor width shall be a minimum of 32 in. (0.81 m) with guides and a maximum of 40 in. (1.02 m).

3.1.6 The belt shall have tread suitable for steep grades and outdoor use.

3.1.7 The minimum ground clearance shall be at least 5 in. (0.15 m).

3.1.8 The loader chassis shall have rub rails on both sides for protection against damage.

3.1.9 To minimize aircraft damage, the forward end of the conveyor shall be provided with a 5 in. (0.13 m) I.D. x 7 in. (0.18 m) O.D. full width rubber bumper. Protection for rear of conveyor shall also be considered.

NOTE: The gap width between the bumper support and belt at front of the conveyor should be chosen with caution. If too small, the risk of getting fingers caught exists. If too large, packages can get hung up or fall through the gap.

3.1.10 The operator's control area shall have adequate room to safely and efficiently operate the loader. Recommended dimensions to accomplish this are shown in Figure 1 and Table I.

3.2 Mechanical and Hydraulic Systems: Design requirements as delineated in SAE ARP 1247 Paragraphs 3.13.1.1 and 3.13.1.3 in particular shall be followed:

3.2.1 The loader shall be a four wheel vehicle with front wheel steering.

3.2.2 Steering effort shall not require more than 20 lb-ft (27.1 n-m) torque as measured from the circumference of the steering wheel.

3.2.3 Service brakes shall be of a dual system hydraulic design with split master cylinder and indicator light on dash to warn the operator if one system fails. Drum brakes, disc brakes or combinations of both are acceptable.

The maximum permissible stopping distance from full speed on level ground shall not be greater than 25 ft. (7.6 m). A brake pedal force required to meet this distance shall not be more than 100 lb. (444 n).

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

3.2.5 Drive wheels shall have at least 2.0 in. (5.1 cm) of clearance to permit installation of tire chains.

3.2.6 The operator's seat shall be adjustable fore and aft with a minimum range of 6 in. (0.15 m). See Fig. 1.

3.2.7 The loader shall be equipped with an adjustable over center manual type hand brake with a pulling motion toward the operator engaging the brake.

3.2.8 The directional control switch for traction drive shall have three positions: forward, neutral, and reverse. The reverse position shall be to the front, neutral in the middle and forward to the rear.

NOTE: For international operators, these positions may have to be reversed.

The neutral position must have a detent. Operation shall be for a right handed person.

3.2.9 Provisions for adjusting belt tension and alignment shall be made.

3.3 Electrical System:

3.3.1 The cargo conveyor is to operate on a common industrial battery pack powering the vehicle, conveyor lift and belt drive. The preferred method for electric drive utilizes an SCR (silicon controlled rectifier) or equivalent electronic controller to produce smooth acceleration and operation. Battery voltage shall reflect the best design for duty cycle, vehicle speed, hydraulic system and minimum current losses.

3.3.2 The electrical system shall use a two wire system; i.e. the battery negative shall use a separate wire isolated from vehicle chassis by at least 500,000 ohms resistance. Battery cleanliness to prevent acid leakage paths is of utmost importance and every attempt to facilitate same should be taken into consideration in the design.

3.3.3 A separate 12 volt DC accessory system using chassis ground to accommodate standard automotive equipment shall be provided. The preferred method to provide the 12 volt system is through an electronic DC to DC converter with or without a cycling type 12 volt storage battery.

3.3.4 The loader shall be equipped with two head lights, two brake/tail lights and a back-up light(s). The back-up light(s) shall be activated through the reverse position of the directional control switch.

3.3.5 Two adjustable flood lights, one forward and one rear, shall be installed with switch on dash panel.

3.3.6 The controller, DC-DC converter and associated equipment shall be enclosed in a sealed compartment with Type NEMA 4 standards or better. All peripheral electrical or electronic components that cannot be contained in this compartment must be of waterproof and heavy duty construction, or adequately protected from wind, ramp splash, snow and ice accumulation, blown rain, dust and sand.

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

3.3.8 Power connectors must comply with SAE ARP 1892: Electrical Connectors for Use in Battery Powered Ground Support Equipment.

3.3.9 Battery and chargers must comply with SAE ARP 1817: Batteries for Battery Powered Ground Support Equipment and SAE ARP 1816: Charger for Battery Powered Ground Support Equipment.

3.3.10 The vehicle charging connector shall be located at the left rear and shall be interlocked to prevent the loader moving with the battery charging cable attached.

4. PERFORMANCE REQUIREMENTS: The following performance requirements apply to the loader on dry, level concrete of good quality and an outdoor ambient temperature range of -15°C (5°F) to +35°C (95°F), unless otherwise specified. Note that this is not the operating temperature range of the equipment, which is as specified in SAE ARP 1247.

4.1 The maximum speed of the vehicle with no load shall be approximately 15 mi/hr (24.1 km/hr).

4.2 Total distributed load capacity of at least 2,000 lb (9.07.0 kg) for conveyor angles up to 15° (0.26 rad.), and at least 1,000 lb (453.5 kg) at the maximum conveyor angle of the loader, is required.

4.3 The conveyor shall have a load density rating of at least 200 lb/ft^2 (976.4 kg/m^2).

4.4 Conveyor belt speed shall be manually controllable within a range of 40 to 100 ft./min. (12.2 to 30.5 m/min) with any loads up to those specified in the duty cycle requirement (See Paragraph 4.7).

4.5 The belt drive system shall not permit a load to move more than 3 in/min (7.62 cm/min) in the unpowered (belt motor off) state. This condition applies to any loads up to those specified in Paragraphs 4.2 and 4.3 and in any weather conditions.

4.6 Conveyor lift speed with no load shall be at least 25 ft/min. (7.62 m/min). Conveyor lowering speed at no load shall be within 50% of lift speed; i.e., within a range of 12.5 to 37.5 ft/min (3.81 to 11.43 m/min).

4.7 As a minimum requirement, the battery pack and electrical system shall be designed to meet a duty cycle of 1.5 hours actual vehicle travel time and 4.5 hours of conveyor belt operating time before recharging or changing batteries.

For purposes of testing and specification, the following conditions shall be used:

a. Vehicle Operation:

(1) Vehicle traveling with no load (except operator) at various speeds,
(2) 15 full stops and starts,
(3) 45 full turns per mile at various speeds,
(4) Rest periods of 20 minutes for every hour of driving.

b. Conveyor/Belt Operation:

(1) Belt operating with 750 lb (340 kg) load
(2) 15° conveyor angle (with respect to horizontal)
(3) 75 ft/min (22.9 m/min.) constant belt speed
(4) 6 full stops and starts per each simulated 20 minute aircraft loading.

5. INSTRUMENTS AND CONTROLS: The requirements of SAE ARP 1247, Paragraphs 3.13.1.8 and 3.13.12 shall be met for instruments and controls.

5.1 Instrumentation shall include as a minimum a battery discharge indicator and an hourmeter. The hourmeter shall register the operating time of the vehicle during travel and belt conveyor function (either event shall activate the hourmeter). An indicator light for the brake system as per Paragraph 3.2.3 is required on brake system as per Paragraph 3.2.3 is required on the dash.

5.2 All control switches and levers except for vehicle movement shall be in the direction of motion and comply with SAE AIR 1375, Paragraph 3.6. Proper placarding shall clearly illustrate the function and direction of each control. Pictograms per Paragraph 2.10 shall be used for this purpose.

5.3 Weatherproof electrical switches at each end of the conveyor shall be provided to control belt movement and emergency stop.

5.4 The belt speed control shall be provided at the aft end of the conveyor or at the operator's compartment.

5.5 The battery discharge indicator shall include a warning device to indicate when batteries require charging or changing.

6. SAFETY REQUIREMENTS: The cargo conveyor and associated components shall contain all safety features required to protect personnel, equipment, the payload and the aircraft being serviced in accordance with generally accepted good design practices.

6.1 All components and systems shall be fail safe.

6.1.1 A handbrake interlock shall be provided to prevent traction system operation unless the handbrake is disengaged. The handbrake interlock shall also prevent belt operation unless the handbrake is fully engaged.

6.2 Controls shall be adequately protected against accidental actuation or damage from items or loads falling from the conveyor belt.

6.3 Permanently installed supports or other methods for locking the conveyor bed at a convenient raised height for maintenance or inspection shall be furnished.

6.4 Protection shall be provided against damage due to high electric motor temperature and/or overload conditions.

6.5 A foldable or retractable hand rail shall be installed on the right side of the conveyor as viewed from the rear for protection when walking up the conveyor to enter the aircraft cargo hold.

6.6 Guards, shields, or interlocks shall be installed to protect personnel operating the equipment or performing maintenance on it against accidental contact with exposed parts which are subject to high voltage, high operating temperatures, or any other hazardous condition.

6.7 Brake pedals and all work surfaces shall be equipped with non-slip material and/or painted with durable non-skid paint.

6.8 Proper placarding of permanent design shall be used for all controls, instrumentation and cautionary information.

6.8.1 Information regarding maximum towing speed shall be properly placarded on the dash and at the tow points if potential damage exists to the traction motor during maintenance towing at higher than recommended speeds, including downhill driving.

6.8.2 Tire inflation pressures shall be placarded or stenciled above the wheel wells.

6.8.3 It is essential that placards be installed warning maintenance personnel to disconnect the main battery and any high voltage capacitors before working on the loader.

6.8.4 Jack points shall be placarded on the loader at all locations.

6.8.5 Adequate means shall be provided for the safe operation of the belt when loaded and unpowered.

7. OPTIONS: The following items shall be offered as optional features:

7.1 Turn signals on the rear of the loader.

7.2 An indicator light on the dash to caution the operator of motor brush wear.

7.3 Seating for one passenger. This seat shall have a hip restraint.

7.4 A weatherproof cab compatible with the airline loading operation.

7.5 Alternate operator positions such as toward the middle or at right front.

7.6 A means of insulating the battery or keeping it warm for extreme cold weather environments.

7.7 An automatic timer and sensing device that stops belt if there is no load placed on it. The timer shall have a manually adjustable range.

7.8 A back-up alarm that is fully audible in the airport ramp environment.

7.9 Accessories operating at battery voltage.

7.10 The location and installation of the battery must provide the capability to service and recharge on the vehicle or to accomplish removal and replacement by one person. Maximum time for replacement shall not exceed five minutes.

7.11 The conveyor raise/lower controls shall be located at the operator's compartment only.

7.12 A deadman type seat switch shall be supplied with an interlock that de-activates the traction circuit whenever the operator is not on the seat.

7.13 The controller shall incorporate a "static return to off" feature. This is an interlock that requires the operator to set the directional control to neutral before tractor movement is possible once the normally closed seat switch has been opened.

7.14 Provision shall be made for safety hand rails on both sides of conveyor.

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