
International Standard



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Air cargo equipment — Ground handling and transport systems for unit load devices — Minimum requirements

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

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Air cargo equipment — Ground handling and transport systems for unit load devices — Minimum requirements

0 Introduction

The aim of this International Standard is to lay down minimum requirements for the handling and restraint of air cargo unit load devices (ULD) whilst on the ground to ensure interchangeability.

1 Scope and field of application

This International Standard specifies minimum performance and compatibility requirements for ground handling and transport systems equipment for air cargo unit load devices, used to service civil wide body freight aircraft.

The purpose of this International Standard is not to specify equipment design, but rather to ensure interface compatibility of the various elements which might make up a complete ground handling and transport system, developed within a number of different operational schemes.

This International Standard is applicable to ground handling and transport systems equipment, designed to deal with main deck unitized cargo in the form of intermodal containers and other compatible unitized load devices. In the context of this International Standard, intermodality concerns, primarily, air and land modes, but does not exclude sea mode. Likewise, compatible equipment, other than that used for main deck cargo, is not excluded.

2 References

- ISO 1161, *Series 1 freight containers — Corner fittings — Specification.*
- ISO 4116, *Ground equipment requirements for compatibility with aircraft unit load devices.*
- ISO 4117, *Air and air-land cargo pallets — Specification and testing.*
- ISO 4118, *Non-certified lower deck containers for air transport — Specification and testing.*
- ISO 4128, *Aircraft — Air mode modular containers.*
- ISO 4171, *Interline air cargo pallets.*
- ISO 6517, *Aircraft — Containers — Base-restrained certified containers for the lower deck of high capacity aircraft.*

ISO 6966, *Aircraft — Basic requirements for aircraft loading equipment.*

ISO 6967, *Aircraft — Wide body aircraft main deck container/pallet loader — Functional requirements.*

ISO 6968, *Aircraft — Wide body aircraft lower deck container/pallet loader — Functional requirements.*

ISO 8323, *Freight containers — Air/surface (intermodal) general purpose containers — Specification and tests.*

3 Equipment

An air cargo ULD ground handling and transport system, in addition to ULDs, is considered as including a loading system or loader and ground transport equipment.

For the purposes of this International Standard, the loading device or loader is that equipment, fixed or mobile, designed to remove ULDs from the ground transport equipment, reposition the ULDs ready for loading and load the ULDs onto the main cargo deck of the aircraft. The loader is also used during unloading operations to remove ULDs from the aircraft main cargo deck and reposition them onto the ground transport equipment. Facility docking equipment can be considered as performing the loader function.

This clause defines the minimum performance requirements for specific elements of the ground handling and transport system. Clause 4 specifies minimum performance requirements of the system, dictated by the interface requirements between these elements of the system.

The ground handling system shall be completely compatible and integrated with the aircraft and the facility environmental features. For example, environmental features associated with the system are: aircraft door opening sizes and locations, cargo envelopes, clearances, cargo movement paths, sill heights, aircraft stabilization characteristics, height limitations for working under the aircraft, noise control, turning radius and driver visibility.

3.1 Unit load devices

3.1.1 Reference documents

The specifications, or applicable portions thereof, relating to unit load devices, laid down in the International Standards contained in clause 2, shall be taken into consideration.

3.1.2 Other applicable documents

The specifications, or portions thereof, relating to handling systems, laid down in ISO 4171, may be considered as applicable.

3.1.3 Outsize cargo

Cargo which exceeds the dimensions of cargo, laid down in the reference documents referred to in 3.1.1, but which is within the maximum aircraft size and load-carrying capabilities should be considered. For that purpose, particular consideration shall be given to the following characteristics:

- a) any part of the handling or loading equipment, protruding beyond the conveyor plane, which might interfere with an overhanging load within the maximum aircraft envelope, should be retractable or removable;
- b) compatibility should be ensured with any additional equipment which might be necessary to handle overweight or oversize pieces of cargo.

3.2 Ground transport equipment

The ground transport equipment provides the carriage and support structure for the unit load devices during ground movements. This equipment shall also incorporate the necessary restraint devices to secure the ULD to the chassis during ground movements. This equipment shall meet the minimum requirements specified in 3.2.1 to 3.2.10.

3.2.1 Types

Air cargo ULD chassis shall be of the following types:

- **Type 1:** Nominal 12,2 m (40 ft) air cargo container chassis, suitable for moving one 12,2 m (40 ft) air cargo container or pallet, or two 6,1 m (20 ft) containers or pallets.
- **Type 2:** Nominal 6,1 m (20 ft) air cargo container chassis, suitable for moving one 6,1 m (20 ft) air cargo container or pallet.
- **Type 3:** ULD chassis, suitable for moving one 12,2 m (40 ft) or one 6,1 m (20 ft) air cargo container or pallet, as well as mixed loads of 6,1 m (20 ft) or 3,05 m (10 ft) air cargo containers or pallets and other ULDs.

3.2.2 Classes

Air cargo ULD chassis shall be of the following classes:

- **Class A:** Transporters with conveyORIZED decks, capable of transporting ULDs as well as interfacing with conveyORIZED loading systems.
- **Class B:** Skeletal transporter chassis, designed for use with lifting equipment for transfer of ULDs onto conveyORIZED airport equipment.

3.2.3 Reference documents

Reference shall be made to the specifications laid down in ISO 4116 and ISO 6966.

Air cargo ULD chassis shall be designed to meet the minimum applicable national and international regulations, when designed for operation on public highways.

3.2.4 Dimensional criteria

Air cargo container chassis shall be designed to have a laden and unladen deck (or roll plane) height of from 1,219 to 1,575 m (48 to 62 in). Chassis width shall be such that, when loaded with ULDs located at the extremes of lateral tolerances, the overall width is less than or equal to the maximum allowable local or national regulations, when designed for operation on public highways (see figure 1).

3.2.5 Environment

Equipment shall be capable of operation under the environmental conditions specified in ISO 6966.

3.2.6 Operation

Equipment shall be such that one man, without tools of any kind, is able to operate it. The operation of the equipment shall not require the operator to leave ground level.

3.2.7 Restraints

Type 3 chassis shall be capable of restraining the various upper deck size ULDs of wide body aircraft, which the equipment is designed to transport, in random mixes, up to the full bed length of the chassis.

3.2.8 Power loading

Powered class A equipment shall include a self-contained powered loading system for loading and unloading ULDs which meets the following criteria:

- a) driveway disconnect umbilical connection for electrical power shall be as specified in either 3.2.8.1e) or 3.2.8.2e);
- b) conveyor deck design shall permit manual movement of ULDs, and shall therefore include an adequate walk area, consisting of a non-slip surface;
- c) the mechanical efficiency of the conveyor system shall be equal to or in excess of 97 %;
- d) manual override shall be achieved by the operator, without the use of tools and within 1 min.

3.2.8.1 For operation on the North American continent, the following items are recommended for the purposes of easy interface:

- a) drive motor voltage — 230 V a.c., 3 phase, 50 to 60 Hz;
- b) conveyor speed — 0,3 m/s (60 ft/min) at nominal 60 Hz;
- c) a safety interlock shall be provided for umbilical connections; interlock voltage shall not exceed 24 V a.c., 50 to 60 Hz;

- d) auxiliary circuit — 24 V d.c.;
- e) the connector [3.2.8a)] used for electrical circuits 3.2.8.1a), b) and d) shall be an 8-pin type as shown in figure 3, wired as specified. Any deviation from this wiring which does not provide a totally safe control system, free of added potential for inadvertent actuation, shall use a different connector which will not mate with a connector of the configuration shown in figure 3.

3.2.8.2 For operation on the European continent, the following items are recommended for the purposes of easy interface:

- a) drive motor voltage — 380 V a.c., 3 phase, 50 Hz;
- b) conveyor speed — 0,3 m/s (60 ft/min) at nominal 50 Hz;
- c) a safety interlock shall be provided for umbilical connections; interlock voltage shall not exceed 24 V a.c., 50 Hz;
- d) no auxiliary circuit is required;
- e) the connector [3.2.8a)] used for electrical circuits 3.2.8.2a) and b) shall be a 6-pin type as shown in figure 4, wired as specified. Any deviation from this wiring which does not provide a totally safe control system, free of added potential for inadvertent actuation, shall use a different connector which will not mate with a connector of the configuration shown in figure 4.

3.2.9 Manual loading

Non-powered equipment shall require minimum effort to operate as designated in 3.2.8c).

3.2.10 Design objectives

Air cargo ULD chassis, particularly those of types 1 and 2, class B, shall meet with the following design criteria: minimum weight, simple construction, ruggedness and low cost.

3.3 Aircraft loader equipment

The aircraft loader equipment shall be designed to meet as many as possible of the alignment and interface requirements for the exchange of ULDs between aircraft and ground transport equipment in order to minimize the complexity, and hence cost, of the considerable amount of equipment used in this system. See 4.2 and 4.4.

3.3.1 Reference documents

In addition to the specifications listed in 3.2.3, reference shall be made to ISO 6967.

3.3.2 Loader types

Aircraft loader systems may be of the following types:

- **Type A:** Direct interchange of ULDs between aircraft and chassis. (This might be a fixed facility or movable equipment.)
- **Type B:** Loader-transporter. In addition to aircraft interchange, the loader transports ULDs to a site other than that of the parked aircraft for loading on or off ground transport equipment.

3.3.3 Environment

Aircraft loader systems shall be capable of operation under the environmental conditions specified in ISO 6966.

3.4 Terminal lifters

The ground transport system family of equipment may include unit load device lifting equipment which would permit transfer of ULDs from skeletal class B transporter-chassis onto class A conveyORIZED transporters, capable of interfacing with the loaded systems.

4 Interface requirements

4.1 ULD to chassis

4.1.1 Restraints — General

The restraint system shall meet or exceed the requirements of applicable national and international regulations for operation on public highways.

4.1.2 Restraints for type 1 and 2 chassis

Air cargo unit load devices of the 6,1 m (20 ft) and 12,2 m (40 ft) lengths shall be restrained to type 1 and 2 chassis by one of the following means:

- a) bottom corner fittings, in accordance with ISO 1161, ISO 4117 or ISO 8322 (type B pallets only);
- b) end slots, in accordance with ISO 4117, ISO 4128 or ISO 8323 (type A and B pallets).

4.1.3 Restraints for type 3 chassis

Unit load devices of the 3,05 m (10 ft), 6,1 m (20 ft) and 12,2 m (40 ft) lengths shall be restrained to type 3 chassis by one of the following means:

- a) end slots, in accordance with ISO 4117, ISO 4128 or ISO 8323 (type A and B pallets);
- b) bottom corner fittings, in accordance with ISO 1161, ISO 4117 or ISO 8323 (type B pallets only).

4.1.4 Support

Air cargo unit load devices of the 3,05 m (10 ft), 6,1 m (20 ft) and 12,2 m (40 ft) lengths shall either be fully supported on the base, as in the case of a conveyORIZED deck, or rest on structural supports only when bottom corner fittings are the support means. Clearance between the base and any other chassis non-supporting member shall be ensured under all conditions. Bottom corner fitting support pad areas shall be consistent with the corner fitting area.

4.1.5 Guides

The chassis shall incorporate suitable guides to ensure smooth continuous transfer of containers. These guides may be retractable in order to conform with 3.1.3a) and/or 3.2.4.

4.2 Chassis to loader system

4.2.1 Alignment

The loader system shall include, if required, provision for such vertical and horizontal alignment of the bed to ensure smooth continuous transfer of ULDs between the vehicles.

The loader system shall provide any necessary accommodation to the chassis to negate any suspension, tyre or structural deflections of the chassis which might be detrimental to the exchange of ULDs between these two units.

4.2.2 Spacing

The distance between the outermost support of the transporter and the outermost support of the loader shall be consistent with ISO 4116. In order to help guard against equipment docking damage, the spacing shall be at the maximum allowable distance between these support elements.

In order to control the spacing at this interface and to prevent equipment damage, an accessory stop assembly on the loader should be used.

4.2.3 Docking positions

The minimum possible ULD transfer attitudes should be:

- between either side of type A or B loaders and either side of type 1 or 2, class B chassis;
- between the aft end of type A or B loaders and the aft end of type 1 or 2, class A chassis;
- between either side or the aft end of type A or B loaders and the aft end of type 3, class A chassis. (See figure 5 and the table.)

Other options may be possible.

The chassis design shall provide the necessary clearance to allow "pick up" or "deposit" of containers onto the chassis with a lifting device.

4.2.4 Height

The recommended loader transfer elevations for interfacing with transporter equipment should be 1,372 m (54 in) with an acceptable range of 1,219 to 1,575 m (48 to 62 in). In specific instances, compatibility with 508 mm (20 in) high systems may be necessary (see figure 2).

4.3 ULD to loader system

4.3.1 Transfer

The loader system shall provide all the necessary power and mechanism to transfer ULDs between the chassis and aircraft.

4.3.2 Contact surfaces

All contact surfaces, such as guide rails, restraints and drive mechanisms, shall be compatible with each container or ULD

type specified in 3.1. Minimum clearance between the conveying surface and fixed parts of the loader shall conform with ISO 4116.

4.3.2.1 Contact surfaces intended for smaller ULDs, and which interfere with transit of larger ULDs, shall retract with a minimum of force and present minimum resistance to continued transit.

4.3.2.2 There shall be no parts of the loader which can damage the ULDs.

4.3.3 Guides

The loader system shall incorporate suitable guides to ensure smooth, continuous transfer of ULDs.

4.3.4 Speed

The loader shall be capable of transferring ULDs in any powered direction at a rate of 0,3 m/s (60 ft/min).

4.4 Loader system to aircraft

4.4.1 Alignment

The upper and lower limits of the lift system shall be such as to provide always a smooth, continuous transfer of ULDs, even during extreme airplane attitudes and poor ramp or climatic conditions (see figure 2). Positive indication shall be provided to determine whether the loader is properly aligned at the aircraft interface.

4.4.1.1 Preferred system maximum height shall be 5,715 m (225 in) with infinitely variable interface positioning.

4.4.1.2 Roll attitude adjustment range shall be $\pm 3^\circ$.

4.4.1.3 Pitch attitude adjustment range shall be $\pm 3^\circ$.

4.4.1.4 It should not be a facility requirement to position and tether the nose of the aircraft during loading/unloading of unitized cargo.

4.4.2 ULD transfer

The loader shall provide for the alignment of the ULD with the aircraft loading system and power it onto the aircraft.

The loader design shall take multidirectional ULD movement across the interface into consideration and shall minimize resultant scuffing.

5 System performance

The total air cargo ULD ground handling and transport system shall be designed to meet minimum aircraft turnaround cycles consistent with those aircraft which it is intended to serve.

6 Reliability, maintainability, safety, materials and workmanship

System equipment shall meet the requirements of ISO 6966.

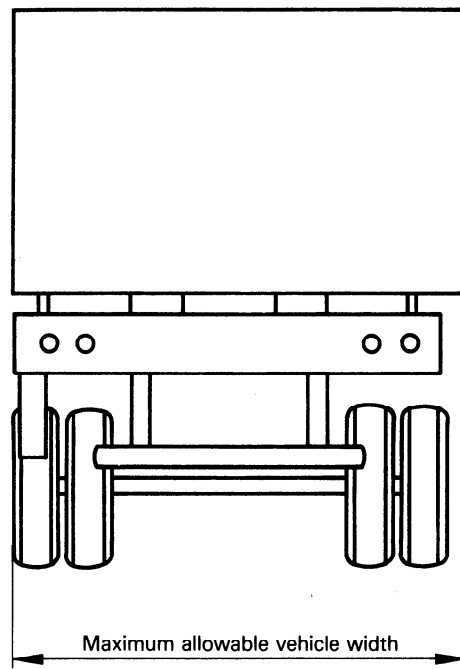
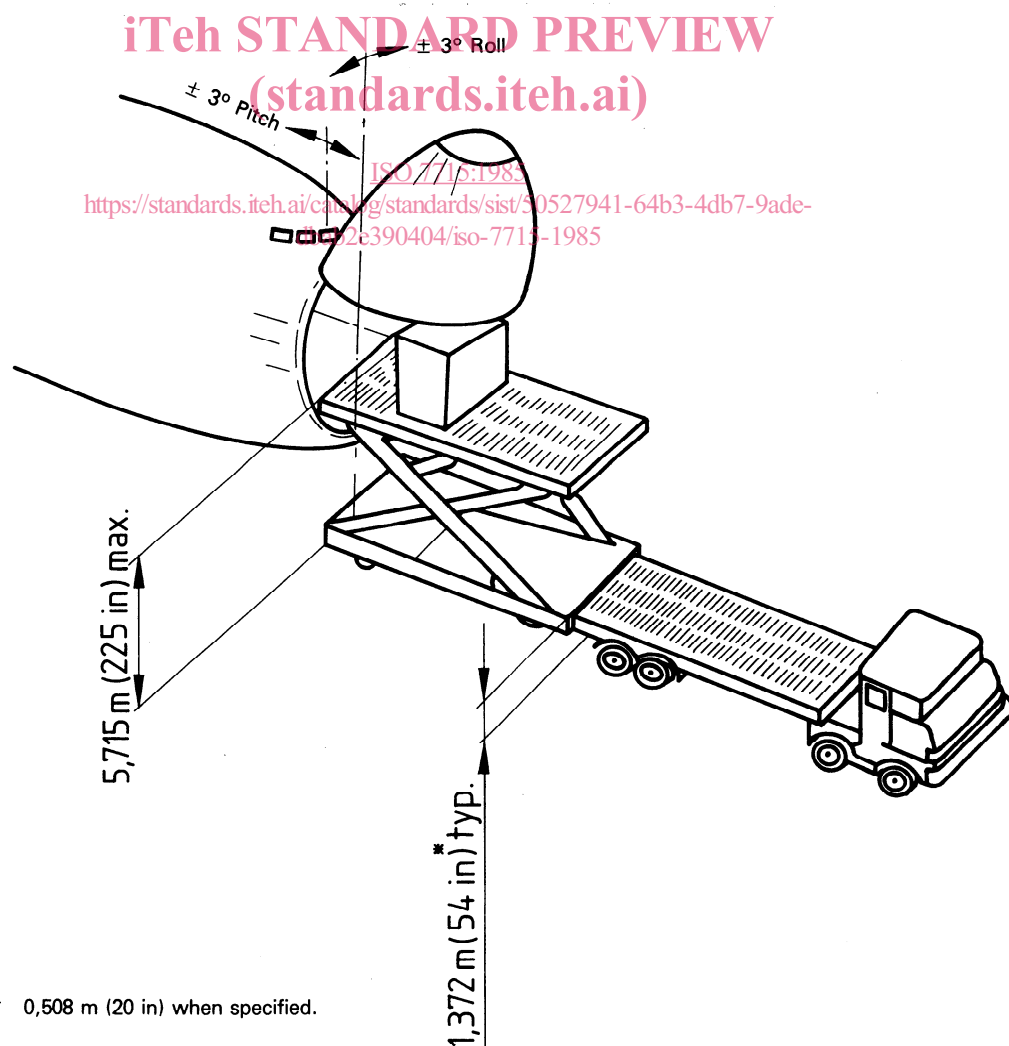


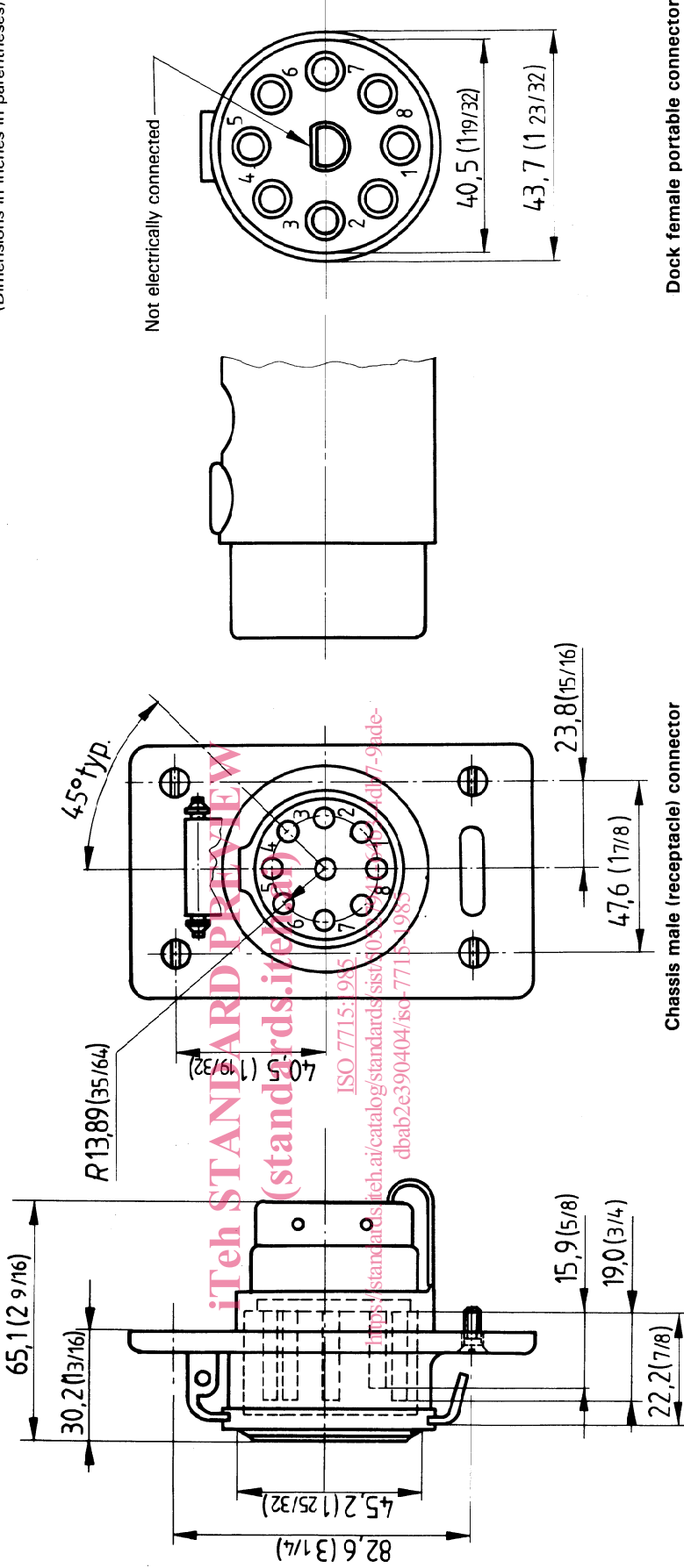
Figure 1 — Lateral positioning tolerance



* 0,508 m (20 in) when specified.

Figure 2 — Loader interfaces
(aircraft front door shown — side door similar)

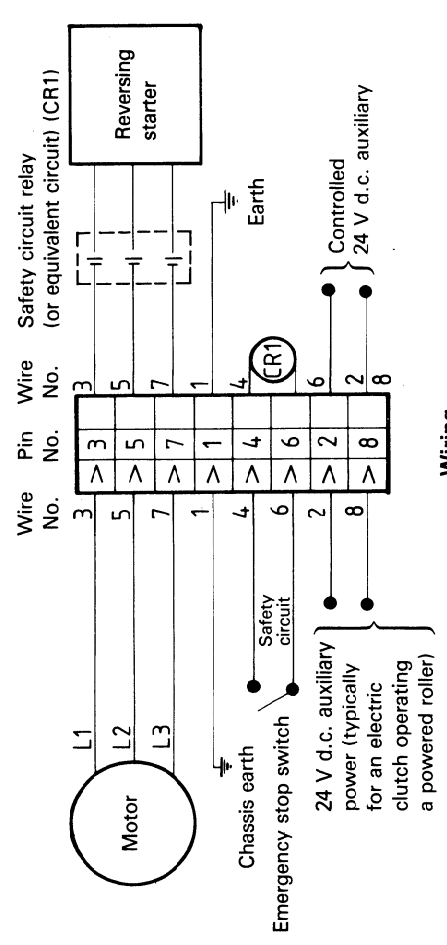
Dimensions in millimetres
(Dimensions in inches in parentheses)



Not electrically connected

Dock female portable connector

Chassis male (receptacle) connector



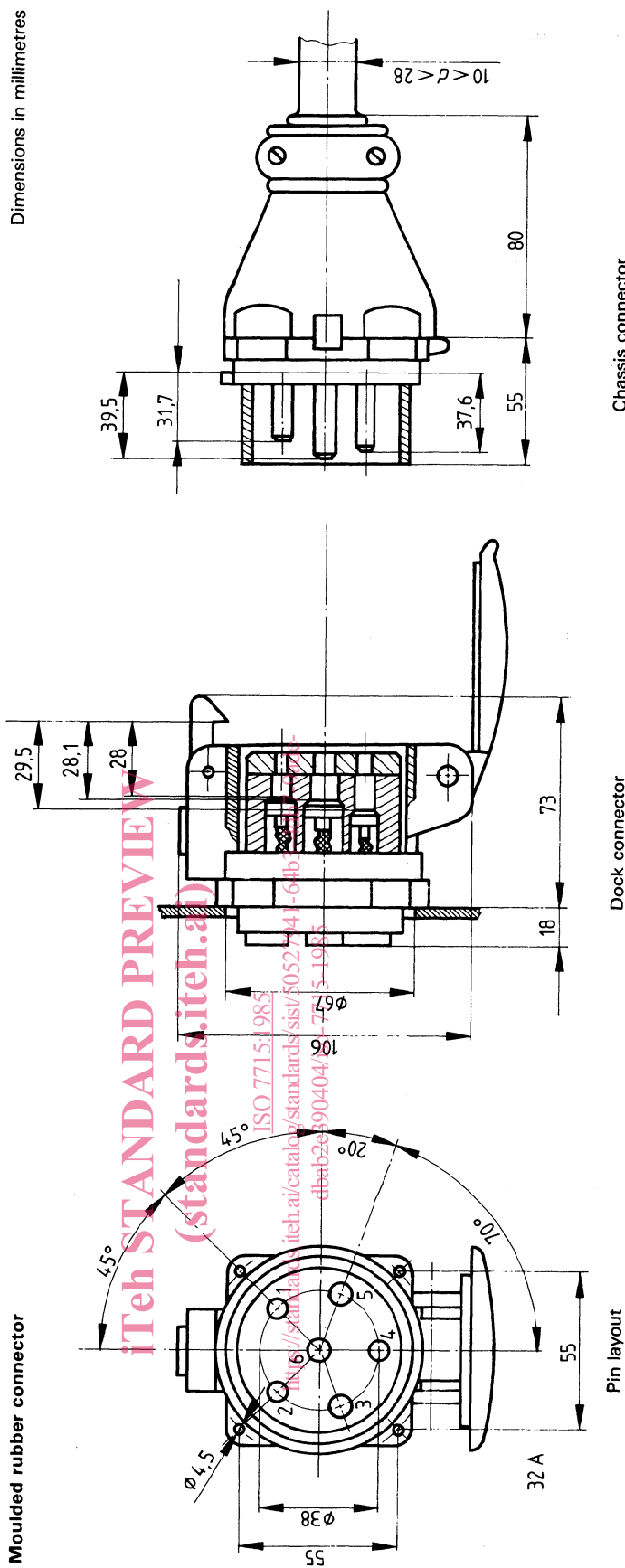
Wiring

NOTES

- 1 All pins have a 4,76 (3/16) diameter.
- 2 The connection between the No. 1 pin and the mounting (earth) may be removed.
- 3 Pins Nos. 2 and 8 are shortened by 3,2 (1/8).
- 4 The polarizing pin is not electrically connected.
- 5 The chassis connector is mounted inboard at the rear on the left side.
- 6 Mounting is standard for type FS and type FSD boxes.

Figure 3 — Standard connector and typical wiring to be used on the North American continent

Dimensions in millimetres



Chassis connector, mounted inboard, at the rear on the left side

Dock connector

Pin layout

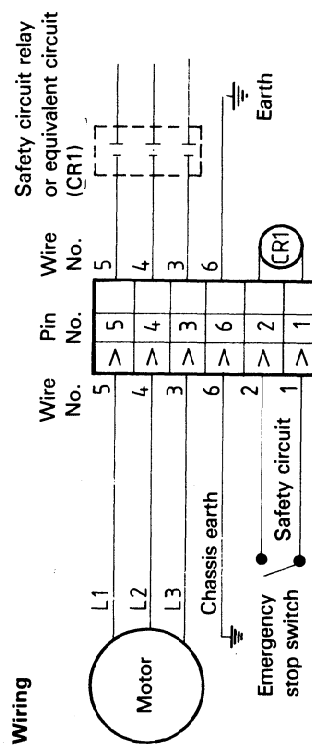


Figure 4 — Standard connector and typical wiring to be used on the European continent