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## Aircraft ground equipment — Design, test and maintenance for towbarless towing vehicles (TLTV) interfaced with nose-landing gear —

### Part 2: Regional aircraft

*Matériels au sol pour aéronefs — Conception, essais et entretien des tracteurs sans barre (TLTV) s'accouplant au train d'atterrissage avant —*

*Partie 2: Aéronefs régionaux*

ICS: 49.100

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 20683-2(E) was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 9, *Air cargo and ground equipment*.

This second/third/... edition cancels and replaces the first/second/... edition (ISO 20683-2:2004), [clause(s) / subclause(s) / table(s) / figure(s) / annex(es)] of which [has / have] been technically revised.

ISO 20683 consists of the following parts, under the general title *Aircraft ground equipment — Design, testing and maintenance requirements for nose gear towbarless towing vehicle (TLTV)*:

- *Part 1: Main line aircraft*
- *Part 2: Regional aircraft*

## Introduction

This International Standard, constituting Part 2 of International Standard ISO 20683, *Aircraft ground equipment — Nose gear towbarless towing vehicles (TLTV) — Design, testing and maintenance requirements*, specifies design, testing, maintenance and associated requirements to be applied on towbarless aircraft towing vehicles to be used on regional civil transport aircraft in order to ensure their operation cannot result in damage to aircraft nose landing gears, their steering systems, or associated aircraft structure.

Throughout this International Standard, the minimum essential criteria are identified by the use of the key word “shall”. Other recommended criteria are identified by the use of the key word “should” and, while not mandatory, are considered to be of primary importance in providing safe and serviceable towbarless tractors. Alternative solutions may be adopted only after careful consideration, extensive testing and thorough service evaluation have shown them to be equivalent.

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# Aircraft ground equipment — Design, testing and maintenance requirements for nose gear towbarless towing vehicle (TLTV) — Part 2(E): Regional aircraft

## 1 Scope

This International Standard is applicable to towbarless aircraft towing vehicles (TLTVs) interfacing with the nose landing gear of civil transport aircraft with a maximum ramp mass comprised between 10 000 kg and 50 000 kg (22 000 lb and 110 000 lb), commonly designated as "regional aircraft". The requirements for main line transport aircraft with a higher maximum ramp mass are specified in ISO 20683-1 (Part 1). It is not applicable to TLTVs which were manufactured before its date of publication.

It specifies general design requirements, testing and evaluation requirements, maintenance, calibration, documentation, records, tracing and accountability requirements in order to ensure that the loads induced by the tow vehicle will not exceed the design loads of the nose gear or its steering system, or reduce the certified safe life limit of the nose gear, or induce a stability problem during aircraft push back and / or maintenance towing operations.

This International Standard specifies requirements and procedures for towbarless tow vehicles (TLTVs) intended for aircraft push-back and gate relocation or maintenance towing only. It is not intended to allow for dispatch (operational) towing (see clause 3, Terms and definitions). Dispatch towing imposes greater loads on nose gears and aircraft structure due to the combination of speed and additional passenger, cargo, and fuel loads.

This International Standard does not apply to towbarless towing vehicles interfacing with aircraft main landing gear.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Federal Aviation Regulations (FAR) 14 CFR Part 25, *Airworthiness Standards: Transport category airplanes*, paragraphs 25.301, *Loads*, and 25.509, *Towing loads* <sup>1)</sup>.

Certification Specifications and Acceptable Means of Compliance for Large Aeroplanes CS-25, paragraphs 25.301, *Loads*, 25.509, *Towing loads*, 25.745(d), *Nose-wheel steering*, and AMC 25.745(d) <sup>2)</sup>.

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- 1) FAR Part 25 constitute the U.S.A. Government transport aircraft airworthiness Regulations, and can be obtained from: US Government Printing Office, Mail Stop SSOP, Washington DC 20402-9328, U.S.A.
  - 2) EASA CS25 constitute the European Governments transport aircraft airworthiness Regulations, and can be obtained from: [European Aviation Safety Agency: Ottoplatz 1, D-50679 Cologne, Germany - http://easa.europa.eu/official-publication/](http://easa.europa.eu/official-publication/).

ISO 6966-1, *Aircraft ground equipment — Basic requirements — Part 1: General requirements*.

ISO 6966-2, *Aircraft ground equipment — Basic requirements — Part 2: Safety requirements*.

NOTE TLTV designers should also take into account the requirements of documents referenced in Bibliography.

### 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

#### 3.1

##### **main line aircraft**

civil passenger and/or freight transport aircraft with a maximum ramp mass over 50 000 kg (110 000 lb)

#### 3.2

##### **regional aircraft**

civil passenger and/or freight transport aircraft with a maximum ramp mass between 10 000 kg (22 000 lb) and 50 000 kg (110 000 lb)

#### 3.3

##### **maximum ramp mass**

##### **MRW**

##### **Maximum Ramp Weight**

maximum mass allowable for an aircraft type when leaving its parking position either under its own power or towed, comprising maximum structural take-off mass (MTOW) and taxiing fuel allowance

#### 3.4

##### **push-back**

moving a fully loaded aircraft (up to maximum ramp mass (MRW)) from the parking position to the taxiway. Movement includes pick-up, push back with turn, a stop, a short push or tow to align aircraft and nose wheels, and release. Engines may or may not be operating. Aircraft movement is similar to a conventional push back operation with a tow bar. Typical speed does not exceed 10 km.h<sup>-1</sup> (6 mph)

#### 3.5

##### **maintenance towing**

movement of an aircraft for maintenance/remote parking purposes (e.g., from the parking position to a maintenance hangar). The aircraft is typically unloaded with minimal fuel load (reference light gross weight, LGW), with speeds up to 32 km.h<sup>-1</sup> (20 mph)

#### 3.6

##### **gate relocation towing**

movement of an aircraft from one parking position to an adjacent one or one in the same general area. The aircraft is typically unloaded with minimal fuel load (reference light gross weight, LGW), with speeds intermediate between push back and maintenance towing

#### 3.7

##### **dispatch towing**

##### **operational towing**

towing a revenue aircraft [loaded with passengers, fuel, and cargo up to maximum ramp mass (MRW)], from the terminal gate/remote parking area, to a location near the active runway, or conversely. The movement may cover several kilometers with speeds up to or over 32 km.h<sup>-1</sup> (20 mph), with several starts, stops and turns. Replaces typical taxiing operations prior to takeoff or after landing

NOTE In the definitions of the towing modes, the frequency of operation has not been included. This should not be interpreted to mean that no limitations are present. For limitations on the frequency of push-back and maintenance operations, refer to the appropriate airframe manufacturer's documentation or consult directly with the airframe manufacturer.



**3.8****towbarless towing vehicle****TLTV**

towing vehicle acting without tow bar on an aircraft's nose landing gear

**3.9****nose landing gear****NLG**

aircraft nose landing gear in a tricycle landing gear layout

**3.10****light gross weight****LGW**

reference aircraft mass for combined testing of the vehicle and aircraft, defined as the manufacturer's operating empty mass of the aircraft type concerned, plus fuel remaining in the tanks on landing (10 % to 20 % of total tanks capacity)

**3.11****heavy gross weight****HGW**

reference aircraft mass for combined testing of the vehicle and aircraft, defined as the manufacturer's operating empty mass of the aircraft concerned, plus at least 50 % of the maximum total fuel tanks capacity on the type, or its equivalent in mass (payload may be accounted if present, providing aircraft balance condition remains within limits)

**3.12****maximum limits**

limits (fore and aft tractive force, torsional, or angular) established by the airframe manufacturer as not-to-exceed values intended to preclude possible damage to nose landing gear or structure

NOTE Maximum limits are established by airframe manufacturer's documentation and may be different for towbarless or tow bar towing operations. All aircraft load limits are limit loads as defined in FAR/JAR paragraph 25.301 (a).

**3.13****operational limits**

limits (fore and aft tractive force, torsional, or angular) which are set at a lesser value than the maximum limits established by the airframe manufacturer

**3.14****aircraft family**

grouping of aircraft types or subtypes, defined by their manufacturer, for which the same maximum limits may be applied

NOTE A family usually encompasses all sub-types of a given type, but may also include other types. Testing for one (usually the lightest) model of the family results in towbarless towing approval for the whole family. See airframe manufacturers towbarless towing evaluation documentation.

**3.15****TLTV setting**

grouping of aircraft types or sub-types, defined by the TLTV manufacturer, for which a single operational limits setting is used

NOTE A single TLTV setting usually encompasses aircraft types or sub-types, which may be produced by different airframe manufacturers, in a same defined MRW range.

**3.16****drag load****towforce**

total force from the tow vehicle on the nose gear tires in the "X" axis

**3.17**

**"X" axis**

fore and aft axis of the tow vehicle, parallel to the ground

**3.18**

**oversteer**

exceedence of maximum torsional load or angular limits where potential damage to the nose landing gear structure or steering system could take place

NOTE These limits are defined in the appropriate airframe manufacturer's documentation. Torsional load limits typically occur after exceeding angular limits, but may occur before the angular limit is reached (e.g., nose gear hydraulic system bypass failure).

**3.19**

**snubbing**

sudden relief and reapplication of acceleration/deceleration loads while TLTV and aircraft are in motion

**3.20**

**jerking**

sudden application of push/pull forces from a complete stop

## **4 Design requirements**

### **4.1 General**

**4.1.1** Towbarless tow vehicles (TLTVs) shall comply with the applicable general requirements of ISO 6966-1 and safety requirements of ISO 6966-2.

**4.1.2** Airframe manufacturers should provide information for each aircraft type which allows TLTV manufacturers or airlines to self-test or evaluate the towbarless tow vehicles themselves. Refer to the airframe manufacturer's documentation for evaluation requirements and detailed testing procedures, that may be different from or additional to those contained in this International Standard.

**4.1.3** TLTV manufacturers should prepare and provide customers or regulatory agencies, as required, with a certificate of compliance or equivalent documentation, as evidence that successful testing and evaluation of a specific tow vehicle/aircraft type combination has been completed in accordance with this International Standard and/or the applicable airframe manufacturer's documentation. This certification shall allow use of the vehicle on specifically designated aircraft models/types. The certificate should be established under an appropriate quality control program meeting the requirements of ISO 9001 (see Bibliography) or equivalent pertinent industry standard.

**4.1.4** Towbarless towing vehicles shall, either by intrinsic design or through appropriate load limiting devices, ensure that the following maximum limits are not exceeded.

### **4.2 Towing loads**

**4.2.1** The push and pull towing forces induced by the TLTV onto the aircraft's nose landing gear as a result of either accelerating or braking shall be verified as per clauses 5 and/or 6 hereafter, and shall not at any time exceed the maximum values specified by the aircraft manufacturer.

**4.2.2** Depending on the range of aircraft types the TLTV is compatible with, preset towing load values may be used for a number of aircraft types or sub-types in a given MRW range. In this case, each TLTV setting shall comply with the maximum limits specified by the manufacturer(s) of the designated aircraft types, sub-types, or family(s) thereof as defined by the aircraft manufacturers, and each TLTV setting shall be subjected to a separate verification.