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Aircraft ground equipment — Design, testing and maintenance requirements for nose gear towbarless towing vehicle (TLTV) —

Part 2: Regional aircraft

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Matériels au sol pour aéronefs — Exigences de conception, essais et entretien pour tracteur sans barre de train avant (TLTV) —

Partie 2: Aéronefs régionaux

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

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The committee responsible for this document is ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 9, *Air cargo and ground equipment*.

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This second edition cancels and replaces the first edition of ISO 20683-2:2004, which has been technically revised.

A list of all parts in the ISO 20683 series can be found on the ISO website.

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Introduction

This document 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 will not result in damage to aircraft nose landing gears, their steering systems or associated aircraft structure.

Throughout this document, the minimum essential criteria are identified by the use of the keyword "shall." Other recommended criteria are identified by the use of the keyword "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:
Regional aircraft

1 Scope

This document 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 and 50 000 kg (22 000 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. 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.

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This document specifies requirements and procedures for towbarless tow vehicles (TLTVs) intended for aircraft pushback and gate relocation or maintenance towing only. It is not intended to allow for dispatch (operational) towing (see Clause 3). 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 document does not apply to towbarless towing vehicles interfacing with aircraft main landing gear.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

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

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

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

Federal Aviation Regulations (FAR) 14 CFR Part 25, *Airworthiness Standards: Transport category airplanes, paragraphs 25.301, Loads, and 25.509, Towing loads*[1)]

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)[2)]

1) FAR Part 25 constitutes 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/.

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3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

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
maximum ramp weight
MRW
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

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3.4
pushback
moving a fully loaded aircraft [up to maximum ramp mass (MRW)] from the parking position to the taxiway

Note 1 to entry: Movement includes pick-up, pushback 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 pushback operation with a tow bar. Typical speed does not exceed 10 km.h-1 (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)

Note 1 to entry: The aircraft is typically unloaded with minimal fuel load (reference light gross weight, LGW), with speeds up to 32 km.h-1 (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

Note 1 to entry: The aircraft is typically unloaded with minimal fuel load [reference light gross weight (LGW)], with speeds intermediate between pushback 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, possibly covering several kilometres with speeds up to or over 32 km.h-1 (20 mph), with several starts, stops and turns

Note 1 to entry: Replaces typical taxiing operations prior to take-off or after landing.

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Note 2 to entry: 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 pushback 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)

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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

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Note 1 to entry: 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/EASA CS 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 1 to entry: 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 1 to entry: 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.

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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 1 to entry: 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

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4 Design requirements

4.1 General

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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 document.

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 document and/or the applicable airframe manufacturer’s documentation. This certificate shall allow the use of the vehicle on specifically designated aircraft model types. The certificate should be established under an appropriate quality control program meeting the requirements of ISO 9001 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.

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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.

4.3 Pick-up and holding system

4.3.1 The TLTV's nose landing gear pick-up/release device should operate in a smooth and continuous manner. Abrupt or oscillating loads during the pick-up/release sequence should not occur. It should be designed to minimize the loads during the pick-up/release sequence. The drag loads induced during pick-up/release should fall well below the "peak" loads experienced during a typical operation.

4.3.2 The maximum loads induced by pick-up and release sequences shall be measured either on an aircraft or on a fixture representative of the nose gear geometry. The vertical load on the nose gear or fixture shall be equal to the vertical load used for fatigue justification (refer to the appropriate airframe manufacturer's documentation). The maximum lift (height above the ground) of the nose gear shall not exceed the values given in the airframe manufacturer's documentation if such values are provided.

4.4 Oversteering protection

4.4.1 The maximum angular or torsional load limits stated by the aircraft's manufacturer in the event of oversteering shall not at any time be exceeded. See aircraft manufacturer's TLTV assessment criteria document.

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4.4.2 This may be achieved either by oversteer protection built into the TLTV, or by an oversteer alerting system being provided.

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4.4.3 Oversteer protection may be achieved either by intrinsic design precluding the possibility of either limit being reached or exceeded, or by a fail-safe oversteer protection system ensuring they shall not be exceeded. Oversteer alerting shall consist in an appropriate fail-safe warning system installed on the TLTV, providing the driver with unmistakable indication that one of the maximum limits was reached.

EASA CS requirements:

For aircraft registered or operated under EASA CS-25 paragraph 25.745(d) and associated AMC 25.745(d), requires the TLTV manufacturers to provide a Declaration of Compliance (4.1.3) of their unit's oversteer protection or oversteer alerting system(s) with the present International Standard and the criteria published by the manufacturer of each aircraft type for which it is intended, and the aircraft manufacturers to list in their appropriate documentation the TLTV models that were specifically accepted for each aircraft type based on this Declaration of Compliance.

4.4.4 No testing of the TLTV oversteer protection or alerting systems shall be performed on an in-service aircraft, in order to preclude any possible damage to the NLG structure or steering system. Such testing should be accomplished with a suitable ground testing device representative of the specific aircraft model for which the TLTV is intended, or through appropriate numeric simulation demonstration.

4.5 Testing operations

4.5.1 Snubbing and jerking

Snubbing and jerking effects or movements should be avoided during testing.

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