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

Part 2: Regional aircraft

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

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.

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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.

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

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.

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.

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.

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/.

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

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.

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)

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 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.

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

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 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.

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.

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

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.

4.5.2 Vibrations

If severe or abnormal vibrations occur, testing should be discontinued and the cause determined.

4.5.3 Aircraft braking

The aircraft brakes should not be used while the aircraft is being towed by a TLTV, except in an emergency situation. Aircraft braking, while the aircraft is under tow, may result in loads exceeding the aircraft's design loads and may result in structural damage and/or nose gear collapse. For these reasons, it is recommended that airlines take appropriate steps to preclude aircraft braking during normal towbarless towing. The carrier's or airframe manufacturer's maintenance manual and operational procedures shall be complied with.

4.5.4 Stability

4.5.4.1 Attention shall be paid to aircraft stability. Stability may be affected by aircraft type, mass, centre of gravity location, weather condition, runway roughness, and slope. Stability shall be demonstrated by tests in accordance with the airframe manufacturer documentation.

4.5.4.2 The testing shall be conducted under maximum speed capability of the vehicle.

4.5.4.3 If a lateral instability is detected, a margin of 5 km/h (3 mph) shall be maintained between the speed at the beginning of instability and the maximum towing speed.

4.5.4.4 With minimal static load on the nose landing gear sufficient to move the airplane, no pitch oscillation of the aircraft shall occur, such that it would extend the shock absorber beyond the allowable strut extension in the ground mode.

4.5.4.5 Proper operational procedures shall be defined and followed to ensure vehicle and airplane stability.

4.6 Vehicle classification

The TLTV model shall be classified according to its intended use, and tested or evaluated accordingly, as either

a) category I: pushback only, or

b) category II: maintenance towing only, or

c) category III: both pushback and maintenance.

4.7 Placarding

Limitations and warnings imposed by all conditions shall be placarded in a location readily visible to the tow vehicle driver, including but not necessarily limited to

a) classification category defined in 4.6,

b) types of aircraft the TLTV is qualified for (by TLTV setting if applicable),

c) maximum allowable speed, and

d) maximum allowable towing angle, etc.

5 Testing requirements

5.1 General

5.1.1 The following tests shall be performed to provide verification that the loads induced by the TLTV do not exceed the allowable maximum limits, and the operation of the unit in an operational pushback environment does not result in events potentially jeopardizing aircraft safety.

5.1.2 Dynamic numeric simulation may be used instead of part of the specified tests, unless prohibited by airframe manufacturer's documentation, and provided it guarantees at least equivalent results reliability (see Clause 6 hereafter). See 4.4.4 for testing of oversteering protection features.

5.2 Static load tests

5.2.1 Static tests shall be performed as follows to verify inadvertent application of TLTV power while the aircraft is braked or chocked will not result in exceeding the NLG maximum loads.

5.2.2 In order to preclude any possible damage to the NLG structure, such testing may be accomplished with a suitable ground testing device representative of the specific aircraft model(s) for which the TLTV is intended.

5.2.3 While recording the force exerted by the TLTV onto the device, each test shall consist in the following sequence:

a) ensuring the device representative of the aircraft is fully braked;

b) progressively applying full power of the TLTV, either push or pull;

c) maintaining maximum power for 5 s;

5.2.4 Two tests shall be performed in each direction. On completion of the tests, the load recordings shall be printed and examined: the maximum towing loads for the aircraft type as per 4.1 shall not be exceeded at any point of the tests.

5.3 Dynamic load tests

5.3.1 Tests shall be performed as follows to verify the maximum push and pull towing forces induced by the TLTV onto the aircraft's nose landing gear as a result of either accelerating or braking.

5.3.2 In order to avoid the difficulties and costs of using an instrumented aircraft, the towing vehicle shall be instrumented to record the towing loads. Installation of strain gauges or equivalent load measuring sensors shall be at the locations most appropriate for accurate and unbiased readings, specified by the TLTV manufacturer. Data should be recorded analogically or, if numerically, at a minimum sampling rate of 50 Hz (50 times per second).

5.3.3 Prior to performing the aircraft test, the strain gauges or equivalent measuring sensors on the TLTV shall be calibrated to known tow load inputs, using a calibration method specified by the TLTV manufacturer, in order to obtain measurements linearity and repeatability. A calibration report should be established.

5.3.4 Using the TLTV and the aircraft type concerned, each test shall consist in the following sequence:

a) aircraft NLG pick-up;

b) for pushback: using maximum available power of the TLTV to accelerate from a dead stop until reaching maximum speed, or approximately 8 km/h (5 mph), or the maximum speed specified by the airframe manufacturer, whichever is less;

c) for maintenance towing: using maximum available power of the TLTV to accelerate from a dead stop until reaching maximum speed, or the maximum speed specified by the airframe manufacturer, whichever is less;

d) maintaining the above speed stabilized for a straight line distance not less than 30 m (100 ft);

e) applying TLTV maximum available braking until the aircraft comes to a complete stop;

f) aircraft NLG release.

Snubbing and jerking are to be avoided during braking and acceleration. Aircraft brakes shall not be used throughout the test. The push and pull loads on the NLG shall be recorded throughout the sequence, and the weight and CG condition of the aircraft at each test noted for reference.

5.3.5 Tests shall be successively performed in the push and pull directions. The minimum number of tests to be performed should be 3 in each direction, to be performed by at least 2 different drivers.

5.3.6 On completion of the tests, the load recordings shall be printed and examined: the maximum towing loads for the aircraft type as per 4.1 shall not be exceeded at any point of the tests. Test reports shall record the aircraft's weight and CG condition.

5.4 Operational tests

5.4.1 Operational pushback tests shall be performed in order to verify operation of the TLTV in an operational pushback environment does not result in events potentially jeopardizing aircraft safety.

5.4.2 These tests may be accomplished on in-service scheduled flights, or as dedicated trials consisting of NLG pick-up, an aft push, with turn, a short tow forward to align the nose gear parallel to the taxiway, and NLG release.

5.4.3 Pushback tests shall be performed taking into account the possibilities of aircraft engines being idle or turned off. The minimum number of tests to be performed should be 5 in each condition, by at least 3 different drivers — each of them accomplishing tests in both engine conditions if applicable. Tests with idle engines may also be replaced by adding their known idle thrust to the towing loads recorded during the tests without engines. In this case, a total of only 5 pushbacks is necessary.

Test reports shall be established and record any observations as well as the recorded towing loads. Test reports shall record the aircraft's weight and CG condition.

5.4.4 Operational maintenance towing tests shall include verification of aircraft lateral and vertical (NLG strut extension) stability throughout the tests.

5.4.5 Throughout the duration of these tests, there shall be no evidence of abnormal behaviour of the aircraft or the TLTV, or risk of interference between them, or potential hazard to the aircraft's or its steering system's structural integrity. The maximum towing loads for the aircraft type as per 4.1 shall not be exceeded at any point of the tests.

5.5 Aircraft braking

The aircraft brakes shall not be used while the aircraft is being towed by a TLTV, except in an emergency.

Aircraft braking while the aircraft is under tow may result in loads exceeding the aircraft's design loads and may result in structural damage and/or NLG collapse. For these reasons, it is recommended

that airlines take appropriate operational steps to preclude aircraft braking during normal towbarless towing. The airline's or airframe manufacturer's maintenance manual and operational procedures shall be followed.

6 Computer modelling

6.1 General

6.1.1 Dynamic numeric simulation (computer modelling) through an appropriate computer model including the relevant parameters of both the tractor and aircraft may be used instead of the tests specified in Clause 5, under the following requirements.

6.1.2 The computer model shall be based on stated and recognized mechanical engineering methods and equations, be validated in accordance with 6.2 hereafter, and be approved for this purpose by the manufacturer(s) of the aircraft type(s)/sub-type(s) the TLTV is to be approved for.

6.1.3 It shall integrate all dynamic effects, including transient ones.

6.1.4 It shall provide continuous data or, if non-continuous, a sampling rate at least twice the minimum rate stated in 5.3.2 for tests recording purposes.

6.1.5 It shall provide at least equivalent overall results dependability.

6.1.6 Computer modelling results shall be printed, handled and filed in the same manner as the specified testing records.

6.2 Validation

6.2.1 Each computer model or variant thereof (except variation limited to parameters) should be validated by comparing its results with at least the following tests:

a) one static load test as per 5.2;

b) one dynamic load test as per 5.3.

6.2.2 Where the tests are used to validate a numeric analysis computer model, they need not necessarily be performed for the worst case. If validated, the analysis shall then be used to assess the critical loads induced on the NLG.

6.2.3 Validation testing required by 6.2.1 should be performed for each TLTV maximum towing force setting, as defined in 4.2.2, by either of

a) actual testing per 6.2.1 above on at least one aircraft type,

b) previous actual testing evidence demonstrating correlations,

c) appropriate testing on a suitable ground device, or

d) combination thereof, as mutually agreed by the TLTV manufacturer and the manufacturer(s) of the aircraft type(s) to be towed.

7 Maintenance

7.1 General

7.1.1 The present clause covers the special requirements and procedures for inspection, maintenance and calibration of towbarless tow vehicles (TLTV) tractive force and steering protection systems or alerting devices, where necessary to ensure protection of the aircraft.

7.1.2 The TLTV aircraft NLG tractive force and steering protection systems or alerting devices which, in the event of failure or malfunction, would as a consequence of failure not preclude potential damage to the aircraft's nose landing gear and its steering system shall be inspected, maintained, tested and calibrated to the TLTV manufacturer's requirements for its classification on all the designated aircraft types which the TLTV is designed to handle.

7.1.3 Inspection, maintenance and calibration schedules, any special tools and training requirements for the TLTV's protection systems or alerting devices shall be available.

7.1.4 The TLTV's aircraft NLG protection systems or alerting devices shall be inspected, maintained and calibrated in accordance with the requirements of this document and the TLTV manufacturer's maintenance manuals and schedules.

7.1.5 The organization responsible for the maintenance of the TLTV shall keep documented records of each TLTV's aircraft NLG protection systems or alerting devices inspection, maintenance and calibration in maintained files to be made available for review and audit by the aircraft airworthiness regulatory authorities when requested.

7.1.6 Records should be kept for a minimum period of 2 years or in accordance with the requirements of the controlling aircraft airworthiness regulatory authority.

7.2 Maintenance manual

The TLTV manufacturer's maintenance manual shall incorporate a separate section covering the inspection, maintenance and calibration of the TLTV aircraft NLG steering and tractive force protection systems or alerting devices. The maintenance manual shall:

— Detail the scope of the aircraft NLG steering and tractive force protection systems or alerting devices.

— List applicable reference documents.

— List applicable equipment required to perform the inspection, calibration and maintenance tasks.

— Include trouble shooting sections.

— List inspection, maintenance and calibration intervals.

— List all items to be checked/calibrated.

— Detail against each task full instructions on how the task/calibration should be carried out.

7.3 Requirements

7.3.1 The TLTV manufacturer shall publish inspection, calibration and maintenance checklists for each model of TLTV.

7.3.2 Each checklist shall

a) detail the scope of the checklist,

b) list applicable reference documents,

c) list applicable equipment required to perform the inspection, calibration and maintenance tasks,

d) list inspection, maintenance and calibration intervals in hours run and/or calendar interval,

e) list all items to be checked/calibrated on the TLTV aircraft NLG steering and tractive force protection systems or alerting devices,

f) provide for the TLTV serial/chassis/fleet number to be recorded,

g) provide for a task reference number to be recorded;

h) provide for details of defects and actions required to be recorded,

i) provide for each checkable item/task to be signed off and dated when complete by the qualified and authorized person completing the task, and

j) provide for the completed checklist to be signed off by the qualified and authorized person completing the tasks and countersigned and dated by an authorized person when all tasks and actions have been completed.

7.4 Calibration

7.4.1 Inspection, maintenance and calibration of the TLTV's aircraft's NLG steering and tractive force protection systems or alerting devices shall be carried out in strict accordance with the TLTV manufacturer's checklist and maintenance instructions as contained in the maintenance manual.

7.4.2 The TLTV's aircraft NLG steering and tractive force protection systems or alerting devices shall be calibrated at service intervals specified in the TLTV manufacturer's maintenance manual, which may be increased if two parallel and independent systems, with a permanent built-in cross-check resulting in an alarm in the event of a discrepancy are included.

7.4.3 Each calibration shall be carried out in accordance with the TLTV manufacturer's inspection/maintenance/calibration checklist, using the tools and equipment listed in the TLTV manufacturer's maintenance manual or suitable equivalents.

7.4.4 Any tools used in the inspection maintenance and calibration tasks shall themselves be calibrated against known standards where applicable.

7.4.5 The qualified and authorized person performing the inspection, maintenance and calibration tasks shall sign off and date each task as it is completed on the maintenance checklist.

7.4.6 The checklist shall be signed off by the qualified and authorized person performing the inspection, maintenance and calibration tasks and countersigned and dated by an authorized person when all tasks and resulting actions have been completed.

7.5 Special tools

7.5.1 The TLTV manufacturer shall list in its maintenance manuals and checklists any special tools that are required to perform the inspection, maintenance and calibration requirements.

7.5.2 Where appropriate, instructions regarding the calibration of the special tools shall be provided. The re-calibration of any special tools shall be performed and recorded at specified intervals.