International Standard 6702

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Aircraft — Requirements for on board weight and balance control systems

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Foreword

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Aircraft — Requirements for on board weight and balance control systems

1 Scope and field of application

This International Standard establishes requirements for the function, characteristics and installation of an On Board Weight and Balance Control System for use on civil transport aircraft. This International Standard is not intended to specify design methods, mechanisms or material to fulfil the requirements specified.

The basic On Board Weight and Balance Control System (OBWBCS) shall provide a direct, accurate measurement and display of the actual aircraft weight and centre of gravity under ground static conditions. Optional functions, such as those given in clause 5, may be included. The system shall function independently of any system external to the aircraft, with the exception of ground electrical power when aircraft power is not available.

2 References

Specification 404A, *Air Transport Equipment Cases and Racking*, Aeronautical Radio Inc. (U.S.), 1974.[1)]

ISO 7137, *Aircraft — Environmental conditions and test procedures for airborne equipment.*

3 Weight and balance control

The purpose of the OBWBCS shall be to serve as a primary means of weight and balance determination and to meet administrative authority regulations pertaining to weight and balance control of the aircraft at dispatch.

4 Requirements

The system shall determine actual aircraft weight and centre of gravity as follows.

4.1 Range of operation

4.1.1 Weights

The system shall determine and display the aircraft weight throughout a range from 10 % less than the aircraft empty weight to 10 % greater than the maximum taxi gross weight.

4.1.2 Centre of gravity

The system shall determine and display the aircraft centre of gravity throughout a system range determined as follows :

Determine the aircraft maximum centre of gravity range, expressed as a percentage of a reference chord, such as Mean Aerodynamic Chord (MAC) or equivalent, by subtracting the most forward limit from the most aft limit. Extend the most forward aircraft limit forward by an amount equal to 50 % of the aircraft range, but not exceeding the forward point equivalent to zero MAC. Extend the most aft aircraft limit aft by an amount equal to 50 % of the aircraft range, or to the static aft tipping point, whichever is further aft.

4.1.2.1 Lateral centre of gravity

Where required for a specific aircraft usage, the system shall be capable of determining the lateral centre of gravity of the aircraft throughout a symmetrical envelope 10 % greater than the aircraft certified lateral centre of gravity limits.

4.2 Mode of operation

The system shall determine the aircraft weight and centre of gravity in the ground static mode and shall compensate for the following factors.

4.2.1 Automatic compensation

4.2.1.1 Any combination of ramp slopes up to 3 %, aircraft pitch and/or roll attitude changes up to 3° in excess of the established range of aircraft ground attitude excursion.

4.2.1.2 Aircraft brakes locked or released.

4.2.1.3 Landing gear steering set for zero to minimum turning radius.

4.2.1.4 Aircraft brakes at ambient or at maximum temperature permitted for dispatch.

1) Or similar, until such time as an International Standard is made available.

4.2.1.5 Plus or minus 50 % variations of normal landing gear oleostrut pressure for any permissible degree of strut extension.

4.2.2 Compensation by correction chart or other means

4.2.2.1 74 km/h (40 kt) wind through an azimuth of 360°.

4.2.2.2 Any combination of operating engines from zero to ground idle thrust, over the aircraft approved range of airport elevation.

4.3 Accuracy

The system shall be capable of determining and displaying aircraft weight and centre of gravity within ± 0,5 % of the actual aircraft weight and ± 0,5 % of the Mean Aerodynamic Chord. Lateral centre of gravity, if required, shall be determined and displayed within 1,0 % of the lateral centre of gravity range.

4.4 Response time

The system shall respond to a command to display the weight and centre of gravity within one minute, including warm-up time.

4.5 System components

The system shall consist of the minimum components required to perform the functions defined in this International Standard. A typical system may consist of four subsystems, plus connecting lines or cabling : the display unit, the computer unit, the calibration unit and the sensors. No external equipment, ramps, stabilizer or temporary aircraft-to-ground supports shall be required.

4.5.1 Component description

4.5.1.1 Display unit

The unit shall provide a digital readout of the aircraft weight in 50 kg increments and the aircraft centre of gravity in increments of 0,10 % of the reference chord (MAC or equivalent), in illuminated digits of 6,4 mm minimum size. The readout shall be visible in conditions ranging from full sunlight to total darkness. Display unit lighting intensity shall be controlled by normal cockpit instrument lighting controls. The display unit shall contain all controls necessary to operate and self-test the system. If controls are required for in-flight adjustment, they shall be located on the display unit. The display unit shall provide separate indication, when preset weight and centre of gravity limits are exceeded, or the system is operating in degraded mode, if that option (see 5.13) is exercised.

4.5.1.2 Computer unit

The computer unit shall perform the operations required by the system functions. The unit may have provisions for signal outputs to additional remote display units and signal outputs when preset weight and centre of gravity limits are exceeded. The computer shall provide the controls or provisions for malfunction troubleshooting.

4.5.1.3 Sensors

The sensor shall detect changes in aircraft weight and attitude and transmit them to the computer unit. Number, mounting and location of sensors shall be determined by the specific aircraft design. Devices to overcome landing gear system friction, if required, and attitude sensors shall be considered a part of the sensor subsystem.

4.5.1.4 Calibration unit

The calibration unit shall contain the controls necessary to adjust the system to read within the specified accuracy limits on a particular aircraft. These controls shall be protected from unauthorized or inadvertent use.

4.5.2 Component dimensions and interface

Component dimensions shall be a minimum, consistent with function, maintenance and reliability requirements.

The display unit shall be compatible with front-mounted installation requirements for a specific aircraft. The computer unit shall be compatible with ARINC Specification 404A electronic rack interface requirements. Sensor units shall be compatible with landing gear or structure attachment requirements for a specific aircraft and shall take into account the environmental maintenance and reliability requirements of this International Standard.

4.5.3 Power requirements

4.5.3.1 Power supply

The system shall operate from aircraft electrical power, 115 V a.c. 400 Hz; 28 V d.c. or 5 V a.c. for lighting purposes. The system shall also operate when the aircraft is powered from a ground power source, and shall continue to operate after normal system transients or power interruptions (for example, changeover from ground power to aircraft power).

4.5.3.2 Power consumption

The system shall consume no more than 500 W peak power. The power factor shall not be less than 0,86.

4.5.4 Mass

The system mass shall be minimized, consistent with function, maintenance and reliability requirements. The design objective of the system mass, excluding connecting lines or cables, shall not exceed 22 kg.

4.6 Compatibility

There shall be no structural, electrical, functioning or servicing interference between the OBWBCS and any other aircraft system or component, whether the OBWBCS is operating, not operating or has experienced any failure mode to be expected in service. The system design shall provide protective devices