



# Federal Aviation Administration

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## Memorandum

Date: November 1, 2012

To: Manager, Small Airplane Directorate, ACE-100

From: Manager, Project Support Branch, ACE-112

Prepared by: Mark S. Orr, Programs & Procedures Branch, ACE-114

Subject: Equivalent Level of Safety Finding, AVIA Ltd., Accord-201, to the provisions of 14 CFR, part 23, § 23.1549, Powerplant and Auxiliary Power Unit Instruments

ELOS Memo#: ACE-13-01

Regulatory Ref: 14 CFR, part 23, § 23.1549(a) (b) (c), and (d), Amendment 23-45, effective 09/07/93

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This memorandum requests your review and concurrence with the proposed finding of equivalent level of safety (ELOS) for the Horizon Instruments, Inc., Model P-1000 tachometer for each engine as used on the AVIA Ltd., Accord-201 airplane. This tachometer provides digital RPM indication and colored lights to indicate operating limits and ranges in lieu of colored radials, arcs, or lines as required by 14 CFR, part 23, § 23.1549, Amendment 23-45, effective 09/07/93.

### **Background:**

Airplane Certification Basis –

The AVIA Ltd., Accord-201 airplane is being validated through the Bilateral Aviation Safety Agreement (BASA) Implementation Procedures (IP) for *Design Approval, Production Activities, Export Airworthiness Approval, Post Design Approval Activities, and Technical Assistance* / between the United States and the Russian Federation. The Interstate Aviation Committee Aircraft Register (IAC/AR) is certifying authority.

The Federal Aviation Administration type certification basis for this airplane is 14 CFR, part 23, effective February 1, 1965, including Amendments 23-1 through Amendment 23-61 and 14 CFR, part 36, effective December 1, 1969, including Amendments 36-1 through Amendment 36-28.

## Airplane Description –

The AVIA Accord-201 airplane is an all-metal high-wing airplane with a twin-finned tail and has fixed tricycle landing gear. It holds six people, including the aircrew and has a maximum take-off weight of 2,200 kg. The airplane has two IO-360 ES7 air cooled piston engines by Teledyne Continental Motors, Inc. (USA) with Hartzell three-blade propellers PHC-H3YF-2EUF/FC7453(A). The aircraft is being certificated as day Visual Flight Rules (VFR).

## Airplane Engine Tachometer Installation Description –

The AVIA Ltd., Accord-201 aircraft cockpit panel instrument suite includes a Horizon Instruments, Inc. Model P-1000 tachometer (see Figure 1) for each engine in compliance with 14 CFR, part 23, § 23.1305. This instrument displays the engine RPM in digital format with green, yellow, and red indicator lights on the upper right used to indicate when the engine is approaching or exceeding RPM limits. The Model P-1000 is approved, manufactured, and qualified to TSO-C49b.



Figure 1: Digital Engine Tachometer Model P-1000 Features

As written, 14 CFR, part 23, § 23.1549(a) (b) (c) and (d), Amendment 23-45, requires all operating limits, normal operating ranges, and precautionary ranges to be marked using radials, arcs, or lines. The use of indicator lights as on the P-1000 tachometer installed on the Accord-201 aircraft does not literally comply with this rule. AVIA Ltd. has requested an ELOS finding based on the operation of the indicator lights detailed below that meets the intent of the required colored radials, arcs, and line along with the digital RPM indication and the placard specifying the different operating ranges.

### **Applicable Regulation:**

14 CFR, part 23, § 23.1549, Amendment 23-45, effective 09/07/93

### **Regulations Requiring an ELOS Finding:**

Per 14 CFR, part 23, § 23.1549, Amendment 23-45, effective 09/07/93:

*Powerplant [and auxiliary power unit instruments.]*

*[For each required powerplant and auxiliary power unit instrument, as appropriate to the type of instruments--]*

*(a) Each maximum and, if applicable, minimum safe operating limit must be marked with a red radial or a red line;*

*(b) Each normal operating range must be marked with a green arc or green line, not extending beyond the maximum and minimum safe limits;*

*(c) Each takeoff and precautionary range must be marked with a yellow arc or a yellow line; and*

*[(d) Each engine, auxiliary power unit, or propeller range that is restricted because of excessive vibration stresses must be marked with red arcs or red lines.]*

### **Description of Compensating Design Features:**

It is the position of AVIA Ltd. that the implementation and operation of the P-1000 tachometer is the digital equivalent of the colored radials, arcs, or lines required by the applicable regulation as evidenced by the operational description of the indicator lights (see figure 2) provided below.



Figure 2: P-1000 Tachometer RPM Range Placard and Indicator Lights

As per 14 CFR, part 23, § 23.1549 (a)(b)(c) and (d), Operating Limitations:

***23.1549 (a), Each maximum and, if applicable, minimum safe operating limit must be marked with a red radial or a red line:***

In relation to the P-1000 Tachometer, the maximum, RED is the “Restricted Operating” range indicator, which illuminates when the Engine RPM goes beyond the limit value of 2800 RPM.

The RED light does not illuminate at any other time other than at the high end.

***23.1549 (b), Each normal operating range must be marked with a green arc or green line, not extending beyond the maximum and minimum safe limits:***

In relation to the P-1000 Tachometer, the normal, GREEN is the “Normal Operating” Range indicator, which illuminates when the Engine RPM is within its specified normal operating range. The normal operating range is from 1900 to 2499 RPM.

***23.1549 (c), Each takeoff and precautionary range must be marked with a yellow arc or a yellow line:***

In relation to the P-1000 Tachometer, the precautionary range, YELLOW is the “Warning, Cautionary or Transient” Range indicator, which illuminates when the Engine RPM is within its specified Cautionary or Transient Operating Range. The warning or intermediate range is between 600 to 1199 RPM.

As the engines operating time is not limited at less than 2800 RPM (as per the Maintenance and Operator’s Manual Form No. X30617), and not limited in the takeoff mode either, there is no precautionary range between the GREEN and RED ranges on the upper end of the RPM scale.

***23.1549 (d), Each engine, auxiliary power unit, or propeller range that is restricted because of excessive vibration stresses must be marked with red arcs or red lines:***

There are no RPM ranges that produce excessive vibration modes for the engines or propellers. There is no RED light illuminated during these RPM ranges. There are also no RPM ranges within the GREEN or YELLOW ranges; it has been shown in the process of type certification that no vibrations are observed in the operating RPM range; therefore, no restrictions were established.

After review of the data submitted by AVIA Ltd. on the operation of the P-1000 tachometer in the Accord-201 airplane, the FAA believes the use of the indicator lights and the RPM placard meet the intent of the colored radials, arcs, or lines specified in 14 CFR, part 23, § 23.1549(a) (b) (c) and (d).

The basis for this ELOS Memorandum comes from the FAA Issue Paper P-1, Stage 4, 14 CFR, part 23, § 23.1549, Powerplant and auxiliary power unit instruments – RPM limit indication ELOS, dated September 27, 2012. This issue paper documents the agreement between the FAA, the Russian Interstate Aviation Committee /Aircraft Register (IAC/AR), and AVIA Ltd.

**Federal Aviation Administration Approval:**

The Small Airplane Directorate concurs that the implementation and operation of the P-1000 tachometer is the digital equivalent to the requirement for radials, arcs, or lines in 14 CFR, part 23, § 23.1549(a) (b) (c) and (d), Amendment 23-45, effective 09/07/93. The FAA finds this provides an equivalent level of safety.

*Earl Lawrence*

*11-1-2012*

Manager, Small Airplane Directorate  
Aircraft Certification Service

Date

ELOS Originated by: Programs & Procedures Branch, ACE-114	Project Support Branch Manager: William J. Timberlake	Routing Symbol: ACE-112
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