Proposed Equivalent Safety Finding on CS 23.1438 (b) at Amendment 3

Applicable to Pilatus PC-24

Introductory Note

The hereby presented Equivalent Safety Finding has been classified as an important Equivalent Safety Finding and as such shall be subject to public consultation, in accordance with EASA Management Board Decision 12/2007 dated 11 September 2007, Article 3 (2.), which states:

"*2. Deviations from the applicable airworthiness codes, environmental protection certification specifications and/or acceptable means of compliance with Part 21, as well as important special conditions and equivalent safety findings, shall be submitted to the panel of experts and be subject to a public consultation of at least 3 weeks, except if they have been previously agreed and published in the Official Publication of the Agency. The final decision shall be published in the Official Publication of the Agency.*"

Statement of Issue

The PC-24 is a Part 23 commuter Jet with a relatively complex combined Pneumatic, Ice Protection and Environmental Control System located in the rear part of the fuselage and RH over-wing fairing. Per CS 23.1438 (b) Amdt 3, all pneumatic system elements must be burst pressure tested to 3 times, and proof pressure tested to 1.5 times, the maximum normal operating pressure, while all pressurization system elements must be burst pressure tested to 2 times, and proof pressure tested to 1.5 times, the maximum normal operating pressure as per CS23.1438 (a). CS23.1438(c) also allows the use of analysis or combination of analysis and test to show compliance to CS23.1438(a) and (b).
The design architecture of the PC-24 is such that compliance to 23.1438 (b) is literally not directly met for some of the components in the bleed air system. Indeed, these components were demonstrated to withstand a burst pressure of 2.0 times instead of 3.0 times the maximum normal operating pressure. However, a redundant means is provided to ensure that these components will not be exposed to steady state pressure higher than the proof pressure of 1.5 times the maximum normal operating pressure.

Therefore, an Equivalent Safety Finding is being requested against the CS 23.1438 (b) Amdt 3 and an equivalent level of safety will be shown by design.

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Engine extracted bleed air serves three different aircraft systems, namely the Pneumatic System (PS), the Ice Protection System (IPS) and the Environmental Control System (ECS). Pressure and temperature in the systems are regulated by dedicated valves and monitored in such manner that, should the regulating device drift, the anomaly is detected and the faulty line automatically isolated before critical thresholds are reached.

Since abnormal pressure transients could be potentially very fast, a pressure relief device (i.e. burst disk) is installed in the pneumatic system, immediately downstream of the pressure regulating valve.

This burst disk is designed to rupture and release the system pressure at a threshold equal (or below) the proof pressure of all the components located downstream.

In case of fast abnormal pressure rise the burst disk assembly rupture will not only relief the pressure, but will also command the isolation the affected line. With such design, the components installed downstream of the burst disk will see pressure not in excess of the proof pressure that the components were demonstrated to withstand without any distortion.

This ensures that all the components located downstream will not be exposed to steady state pressure higher than 1.5 times the maximum normal operating pressure. This pressure is the minimum pressure for which the components are qualified through proof pressure testing.

The release of hot bleed air through the burst disk into the rear fuselage is not hazardous, since the assembly is designed to direct the bleed air away from surrounding structure/components. The time necessary to isolate the line, in addition to the pressure relief, varies from 3 to 4 seconds depending on the system pressure. Therefore, the presence of the burst disk therefore protects the PS, ECS and IPS components from exposure to pressures that may impair their correct functionality. The automatic command of the shut off function, in addition to the burst disc rupture, also prevents the engine from excessive bleed air extraction and adverse effect on engine handling.

The burst disc design will follow the EN ISO 4126-2:2003 standard requirements beside the DO-160F environmental testing requirements to ensure such that it is demonstrated the disc rupture pressure is maintained until reaching its end of life.

Hence in summary, the components installed upstream of the burst disk were tested to three (3) times the Maximum Normal Operating Pressure. All the components installed downstream of the burst disk are exposed to steady state pressures not in excess of the proof pressure the components were demonstrated to withstand.

Therefore, the applicant believes that the burst disk installation guarantees sufficient margin to the burst pressure level utilised for some of the components and an equivalent level of safety to the one required by CS 23.1438 (b) Amdt 3 is achieved.