Federal Aviation Administration

Memorandum

Date: August 30, 2012

To: Manager, Small Airplane Directorate, ACE-100

From: Manager, Wichita Aircraft Certification Office, ACE-115W

Prepared by: David Enns, ASE (Mechanical Systems), ACE-116W

Subject: Extension of Equivalent Level of Safety for Cabin Pressurization – Exceedance of 15,000 Feet Cabin Altitude Limit for Cessna Model 525 (S/N 0800 and on)

ELOS Memo#: ACE-00-05C

Regulatory ref: 14 CFR § 23.841(a), Amdt. 23-17

This memorandum requests your office to review and provide concurrence with the proposed extension of the equivalent level of safety (ELOS) for the Model 525 (S/N 0800 and on) exceedance of 15,000 foot cabin altitude.

References

1) Cessna letter L390-12-1635, dated July 31, 2012, requesting extension of ELOS ACE-00-05 to the Model 525 (S/N 0800 and on).
2) Federal Aviation Administration Memorandum ACE-00-05, granting the ELOS for 14 CFR, part 23, § 23.841(a) for the Model 525A.
3) FAA Memorandum ACE-00-05A, extending the ELOS Memorandum ACE-00-05 to the Model 525B.
4) FAA Memorandum ACE-00-05B, extending the ELOS Memorandum ACE-00-05 to the Model 525C.

Background

In Reference 1, Cessna requested an extension of ELOS ACE-00-05 to the Model 525 (S/N 0800 and on).

14 CFR, part 23, § 23.841(a), requires a cabin pressure altitude (CPA) of not more than 15,000 feet in event of any probable failure or malfunction in the pressurization system. For the Model 525 (S/N 0800 and on) aircraft, failure of one of the outflow valves to close until overridden by the Altitude Limiter is a probable failure or malfunction in the pressurization system. Several company development flight tests were performed that showed for this type

of failure in the cabin pressure altitude could exceed 15,000 feet for brief periods of time, which requires an ELOS.

An ELOS was issued for the Model 525A by Reference 2, and then extended to the Model 525B by Reference 3, and to the Model 525C by Reference 4, for exceedance of 15,000 feet cabin pressure altitude during outflow valve failures limited by the altitude limiter. For comparison, the table below shows the data collected during 525 development testing, and the historical data from 525A, 525B, and 525C testing. Note that testing on the Model 525 (S/N 0800 and on) has resulted in the maximum Peak CPA to date.

Test	Model	Airplane Altitude (ft)	Peak CPA (ft)	Time CPA above 15,000 ft (sec)	CPA at stabilization (ft)
Development	525 (S/N 0800 & on)	17,500	15,900	6	14,100
Development	525 (S/N 0800 & on)	17,500	15,700	8	13,600
Development	525 (S/N 0800 & on)	17,350	14,800	n/a	13,900
Development	525 (S/N 0800 & on)	17,500	15,240	3	n/a
Certification	525A	unknown	15,745	7	14,614
unknown	525B	unknown	15,060	4	14,386
unknown	525B	unknown	15,156	5	n/a
unknown	525B	unknown	15,159	3	14,206
Development	525C	unknown	15,310	3	14,330
Development	525C	17,350	15,170	5	14,200

Applicable regulation(s)

The Cessna Model 525 (S/N 0800 and on) will be certified in the Normal Category to the certification basis of 14 CFR part 23 as amended by Amendments 23-1 through 23-38 and 23-40.

Regulation(s) requiring an ELOS finding

14 CFR, part 23, § 23.841(a) at Amendment 17 requires the following:

> *(a) If certification for operation over 31,000 feet is requested, the airplane must be able to maintain a cabin pressure altitude of not more than 15,000 feet in event of any probable failure or malfunction in the pressurization system.*

Description of compensating design features or alternate Methods of Compliance (MoC) which allow the granting of the ELOS (include design changes, limitations or equipment need for equivalency)

Per reference 1) above:

Compensating factors that will provide an equivalent level of safety to the requirements of 14 CFR, part 23, § 23.841(a), as required by 14 CFR, part 21, § 21.21(b)(1), for the Model 525 are outlined in the following:

1. The EMER pressurization system will limit the overshoot and the exposure time.
2. The stabilized CPA on Model 525 is set to be at least 400 feet below the limit of 15,000 feet specified by 14 CFR, part 23, § 23.841(a). The altitude limiter setting for the Model 525 is 14,300 ± 300 feet.
3. The cabin altitude limiter for the Model 525 is a reliable, proven design. It is utilized on Models 510, 525A, 525B, and 525C, and previously on this model.
4. The effects of the brief cabin altitude overshoot are compensated for by the comparatively low altitude limiter setting. Review of physiological data contained in FAA AC 25-20, AC 61-107A, SAE AIR822 and AIR825B, shows severe hypoxia effects increase progressively with increasing CPA and duration of exposure. The effects are cumulative. Rate of onset and severity of symptoms increase in proportion to increase in CPA. Conversely, severity of hypoxia effects decrease in proportion to a decrease in CPA. Flight test experience with other Cessna models has shown that, as aircraft altitude increased, the duration of the overshoot decreased.
5. CPA climb to the setting of the cabin altitude limiters will be accompanied by warning annunciation of excessive cabin altitude at 10,000 feet as required by 14 CFR, part 23, § 23.841(b)(6). The passenger oxygen masks are auto-deployed by 15,000 feet. AFM procedures require the flight crew to don their oxygen masks, to ensure oxygen is provided to the passengers, and to initiate an emergency descent. This prevents the brief exposure of the occupants to CPA above 15,000 feet from being a hazard.

Explanation of how design features or alternative Methods of Compliance (MoC) provide an equivalent level of safety to the level of safety intended by the regulation

Per reference 1) above:

The intent of 14 CFR, part 23, § 23.841(a), is to prevent exposure of the occupants to CPA that could prevent the flight crew from safely flying and landing the aircraft, or cause permanent physiological injury to the occupants. The design and tested performance of the Model 525 Cabin Pressure Control System (CPCS) meets this intent. Therefore, it appears that the features provided by the Model 525 CPCS provide an equivalent level of safety to that specified by 14 CFR, part 23, § 23.841(a).

ACO recommendation

The Wichita ACO has reviewed the information presented in Cessna Letter L390-12-1635, dated July 31, 2012. In addition, the FAA released 14 CFR, part 23, § 23.841, Amendment 23-62 in January 2012. This amendment permits an overshoot above 15,000 feet cabin altitude for 10 seconds or less following a decompression from a probable failure of the pressurization system. The overshoot can not exceed 25,000 feet. Therefore, the Wichita ACO concurs that it is appropriate to extend ELOS ACE-00-05 to the Model 525 (S/N 0800 and on), as long as the certification test results are within these limits.

Concurrence:

/s/ Daniel Hilton for Margaret Kline	*8/10/2012*
Manager, Wichita Aircraft Certification Office, ACE-115W	Date
Pat Mullen	*8/28/2012*
Manager, Standards Office, ACE-110	Date
Earl Lawrence	*8/30/2012*
Manager, Small Airplane Directorate, Aircraft Certification Service, ACE-100	Date