Exemption No. 8857

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
RENTON, WASHINGTON 98057-3356

In the matter of the petition of The Boeing Company for an exemption from § 25.841(a)(2) and (a)(3) of Title 14, Code of Federal Regulations	**Regulatory Docket No. FAA-2004-19890**

PARTIAL GRANT OF EXEMPTION

By letter dated December 8, 2004 (B-H320-2004-00722), Mr. Edgars Kupis, Manager, Certification Programs, The Boeing Company, P.O. Box 3707, Seattle, WA 98124-2207, petitioned to exempt the Model 7E7 airplane, now known as Model 787-8, from the requirements of 14 CFR 25.841(a)(2) and (a)(3), as amended by Amendment 25-87. If granted, the exemption would relieve these airplanes from the requirement that—during a decompression caused by failures of the engines —airplane cabin pressure altitude not exceed 25,000 feet for more than 2 minutes or exceed 40,000 feet for any duration.

The petitioner requires relief from the following regulation(s):

> **Section 25.841(a)(2)** at Amendment 25-87, requires that "The airplane must be designed so that occupants will not be exposed to a cabin pressure altitude that exceeds the following after decompression from any failure condition not shown to be extremely improbable:
>
> (i) Twenty-five thousand (25,000) feet for more than 2 minutes; or
>
> (ii) Forty thousand (40,000) feet for any duration."
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> **Section 25.841(a)(3)** at Amendment 25-87, requires that "Fuselage structure, engine and system failures are to be considered in evaluating the cabin decompression."

The petitioner's supporting information:

The petition for exemption submitted by The Boeing Company contains technical information that supports the petition, a public interest statement, and a list of references. A copy of the petition is available at http://dms.dot.gov (select Simple Search, and then enter Docket Number 19890).

The Boeing 7E7, now designated as the 787-8 airplane is designed to cruise at a maximum altitude of 43,000 feet pressure altitude. However, the petitioner originally requested the exemption be granted to 45,000 feet. While consideration was given to their request, the data presented were limited to a maximum cruise altitude of 43,000 feet pressure altitude. The petitioner would have to submit additional data corroborating their airplane descent time and the cabin environment in case of rapid decompression at 45,000 feet pressure altitude for FAA to consider such a request. Therefore, FAA considered this exemption for cruise flight to 43,000 feet pressure altitude. Should an uncontained engine rotor burst event occur, it is possible that the cabin pressure could exceed the limits contained in current regulations. Boeing offers the following justification in support of its petition for exemption. Some of this justification is based on cabin decompression evaluations performed and reported by the Mechanical Systems Harmonization Working Group (MSHWG) under the auspices of the Aviation Rulemaking Advisory Committee (ARAC).[1]

The Boeing Company requests an exemption from compliance with §§ 25.841(a)(2), and 25.841(a)(3) for cabin depressurization that can occur from uncontained engine rotor failures that result in large holes in the fuselage (i.e., those holes with an effective area exceeding 225 inches^2). Boeing believes, based on fleet service experience, that these are rare events. The new aircraft complies with the latest FAA requirements and, therefore, offers a significantly higher basic level of safety than previously certified transport category aircraft. Modern transport category aircraft have a 45 year safety record with millions of hours at altitudes similar to the maximum cruise altitude proposed for the 7E7. In addition, Boeing observes that neither the Joint Airworthiness Authorities nor the European Aviation Safety Administration has implemented similar restrictions.

Boeing notes that very few, if any, decompression incidents have exposed an airplane cabin to pressure altitude profiles which pose a risk of injury to passengers. Industry history reveals that few cases of catastrophic decompressions at high altitude have occurred, and those that have occurred have typically involved small business jets. The petitioner observes that the FAA has cited a few cases of rotor burst in cruise. In one such instance, the crew of a DC-10 crossing New Mexico reported several cases of initial decompression sickness, apparently with no permanent injuries.

Boeing supplied data for the 787-8 and provided information on the likelihood of various failure events. In its decompression analysis, Boeing included a measure of the severity

[1] The Final Report of the MSHWG, dated August 2003, was approved by a majority of the members of ARAC's Transport Airplane Engine Issues Group (TAEIG). Seven members of TAEIG voted to submit the report as a recommendation to the FAA, two members voted against submitting the report, and one member abstained.

of exposure for occupants, based on a Depressurization Exposure Integral (DEI) from the Mechanical Systems Harmonization Working Group report. Boeing used the relationship between cabin pressure and the Depressurization Severity Indicator (DSI), which is a measure of the partial pressure of oxygen, as was proposed by the Mechanical Systems Harmonization Working Group. The petitioner showed that for the failures modes reviewed for this exemption, the resultant DSI levels were much less than the critical value specified by the Mechanical Systems Harmonization Working Group. The analysis considers certain design and operational features of the 787-8 which would mitigate the effects of an increase in cabin pressure altitude. One of these design features is the cabin pressurization control system (CPCS) which was designed to minimize system failures that would lead to loss of cabin pressurization events.

The 7E7 is designed to fly at cruise altitudes that will maximize fuel efficiency. The reduction in maximum cruise altitude resulting from compliance with §§ 25.841 (a)(2) and 25.841 (a)(3) for uncontained engine failure is a concern shared by other manufacturers of airplanes with wing-mounted engines seeking new or amended Type certification. No transport category airplane with wing-mounted engines certificated today for operation above 39,000 feet can meet the new cabin altitude limits within the current §§ 25.841(a)(2) and 25.841(a)(3) without an exemption."

The Boeing Company mitigates risk to high cabin altitude exposure to passengers by reasonable design requirements, proven design methodologies and operational considerations regardless of the cause of the decompression event. The proposed exemption addresses the concern for safety driven by §§ 25.841(a)(2) and 25.841(a)(3).

"Safety enhancement initiatives with respect to critical rotating parts (inspecting for cracks in disks and using continually updated maintenance data to refine disk inspection criteria), as well as improvement in engine technology, lessons learned, and 2^{nd} / 3^{rd} generation engine design practices have resulted in a reduction in uncontained engine failure events. The uncontained engine failure rates of 2^{nd} / 3^{rd} generation engines compared to 1^{st} generation engines have improved by approximately 95% based on historical Boeing data on uncontained engine failures."

A reduction in maximum cruise altitude would adversely impact the ability of the Boeing 7E7 to compete with previously certificated airplanes which can operate at the more economical cruise altitudes typically in excess of 37,000 feet. In addition, restricting airplane operations to lower altitudes will increase traffic congestion. Limiting operation of new generation airplanes to lower altitudes will result in higher traffic density, which in turn will result in higher cost of safety in order to maintain established air traffic vertical and horizontal separation requirements.

The Boeing 7E7 will meet the latest amendments in effect at the time of application. The net result is that the 7E7 incorporates all the safety advancements as intended within these later amendments. Any significant impact to the marketability of the 7E7 will, at a minimum, result in a reduced number of aircraft with this higher level of safety as compared with the previous generation of aircraft, or at a maximum, preclude the

manufacture of this new generation of aircraft. In either case, Amendment 25-87 results in a reduced potential for overall aviation safety improvements.

"It must be reiterated that this request for exemption for §§ 25.841(a)(2) and 25.841(a)(3) is limited to only uncontained engine failures. For other sources of rapid depressurization, including system failures and specific structural failures, §§ 25.841(a)(2) and 25.841 (a)(3) will be complied with as amended by Amendment 25-87. All mechanical and/or functional interfaces that could potentially violate the physiological limits imposed by § 25.841 (a) are considered. Robust structural and systems design and the ability for the airplane to rapidly descend are key to assuring the safety of airplane occupants and are an inherent part of the 7E7 design. The Boeing Company design practices refine the requirements into sub-requirements for systems, structures, aerodynamics, and performance in order to assure airplane level compliance."

"Other threat minimization philosophies employed in the 7E7 design include an automatic pressure demand mask (FAA approved for 45,000 feet) for the pilots which will be certified to § 25.1441(d), separation and redundancy of key systems such as electrical power, passenger oxygen, cabin pressure control and spoiler actuation."

The petitioner's statement of public interest:

"The exemption requested will not adversely affect safety. As previously discussed, the 7E7 complies with § 25.841(a) in all other aspects of a rapid depressurization. In the unlikely event of an uncontained engine failure, the 7E7 preserves an even higher level of safety relative to previously certificated airplanes due to its higher descent capability and other design features. As concluded herein, and based on the MSHWG report, Reference (3) [available in the Docket], the world commercial jet fleet has had no hypoxia related fatalities due to in-flight decompression events caused by an uncontained engine failure. This safety record has been maintained even as newer airplanes fly at higher altitudes more often than older airplanes. In keeping with time-above-altitude FAA guidance and the recommendations of the MSHWG report, as adopted by TAIEG [available in the Docket], Boeing has incorporated design features that appropriately address the risk to safety following an uncontained engine failure. Therefore, granting of the exemption will not compromise safety to the airplane occupants."

This petition would provide the public with benefits from a new family of airplanes. The 7E7 family of airplanes will incorporate new technology, lessons learned from previous and current production airplanes, and comply with the latest airworthiness standards throughout to provide a safer, more efficient transportation option for airlines and airline passengers.

Notice and opportunity for public comment

A Notice of Petition for Exemption was published in the Federal Register on February 22, 2005. No comments were received.

The FAA's analysis of the petition

The Boeing Company provided a background of the current rule and recent activities to harmonize it, a review of the safety history of high altitude commercial flight, a discussion of hypoxia physiology data upon which recent rulemaking activities are based, a discussion of the impact of compliance with uncontained engine rotor burst aspects of existing rule, as related to economics, environmental, and air traffic considerations, and statements addressing public interest and no adverse impact to safety. In response to FAA inquiries, Boeing subsequently provided estimated cabin pressure altitude and airplane flight altitude time history plots following decompressions per emergency descent procedures, and a description of the Boeing methodology of evaluating the threat from uncontained engine rotor burst.

1. Need for exemption

Boeing requests relief from § 25.841(a)(2)(i) which specifies that cabin pressure altitude may not exceed 25,000 feet for more than 2 minutes after decompression from any failure condition not shown to be extremely improbable. A grant of exemption from this regulation would allow the Model 787-8 to take longer than 2 minutes to descend from 43,000 feet to 25,000 feet after such decompression.

Boeing also requests relief from § 25.841(a)(2)(ii) which specifies that cabin pressure altitude may not exceed 40,000 feet for any duration after decompression from any failure condition not shown to be extremely improbable. A grant of exemption from this regulation would allow the Model 787-8 cabin pressure altitude to exceed 40,000 feet after such decompression.

Boeing has stated that the 787-8 design will meet the requirements of §§ 25.841(a)(2)(i) and (ii) for all system and structural failures but not for all types of engine failures. For some uncontained engine rotor failures that result in pressure vessel penetration by fragments, the design of the 787-8 does not meet the requirements of §§ 25.841(a)(2)(i) and (ii). While the petitioner requested the exemption be granted "for altitudes up to the 7E7 Model's maximum cruise altitude as demonstrated in flight test, not to exceed 45,000 feet"; subsequent information provided by the petitioner indicates that the maximum cruise altitude is 43,000 feet. A grant of exemption from this regulation would allow the Model 787-8 to operate up to 43,000 feet, which could briefly expose cabin occupants to this altitude in the event of a worst-case decompression.

Finally, Boeing requests relief from § 25.841(a)(3) which requires that an airplane manufacturer consider fuselage structure, engine, and system failures when evaluating the cabin pressure altitude following a decompression due to one of these failure events. As noted in the preamble to this regulation,

"Possible modes of failure to be evaluated include malfunctions and damage from external sources such as tire burst, wheel failure, uncontained engine failure, engine fan, compressor or turbine multi blade failure, and loss of antennas…."

FAA's analysis shows that Boeing did consider these failures in its analysis. Therefore, the petitioner complies with § 25.841(a)(3), obviating the need for an exemption from it.

2. Conformance with applicable FAA policy

The FAA reviewed this petition in the context of the MSHWG Final Report on § 25.841(a)(2) and (a)(3) and of our Interim Policy on Amendment 25-87 Requirements. The Interim Policy applies only to those decompression events which are due to uncontained engine rotor failure. The basis of the Interim Policy is data from research on the response of humans and other primates to changes in ambient pressure. Evaluation of this data indicates that there is a direct correlation between the alveolar partial pressure of oxygen time integral and the likelihood of fatalities or permanent physiological damage to those exposed to such pressure changes. That is, as the value of the integral increases, the likelihood of fatalities or permanent physiological damage also increases. The FAA has issued a final version of our Interim Policy which uses a table of altitudes and cumulative exposure times in lieu of the pressure-time integral. The values of altitude and time in the table and the results of the pressure-time integral method are in agreement.

Accordingly, our Interim Policy focuses on minimizing the likelihood that—if a person is exposed to high altitude cabin pressure from any failure not shown to be extremely improbable—he/she will suffer permanent physiological damage. To analyze petitions for exemption from § 25.841(a)(2), the FAA requires information about emergency descent rates, any design features that increase such rates, other design features that offset the inherent increased risk of exposure to high altitude cabin pressure, and operational procedures.

As stated above and in our Interim Policy, the FAA acknowledges that there is a lack of relevant data on the effects of exposure to high altitude cabin pressure following decompression and, particularly, those effects on people of various ages, people with circulatory or respiratory diseases or certain other medical conditions.

Our review of the Boeing petition indicates that Boeing used the criteria recommended in the FAA's Interim Policy. Boeing's design incorporated these limits to ensure airplane descent performance. The FAA believes that this methodology is conservative in the sense that it assumes a lower partial pressure of oxygen than would likely be present during decompression at 43,000 feet.

Boeing provided descent profiles for the 787-8, based on conservative estimates of descent performance for failure scenarios, as described in the FAA's Interim Policy. The descent profiles indicate that the 787-8 can descend rapidly from 43,000 feet altitude to below 25,000 feet.

Boeing also performed a depressurization analysis, based upon maximum cruise flight conditions, and defined the envelope of vulnerability of passengers following failures that result in a decompression, and identified design and operational features of the 787-8 which would mitigate the effects of an increase in cabin pressure altitude.

The decompression analysis used several measures recommended in the MSHWG Final Report. Specifically, Boeing estimated the severity of exposure to high altitude cabin pressure for occupants, based on calculation of a Depressurization Exposure Integral (DEI). The analysis also considers the relationship between cabin pressure and the Depressurization Severity Indicator (DSI), a measure of the partial pressure of oxygen. The analysis indicates that the physiological effect of a slight increase in the length of time spent above 25,000 feet is within the uncertainty band of available physiological data. The Boeing analysis also shows that—for all of the failures modes reviewed for this exemption—resultant DSI levels were much less than the critical value recommended by the MSHWG.

The FAA reviewed information provided by Boeing about design features and operational procedures that would increase the descent capability of the 787-8 and/or occupant survival. We concluded that the design features and operational procedures associated with rapid decompression followed by an emergency descent support grant of an exemption.

3. Review of historical data and research

The FAA reviewed databases from our own National Aviation Safety Data Analysis Center, covering 1959 to the present. Since 1959 there have been approximately 3,000 instances of loss-of-cabin-pressure. The vast majority of these have been caused by system failures, (e.g., cabin pressurization controller failures and valve failures) and structural failures, (e.g., door seal failures) which have typically been recognized at low altitude within a few minutes after takeoff. Pilot error has also contributed to the number of events. The majority of these events have not subjected the occupants to exposures above 25,000 feet (an altitude considered physiologically significant). Indeed, the cabin pressure altitude in most events did not exceed 15,000 feet (the cabin pressure altitude at which passenger oxygen masks are deployed).

Similarly, uncontained engine rotor burst failures tend to be very rare. A simple calculation shows that grouping all engines and transport airplanes together yields an average probability of an uncontained engine failure at cruise of approximately $1x10^{-7}$ per

engine hour. New engine designs appear to reduce this probability by an order of magnitude. We found, as noted in the MSHWG report on § 25.841(a), that no fatalities from hypoxia were due to in-flight rapid decompression events as envisioned by Amendment 25-87. The data indicate that decompression is not a significant cause of fatalities. It is because these events are so rare that the FAA considers the risk to be acceptable.

In addition, Boeing provided the FAA with proprietary data from its analysis of uncontained engine rotor failures and the size and number of holes in the fuselage resulting from such failures. Using historical service data and theoretical values, the petitioner performed decompression analysis for several scenarios. Boeing analyzed the probability of uncontained engine rotor failure and of penetration of the fuselage of the 787-8 from fragments of various sizes resulting from such failures. This analysis was used to assess the threat of such an event to occupants of the airplane. FAA did not agree with one assumption in the Boeing analysis, regarding the exclusion of larger holes from two historical events. However, the petitioner's analysis was conducted in a manner consistent with the recommendations within the MSHWG report and their data showed that even for the largest survivable hole the 787-8 would be able to meet the FAA's interim policy criteria.

The FAA concurs with the petitioner that uncontained engine rotor failures are rare events, and this consideration had a bearing on the granting of the exemption. Our analysis in this case is in contrast to our analysis of an earlier petition for exemption from a different applicant for an airplane with a lower cruise altitude (41,000 feet). The petition submitted by a previous applicant included estimates of the probability of occurrence of an uncontained engine rotor failure. In that case, the altitude excursion above 40,000 feet was less than 1,000 feet. We concluded that the risk associated with exposure of the occupants to the slightly higher altitude was essentially the same as the risk of exposure at 40,000 feet. In other words, the risk from exposure at altitude was essentially the same with or without the grant of the exemption. Therefore, the rarity of uncontained engine rotor failures did not significantly enter into consideration regarding the previous grant of exemption.

4. Holes from uncontained engine rotor failure

The FAA evaluated the Boeing methodology for determining the size of holes in the fuselage and/or wings caused by uncontained engine rotor failure. We concluded that the method makes some assumptions which one could question. However, this issue is not of great significance since the FAA required Boeing to assume a failure which produced a very large hole in the fuselage, causing a sudden decompression.

5. Use of supplemental oxygen

As discussed below, the FAA has analyzed the Boeing petition in the context of those recommendations, the part 25 requirements pertaining to supplemental oxygen, and certain technical standards for supplemental oxygen equipment. Section 25.1441(d) requires approval of oxygen equipment for airplanes that are approved to operate above 40,000 feet altitude. Section 25.1443 specifies the minimum mass flow of supplemental oxygen for flightcrew and passenger oxygen systems up to a cabin altitude of 40,000 feet. Part 25 does not contain standards for oxygen systems above 40,000 feet. However, FAA Technical Standard Orders (TSOs) provide requirements for diluter demand pressure breathing regulators (TSO-89) and demand oxygen masks (TSO-78) up to 45,000 feet. In addition, the Society of Automotive Engineers (SAE) Standard AS 8027 provides specifications for diluter demand pressure breathing regulators up to 45,000 feet. It is the FAA's understanding that no diluter demand pressure breathing regulators available for commercial airplanes meet all the requirements of TSO-89 or AS 8027.

As part of the certification work on the Model 787-8 Boeing must substantiate the adequacy of the supplemental oxygen systems installed for the flightcrew for the cabin altitudes that they can be exposed to above 40,000 feet.

Flightcrew pressure breathing equipment requires training to ensure effective use. Pressure breathing requires physical effort to exhale and minimal effort to inhale. This reversal of the normal breathing cycle can lead to hyperventilation. Training of passengers to use pressure breathing equipment safely is considered impractical. The FAA determined that an acceptable means of compliance for the fixed and portable oxygen systems used by flight attendants and passengers would be to install oxygen equipment that is certificated to 40,000 feet and limit exposure to the reduced pressure environment above 40,000 feet via airplane descent performance. The FAA believes that, ultimately, occupant survival during a decompression event depends upon swift descent to a lower altitude. In its review of the petitioner's airplane descent profile, the FAA finds that the Model 787-8 can descend at acceptable rates.

6. Conclusion of FAA analysis

Permitting airplanes to fly above 40,000 feet does offer real and tangible benefits to the aerospace industry, the traveling public, and the U.S. economy by reducing congestion, improving fuel economy, and reducing pollution. If compliance with § 25.841 at Amendment 25-87 were to limit airplanes operations to a maximum altitude of 40,000 feet, it would impose a significant disadvantage on newly designed airplanes that have many safety advantages over older airplanes currently allowed to operate at higher altitudes. This would delay the introduction of these airplanes and the benefits of their more advanced technology.

Based upon its evaluation of the data and analysis provided by Boeing, the FAA has determined that there is sufficient justification for a partial grant of exemption from § 25.841(a)(2)(i) and (ii).

This partial grant of exemption does not provide relief from 14 CFR 25.841(a) for any other system and structural failure events not shown to be extremely improbable. The petitioner will have to demonstrate compliance for those failures events, and this partial grant is predicated on the belief that the applicant will successfully demonstrate that compliance for the Boeing Model 787-8. As noted in the MSHWG report on § 25.841(a), tire burst in flight is not extremely improbable as demonstrated by historic data. The ground loads are not applicable in flight and for this condition tires are extremely robust; according to § 25.729(f)(1) and historic data, the tire burst occurs in flight and as it is very difficult to demonstrate that tire cannot be burst in case of overheat, it is not possible to demonstrate that this event does not occur in high altitude flight. Therefore, the tire burst event must be considered in the depressurization analysis. In addition, pressure vessel openings resulting from loss of antennas, or stall warning vanes, or any system failure conditions that are not shown to be extremely improbable must be considered. The effects of such damage while operating under maximum normal cabin pressure differential must be evaluated. Also, structural cracks will be addressed as per the existing Amendment 25-87 preamble, i.e., "The maximum pressure vessel opening resulting from an initially detectable crack propagating for a period encompassing four normal inspection intervals. Mid panel cracks and cracks through skin stringer and skin frame combinations must be evaluated."

In addition, this partial grant of exemption is predicated on the requirement that the Boeing Model 787-8 successfully demonstrate compliance to 14 CFR 25.1441, 25.1443, 25.1445, 25.1447 and 25.1449.

This partial grant of exemption takes into account operating rules in 14 CFR parts 91, 121 and 135 which require (a) that one pilot wear and use his oxygen mask when operating above 41,000 feet altitude and (b) that an adequate quantity of oxygen is provided for crew operations. This partial grant of exemption is also premised on the condition that—in the Airplane Maintenance Manual—the airplane manufacturer and the airline operator include any required maintenance and checks of supplemental oxygen systems prior to each flight. In addition, this partial grant of exemption is premised on the condition that—if dispatch is deemed appropriate with a malfunctioning system that is required to ensure that the airplane is capable of performing an emergency descent (i.e., spoilers fully deployed, if appropriate; maximum descent rate; maximum operating limit V_{MO}/M_{MO} speed)—then the Master Minimum Equipment List (MMEL) must limit dispatch to a maximum flight altitude of 40,000 feet, unless other regulations or limitations require a lower altitude. Though V_{MO}/M_{MO} is normally the best speed for a rapid decompression descent, the pilots should follow the recommended emergency descent procedures in the AFM. Rather than place an MMEL dispatch limitation as an explicit condition of granting the exemption, we have determined that it is appropriate for the FAA Flight Operations Evaluation Board to evaluate the matter of dispatch with a malfunctioning

system that is required to ensure that the airplane is capable of performing an emergency descent.

The applicable rapid decompression procedures for the flightcrew must be included in the emergency procedures section of the Airplane Flight Manual. This information should also be included in the Boeing Flight Crew Operating Manual. Note that initial and recurrent emergency training for all crewmembers, in accordance with §§ 121.397, 121.417, and 121.427, must include training for a rapid decompression and donning of oxygen masks.

Regarding the provisions of § 25.841(a)(3), the petitioner included in its analysis consideration of engine failures. In addition, as part of the normal certification process, the petitioner will consider fuselage structure, and system failures. Therefore, relief from this requirement is not necessary.

The partial grant of exemption from § 25.841(a)(2)(ii) will permit cabin pressure altitude to exceed 40,000 feet for 1 minute (but not to exceed 43,000 feet for any duration) after decompression from any uncontained engine failure condition not shown to be extremely improbable. The partial grant of exemption from § 25.841(a)(2)(i) will permit cabin pressure altitude to exceed 25,000 feet for more than 2 minutes (but not more than 3 minutes) after decompression from any uncontained engine failure condition not shown to be extremely improbable, allowing time for the airplane to descend from an altitude of 43,000 feet to 25,000 feet.

The Partial Grant of Exemption

In consideration of the foregoing, I find that a partial grant of exemption is in the public interest regarding 14 CFR 25.841(a)(2)(i), and 25.841(a)(2)(ii) as amended by Amendment 25-87. Therefore, pursuant to the authority contained in 49 U.S.C. 40113 and 44701, delegated to me by the Administrator, the petition of Boeing for an exemption from the requirement of 14 CFR 25.841(a)(2)(i), and 25.841(a)(2)(ii), as amended by Amendment 25-87, is granted, on The Boeing Company's Model 787-8 airplanes.

This partial grant of exemption is subject to the following conditions:

1. The Airplane Flight Manual for the Boeing Model 787-8 must indicate that the maximum indicated operating pressure altitude is 43,000 feet.

2. The Airplane Flight Manual must contain applicable flightdeck crew procedures for rapid decompression event. The section of the Airplane Flight Manual for the Boeing Model 787-8 which pertains to actions in the event of a decompression must state that the flightdeck crew should initiate a descent at the maximum rate of descent and safe descent speed, which is typically the maximum operating speed (V_{MO}/M_{MO}) assuming structural integrity of the airplane.

3. The petitioner must submit certification flight test data for the Boeing Model 787-8 that corroborate the descent profiles used in the analysis to show that after decompression at an airplane indicated operating pressure altitude of 43,000 feet, the cabin pressure altitude will not exceed 25,000 feet for more than 3 minutes or 40,000 feet for more than 1 minute.

Issued in Renton, Washington, on March 30, 2007.

/s/
Ali Bahrami
Manager
Transport Airplane Directorate
Aircraft Certification Service