

**UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
RENTON, WASHINGTON 98055-4056**

In the matter of the petition of

Boeing Commercial Airplane Group

for an exemption from § 25.1435(b)(1) of the
Federal Aviation Regulations

Regulatory Docket No. 28598

PARTIAL GRANT OF EXEMPTION

By letter of May 16, 1996, Mr. T.E. Hickcox, Manager, Certification Programs, B-T111, Boeing Commercial Airplane Group, P.O. Box 3707, Seattle, WA, 98124-2207, petitioned for exemption from the static pressure test requirement of § 25.1435(b)(1) of the Federal Aviation Regulations (FAR), for the hydraulic system on the Boeing Model 777-300 airplane.

Section of the FAR affected:

Section 25.1435(b)(1) states that a complete hydraulic system must be static tested to show that it can withstand 1.5 times the design operating pressure without a deformation of any part of the system that would prevent it from performing its intended function. Clearance between structural members and hydraulic system elements must be adequate, and there must be no permanent detrimental deformation. For the purpose of this test, the pressure relief valve may be made inoperable to permit application of the required pressure.

Related Section of the FAR:

Section 25.1435(a)(2) states that each element of the hydraulic system must be able to withstand, without rupture, the design operating pressure loads multiplied by a factor of 1.5, in combination with ultimate structural loads that can reasonably occur simultaneously. Design operating pressure is maximum normal operating pressure, excluding transient pressure.

The petitioner's supportive information is as follows:

In place of the static test (4500 psi), Boeing proposes to (1) use the Model 777-200 airplane hydraulic system proof pressure test results to show compliance for the longer fuselage Model 777-300 airplane hydraulic system by conducting a similarity analysis; and (2) for the newly added tail skid hydraulic system on the Model 777-300, conduct a proof pressure test at 3400 ±100 psig and component testing at 1.5 times operating pressure (4500 psi) per § 25.1435(a)(2).

Boeing states that the majority of hydraulic tubing changes associated with the 777-300 are minor and do not invalidate the 777-200 proof pressure test conducted to demonstrate compliance with § 25.1435(b)(1). The hydraulic tubing added to power the 777-300 tail skid system are the only tubing changes not considered minor. Therefore, compliance with § 25.1435(b)(1) should be by similarity to the 777-200 for minor changes, and by a proof pressure test to 3400 ±100 psig for the tailskid hydraulic tubing. The compliance data (similarity analysis and proof pressure test report) would be provided via an 8110-3 form with DER approval.

Boeing asserts that the granting of this exemption with respect to testing a complete hydraulic system at 1.5 times operating pressure is in the public interest because the proposed method of demonstrating compliance will provide greater assurance of airplane safety than that required by § 25.1435(b)(1).

Boeing provides the following factors to substantiate their position that this petition for exemption not only provides for an equal or greater level of safety, but eliminates inefficiencies and added cost as well.

Previously Granted Partial Exemption for 777-200

Exemption No. 5758A, dated October 29, 1993, allowed the complete 777-200 hydraulic system proof pressure test required by § 25.1435(b)(1) to be performed at a pressure just below the system relief valve cracking pressure (3400 psig), instead of 1.5 times the design operating pressure (4500 psig). The partial exemption was granted

based on negligible tubing deflection differences between tubing pressurized to 3400 and 4500 psig; the new digital pre-assembly (DPA) buy off process implemented to check 777 installation drawing releases; and because testing at 4500 psig requires deactivating many components rendering the hydraulic system out of configuration, while testing at 3400 psig allows for checking the complete hydraulic system and checking separation during normal actuation. Testing to demonstrate compliance with § 25.1435(b)(1) was successfully completed on 777-200 airplane WA004 (and WA006 and WA101 for GE and RR engine hydraulic installations, respectively).

777-300 vs. 777-200 Hydraulic System and a Similarity Analysis

Boeing states that the 777-300 hydraulic distribution system is identical to the 777-200, except hydraulic tubing was added for the stretched 43 and 46 body sections, the tail skid system, and spoilers 6, 7, 8, and 9 emergency retraction system. Additionally, re-routes were required under the keel beam ladder and over the wingbox. The 777-300 was stretched 34 feet by adding a body plug (ten new body frames) to section 43 and section 46 (nine new body frames). The associated new hydraulic tubing is routed, supported, and separated relative to surrounding systems and structure similarly to the hydraulic tubing located forward and aft of the new body frames. These changes are considered minor.

Boeing further states that minor changes were incorporated into spoilers 6, 7, 8, and 9 hydraulic tubing installations to accommodate the spoiler emergency retraction system. This system ensures that these spoilers do not impede overwing escape slide deployment. The changes did not compromise separation relative to surrounding systems and structure.

Minor re-routes were completed for hydraulic system tubing located over the wingbox to accommodate structural modifications and gauge changes. Clamp spacing and separation relative to surrounding systems and structure are similar to the 777-200.

Boeing asserts that the above tubing changes are considered minor and therefore do not invalidate the 777-200 proof pressure test conducted to demonstrate compliance with § 25.1435(b)(1).

New Tail Skid System

Boeing states that hydraulic tubing was added to power the new tail skid system. This is the first 777 airplane with a tail skid system and this tube clamping arrangement. It is recommended that a proof pressure test of the tail skid system be conducted at 3400 ± 100 psig in line with the partial exemption granted for the 777-200 hydraulic system. A test report would be provided for this proof pressure test.

In view of the substantiating factors detailed above, Boeing asserts that its proposed method of pressure testing of the new tail skid hydraulic system of the 777-300 airplane and a similarity analysis for the remainder of the hydraulic system is in the public interest, as it provides greater assurance of safe operation and does not impose inefficiencies and added cost (work and rework) associated with the static pressure test defined in § 25.1435(b)(1), and hereby petitions the FAA to grant the subject exemption.

A summary of the petition was published in the Federal Register on July 16, 1996 (61 FR 37105). No comments were received.

The Federal Aviation Administration's analysis/summary is as follows:

The FAA has carefully considered the information provided by the petitioner, and has determined that there is sufficient merit to warrant a partial grant of exemption.

Previously Granted Partial Exemption for 777-200

The FAA concurs that the basis for the partial exemption granted for the 777-200, the substantiating factors, and the compliance documentation to a large extent still apply to the 777-300 hydraulic system, and that only the modified portions of the system need to be tested to show compliance with the terms of this exemption.

777-300 vs. 777-200 Hydraulic System and Similarity Analysis

The FAA concurs that the 777-200 proof pressure test conducted to demonstrate compliance with Exemption 5758A is still valid for the unchanged portions and tubing runs on the 777-300. However, the added hydraulic tubing runs for the stretched 43 and 46 body sections and spoilers 6, 7, 8, and 9 emergency retraction system, plus any tubing re-routes must be tested for system integrity and adequate clearances. A similarity analysis is not adequate to show compliance. In light of the minor tubing changes and the previously submitted deflection test comparisons at 3000 and 4500 psig (ref. Exemption No. 5758A for the 777-200), testing the modified/added tubing runs at 3000 psig while verifying that adequate clearances exist would be satisfactory.

New Tail Skid System

The FAA concurs that conducting a proof pressure test of the tail skid hydraulic system at 3400 ±100 psig is satisfactory to show compliance with the terms of this exemption and that a test report documenting test results would be submitted to the FAA. In addition, the static proof

pressure testing must be conducted at 4500 psig on all components, assuming a 3000 psig operating pressure, during component qualification testing.

In consideration of the foregoing, I find that a partial grant of exemption is in the public interest. Therefore, pursuant to the authority contained in 49 USC 40113 and 44701, delegated to me by the Administrator (14 CFR 11.53), the Boeing Commercial Airplane Group is hereby granted a partial exemption from § 25.1435(b)(1) of the FAR to the extent necessary to permit type certification of the Model 777-300 by conducting a 3000 psig test of the modified/added hydraulic tubing runs for the stretched body sections, the spoiler retraction system, and any re-routed sections, while verifying that adequate clearances exist, and testing of the tail skid hydraulic system at 3400 ± 100 psig (the system relief pressure). All test results pertinent to this exemption must be documented in a report and a copy provided to this office.

Issued in Renton, Washington, on September 3, 1996.

/s/ James V. Devany
Acting Manager, Transport Airplane Directorate
Aircraft Certification Service, ANM-100