

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

In the matter of the petition of

Raytheon Aircraft Company

for an exemption from § 25.1435(a)(1), Amendment
25-104, of Title 14, Code of Federal Regulations

**Regulatory Docket
No. FAA-2006-25155**

GRANT OF EXEMPTION

By letter of June 14, 2006, Mr. David Bernstorf, Director, Airworthiness and Certification, Raytheon Aircraft Company, 9709 E. Central, P.O. Box 85, Wichita, Kansas, 67201-0085, petitioned for an exemption until June 1, 2007, from the requirements of Title 14 Code of Federal Regulations (14 CFR) 25.1435(a)(1), Amendment 25-104. The proposed exemption, if granted, would allow (1) completion of the type certification program by December 31, 2006, with the hydraulic system in compliance with Amendment 25-72, (2) sufficient time to complete analysis, testing, and documentation of the affected hydraulic system components to show compliance with Amendment 25-104, and (3) if required, develop any design changes and retrofit the Model 4000 fleet. Additional information relevant to this petition was provided in a letter dated June 21, 2006, by Mr. Bernstorf.

The petitioner requests relief from the following regulation:

§ 25.1435 Hydraulic systems.

- (a) Element design. Each element of the hydraulic system must be designed to:
- (1) Withstand the proof pressure without permanent deformation that would prevent it from performing its intended functions, and the ultimate pressure without rupture. The proof and ultimate pressures are defined in terms of the design operating pressure (DOP) as follows:

Element	Proof(xDOP)	Ultimate(xDOP)
1. Tubes & fittings.	1.5	3.0
2. Pressure vessels containing gas		
High pressure (e.g., accumulators)	3.0	4.0
Low pressure (e.g., reservoirs)	1.5	3.0
3. Hoses	2.0	4.0
4. All other elements	1.5	2.0

Related Sections of 14 CFR:

§ 25.1435 Hydraulic systems.

- (a) Element design. Each element of the hydraulic system must be designed to:
- (2) Withstand, without deformation that would prevent it from performing its intended function, the design operating pressure in combination with limit structural loads that may be imposed;
 - (3) Withstand, without rupture, the design operating pressure multiplied by a factor of 1.5 in combination with ultimate structural load that can reasonably occur simultaneously;
 - (4) Withstand the fatigue effects of all cyclic pressures, including transients, and associated externally induced loads, taking into account the consequences of element failure; and
 - (5) Perform as intended under all environmental conditions for which the airplane is certificated.

- (b) System design. Each hydraulic system must:
- (1) Have means located at a flightcrew station to indicate appropriate system parameters, if
 - (i) It performs a function necessary for continued safe flight and landing; or
 - (ii) In the event of hydraulic system malfunction, corrective action by the crew to ensure continued safe flight and landing is necessary;
 - (2) Have means to ensure that system pressures, including transient pressures and pressures from fluid volumetric changes in elements that are likely to remain closed long enough for such changes to occur, are within the design capabilities of each element, such that they meet the requirements defined in § 25.1435(a)(1) through (a)(5);
 - (3) Have means to minimize the release of harmful or hazardous concentrations of hydraulic fluid or vapors into the crew and passenger compartments during flight;
 - (4) Meet the applicable requirements of §§ 25.863, 25.1183, 25.1185, and 25.1189 if a flammable hydraulic fluid is used; and
 - (5) Be designed to use any suitable hydraulic fluid specified by the airplane manufacturer, which must be identified by appropriate markings as required by § 25.1541.

- (c) Tests. Tests must be conducted on the hydraulic system(s), and/or subsystem(s) and elements, except that analysis may be used in place of or to supplement testing,

where the analysis is shown to be reliable and appropriate. All internal and external influences must be taken into account to an extent necessary to evaluate their effects, and to assure reliable system and element functioning and integration. Failure or unacceptable deficiency of an element or system must be corrected and be sufficiently retested, where necessary.

- (1) The system(s), subsystem(s), or element(s) must be subjected to performance, fatigue, and endurance tests representative of airplane ground and flight operations.
- (2) The complete system must be tested to determine proper functional performance and relation to the other systems, including simulation of relevant failure conditions, and to support or validate element design.
- (3) The complete hydraulic system(s) must be functionally tested on the airplane in normal operation over the range of motion of all associated user systems. The test must be conducted at the system relief pressure or 1.25 times the DOP if a system pressure relief device is not part of the system design. Clearances between hydraulic system elements and other systems or structural elements must remain adequate and there must be no detrimental effects.

The petitioner provides the following supportive information:

“Issue:

”Raytheon Aircraft Company requests a time-limited exemption from compliance with Amendment 104 to 14 CFR 25.1435(a)(1). The extension period would be until June 1, 2007.

“Initial coordination with Raytheon suppliers has indicated there may be inadequate time available (prior to December 31, 2006) to conduct and document the required certification tests of the three (3) accumulators and two (2) hose assemblies requiring testing. Note: All other components have been tested to levels that support Amendment 104 requirements.

“The Raytheon Aircraft Company Model 4000 Type Certificate (TC) effort is in the final stages of completion. On May 31, 2006, the FAA granted RAC an extension to the Model 4000 type certificate application date to December 31, 2001 (per 14 CFR 21.17(d)(2)), extending the date for TC issuance to on-or-before December 31, 2006. This allows RAC time to complete the remaining TC activity while providing adequate time for FAA approvals.

“Based on the TC extension, RAC has been evaluating Part 25 amendments that were issued on or before December 31, 2001 for applicability and ability to demonstrate compliance. This includes amendments 25-102 through 25-105. Amendment 104 was written to harmonize FAA and JAA requirements in relation to hydraulic systems and components.

“Prior to the TC application date extension, the certification basis included 14 CFR 25.1435 at Amendment 25-72. RAC documentation supports compliance with Amendment 25-72.

“Extent and Reason for Relief:

“Raytheon Aircraft Company is requesting a time-limited exemption from compliance with Amendment 104 to 14 CFR 25.1435(a)(1). The extension period would be until June 1, 2007. Raytheon will demonstrate and document compliance with 14 CFR 25.1435(a)(2) through (c)(2) prior to issuance of the Type Certificate. In addition, Raytheon has requested an equivalent level of safety finding to 14 CFR 25.1435(c)(3).

“Initial coordination with Raytheon suppliers has indicated there may be inadequate time available to conduct and document the required certification tests of the few affected components, such as accumulators and hose assemblies. FAA concurrence with this time-limited exemption will allow FAA and RAC designee resources to continue to provide primary focus on efforts associated with issuance of the Model 4000 Type Certificate while RAC and affected suppliers coordinate and complete the required testing and documentation. RAC anticipates the new tests will be successful at the new pressure levels.

“Public Interest:

“Granting this time limited exemption is in the public interest. RAC has concluded there is no adverse affect on safety based on current Model 4000 design features. Without the time limited exemption, additional strain on FAA and designee resources will take place and another delay may result in completing type certification and delivery of Model 4000 aircraft due to timing issues associated with supplier related testing. Additional delay of type certificate issuance from the current plan would have significant negative impact in several areas, such as:

- Continued resource demands of both the FAA and FAA designees
- Customer relations
- Several of the major corporations around the US and the world anticipate the delivery of the Model 4000 aircraft to meet their business needs would need to find alternatives
- The balance of trade between the US and other nations would be negatively impacted due to delayed deliveries and potential for lost sales
- Possible employment impact of production workers at Raytheon Aircraft Company and its suppliers around the US and the world
- Taxation at the local, state, and federal levels would be adversely impacted from loss of wage taxes and sales taxes

“Impact on Safety:

“Raytheon Aircraft Company believes granting this time limited exemption has no safety impact.

“The Model 4000 Hydraulic System has been tested, analyzed and determined to be airworthy and compliant to the applicable requirements of regulations specified by the certification basis in place until May 31, 2006 (14 CFR 25.1435, Amendment 25-72). The safety record for hydraulic system designs similar to the Model 4000 indicates that designs to Amendment 25-72 requirements are safe and adequate.

“RAC efforts to ensure the Model 4000 has a safe and compliant hydraulic system are summarized below:

RAC Efforts to Ensure Model 4000 Has a Safe and Compliant Hydraulic System	Applicable Regulation	
	25.1435 Amdt 25-72	25.1435 Amdt 25-104
a. Conducted performance, fatigue, and endurance tests at the system, sub-system, and element level representative of airplane ground and flight operations.		(c)(1)
b. Documented compliance with 25.1309, taking into account static and dynamic loads including flight, ground, pilot, hydrostatic, inertial and thermally induced loads, and combinations thereof; motion, vibration, pressure transients and fatigue; abrasion, corrosion, and erosion; fluid and material compatibility, and leakage and wear.	(b)(2)	
c. Conducted complete system level testing to ensure proper functional performance and relation to other systems, including simulation of relevant failure conditions, to validate system and element designs.	(b)(1)	(c)(2)
d. Completed hydraulic system static testing to demonstrate system ability to withstand 1.5 times design operating pressure without deformation of any part that would prevent it from performing its intended function. Clearance between structural members and hydraulic system components were found to be adequate and there was no permanent detrimental deformation. In addition, successful follow-on testing of associated user systems validated the system design.	(b)(1)	ELOS to (c)(3)
e. Determined by test and analysis that the hydraulic system performs as intended under all environmental conditions for which the airplane is to be certified.		(a)(1)
f. Documented that all elements of the hydraulic system have been designed, analyzed, and/or tested to withstand, without deformation that would prevent performance of its intended function, design operating pressure loads in combination with structural load limits that may be imposed.	(a)(1)	(a)(2)
g. Documented that all elements of the hydraulic system have been demonstrated (tested and analyzed) to withstand	(a)(2)	(a)(3)

the design operating pressure multiplied by a factor of 1.5 in combination with ultimate structural loads that can reasonably occur simultaneously.		
h. Determined that each element of the hydraulic system has been designed to withstand the fatigue effects of all cyclic pressures, including transients, and associated externally induced pressures (taking into consideration consequences of element failure).		(a)(4)
i. Designed flight crew indications that identify appropriate system parameters, since the system performs functions necessary for continued safe flight and landing, and since system malfunction may require corrective action by the flight crew.	(b)(2) [25.1309(c)]	(b)(1)
j. Analyzed design to ensure system pressures, including transient pressures and pressures from volumetric changes are within design capabilities of each element.	(b)(2) [25.1309(b)]	(b)(2)
k. Analyzed design to ensure the hydraulic system design minimizes the possible release of hydraulic fluid or vapors into the crew and passenger compartments while in flight.	(b)(2) [25.1309(b)]	(b)(3)
l. Analyzed design to ensure the hydraulic system meets the fire protection requirements of 25.863, 25.1183, 25.1185 and 25.1189.	(c)	(b)(4)
m. Verified installation of appropriate markings per Section 25.1541 to identify the types of authorized Hydraulic fluid.		(b)(5)

“14 CFR 25.1435 (Amendment 104) changes the element proof pressure and ultimate pressure loads (25.1435(a)(1)), and other requirements that require RAC compliance documentation. RAC intends to complete new certification tests, as appropriate, to document compliance to the new requirements. RAC does not anticipate any design changes based on the new tests.

“Components that require new testing are limited to three accumulators and two hose assemblies. All other components have been tested to levels that support Amendment 104 requirements.”

	Proof Pressure			Ultimate Pressure		
	Amdt 25-72	Amdt 25-104	Tested To	Amdt 25-72	Amdt 25-104	Tested To
Tubes and Fittings	1.5	1.5	1.5	1.5	3.0	3.0
Pressure Vessels containing gas High Pressure (e.g. accumulators)	1.5	3.0	2.0 – 2.1	1.5	4.0	4.1 – 4.3
Low Pressure (e.g. reservoirs)	1.5	1.5	1.8 – 2.0	1.5	3.0	3.0 – 3.1
Hoses	1.5	2.0	2.0 – 2.7	1.5	4.0	3.0
All Other Elements	1.5	1.5	1.5	1.5	2.0	2.0

“Conclusion:

“The Model 4000 is near the completion of the type certification program, with design and build finished. The hydraulic system has been designed and built to meet 25.1435 Amendment 25-72. Based on Amendment 25-104, additional testing is required to document compliance with the new requirements. RAC intends to coordinate and complete the additional testing, however scheduling and completing these tests and completing the associated documentation and approvals prior to December 31, 2006 is unlikely. Existing components are expected to comply with the new test requirements. To minimize impact to FAA resources, including designees, and allow appropriate FAA and DER focus to support timely issuance of the Model 4000 type certificate, a time-limited exemption for 25.1435(a)(1) is an appropriate means to satisfy the new requirements.”

On June 30, 2006, the FAA published a summary of the petition in the Federal Register (71 FR 37637) and requested comments on it from the public. No comments were submitted in response to the notice.

The FAA’s analysis and summary of this petition is as follows:

The FAA considers the petitioner’s request for a time-limited exemption to be in the public interest for some of the reasons stated by the petitioner. Notably, several large corporations are relying on a December 31, 2006, certification date for this airplane and there is no ready alternative. Thus, if this exemption is not granted, there would be a significant disruption to air commerce.

Under Amendment 25-104, § 25.1435(a)(1), the FAA added the existing requirements of the Joint Aviation Regulations (JAR) 25.1435(a)(10) and associated Appendix K requirements regarding design load factors for proof and ultimate pressure conditions for elements of the hydraulic system. The proof and ultimate pressure conditions were defined as the design operating pressure times the factor of safety. This was done to address unusually high pressures which may be seen in service, material defects and differences, manufacturing/construction tolerances and the consequences of failures

(e.g., pressure vessel failure). The proposed load factors, ranging between 1.5 and 4.0 relate to the design operating pressure (DOP) and apply to tubes, fittings, pressure vessels containing gas at high pressure (e.g., accumulators) and at low pressure (e.g., hydraulic reservoirs), hoses, and all other elements.

By adopting these JAR minimum factors of safety standards which at Amendment 25-72 were not specifically stated in part 25, the FAA intended to maintain an existing level of safety because normal U.S. Industry practices met or exceeded these standards.

We consider it necessary in the interests of safety for Raytheon to comply with these applicable requirements. However, we recognize the unusual circumstances associated with these requirements becoming applicable only because of unanticipated delays in Raytheon's certification program for the Model 4000. Under these circumstances, we consider Raytheon's request for a delay in showing compliance until June 1, 2007, for a limited number of components, to be reasonable. This brief extension will not have an adverse effect of safety.

If it becomes necessary to modify the design to comply with these requirements, Raytheon has agreed to develop the necessary design changes and make them available to affected operators. To ensure that these changes are incorporated in the airplanes, we are adopting a condition in this exemption that the "Airworthiness Limitation" section of the Raytheon 4000 "Instructions for Continued Airworthiness" will limit operation unless any design changes and/or limitations developed are incorporated by the owner or operator.

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

Note that the conditions associated with the granting of this exemption may affect the production of new Model 4000 airplanes after June 1, 2007. If the type design is modified per the compliance requirements specified in the conditions of this exemption, no new airworthiness certificates would be issued after June 1, 2007, unless the newly produced airplanes conform to the modified type design.

In consideration of the foregoing, I find that a grant of exemption is in the public interest. Therefore, pursuant to the authority contained in 49 U.S.C. §§ 40113 and 44701, delegated to me by the Administrator, Raytheon Aircraft Company, is hereby granted an exemption until June 1, 2007, from the requirements of 14 CFR 25.1435(a)(1) to the extent necessary to permit type certification of the Raytheon Model 4000 by showing compliance for the hydraulic system to Amendment 25-72, and is subject to the following provisions:

1. Raytheon will demonstrate and document compliance with 14 CFR 25.1435(a)(2) through (c)(3), Amendment 25-104, prior to issuance of the type certificate.

2. Complete analysis, testing, and documentation of the affected accumulators and hose assemblies to show compliance to § 25.1435(a) (1), Amendment 25-104, prior to June 1, 2007, and
3. Before June 1, 2007, Raytheon will develop and submit for FAA approval service information to incorporate any design changes and/or operating and maintenance limitations developed to meet the provision of § 25.1435(a)(1), as amended by Amendment 25-104.
4. The “Airworthiness Limitation” section of the Raytheon 4000 “Instructions for Continued Airworthiness” will state that the airplanes produced before June 1, 2007, cannot be operated after June 1, 2008, unless any design changes and/or limitations developed in accordance with paragraph 3 (above) are incorporated by the owner or operator.

All test results, and if required, any design changes to retrofit the Model 4000 fleet, pertinent to this exemption must be documented in a report and a copy provided to this office at the following address:

Federal Aviation Administration
Transport Airplane Directorate
Attention: Mahinder Wah, ANM-112
Propulsion and Mechanical Systems Branch
1601 Lind Avenue S.W.
Renton, WA 98057-3356
U.S.A.

Issued in Renton Washington, on August 7, 2006.

/s/

Ali Bahrami
Manager, Transport Airplane Directorate
Aircraft Certification Service