Federal Aviation Administration
Aviation Rulemaking Advisory Committee

Transport Airplane and Engine Issue Area
Mechanical System Harmonization Working Group

Task 1 – Pressurization and Pneumatic Systems

Task Assignment

[Federal Register: September 2, 1998 (Volume 63, Number 170)]
[Notices]
[Page 46823-46824]
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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Aviation Rulemaking Advisory Committee; Transport Airplane and Engine Issues--New Task

AGENCY: Federal Aviation Administration (**FAA**), DOT.

ACTION: Notice of new task assignment for the Aviation Rulemaking Advisory Committee (ARAC).

SUMMARY: Notice is given of a new task assigned to and accepted by the Aviation Rulemaking Advisory Committee (ARAC). This notice informs the public of the activities of ARAC.

FOR FURTHER INFORMATION CONTACT:
Stewart R. Miller, Transport Standards Staff (ANM-110), Federal Aviation Administration, 1601 Lind Avenue, SW., Renton, WA 98055-4056; phone (425) 227-1255; fax (425) 227-1320.

SUPPLEMENTARY INFORMATION:

Background

The **FAA** has established an Aviation Rulemaking Advisory Committee to provide advice and recommendations to the **FAA** Administrator, through the Associate Administrator for Regulation and Certification, on the full range of the **FAA**'s rulemaking activities with respect to aviation-related issues. This includes obtaining advice and recommendations on the **FAA**'s commitment to harmonize its Federal Aviation Regulations (FAR) and practices with its trading partners in Europe and Canada.

One area ARAC deals with is Transport Airplane and Engine Issues. These issues involve the airworthiness standards for transport category airplanes and engines in 14 CFR parts 25, 33, and 35 and parallel provisions in 14 CFR parts 121 and 135.

The Task

This notice is to inform the public that the **FAA** has asked ARAC to provide advice and recommendation on the following harmonization task:

Pressurization and Pneumatic Systems

The following differeces between Part 25 and JAR 25 and their

associated guidance material have been identified as having a potentially significant impact on airplane design and cost.

Task: Pressurization and Pneumatic Systems. Section 25.1438 of the FAR and JARs 25X1436 and 25.1438 currently require different proof and burst pressure multipliers under specific established normal and abnormal conditions. The JAR also distinguishes between high and low pressure pneumatic systems. In harmonizing 25.1438, consideration must be given to JAR 25X1436 due to the relationship between part 25.1438 of the FAR and JAR 25X1436.

For the above task the working group is to review airworthiness, safety, cost, and other relevant factors related to the specified differences, and reach consensus on harmonized part 25/JAR 25 regulations and guidance material.

The **FAA** expects ARAC to forward its recommendation(s) to the **FAA** by July 31, 2000.

ARAC Acceptance of Tasks

ARAC has accepted the tasks and has chosen to establish a new Mechanical Systems Harmonization Working Group. The working group will serve as staff to ARAC to assist ARAC in the analysis of the assigned task. Working group recommendations must be reviewed and approved by ARAC. If ARAC accepts the

[[Page 46824]]

working group's resommendations, it forwards them to the **FAA** as ARAC recommendations.

Working Group Activity

The Mechanical Systems Harmonization Working Group is expeced to comply with the procedures adopted by ARAC. As part of the procedures, the working group is expected to:

1. Recommend a work plan for completion of the task, including the rationale suppporting such a plan, for consideration at the meeting of ARAC to consider transport airplane and engine issues held following publication of this notice.

2. Give a detailed conceptual presentation of the proposed recommendations, prior to proceeding with the work stated in item 3 below.

3. Draft appropriate regulatory documents with supporting economic and other required analyses, and/or any other related guidance material or collateral documents the working group determines to be appropriate; or, if new or revised requirements or compliance methods are not recommended, a draft report stating the rationale for not making such recommendations. If the resulting recommendation is one or more notices of proposed rulemaking (NPRM) published by the **FAA**, the **FAA** may ask ARAC to recommend disposition of any substantive comments the **FAA** receives.

4. Provide a status report at each meeting of ARAC held to consider transport airplane and engine issues.

Participation in the Working Group

The Mechanical Systems Harmonization Working Group will be composed of technical experts having an interest in the assigned task. A working

group member need not be a representative of a member of the full committee.

An individual who has expertise in the subject matter and wishes to become a member of the working group should write to the person listed under the caption FOR FURTHER INFORMATION CONTACT expressing that desire, describing his or her interest in the tasks, and stating the expertise he or she would bring to the working group. All requests to participate must be received no later than October 5, 1998. The requests will be reviewed by the assistant chair and the assistant executive director, and the individuals will be advised whether or not the request can be accommodated.

Individuals chosen for membership on the working group will be expected to represent their aviation community segment and participate actively in the working group (e.g., attend all meetings, provide written comments when requested to do so, etc.). They also will be expected to devote the resources necessary to ensure the ability of the working group to meet any assigned deadline(s). Members are expected to keep their management chain advised of working group activities and decisions to ensure that the agreed technical solutions do not conflict with their sponsoring organization's position when the subject being negotiated is presented to ARAC for a vote.

Once the working group has begun deliberations, members will not be added or substituted without the approval of the assistant chair, the assistant executive director, and the working group chair.

The Secretary of Transportation has determined that the formation and use of ARAC are necessary and in the public interest in connection with the performance of duties imposed on the **FAA** by law.

Meetings of ARAC will be open to the public. Meetings of the Mechanical Systems Harmonization Working Group will not be open to the public, except to the extent that individuals with an interest and expertise are selected to participate. No public announcement of working group meetings will be made.

Issued in Washington, DC, on August 27, 1998.

Joseph A. Hawkins,

Executive Director, Aviation Rulemaking Advisory Committee.

[FR Doc. 98-23632 Filed 9-1-98; 8:45 am]

BILLING CODE 4910-13-M

Recommendation Letter

Pratt & Whitney
400 Main Street
East Hartford, CT 06108

Pratt & Whitney
A United Technologies Company

December 20, 1999

Department of Transportation
Federal Aviation Administration
800 Independence Ave, SW
Washington, D.C. 20591

Attention: Mr. Tom McSweeny, Associate Administrator for Regulation and Certification

Reference: ARAC Tasking, Federal Register, November 26, 1999

Dear Tom,

In accordance with the reference tasking statement, the ARAC Transport Airplane and Engine Issues Group is pleased to forward the attached technical report which provides ARAC's recommendations for FAR/JAR harmonization of 25.1438, "Pressurization and low pressure pneumatic systems." This report has been prepared by the Mechanical Systems Harmonization Working Group of the TAEIG.

Sincerely,

C. R. Bolt

C. R. Bolt
Assistant Chair, TAEIG
Phone: 860-565-9348, Fax 860-557-2277, M/S 162-24
Email: boltcr@pweh.com

cc: Dorenda Baker – FAA-NWR*
Tony Fazio – FAA. ARM-1*
Kristin Larson – FAA-NWR
Kenneth Waters, Boeing*
*letter only

MAR 15 2000

Mr. Craig Bolt
Assistant Chair, Transport Airplanes
and Engines Issues Group
400 Main Street
East Hartford, CT 06108

Dear Mr. Bolt:

This letter acknowledges receipt of the following working group technical reports that you have submitted on behalf of the Aviation Rulemaking Advisory Committee (ARAC) on Transport Airplane and Engine Issues (TAE):

Date of Letter	Task No.	Description of Recommendation	Working Group
12/14/00	1, 2, 3	Fast track reports addressing §§ 25.703(a) thru (c) (takeoff warning system); 25.1333(b) (instrument systems; and 25.1423(b) (public address system)	ASHWG
12/17/00	5	Fast track reports addressing §§ 25.111(c)(4), 25.147, controllability in 1-engine inoperative condition; 25.161 (c) (2) and (4), and (e) (longitudinal trim and airplanes with 4 or more engines) 25.175(d) (static longitudinal stability; 25.177(a)(b) (static lateral-directional stability); 25.253(a)(3) (high speed characteristics); 25.1323(c) (airspeed indicating system); 25.1516 (landing gear speeds); 25.1527 (maximum operating altitude); 25.1583(c) and (f) operating limitations) 25.1585 (operating procedures); and 25.1587 (performance information)	FTHWG
12/17/00	7	Fast track report addressing § 25.903(e) (inflight engine failures)	PPIHWG

12/20/00	5	Fast track reports addressing §§ 25.1103 (auxiliary power units); 25.933(a) (thrust reverers); 25.1189 (shutoff means); 25.1141 (powerplant controls); 25.1093 (air intake/induction systems); 25.1091 (air intake system icing protection; 25.943 (thrust reverser system tests); 25.934 (negative acceleration); 25.905(d) (propeller blade debris); 25.903(d)(1) (engine case burn-through); 25.901(d) (auxiliary power unit installation; and 1.1 (general definitions)	PPIHWG
12/20/00	4	Fast track report, category 2 format--NRRM addressing § 25.302 and appendix K (interaction of systems and structures	LDHWG
12/20/00	2	Fast track report—(in NPRM/AC format) addressing §§ 25.361 and 25.362 (engine and auxiliary power unit load conditions)	LDHWG
12/20/00	1	Fast track report addressing § 25.1438 (pressurization and low pressure pneumatic systems)	MSHWG

The above listed reports will be forwarded to the Transport Airplane Directorate for review. The Federal Aviation Administration's (FAA) progress will be reported at the TAE meetings.

This letter also acknowledges receipt of your July 28, 1999, submittal which included proposed notices and advisory material addressing lightning protection. We apologize for the delay. Although the lightning protection task is not covered under the fast track proposal, the FAA recognizes that technical agreement has been reached and we will process the package accordingly. The package has been sent to Aircraft Certification for review; the working group will be kept informed of its progress through the FAA representative assigned to the group.

Lastly, at the December 8 - 9, 1999, TAE meeting, Mr. Phil Salee of the Powerplant Installation Harmonization Working Group indicated that the working group members agreed that § 25.1103 was sufficiently harmonized and that any further action was beyond the scope of task 8 assigned. We agreed with the TAE membership to close the task. This letter confirms the FAA's action to close the task to harmonize § 25.1103.

I would like to thank the ARAC, particularly those members associated with TAE for its cooperation in using the fast track process and completing the working group reports in a timely manner.

Sincerely,

ORGINIAL SIGNED BY
ANTHONY F. FAZIO

Tony F. Fazio
Director, Office of Rulemaking

ARM-209:EUpshaw:fs:6/27/00:PCDOCS #12756v1
cc: ARM-1/20/200/209; APO-300/320, ANM-114
File #1340.12

File #ANM-98-182-A (landing gear shock absorption test requirements) and ANM-94-461-A (Taxi, takeoff, and landing roll design loads)

Recommendation

ARAC WG Report Format

1 - What is underlying safety issue addressed by the FAR/JAR? **[Explain the underlying safety rationale for the requirement. Why does the requirement exist?]**

Ruptures of pneumatic and pressurization system elements (components and ducts) can lead to unsafe conditions due to system malfunction or loss and can cause ancillary damage to critical systems. The rules define design and test requirements for pneumatic and pressurization system elements to ensure reliable and safe operation

2 - What are the current FAR and JAR standards? **[Reproduce the FAR and JAR rules text as indicated below.]**

FAA REQUIREMENTS

cfr.14.25.1438
§ 25.1438 Pressurization and Pneumatic Systems.

Date: January 1, 1998

(a) Pressurization system elements must be burst pressure tested to 2.0 times, and proof pressure tested to 1.5 times, the maximum normal operating pressure.

(b) Pneumatic system elements must be burst pressure tested to 3.0 times, and proof pressure tested to 1.5 times, the maximum normal operating pressure.

(c) An analysis, or a combination of analysis and test, may be substituted for any test required by paragraph (a) or (b) of this section if the Administrator finds it equivalent to the required test.

[Amdt. 25-41, 42 FR 36971, July 18, 1977]

JAA REQUIREMENTS

jar.25.25.1438
JAR 25.1438 Pressurization and low pressure pneumatic systems

Date: May 27, 1994

Pneumatic systems (ducting and components) served by bleed air, such as engine bleed air, air conditioning, pressurization, engine starting and hot-air ice-protection system which are essential for the safe operation of the airplane or whose failure may affect any essential or critical part of the airplane or the safety of the occupants, must be so designed and installed as to comply the JAR 25.1309 In particular account must be taken of bursting or excessive
leakage. (See ACJ 25.1438 paragraph 1 for strength and ACJ 25.1438 paragraph 2 for testing.)

ar.25.s2.acj.25.1438
ACJ 25.1438 - Pressurization and Low Pressure Pneumatic Systems (Acceptable Means of Compliance)

Date: May 27, 1994

See JAR 25.1438

1 Strength

1.1 Compliance with JAR 25.1309(b) in relation to leakage in ducts and components will be achieved if it is shown that no hazardous effect will result from any single burst or excessive leakage.

1.2 Each element (ducting and components) of a system, the failure of which is likely to endanger the aeroplane or its occupants, should satisfy the most critical conditions of Table 1.

TABLE 1

Conditions 1	Conditions 2
1.5 P1 at T1	3.0 P1 at T1
1.33 P2 at T2	2.66 P2 at T2
1.0 P3 at T3	2.0 P3 at T3
--	1.0 P4 at T4

P1 = the most critical value of pressure encountered during normal functioning.

T1 = the combination of internal and external temperatures which can be encountered in association with pressure P1.

P2 = the most critical value of pressure corresponding to a probability of occurrence 'reasonably probable'.

T2 = the combination of internal and external temperatures which can be encountered in association with pressure P2.

P3 = the most critical value of pressure corresponding to a probability of occurrence 'remote'.

T3 = the combination of internal and external temperatures which can be encountered in association with pressure P3.

P4 = the most critical value of pressure corresponding to a probability of occurrence 'extremely remote'.

T4 = the combination of internal and external temperatures which can be encountered in association with pressure P4.

1.3 After being subjected to the conditions given in column 1 of Table 1, and on normal operating conditions being restored, the element should operate normally and there should be no detrimental permanent distortion.

1.4 The element should be capable of withstanding the conditions given in column 2 of Table 1 without bursting or excessive leakage. On normal operating conditions being restored, correct functioning of the element is not required.

1.5 The element should be capable of withstanding, simultaneously with the loads resulting from the temperatures and pressures given in the Table, the loads resulting from --

a. Any distortion between each element of the system and its supporting structures.

b. Environmental conditions such as vibration, acceleration and deformation.

1.6 The system should be designed to have sufficient strength to withstand the handling likely to occur in operation (including maintenance operations).

2 Tests

2.1 Static tests. Each element examined under 1.2 should be static-tested to show that it can withstand the most severe conditions derived from consideration of the temperatures and pressures given in the Table. In addition, when necessary, sub-systems should be tested to the most severe conditions of 1.2 and 1.5. The test facility should be as representative as possible of the aircraft installation in respect of these conditions.

2.2 Endurance tests. When failures can result in hazardous conditions, elements and/or sub-systems should be fatigue-tested under representative operating conditions that simulate complete flights to establish their lives.

jar.25.25x1436
JAR 25X1436 Pneumatic systems -- high pressure

Date: May 27, 1994

(a) General. Pneumatic systems which are powered by, and/or used for distributing or storing, air or nitrogen, must comply with the requirements of this paragraph.

(1) Compliance with JAR 25.1309 for pneumatic systems must be shown by functional tests, endurance tests and analysis. Any part of a pneumatic system which is an engine accessory must comply with the relevant requirements of JAR 25.1163.

(2) No element of the pneumatic system which would be liable to cause hazardous effects by exploding, if subject to a fire, may be mounted within an engine bay or other designated fire zone, or in the same compartment as a combustion heater.

(3) When the system is operating no hazardous blockage due to freezing must occur. If such blockage is liable to occur when the airplane is stationary on the ground, a pressure relieving device must be installed adjacent to each pressure source.

(b) Design. Each pneumatic system must be designed as follows:

(1) Each element of the pneumatic system must be designed to withstand the loads due to the working pressure, PW, in the case of elements other than pressure vessels or to the limit pressure, PL, in the case of pressure vessels, in combination with limit structural loads which may be imposed without deformation that would prevent it from performing its intended function, and to withstand without rupture, the working or limit pressure loads multiplied by a factor of 1.5 in combination with ultimate structural loads that can reasonably occur simultaneously.

(i) PW. The working pressure is the maximum steady pressure in service acting on the element including the tolerances and possible pressure variations in normal operating modes but excluding transient pressures.

(ii) PL. The limit pressure is the anticipated maximum pressure in service acting on a pressure vessel, including the tolerances and possible pressure variations in normal operating modes but excluding [transient pressures.]

(2) A means to indicate system pressure located at a flight-crew member station, must be provided for each pneumatic system that --

(i) Performs a function that is essential for continued safe flight and landing; or

(ii) In the event of pneumatic system malfunction, requires corrective action by the crew to ensure continued safe flight and landing.

(3) There must be means to ensure that system pressures, including transient pressures and pressures from gas volumetric changes in components which are likely to remain closed long enough for such changes to occur --

(i) Will be within 90 to 110% of pump average discharge pressure at each pump outlet or at the outlet of the pump transient pressure dampening device, if provided; and

(ii) Except as provided in sub-paragraph (b)(6) of this paragraph, will not exceed 125% of the design operating pressure, excluding pressure at the outlets specified in sub-paragraph (b)(3)(i) of this paragraph. Design operating pressure is the maximum steady operating pressure.

The means used must be effective in preventing. excessive pressures being generated during ground charging of the system. (See ACJ 25X1436 (b)(3).)

(4) Each pneumatic element must be installed and supported to prevent excessive vibration, abrasion, corrosion, and mechanical damage, and to withstand inertia loads.

(5) Means for providing flexibility must be used to connect points in a pneumatic line between which relative motion or differential vibration exists.

(6) Transient pressure in a part of the system may exceed the limit specified in sub-paragraph (b)(3)(ii) of this paragraph if --

(i) A survey of those transient pressures is conducted to determine their magnitude and frequency; and

(ii) Based on the survey, the fatigue strength of that part of the system is substantiated by analysis or tests, or both.

(7) The elements of the system must be able to withstand the loads due to the pressure given in Appendix K, for the proof condition without leakage or permanent distortion and for the ultimate condition without rupture. Temperature must be those corresponding to normal operating conditions. Where elements are constructed from materials other than aluminum alloy, tungstun or medium-strength steel, the Authority may prescribe or agree other factors.
The materials used should in all cases be resistant to deterioration arising from the environmental conditions of the installation, particularly the effects of vibration.(AMENDED BY ORANGE PAPER AMENDMENT 25/96/1)

(8) Where any part of the system is subject to fluctuating or repeated external or internal loads, adequate allowance must be made for fatigue.

(c) Tests

(1) A complete pneumatic system must be static tested to show that it can withstand a pressure of 1.5 times the working pressure without a deformation of any part of the system that would prevent it from performing

its intended function. Clearance between structural members and pneumatic 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.

(2) The entire system or appropriate sub-systems must be tested in an airplane or in a mock-up installation to determine proper performance and proper
relation to other airplane systems. The functional tests must include simulation of pneumatic system failure conditions. The tests must account for flight loads, ground loads, and pneumatic system working, limit and transient pressures expected during normal operation, but need not account for vibration loads or for loads due to temperature effects. Endurance tests must simulate the repeated complete flights that could be expected to occur in service.
Elements which fail during the tests must be modified in order to have the design deficiency corrected and, where necessary, must be sufficiently retested.
Simulation of operating and environmental conditions must be completed on elements and appropriate portions of the pneumatic system to the extent necessary to evaluate the environmental effects. (See ACJ 25X1436 (c)(2).)

(3) Parts, the failure of which will significantly lower the airworthiness or safe handling of the airplane must be proved by suitable testing, taking into account the most critical combination of pressures and temperatures which are applicable.

jar.25.s2.acj.25x1436.b.3
ACJ 25X1436(b)(3) - Pneumatic Systems (Interpretative Material)

Date: May 27, 1994

See JAR 25X1436(b)(3)

1 In systems in which the air pressure of the supply sources is significantly greater than the system operating pressure (e.g. an engine bleed-air tapping) due account should be taken of the consequences of failure of the pressure-regulating device when assessing the strength of the system, downstream of the device relative to the values of PW, PL and PR.

2 Such devices should be protected as necessary against deleterious effects resulting from the presence of oil, water or other impurities which may exist in the system.

jar.25.s2.acj.25x1436.c.2
ACJ 25X1436(c)(2) - Pneumatic Systems (Interpretative Material)

Date: May 27, 1994

See JAR 25X1436(c)(2)

The loads due to vibration and the loads due to temperature effects are those loads which act upon the elements of the system due to environmental conditions.

The MSHWG has been using the JAA PNPA25F-293 Issue 1 Dated May 19, 1998 as the basis for harmonization since the PNPA had been released for comment and was ready to be published in JAR 25 change 15.

Element of System	Strength Value		Remarks
	Proof	Ultimate	
Rigid pipes and ducts	1·5 Pw	3·0 Pw	
Couplings	1·5 Pw	3·0 Pw	
Flexible hoses	2 0 Pw	4·0 Pw	
Return line elements	—	1·5 Pr	Pr The maximum pressure applied during failure conditions.
Components other than pipes, couplings, ducts or pressure vessels	1·5 Pw	2·0 Pw	
Pressure vessels fabricated from metallic materials. (For non-metallic materials see JAR 25.1435(a)(10) and JAR 25X1436(b)(7))			
Pressure vessels connected to a line source of pressure	3·0 PL or 1·5 PL	4·0 PL or 2·0 PL	The lower values are conditional upon justification by a fatigue endurance test from which a permissible fatigue life is declared, and upon the ultimate load test being made on the test specimen used for the fatigue life test.
Pressure vessels not connected to a line source of pressure, e.g. emergency vessels inflated from a ground source	2·5 PL or 1·5 PL	3·0 PL or 2·0 PL	The lower values are conditional upon justification by a life endurance test of a suitably factored permissible number of inflation/deflation cycles, including temperature fluctuation results in a significant pressure variation, and upon the ultimate load test being made on the test specimen used for the life endurance test. For all pressure vessels: (1) The minimum acceptable conditions for storage, handling and inspection are to be defined in the appropriate manual. See JAR 25.1529(h). (2) The proof factor is to be sustained for at least three minutes. (3) The ultimate factor is to be sustained for at least one minute. The factor having been achieved, the pressure vessel may be isolated from the pressure source for the remaining portion of the test period.

3 - What are the differences in the standards and what do these differences result in?:
[Explain the differences in the standards, and what these differences result in relative to (as applicable) design features/capability, safety margins, cost, stringency, etc.]
See Table A

TABLE A

ITEM	Description	FAR 25.1438	JAR 25X1436 NPA 25F-293	JAR 25.1438	Report Question 3 Response (Relevance of Difference)	Report Question 4 Respons (Compliance Criteria)
1	General rule structure	Rule description are within 25.1438	Rule description is within the JAR	Rule refers to ACJ which contains all details	Differences in rule structure can lead to compliance confusion and additional certification constraints	FARs and JARs are requirements. The ACJ to JAR 25.1438 is an acceptable means of compliance.
2	Probability of occurrence. Normal operation and multiple failures	Probability is not addressed System failures not considered	Probability is not addressed	ACJ assigns a pressure multiplier for each specific probability of occurrence. 1) 1.5x & 3.0x @ "normal functioning" 2) 1.33x & 2.66x@"reasonably probable" 3) 1x & 2x @ "remote" 4) none & 1x @ "extremely remote"	The JAR requirements account for failure conditions which can require higher design factors.	JAR requires more analysis and test ar is more stringent. JAR25.148 requires probability analysis to determine prope design factors.
3	Multiplier for various systems	Pressurization 1.5x & 2x Pneumatic- 1.5x & 3x Air-conditioning -- none Engine Starting - none Ice Protection -- none	Compliance level does not vary with different systems.	Compliance level does not vary with different systems. System listed are air conditioning , Pressurization, engine starting, & I/P	The JAR25.1438 requires higher factors for pressurization systems and may result in additional test and analysis. The JAR25X1436 requires higher factors for specific system components (pressure vessels, hoses)	JARs result in more analysis and testing .
4	System function after "condition 1" proof	Does not address system requirement after a Proof event.	Elements should withstand proof without permanent deformation and negative effects on intended function	Element should operate normally and with no detrimental permanent distortion.	JAR sets acceptance requirements more clearly and provides a more standardized acceptance criteria.	JAR defines post test acceptance criteria
5	System function after "condition 2" burst	Does not address system requirement after a burst event.	Elements should withstand burst without rupture	Element should withstand burst pressure without bursting or excessive leakage	JAR sets acceptance requirements more clearly and provides a more standardized acceptance criteria.	JAR defines post test acceptance criteria

6	Combined load requirements	None	Must consider additional loads: structural and externally induced loads	Must consider additional load: 1)"loads resulting from any distortion between each element of the system and its supporting structures". 2) Vibration, acceleration and deformation.	The JAR includes combined loads for pressurization and pneumatic systems and may result in additional test and analysis.	JAR requires consideration of combined loads requiring additional analysis and improved tests.
7	Testing	No mention of testing	Tests addressed in requirement	Section 2 of ACJ address testing: 2.1 Static tests, and 2.2 Endurance tests.	JAR test requirements are more expensive and time consuming.	JAR requires more complicated testing including a complete system.

The JAA applies JAR Paragraph 25X1436 to pneumatic systems not covered by 25.1438 such as slide deployment systems, thrust reverser actuation systems, door release mechanisms. There is no equivalent FAR 1436. The FAA applies FAR 1301, 1309, 25.1438 to pneumatic systems and Department Of Transportation (DOT) regulations to gas storage devices. The JAR also distinguishes between pneumatic systems and high pressure systems. Part 25.1438 of the FAR and Paragraph 25X1436 of the JAR have been applied to gas storage devices such a hydraulic accumulators. JAR 25X1436 applies to the installation including the piping and components of high-pressure systems. No equivalent FAA rule leads to inconsistent compliance means, which may not support JAA certification requirements resulting in additional certification documentation and testing.

4 - What, if any, are the differences in the means of compliance? **[Provide a brief explanation of any differences in the compliance criteria or methodology, including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]**
See Table A

5 – What is the proposed action? **[Is the proposed action to harmonize on one of the two standards, a mixture of the two standards, propose a new standard, or to take some other action? Explain what action is** being proposed (not the regulatory text, but the underlying rationale) and why that direction was chosen.]

The proposed action is to merge the requirements of all the rules, to compare these requirements with industry standards and to simplify the rule by using the industry standards which have resulted in systems that have been demonstrated safe by service experience. The harmonized 1438 rule will combine the requirements of FAR 1438, JAR 1438 and 1436 into one harmonized rule and eliminate the need for JAR 1436 and the ACJ 1438. This method was chosen after an investigation of rule contents and applications of JAR25X1436 in state-of-the-art-design. As the NPA25F-293 to JAR25X1436 is mature for publication in the JAA-system the group agreed to take it as basis for inclusion. JAA accepted this proceeding. Without inclusion of JAR25X1436 it would be necessary to create a corresponding FAR25.1436 to achieve harmonization within the scope of the MSHWG. The so harmonized and simplified rule is in line with industry standards which have resulted in systems that have been demonstrated safe by A/C certifications and service experience.

6 - What should the harmonized standard be? **[Insert the proposed text of the harmonized standard here]**

. 25.1438 Pneumatic Systems

(a) This requirement is applicable to pneumatic systems and elements (components and ducting) served by gas storage devices such as, evacuation, water systems, accumulators and/or pressurized gas from compressors such as engine and APU bleed air, air conditioning, pressurization, engine starting, ice-protection, and pneumatic actuation systems. Design compliance may be in the form of analysis, test, or combination of analysis and test. All foreseen normal and failure mode combinations of environmental loads (installation, thermal, vibration, and aerodynamic), pressures, temperatures, material properties, and dimensional tolerances must be considered. This requirement is not applicable to portable gas storage devices.

(b) Each element of the system must be designed to operate without detrimental permanent deformation or increase in design leakage that would prevent the element from performing its intended function. For demonstrating compliance, the following factors are to be applied to the pressure at the associated temperature for the most critical of the following conditions:

- 1.5 times maximum normal operating
- 1.33 times the failure pressure occurring in the probability range between 10E-03 to 10E-05 failures/flight hour
- 1.0 times the failure pressure occurring in the probability range between 10E-05 to 10E-07 failures/flight hour
- 1.0 times the maximum normal operating pressure in combination with the limit structural loads

After being subjected to the above conditions and on normal operating conditions being restored, the element should operate normally.

(c) Each element of the system must be designed to operate without rupture or increase in design leakage which is likely to endanger the airplane or its occupants. For demonstrating compliance, the following factors are to be applied to the pressure at the associated temperature for the most critical of the following conditions:

- 3.0 times maximum normal operating pressure. Pressurization system elements shall use a factor of 2.0 time maximum normal operating pressure
- 2.66 times the failure pressure occurring in the probability range between 10E-03 to 10E-05 failures/flight hour
- 1.5 times the failure pressure occurring in the probability range between 10E-05 to 10E-07 failures/flight hour is applicable to components. Ducting shall use a factor of 2.0 times the failure pressure occurring in the probability range between 10E-05 to 10E-07 failures/flight hour

- 1.0 times the failure pressure occurring in the probability range between 10E-07 to 10E-09 failures/flight hour
- 1.5 times the maximum normal operating pressure in combination with the 1.0 times the ultimate structural loads

After being subjected to the above conditions and on normal operating conditions being restored, the element need not operate normally.

(d) If the failure of an element can result in a hazardous condition, it must be designed to withstand the fatigue effects of all cyclic pressures, including transients, and associated externally induced loads and perform as intended for the design life of the element under all environmental conditions for which the airplane is certified.

(e) In addition, each gas storage device must meet the requirement of this rule and not cause hazardous effects by exploding when installed. Other standards may be made applicable by the local authority.

7 - How does this proposed standard address the underlying safety issue (identified under #1)? **[Explain how the proposed standard ensures that the underlying safety issue is taken care of.]**

The new ruling clearly defines design and compliance criteria in one rule without relying on separate documents and defines minimum design and test standards for pneumatic and pressurization system components and pressure vessels. The harmonized rule merges existing proven requirements and industry standards which have resulted in safe aircraft systems with proven service experience

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain. **[Explain how each element of the proposed change to the standards affects the level of safety relative to the current FAR. It is possible that some portions of the** proposal may reduce the level of safety even though the proposal as a whole may increase the level of safety.]

The proposed standard formally improves the level of safety, ensures competitiveness and state-of-the-art levels of safety and reliability of aircraft pneumatic systems. It supplements the FAR standard with design and test requirements used by major manufacturers, government organizations and industry which have been validated by service experience. This has enabled the industry also to meet the corresponding JARs which include aspects of these industry practices or have formalized them in advisory material.

The industry practices (consideration of fatigue strength and system failure conditions, increased margins of safety for failure pressures related to their probabilities of occurrence, gas storage devices etc.) have been incorporated into the proposed standard and its regulatory content is significantly improved because important safety relevant practices are now set as a minimum standard, and thus, enforceable.

For failure conditions, new pressure factors have been introduced into the proposed rule. The proposed rule requires applicants to design and test the bleed air system considering installation and operating loads. The existing rule only required static pressure tests based on a normal operating pressure multiplied by a factor. The existing rule did not account for factors introduced on bleed air systems from installation and operating conditions.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain. **[Since industry practice may be different than what is required by the FAR (e.g., general industry practice may be more restrictive), explain how each element of** the proposed change to the standards affects the level of safety relative to current industry practice. Explain whether current industry practice is in compliance with the proposed standard.]

The proposed standard maintains the same level of safety relative to current industry practice, which is in compliance with the proposed standard. It is derived in part from the requirements used to design and qualify transport aircraft systems and components of major United States and European manufacturers which have demonstrated their products safe operation in service. Design factors for components having relatively low reliability may be higher than used by Boeing in the past, however data show that the design factors which have been used are consistent with the components' higher reliability and are in line with the proposed rule.

10 - What other options have been considered and why were they not selected?: **[Explain what other options were considered, and why they were not selected (e.g., cost/benefit, unacceptable** decrease in the level of safety, lack of consensus, etc.]

The most stringent requirements of the FAR and JAR were considered to be incorporated into one ruling. Analysis and service experience was used to show that a level of requirements lower than JAR 25.1438/ACJ25.1438, but combined with standards like the BOEING Design Requirements and Objectives (DRO) or the American Department of Transport standards, have proven satisfactory at reduced cost and weight to the industry. Several Type Certificate (TC) applicants have applied for an exception to JAR 25.1438 airplanes. The exception has been approved by the Joint Aviation Authorities based on the presentation of procedures and standards used to supplement FAR25.1438 (Equivalent safety finding). The exception allowed the TC applicant to show compliance to JAR 25.1438 by using in service experience of pneumatic duct components that were tested to factors lower than specified in JAR 25.1438.
Also, a new FAR 25.1436 was considered, the same as the JAR25X1436. Based on investigations of content and applications for JAR25X1436 it was decided to combine the requirements of JAR25X1436 into a single merged rule (named JAR/FAR25.1438) to eliminate confusion and competing requirements for like systems.

11 - Who would be affected by the proposed change? **[Identify the parties that would be materially affected by the rule change – airplane manufacturers, airplane operators, etc.]**

Airplane manufactures and suppliers will benefit from the single well defined harmonized ruling reducing certification costs. Manufactures and suppliers not in the global market, may have increased costs. Amongst others the proposed rule added fatigue design requirements and pressure factors for certain failure modes. The proposed rule may increase costs for TC applicants manufacturers that have only showed compliance to §25.1438 and for those applicants that do not have experience in fatigue design requirements and probability analysis tools/skills.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? **[Does the existing advisory material include substantive requirements that should be contained in the regulation? This may occur** because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

No current advisory material should be included, however the preamble should include the following-

PREAMBLE

SUMMARY: This notice proposes to revise the requirements for pneumatic and pressurization systems by specifying load factors in combination with proof and burst pressure factors in the rule. This action is in response to the Aviation Rulemaking Advisory Committee (ARAC) Mechanical Systems Harmonization Working Group recommendation to harmonize paragraphs 25X1436 and 25.1438 of the Joint Aviation Requirements (JAR) with part 25.1438 of the Federal Aviation Regulations (FAR).

BACKGROUND

On September 2, 1998 the FAA issued a Notice of a new task to harmonize §25.1438 with JAR Paragraphs 25X1436 and 25.1438. The notice was issued to inform the public that the FAA has asked ARAC to provide advice and recommendations on harmonization of the FAA regulations and JAA requirements for pressurization and pneumatic systems. This Notice of Proposed Rulemaking proposes a new Pneumatic and Pressurization rule that has been harmonized to satisfy both the FAA and JAA.

General Discussion:

The intent of this rule is to combine the requirements of section 25.1438 of the Federal Aviation Regulations (FAR), paragraph 25X1436 and 25.1438 Joint Aviation Requirements (JAR), and the advisory material for paragraphs 25X1436 and 25.1438 of the JAR into one rule. The rule format is similar to the advisory material for JAR 25.1438, however, the design standards have been placed in the text of the rule instead of the advisory material.

The multipliers from JAR25X1438 and those from the advisory material for JAR25.1438 have been adapted based on airplane manufacturer design practice and service history. This rule applies to bleed air and gas storage served systems like air conditioning, pressurization emergency deployment system and their elements.
For the purpose of this rule-
-the bleed air and air conditioning system elements include the ducting, control devices and components from the air supply source to the pressure bulkhead.
-Pressurization system elements are the elements exposed to cabin pressure. Pressurization system elements include the out flow valve and pressure relief valves. This rule does not apply to the structural parts of the pressurized cabin.
- An element is considered to be any component, tube or duct in the pneumatic or pressurization system.

This rule has been changed to harmonize and clarify sections 25.1438 of the FAR and JAR 25.1438. Current versions of §25.1438 of the FAR and paragraph 25.1438 of the JAR do not require the applicant to demonstrate compliance to the rules using the worst possible combination of temperature and pressure. In addition, §25.1438 of the FAR does not require the applicant to consider stress loads on pneumatic system components from pressure & temperature changes in combination with vibration and external loads. The proposed changes in the rule reflect current airplane manufacturer design practices.

Section 25.1438 of FAR and the advisory material for paragraphs 25X1436 and 25.1438 of the JAR require different proof and burst pressure multipliers for high pressure pneumatic systems, pressurization and pneumatic systems normal and abnormal conditions. The JAR also distinguishes between high and low pressure pneumatic systems. Part 25.1438 of the FAR and paragraph 25X1436 of the JAR have been applied to gas storage devices such a hydraulic accumulators. The MSHWG was tasked by the FAA to consider JAR 25X1436 in the harmonization rule because JAR 25X1436 and § 25.1438 both apply to gas storage devices such as hydraulic accumulators.

JAR 25X1436 has been applied to gas storage devices such as hydraulic system accumulators used in back up thrust reverser, flight control, and nitrogen bottles used in door opening and evacuation systems. The FAA applies Department of Transportation (DOT) regulations to gas storage devices such as nitrogen and oxygen bottles. The MSHWG found it acceptable to include requirements for gas storage devices in the rule; however, each country can apply national standards in addition to the proposed minimum requirement for gas storage devices.

JAR 25X1436 applies to the installation including the piping and components of high-pressure systems. The MSHWG has determined the requirements the harmonized rule for pneumatic and pressurization system rule will accommodate installation of the system, this includes the piping and components of pneumatic systems, including gas storage devices. As a result the intent of 25X1436 will be captured within the

harmonized rule for 25.1438, therefore eliminating the need for a separate rule. Pressure requirements specified in the harmonized rule apply to the system and components including actuators, pressure control regulators, pressurized lines to the regulating devices, and pressure sensors. Piping and components of gas storage devices covered by DOT regulations must meet the new requirements specified in this rule.

Section 25.1438 of the FAR has been applied by the JAA to oxygen systems down stream of the regulating device. The FAA now also will apply this rule to oxygen systems down stream of the first regulating device until the rules governing oxygen systems supercede this requirement.

Section 25.1438 of the FAR and the advisory material for JAR 25.1438 currently list different proof and burst pressure multipliers for pneumatic and pressurization systems. Application of the multipliers has not been consistent from one airplane program to the next program because the rules do not clearly distinguish where the pneumatic system ends and the pressurization system starts. This rule eliminates the need to define pneumatic systems and pressure systems because ducting and components must be designed to withstand the pressures of upstream component failures based on the probability of the upstream component failure. Distribution duct failures located in the pressurized cabin do not have to show compliance with this rule (unless the failure is hazardous to the airplane or occupants) because the failure does not cause the cabin to depressurize.

Section 25.1438 of the FAR currently require a set of multipliers for proof and burst pressure testing for both the pneumatic and pressurization systems based on normal operating pressure. The basis of the multipliers in the FAR is not currently known. It is believed the multipliers in §25.1438 were based on military or industry specifications. The advisory material for JAR 25.1438 uses pressures and related temperatures derived from probability of component failures to determine burst and proof pressure multipliers. Members of the MSHWG agree that a proof and burst test requirement does not necessarily represent the highest stress conditions encountered during operation. The MSHWG decided to develop the multipliers in the harmonized rule to reflect industry practices used to design pressurized ducting in airplane systems. In showing compliance to this rule the normal operating pressure is multiplied by the factor specified in the proposed rule in combination with highest stress condition resulting from the realistic simultaneous application of pressure/temperature combined with duct, vibration, and external loads. The normal operating pressure is the maximum pressure the system uses in normal operations during the flight envelope. The flight envelope includes take off and landing.

Section 25.1438 of the FAR and JAR 25.1438 do not require consideration of weaker material strength in the design as the system ages. If the material strength decreases due to aging, then the applicant must account for the aged material condition in showing design compliance to the requirements in this rule.

The value of each multiplier is based on airplane manufacture design practices. The airplane manufacturer data showed these design practices resulted in a long reliable service history for bleed air systems and components.

Maximum normal operating pressure is the highest value of pressure occurring at any time during steady state normal operating conditions, with all the components of the system functioning normally. Higher pressures occurring momentarily, such as during normal operating transients must be accounted for when considering failure conditions. .

References to FAR 25.1309 which is in the present JAR 25.1438 were not included in this rule. Section 25.1309 of the FAR applies to all airplane systems regardless of special references in this rule or any other rule.

Proposed Rule Discussion:

Paragraph (a) of the proposed rule is written to define the applicable systems that the rule applies too and list the conditions that must be considered in combination with the proof and burst pressure test requirements in paragraphs (b) and (c). The intent of this rule is to require the conditions in paragraph (a) to be combined with the specified test requirements in paragraphs (b) and (c) when showing compliance to this rule.

Paragraph (b) defines the first test condition and the pass/fail criteria. The element must be shown to operate without detrimental permanent deformation or increase in design leakage that would prevent the element from performing its intended function after the element is tested to the conditions specified in paragraph (b). The „most critical condition" is the worst combination of the factors specified in paragraph (a). Compliance must be show by testing the element to the factors specified in paragraph (b) in combination with the "most critical condition". Analysis may be used to show compliance with this rule provided the analysis is validated by test results using similar systems or components. Engine over speed conditions resulting in higher than normal operating pressures are considered as a first failure when showing compliance to this condition.

Paragraph (c) defines the second test condition and the pass/fail criteria for that condition. Like paragraph (a) the „most critical condition" is the worst combination of the factors specified in paragraph (a). Compliance must be show by testing the element to the factors specified in paragraph (c) in combination with the „most critical condition". Analysis may be used to show compliance with this rule provided the analysis is demonstrated reliable based on test results from similar systems or components. The test element need not operate normally after being subjected to the conditions in paragraph (c). Engine over speed conditions considered resulting in higher than normal operating pressures are considered as a first failure when showing compliance to this condition.

Paragraph (d) defines design criteria for components that can be hazardous to the airplane or the occupants. Hazardous to the airplane or occupants is defined in accordance with JAR/FAR25.1309 as any effect

-that could cause serious injury to or death of a relatively small portions of the occupants,
-that largely reduces the margins of safety
-that results in physical distress or a workload such that the flight crew cannot be relied upon to perform their tasks accurately or competely

Paragraph (e) defines requirements for gas storage devices.

DEFINITION OF TERMS

Air Conditioning System
All elements comprising the system which control the airflow, gas composition and temperature to the pressurized zones of the airplane
Components
All elements of the pneumatic system, which perform mechanical, pneumatic, thermodynamic, electric functions or are used in controlling these functions
Compressor
Any machine which increases gas pressure

Design Life
The time that the component will perform its intended function, including overhauls before it is permanently replaced
Design Leakage
The value of airflow exiting a component, either internally or externally for which the system and surrounding systems have been designed to accommodate
Detrimental Deformation
A change of physical shape which reduces the structural integrity or the design fatigue life of the element or reduces normal operating system performance
Ducts
All elements of the system, having no moving parts, which direct and transport gas from one component of the system to another.
Elements
All individual components (for example ducts, valves, tubes, couplings, brackets, controllers, sensors etc) comprising the system.
Exploding
Pneumatic rupture of an element resulting in a sudden and violent release of energy
Failure Mode
Set of conditions which result in an element not performing as intended
Failure Pressure or Temperature
The value of pressure or temperature which occurs at a point in a system as the result of a failure of a control device
Gas Storage Device
A component which acts as a resevoir for compressed gas, and which is designed to release the gas to serve user systems.
Hazardous Effects

A hazardous condition resulting from the failure of an airplane system or system element

Hazardous Condition

A failure of an element which endangers the airplane or its occupants

Maximum Normal Operating Pressure or Temperature

The highest pressure or temperature at a point in the system which occurs with all the elements of the system operating normally under steady state and transient conditions.

Most Critical

The combination of pressure and temperature imposed on an element which is being analyzed, that results in the smallest difference of actual stress and allowable stress.

Normal Mode

With all the component parts of the system operating normally

Pneumatic System

All of the elements of the system that convey gas and/or control pressure and temperature from compressed gas sources to provide a conditioned gas mass flow or provide energy to perform mechanical work.

Pressurization System

All elements comprising the system which control the air pressure of the airplane ~~occupied~~ pressurized zones

Tubing

Small diameter pipes, serving the same purpose as ducts, providing low airflow within or between components

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted? **[Indicate whether the existing advisory material (if any) is adequate. If the current advisory material is not adequate, indicate whether the existing material should be revised, or new material provided.** Also, either insert the text of the proposed advisory material here, or summarize the information it will contain, and indicate what form it will be in (e.g., Advisory Circular, policy, Order, etc.)]

[]

No FAA advisory material exists nor is intended for the harmonized ruling. No ACJ 1438 will be required either. The harmonized ruling and preamble will be written to stand alone.

14 - How does the proposed standard compare to the current ICAO standard? **[Indicate whether the proposed standard complies with or does not comply with the applicable ICAO standards (if any)]**

"Due to their commitments as ICAO members the US and all JAA-countries converted ICAO requirements into their airworthiness codes. So both the JAR and FAR 25 at least fulfill the ICAO minimum standards. As the proposed standard does not decrease the level of safety of FAR or JAR25, it is in line with ICAO Annex 8 "Airworthiness of Aircraft"."

15 - Does the proposed standard affect other HWG's? **[Indicate whether the proposed standard should be reviewed by other harmonization working groups and why.]**

No.

16 - What is the cost impact of complying with the proposed standard? **[Is the overall cost impact likely to be significant, and will the costs be higher or lower? Include any cost savings that would** result from complying with one harmonized rule instead of the two existing standards. Explain what items affect the cost of complying with the proposed standard relative to the cost of complying with the current standard.]

The proposed new standard will reduce the overall cost and time of the joint certification process and will not increase cost for any present major manufacturer that has a service demonstrated safety record. An increase in certification costs may result to those manufactures applying only for FAA type certificate due to the addition of failure mode pressure factors and fatigue design requirements. In addition, certification of pressurized bottles may experience higher costs in analyzing pressure vessel rupture effects to ancillary systems. None of these costs are considered significant relative to the costs of potential warranty claims and product improvements

17 - Does the HWG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

YES

18 – In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process. Explain. **[A negative answer to this question will prompt the FAA to pull the project out of the Fast Track process and forward the issues to the** FAA's Rulemaking Management Council for consideration as a "significant" project.]

The "Fast Track" process IS appropriate

Recommendation Letter

Pratt & Whitney
400 Main Street
East Hartford, CT 06108

Pratt & Whitney
A United Technologies Company

February 18, 2002

Federal Aviation Administration
800 Independence Avenue SW
Washington, DC 20591

Attention: Mr. Nicholas Sabatini, Associate Administrator for Regulation and Certification, AVR-1

Subject: ARAC Recommendation

Reference: 25.1438, Pneumatic Systems

Dear Mr. Sabatini,

In accordance with Phase 4 of the Fast Track process, the proposed NPRM addressing 25.1438, Pneumatic Systems, was sent to the Mechanical Systems HWG of TAEIG for review. During this review, the MSHWG felt that substantive changes were made to the original ARAC recommendation (3 minutes and 1 minute test times for proof and burst pressure). The MSHWG and FAA-NWR have reviewed the issue and reached agreement on revised wording which is included in the attached NPRM.

This revised NPRM has been approved by TAEIG and is submitted as an ARAC recommendation.

Sincerely,

Craig R. Bolt

C. R. Bolt
Assistant Chair TAEIG

Copies: Mike Kaszycki – FAA-NWR
Pat Waters – Boeing (MSHWG Chair)
Effie Upshaw – FAA-Washington, D.C.
Dianne Krebs – FAA-NWR

Recommendation

[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. _____; Notice No. _____

RIN: 2120- AG92

Design Requirements for Pressurization and Pneumatic Systems Installed on Transport Category Airplanes

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of proposed rulemaking.

SUMMARY: The Federal Aviation Administration proposes to amend the airworthiness standards for transport category airplanes concerning the design requirements for pneumatic systems. This action would revise the standards by incorporating more defined design and compliance criteria currently contained in the counterpart European standards. It would also simplify the current rule by incorporating industry standards that have resulted in systems shown to be safe by certification and service experience. Adopting this proposal would eliminate regulatory differences between the airworthiness standards of the U.S. and the Joint Aviation Requirements of Europe, without affecting current industry design practices.

DATES: Send your comments on or before [Insert date 60 days after date of publication in the Federal Register.]

ADDRESSES:

Address your comments to Dockets Management System, U.S. Department of Transportation Dockets, Room Plaza 401, 400 Seventh Street SW., Washington, DC 20590-0001. You must identify the docket number _____ at the beginning of your comments, and you should submit two copies of your comments. If you wish to receive confirmation that the FAA has received your comments, please include a self-

addressed, stamped postcard on which the following statement is made: "Comments to Docket No. _____." We will date-stamp the postcard and mail it back to you.

You also may submit comments electronically to the following Internet address: http://dms.dot.gov.

You may review the public docket containing comments to this proposed regulation at the Department of Transportation (DOT) Dockets Office, located on the plaza level of the Nassif Building at the above address. You may review the public docket in person at this address between 9:00 a.m. and 5:00 p.m., Monday through Friday, except Federal holidays. Also, you may review the public dockets on the Internet at http://dms.dot.gov.

FOR FURTHER INFORMATION CONTACT: Kenneth W. Frey, FAA, Systems and Equipment Branch, ANM-130S, Seattle Aircraft Certification Office, Transport Airplane Directorate, 1601 Lind Avenue SW., Renton, WA 98055-4056; telephone 425-227-2673; facsimile 425-227-1181, e-mail ken.frey@faa.gov.

SUPPLEMENTARY INFORMATION:

How Do I Submit Comments to this NPRM?

Interested persons are invited to participate in the making of the proposed action by submitting such written data, views, or arguments, as they may desire. Comments relating to the environmental, energy, federalism, or economic impact that might result from adopting the proposals in this document are also invited. Substantive comments should be accompanied by cost estimates. Comments must identify the regulatory docket number and be submitted in duplicate to the DOT Rules Docket address specified above.

All comments received, as well as a report summarizing each substantive public contact with FAA personnel concerning this proposed rulemaking, will be filed in the docket. The docket is available for public inspection before and after the comment closing date.

We will consider all comments received on or before the closing date before taking action on this proposed rulemaking. Comments filed late will be considered as far as possible without incurring expense or delay. The proposals in this document may be changed in light of the comments received.

How Can I Obtain a Copy of this NPRM?

You may download an electronic copy of this document using a modem and suitable communications software from the FAA regulations section of the Fedworld electronic bulletin board service (telephone: 703-321-3339); the Government Printing Office (GPO)'s electronic bulletin board service (telephone: 202-512-1661); or, if applicable, the FAA's Aviation Rulemaking Advisory Committee bulletin board service (telephone: 800-322-2722 or 202-267-5948).

Internet users may access recently published rulemaking documents at the FAA's web page at http://www.faa.gov/avr/arm/nprm/nprm.htm or the GPO's web page at http://www.access.gpo.gov/nara.

You may obtain a copy of this document by submitting a request to the Federal Aviation Administration, Office of Rulemaking, ARM-1, 800 Independence Avenue, SW., Washington, DC 20591; or by calling 202- 267-9680. Communications must identify the docket number of this NPRM.

Any person interested in being placed on the mailing list for future rulemaking documents should request from the above office a copy of Advisory Circular 11-2A, "Notice of Proposed Rulemaking Distribution System," which describes the application procedure.

What Are the Relevant Airworthiness Standards in the United States?

In the United States, the airworthiness standards for type certification of transport category airplanes are contained in Title 14, Code of Federal Regulations (CFR) part 25. Manufacturers of transport category airplanes must show that each airplane they produce

of a different type design complies with the appropriate part 25 standards. These standards apply to:

- airplanes manufactured within the U.S. for use by U.S.-registered operators, and
- airplanes manufactured in other countries and imported to the U.S. under a bilateral airworthiness agreement.

What Are the Relevant Airworthiness Standards in Europe?

In Europe, the airworthiness standards for type certification of transport category airplanes are contained in Joint Aviation Requirements (JAR)-25, which are based on part 25. These were developed by the Joint Aviation Authorities (JAA) of Europe to provide a common set of airworthiness standards within the European aviation community. Twenty-three European countries accept airplanes type certificated to the JAR-25 standards, including airplanes manufactured in the U.S. that are type certificated to JAR-25 standards for export to Europe.

What is "Harmonization" and How Did it Start?

Although part 25 and JAR-25 are very similar, they are not identical in every respect. When airplanes are type certificated to both sets of standards, the differences between part 25 and JAR-25 can result in substantial additional costs to manufacturers and operators. These additional costs, however, frequently do not bring about an increase in safety. In many cases, part 25 and JAR-25 may contain different requirements to accomplish the same safety intent. Consequently, manufacturers are usually burdened with meeting the requirements of both sets of standards, although the level of safety is not increased correspondingly.

Recognizing that a common set of standards would not only benefit the aviation industry economically, but also maintain the necessary high level of safety, the FAA and the JAA began an effort in 1988 to "harmonize" their respective aviation standards. The goal of the harmonization effort is to ensure that:

- where possible, standards do not require domestic and foreign parties to manufacture or operate to different standards for each country involved; and
- the standards adopted are mutually acceptable to the FAA and the foreign aviation authorities.

The FAA and JAA have identified a number of significant regulatory differences (SRD) between the wording of part 25 and JAR-25. Both the FAA and the JAA consider "harmonization" of the two sets of standards a high priority.

What is ARAC and What Role Does it Play in Harmonization?

After initiating the first steps towards harmonization, the FAA and JAA soon realized that traditional methods of rulemaking and accommodating different administrative procedures was neither sufficient nor adequate to make appreciable progress towards fulfilling the goal of harmonization. The FAA then identified the Aviation Rulemaking Advisory Committee (ARAC) as an ideal vehicle for assisting in resolving harmonization issues, and, in 1992, the FAA tasked ARAC to undertake the entire harmonization effort.

The FAA had formally established ARAC in 1991 (56 FR 2190, January 22, 1991), to provide advice and recommendations concerning the full range of the FAA's safety-related rulemaking activity. The FAA sought this advice to develop better rules in less overall time and using fewer FAA resources than previously needed. The committee provides the FAA firsthand information and insight from interested parties regarding potential new rules or revisions of existing rules.

There are 64 member organizations on the committee, representing a wide range of interests within the aviation community. Meetings of the committee are open to the public, except as authorized by section 10(d) of the Federal Advisory Committee Act.

The ARAC establishes working groups to develop recommendations for resolving specific airworthiness issues. Tasks assigned to working groups are published in the

Federal Register. Although working group meetings are not generally open to the public, the FAA solicits participation in working groups from interested members of the public who possess knowledge or experience in the task areas. Working groups report directly to the ARAC, and the ARAC must accept a working group proposal before ARAC presents the proposal to the FAA as an advisory committee recommendation.

The activities of the ARAC will not, however, circumvent the public rulemaking procedures; nor is the FAA limited to the rule language "recommended" by ARAC. If the FAA accepts an ARAC recommendation, the agency proceeds with the normal public rulemaking procedures. Any ARAC participation in a rulemaking package is fully disclosed in the public docket.

What is the Status of the Harmonization Effort Today?

Despite the work that ARAC has undertaken to address harmonization, there remain a large number of regulatory differences between part 25 and JAR-25. The current harmonization process is extremely costly and time-consuming for industry, the FAA, and the JAA. Industry has expressed a strong desire to conclude the harmonization program as quickly as possible to alleviate the drain on their resources and to finally establish one acceptable set of standards.

Recently, representatives of the aviation industry [including Aerospace Industries Association of America, Inc. (AIA), General Aviation Manufacturers Association (GAMA), and European Association of Aerospace Industries (AECMA)] proposed an accelerated process to reach harmonization.

What is the "Fast Track Harmonization Program"?

In light of a general agreement among the affected industries and authorities to expedite the harmonization program, the FAA and JAA in March 1999 agreed upon a method to achieve these goals. This method, which the FAA has titled "The Fast Track Harmonization Program," is aimed at expediting the rulemaking process for harmonizing

not only the 42 standards that are currently tasked to ARAC for harmonization, but approximately 80 additional standards for part 25 airplanes.

The FAA initiated the Fast Track program on November 26, 1999 (64 FR 66522). This program involves grouping all of the standards needing harmonization into three categories:

Category 1: Envelope – For these standards, parallel part 25 and JAR-25 standards would be compared, and harmonization would be reached by accepting the more stringent of the two standards. Thus, the more stringent requirement of one standard would be "enveloped" into the other standard. In some cases, it may be necessary to incorporate parts of both the part 25 and JAR standard to achieve the final, more stringent standard. (This may necessitate that each authority revises its current standard to incorporate more stringent provisions of the other.)

Category 2: Completed or near complete – For these standards, ARAC has reached, or has nearly reached, technical agreement or consensus on the new wording of the proposed harmonized standards.

Category 3: Harmonize – For these standards, ARAC is not near technical agreement on harmonization, and the parallel part 25 and JAR-25 standards cannot be "enveloped" (as described under Category 1) for reasons of safety or unacceptability. A standard developed under Category 3 would be mutually acceptable to the FAA and JAA, with a consistent means of compliance.

Further details on the Fast Track Program can be found in the tasking statement (64 FR 66522, November 26, 1999) and the first NPRM published under this program, Fire Protection Requirements for Powerplant Installations on Transport Category Airplanes (65 FR 36978, June 12, 2000).

DISCUSSION OF THE PROPOSAL

How Does This Proposed Regulation Relate to "Fast Track"?

This proposed regulation results from the recommendations of ARAC submitted under the FAA's Fast Track Harmonization Program. In this notice, the FAA proposes to amend § 25.1438, concerning the design requirements for pressurization and pneumatic systems installed on transport category airplanes. This action has been designated as a Category 2 project under the Fast Track program.

What is the Underlying Safety Issue Addressed by the Current Standards?

Ruptures of pneumatic and pressurization system elements (components and ducts) can lead to unsafe conditions because they can lead to system loss or malfunction, and can cause ancillary damage to critical systems. The current standards define design and test requirements for pneumatic and pressurization system elements to ensure their reliable and safe operation.

What are the Current 14 CFR and JAR Standards?

The current text of 14 CFR 25.1438 (amendment 25-41; 42 FR 36971, July 18, 1977) is:

> ***"§ 25.1438 Pressurization and Pneumatic Systems***
>
> *(a) Pressurization system elements must be burst pressure tested to 2.0 times, and proof pressure tested to 1.5 times, the maximum normal operating pressure.*
>
> *(b) Pneumatic system elements must be burst pressure tested to 3.0 times, and proof pressure tested to 1.5 times, the maximum normal operating pressure.*
>
> *(c) An analysis, or a combination of analysis and test, may be substituted for any test required by paragraph (a) or (b) of this section if the Administrator finds it equivalent to the required test."*

The current text of JAR-25.1438 (Change 14, Orange Paper 96/1) is:

> ***"JAR 25.1438 Pressurization and low pressure pneumatic systems***
>
> *Pneumatic systems (ducting and components) served by bleed air, such as engine bleed air, air conditioning, pressurization, engine starting and hot-air ice-protection system which are essential for the safe operation of the airplane or whose failure may affect any essential or critical part of the airplane or the safety of the occupants, must be so designed and installed as to comply the JAR 25.1309. In particular account must be taken of bursting or excessive leakage. (See ACJ 25.1438 paragraph 1 for strength and ACJ 25.1438 paragraph 2 for testing.)"*

JAR 25.1436 also relates to pneumatic systems. Its text is as follows:

> ***JAR 25X1436 Pneumatic systems -- high pressure***
>
> *(a)* ***General****. Pneumatic systems which are powered by, and/or used for distributing or storing, air or nitrogen, must comply with the requirements of this paragraph.*
>
> *(1) Compliance with JAR 25.1309 for pneumatic systems must be shown by functional tests, endurance tests, and analysis. Any part of a pneumatic system which is an engine accessory must comply with the relevant requirements of JAR 25.1163.*
>
> *(2) No element of the pneumatic system which would be liable to cause hazardous effects by exploding, if subject to a fire, may be mounted within an engine bay or other designated fire zone, or in the same compartment as a combustion heater.*

(3) When the system is operating no hazardous blockage due to freezing must occur. If such blockage is liable to occur when the airplane is stationary on the ground, a pressure-relieving device must be installed adjacent to each pressure source.

(b) ***Design****. Each pneumatic system must be designed as follows:*

(1) Each element of the pneumatic system must be designed to withstand the loads due to the working pressure, PW, in the case of elements other than pressure vessels or to the limit pressure, PL, in the case of pressure vessels, in combination with limit structural loads which may be imposed without deformation that would prevent it from performing its intended function, and to withstand without rupture, the working or limit pressure loads multiplied by a factor of 1.5 in combination with ultimate structural loads that can reasonably occur simultaneously.

(i) PW. The working pressure is the maximum steady pressure in service acting on the element including the tolerances and possible pressure variations in normal operating modes but excluding transient pressures.

(ii) PL. The limit pressure is the anticipated maximum pressure in service acting on a pressure vessel, including the tolerances and possible pressure variations in normal operating modes but excluding [transient pressures.]

(2) A means to indicate system pressure located at a flight-crew member station, must be provided for each pneumatic system that --

(i) Performs a function that is essential for continued safe flight and landing; or

(ii) In the event of pneumatic system malfunction, requires corrective action by the crew to ensure continued safe flight and landing.

(3) There must be means to ensure that system pressures, including transient pressures and pressures from gas volumetric changes in components which are likely to remain closed long enough for such changes to occur --

(i) Will be within 90 to 110% of pump average discharge pressure at each pump outlet or at the outlet of the pump transient pressure dampening device, if provided; and

(ii) Except as provided in sub-paragraph (b)(6) of this paragraph, will not exceed 125% of the design operating pressure, excluding pressure at the outlets specified in sub-paragraph (b)(3)(i) of this paragraph. Design operating pressure is the maximum steady operating pressure.

The means used must be effective in preventing excessive pressures being generated during ground charging of the system. (See ACJ 25X1436 (b)(3).)

(4) Each pneumatic element must be installed and supported to prevent excessive vibration, abrasion, corrosion, and mechanical damage, and to withstand inertia loads.

(5) Means for providing flexibility must be used to connect points in a pneumatic line between which relative motion or differential vibration exists.

(6) Transient pressure in a part of the system may exceed the limit specified in sub-paragraph (b)(3)(ii) of this paragraph if --

(i) A survey of those transient pressures is conducted to determine their magnitude and frequency; and

(ii) Based on the survey, the fatigue strength of that part of the system is substantiated by analysis or tests, or both.

(7) The elements of the system must be able to withstand the loads due to the pressure given in Appendix K, for the proof condition without leakage or permanent distortion and for the ultimate condition without rupture. Temperature must be those corresponding to normal operating conditions. Where elements are constructed from materials other than aluminum alloy, tungsten or medium-strength steel, the Authority may prescribe or agree to other factors.

The materials used should in all cases be resistant to deterioration arising from the environmental conditions of the installation, particularly the effects of vibration. *(AMENDED BY ORANGE PAPER AMENDMENT 25/96/1)*

(8) Where any part of the system is subject to fluctuating or repeated external or internal loads, adequate allowance must be made for fatigue.

(c) ***Tests***

1) A complete pneumatic system must be static tested to show that it can withstand a pressure of 1.5 times the working pressure without a deformation of any part of the system that would prevent it from performing its intended function. Clearance

between structural members and pneumatic 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.

(2) The entire system or appropriate sub-systems must be tested in an airplane or in a mock-up installation to determine proper performance and proper relation to other airplane systems. The functional tests must include simulation of pneumatic system failure conditions. The tests must account for flight loads, ground loads, and pneumatic system working, limit and transient pressures expected during normal operation, but need not account for vibration loads or for loads due to temperature effects. Endurance tests must simulate the repeated complete flights that could be expected to occur in service. Elements which fail during the tests must be modified in order to have the design deficiency corrected and, where necessary, must be sufficiently retested. Simulation of operating and environmental conditions must be completed on elements and appropriate portions of the pneumatic system to the extent necessary to evaluate the environmental effects. (See ACJ 25X1436(c)(2).)

(3) Parts, the failure of which will significantly lower the airworthiness or safe handling of the airplane must be proved by suitable testing, taking into account the most critical combination of pressures and temperatures which are applicable."

The JAA also relies on advisory material contained in three different Advisory Circulars Joint (ACJ) for demonstration and interpretation of compliance with JAR 25.1438 and JAR 25X1436:

- ACJ 25.1438, "Pressurization and Lower Pressure Pneumatic Systems," describes an acceptable means of compliance with JAR 25.1438;
- ACJ 25X1436(b)(3), "Pneumatic Systems," is interpretive material that pertains to JAR 25X1436(b)(3); and
- ACJ 25X1436(c)(2), "Pneumatic Systems," is interpretive material that pertains to JAR 25X1436(c)(2)

What are the Differences in the Standards and the Means of Compliance with the Standards?

There are numerous differences between the standards -- in the way they are applied and the way applicants comply with them. Table 1, below, describes the details of the specific differences. Certain of the significant differences include:

- The JAA applies JAR 25X1436 to pneumatic systems not covered by § 25.1438, such as slide deployment systems, thrust reverser actuation systems, and door release mechanisms. There is no equivalent § 25.1436 in part 25.
- The FAA applies §§ 25.1301, 25.1309, and 25.1438 to all pneumatic systems, and Department Of Transportation (DOT) regulations to gas storage devices. The JAR also distinguishes between pneumatic systems and high-pressure systems. Section 25.1438 and JAR 25X1436 have been applied to gas storage devices, such as hydraulic accumulators.
- JAR 25X1436 applies to the pressurization installation, including the piping and components of high-pressure systems. This is no equivalent FAA regulation.

TABLE 1
Differences Between the Standards

Item Description	§ 25.1438	JAR 25X1436	JAR 25.1438	Relevance of Difference	Compliance Criteria
General structure of standard	Rule description is contained within the rule itself	Rule description is contained within the rule itself	Rule refers to ACJ 25.1438, which contains all details	Differences in rule structure can lead to compliance confusion and additional certification constraints	The part 25 and JAR-25 standards are requirements. ACJ 25.1438 is an acceptable means of compliance.
Probability of occurrence. Normal operation and multiple failures.	Probability is not addressed. System failures are not considered	Probability is not addressed	The referenced ACJ assigns a pressure multiplier for each specific probability of occurrence: 1) 1.5x & 3.0x @ "normal functioning" 2) 1.33x & 2.66x @ "reasonably probable" 3) 1x & 2x @ "remote" 4) none & 1x @ "extremely remote"	The JAR standards account for failure conditions, which can require higher design factors.	The JAR requires more analysis and test and is more stringent. JAR-25.1438 requires probability analysis to determine proper design factors.
Multiplier for various systems	Compliance level varies with different systems: • Pressurization: 1.5x & 2x • Pneumatic: 1.5x & 3x • Air-conditioning: none • Engine Starting: none • Ice Protection: none	Compliance level does not vary with different systems.	Compliance level does not vary with different systems. Systems listed are air conditioning, pressurization, engine starting, and ice protection.	JAR 25.1438 requires higher factors for pressurization systems and may result in additional test and analysis. JAR 25X1436 requires higher factors for specific system components (pressure vessels, hoses)	The JAR standards result in more analysis and testing.

System function after "Condition 1" - proof	Does not address system requirement after a proof event.	Requires that elements must withstand proof without permanent deformation and negative effects on intended function	Requires that elements must operate normally and with no detrimental permanent distortion.	The JAR standard sets acceptance requirements more clearly and provides a more standardized acceptance criteria.	The JAR standard defines post-test acceptance criteria
System function after "Condition 2" - burst	Does not address system requirement after a burst event.	Requires that elements must withstand burst without rupture	Requires that elements must withstand burst pressure without bursting or excessive leakage	The JAR standard sets acceptance requirements more clearly and provides a more standardized acceptance criteria.	The JAR standard defines post-test acceptance criteria
Combined load requirements	None	Requires that additional loads must be considered: 1) structural and 2) externally induced loads	Requires that additional loads must be considered: 1) "Loads resulting from any distortion between each element of the system and its supporting structures." 2) Vibration, acceleration and deformation.	The JAR standard includes combined loads for pressurization and pneumatic systems, and may result in additional test and analysis.	The JAR standard requires consideration of combined loads, which requires additional analysis and improved tests.
Testing	No mention of testing	Tests are addressed in requirement	Section 2 of referenced ACJ 25.1438 addresses testing: 1) Static tests, and 2) Endurance tests.	The JAR standard's test requirements are more expensive and time consuming.	The JAR standard requires more complicated testing, including testing of a complete system.

What Do Those Differences Result In?

In general, the JAR standards are considered "more stringent" than the part 25 standards. This results in U.S. manufacturers having to perform additional certification documentation and testing in order to sell their airplanes in Europe. Among other things, the more stringent JAR requires that applicants:

- account for failure conditions, which can require higher design factors for pressurization systems and system components; and
- consider additional loads (structural and externally induced loads), which requires additional analysis and testing.

The current § 25.1438 of part 25 does not require these actions.

What Is the Proposed Action?

The FAA is proposing to revise § 25.1438 to:

- merge the more stringent and the more defined design and compliance criteria currently in the JAR's and the related ACJ's;
- simplify the rule by incorporating industry standards that have resulted in systems shown to be safe by aircraft certifications and service experience; and
- provide one harmonized rule that would address pneumatic systems overall.

The specific proposed revisions are as follows:

Paragraph (a) of the proposed rule would be re-written to define the applicable systems that the rule applies to, and to list the conditions that must be considered in combination with the proof and burst pressure test requirements in paragraphs (b) and (c). The intent of this proposed rule is to require the conditions in paragraph (a) to be combined with the specified test requirements in paragraphs (b) and (c) when showing compliance with this rule.

Paragraph (b) of the proposed rule would define the **first test condition** and the pass/fail criteria for that condition. It would require that the element be shown to operate without detrimental permanent deformation or increase in design leakage that would prevent the element from performing its intended function after the element is tested to the conditions specified in paragraph (b). The "most critical condition" is the worst combination of the factors specified in paragraph (a). Compliance would be required to

be shown by testing the element to the factors specified in paragraph (b) in combination with the "most critical condition." Analysis may be used to show compliance with this requirement, provided the analysis is validated by test results using similar systems or components. Engine overspeed conditions resulting in higher-than-normal operating pressures are considered as a first failure when showing compliance with this condition.

Paragraph (c) of the proposed rule defines the **second test condition** and the pass/fail criteria for that condition. Like paragraph (b), the "most critical condition" is the worst combination of the factors specified in paragraph (a). Applicants would be required to show compliance by testing the element to the factors specified in paragraph (c), in combination with the "most critical condition." Analysis may be used to show compliance with this requirement, provided the analysis is demonstrated reliable based on test results from similar systems or components. The test element need not operate normally after being subjected to the conditions in paragraph (c). Engine overspeed conditions that result in higher-than-normal operating pressures are considered as a first failure when showing compliance with this condition.

Paragraph (d) of the proposed rule defines the design criteria for components that can be hazardous to the airplane or the occupants. For the purposes of this proposed rule, "hazardous to the airplane or occupants" is defined as any effect that:

- could cause serious injury to or death of a relatively small number of the occupants,
- largely reduces the margins of safety, or
- results in physical distress or a workload such that the flight crew cannot be relied upon to perform their tasks accurately or competently.

This definition is comparable to that provided in FAA Advisory Circular 25.1309-1A, "System Design Analysis." The FAA has applied this definition in numerous certification projects when applicants have demonstrated compliance with § 25.1309 in accordance with the means described in AC 25.1309-1A.

Paragraph (e) of the proposed rulemaking defines the requirements for gas storage devices.

The JAA plans to restructure the related JAR's and ACJ's in a similar manner. As a result, the intent of JAR 25X1436 will be captured within the harmonized paragraph 25.1438; therefore, the JAA plans to eliminate the current paragraph 25X1436.

How is Special Terminology Used in the Proposed Rule Defined?

For the purpose of the proposed rule, the following definitions of terms apply:

- Air Conditioning System: All elements comprising the system that controls the airflow, gas composition, and temperature to the pressurized zones of the airplane.
- Components: Parts in the system that perform mechanical, pneumatic, thermodynamic, or electric functions; or are used in controlling these functions. Examples include ducts, valves, tubes, couplings, brackets, controllers, and sensors.
- Compressor: Any machine that increases gas pressure.
- Design Life: The time that the component will perform its intended function, including overhauls, before it is permanently replaced.
- Design Leakage: Airflow exiting a component, either internally or externally, for which the system and surrounding systems have been designed to accommodate.
- Detrimental Deformation: A change of physical shape that reduces the structural integrity or the design fatigue life of the element, or reduces normal operating system performance.
- Ducts: All elements of the system, having no moving parts, that direct and transport gas from one component of the system to another.
- Elements: All individual components that comprise the system.
- Exploding: Pneumatic rupture of an element, resulting in a sudden and violent release of energy.

- Failure Mode: A set of conditions that result in an element not performing as intended.

- Failure Pressure or Temperature: The value of pressure or temperature that occurs at a point in a system as the result of a failure of a control device or component.

- Gas Storage Device: A component that acts as a reservoir for compressed gas, and that is designed to release the gas to serve user systems.

- Hazardous Effects: A hazardous condition resulting from the failure of an airplane system or system element.

- Hazardous Condition: A failure of an element that endangers the airplane or its occupants.

- Maximum Normal Operating Pressure or Temperature: The highest pressure or temperature at a point in the system that occurs with all the elements of the system operating normally under steady state and transient conditions.

- Most Critical: The combination of pressure and temperature imposed on an element that is being analyzed, which results in the smallest difference of actual stress and allowable stress.

- Normal Mode: A condition with all the component parts of the system operating normally.

- Pneumatic System: All of the elements of the system that convey gas and/or control pressure and temperature from compressed gas sources to provide a conditioned gas mass flow or provide energy for heating or to perform mechanical work.

- Pressurization System: All elements comprising the system that controls the air pressure of the airplane pressurized zones.

- Tubing: Small diameter pipes, serving the same purpose as ducts, that provide low airflow within or between components.

Additionally, for the purpose of the proposed rule:

- Bleed air and air conditioning system elements include the ducting, control devices, and components from the air supply source to the pressure bulkhead.
- Pressurization system elements are the elements exposed to cabin pressure. Pressurization system elements include the out flow valve and pressure relief valves. This proposed rule would not apply to the structural parts of the pressurized cabin.
- An element is considered to be any component, tube, or duct in the pneumatic or pressurization system.

How Does This Proposed Standard Address the Underlying Safety Issue?

The proposed standard formally improves the level of safety because it ensures state-of-the-art levels of safety and reliability of aircraft pneumatic systems. It supplements the part 25 standard with design and test requirements used by major manufacturers, government organizations, and industry, which have been validated by service experience.

The proposed changes in the rule reflect current airplane manufacturer design practices relative to:

- consideration of fatigue strength and system failure conditions,
- increased margins of safety for failure pressures related to their probabilities of occurrence, and
- gas storage devices.

This significantly improves the rule's regulatory content because important safety-relevant practices are now set as a minimum standard and, thus, enforceable.

For failure conditions, new pressure factors have been introduced into the proposed rule. The proposed rule would require applicants to design and test the bleed air system, considering installation and operating loads. The existing rule only requires static pressure tests based on a normal operating pressure multiplied by a factor. The existing rule does not account for factors introduced on bleed air systems from installation and operating conditions.

What is the Effect of the Proposed Standard Relative to the Current Regulations?

The proposed changes to § 25.1438 will help to standardize application of the rule. Pressurization and pneumatic systems were not clearly defined in previous rulemaking; this has led to inconsistent application of the burst and pressure factors of the existing rule. In addition, the existing § 25.1438 does not account for failures in upstream components that would cause higher-than-normal operating conditions.

To address these issues as they have arisen in certification programs, the FAA over the past several years has granted exemptions to manufacturers to use the standards similar to those proposed in this action; likewise, the JAA has granted "exceptions." Thus, in effect, industry already has been complying with the proposed standards

What is the Effect of the Proposed Standard Relative to Current Industry Practice?

The proposed standard maintains the same level of safety relative to current industry practice, which is in compliance with the proposed standard. It is derived in part from the requirements used to design and qualify transport aircraft systems and components of major United States and European manufacturers that have demonstrated their products' safe operation in service.

What Other Options Have Been Considered and Why Were They Not Selected?

The FAA considered several different ways to restructure the proposed rule. Additionally, the FAA considered adding a new § 25.1436 that would be parallel to JAR 25X1436. However, based on investigations of the content and application of JAR 25X1436, the FAA concluded that it would be more reasonable to combine the requirements of JAR 25X1436 with § 25.1438, JAR 25.1438, and the appropriate portions of the ACJ's into a single "merged" rule -- a new § 25.1438, as presented in this proposal. The JAA reached this same conclusion and is taking similar action. Having one harmonized standard will eliminate confusion for applicants. The FAA considers the proposed action to be the most appropriate way to fulfill harmonization goals while maintaining safety and without affecting current industry design practices.

Who Would Be Affected by the Proposed Change?

Airplane manufactures and suppliers will benefit from a single, well-defined harmonized ruling that will reduce certification costs.

Because of the new fatigue design requirements and probability analysis that would be included in the proposed rule, applicants who are not in the global market may have increased costs if they only were required in the past to show compliance with § 25.1438.

Is Existing FAA Advisory Material Adequate?

The FAA does not consider additional advisory material necessary.

What Regulatory Analyses and Assessments Has the FAA Conducted?

Regulatory Evaluation Summary

Proposed changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic effect of regulatory changes on small entities. Third, the Trade Agreements Act (19 U.S.C. section 2531-2533) prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. In developing U.S. standards, this Trade Act also requires the consideration of international standards and, where appropriate, that they be the basis of U.S. standards. And fourth, the Unfunded Mandates Reform Act of 1995 requires agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local, or tribal governments, in the aggregate, or by the private sector of $100 million or more annually (adjusted for inflation).

The FAA has determined that this proposal has no substantial costs, and that it is not "a significant regulatory action" as defined in Executive Order 12866, nor "significant" as defined in DOT's Regulatory Policies and Procedures. Further, this proposed rule would not have a significant economic impact on a substantial number of small entities, would reduce barriers to international trade, and would not impose an Unfunded Mandate on state, local, or tribal governments, or on the private sector.

The DOT Order 2100.5 prescribes policies and procedures for simplification, analysis, and review of regulations. If it is determined that the expected impact is so minimal that the proposed rule does not warrant a full evaluation, a statement to that effect and the basis for it is included in the proposed regulation. Accordingly, the FAA has determined that the expected impact of this proposed rule is so minimal that the

proposed rule does not warrant a full evaluation. The FAA provides the basis for this minimal impact determination as follows:

Currently, airplane manufacturers must satisfy both part 25 and the European JAR-25 standards to certificate transport category aircraft in both the United States and Europe. Meeting two sets of certification requirements raises the cost of developing a new transport category airplane often with no increase in safety. In the interest of fostering international trade, lowering the cost of aircraft development, and making the certification process more efficient, the FAA, JAA, and aircraft manufacturers have been working to create, to the maximum possible extent, a single set of certification requirements accepted in both the United States and Europe. As explained in detail previously, these efforts are referred to as "harmonization."

This proposal would incorporate more defined design and compliance criteria for pneumatic systems, as currently contained in the counterpart European standards. It would also simplify the current regulations by incorporating industry standards that have resulted in systems shown to be safe by certification and service experience. This proposed rule results from the FAA's acceptance of recommendations made by ARAC. We have concluded that, for the reasons previously discussed in the preamble, the adoption of the proposed requirements in 14 CFR part 25 is the most efficient way to harmonize these sections and in so doing, the existing level of safety will be preserved.

There was consensus within the ARAC members, comprised of representatives of the affected industry, that the requirements of the proposed rule will not impose additional costs on U.S. manufacturers of part 25 airplanes. We have reviewed the cost analysis provided by industry through the ARAC process. A copy is available through the public docket. Based on this analysis, we consider that a full regulatory evaluation is not necessary.

We invite comments with supporting documentation regarding the regulatory evaluation statements based on ARAC's proposal.

Initial Regulatory Flexibility Determination

The Regulatory Flexibility Act (RFA) of 1980, 50 U.S.C. 601-612, as amended, establishes "as a principle of regulatory issuance that agencies shall endeavor, consistent with the objective of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the business, organizations, and governmental jurisdictions subject to regulation." To achieve that principle, the RFA requires agencies to solicit and consider flexible regulatory proposals and to explain the rationale for their actions.

Agencies must perform a review to determine whether a proposed or final rule will have a significant impact on a substantial number of small entities. If the determination is that the rule will, the Agency must prepare a regulatory flexibility analysis as described in the RFA.

However, if an agency determines that a proposed or final rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the RFA provides that the head of the agency may so certify and a regulatory flexibility analysis is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

The FAA considers that this proposed rule would not have a significant impact on a substantial number of small entities for two reasons:

First, the net effect of the proposed rule is minimum regulatory cost relief. The proposed rule would require that new transport category aircraft manufacturers meet just one certification requirement, rather than different standards for the United States and Europe. Airplane manufacturers already meet or expect to meet this standard as well as the existing 14 CFR part 25 requirement.

Second, all U.S. transport-aircraft category manufacturers exceed the Small Business Administration small-entity criteria of 1,500 employees for aircraft manufacturers. The current U.S. part 25 airplane manufacturers include: Boeing, Cessna Aircraft, Gulfstream Aerospace, Learjet (owned by Bombardier), Lockheed Martin,

McDonnell Douglas (a wholly-owned subsidiary of The Boeing Company), Raytheon Aircraft, and Sabreliner Corporation.

Given that this proposed rule is minimally cost-relieving and that there are no small entity manufacturers of part 25 airplanes, the FAA certifies that this proposed rule would not have a significant impact on a substantial number of small entities.

International Trade Impact Assessment

The Trade Agreement Act of 1979 prohibits Federal agencies from engaging in any standards or related activities that create unnecessary obstacles to the foreign commerce of the United States. Legitimate domestic objectives, such as safety, are not considered unnecessary obstacles. The statute also requires consideration of international standards and, where appropriate, that they be the basis for U.S. standards. In addition, consistent with the Administration's belief in the general superiority and desirability of free trade, it is the policy of the Administration to remove or diminish to the extent feasible, barriers to international trade, including both barriers affecting the export of American goods and services to foreign countries and barriers affecting the import of foreign goods and services into the United States.

In accordance with the above statute and policy, the FAA has assessed the potential effect of the proposed rule and has determined that it supports the Administration's free trade policy because this rule would use European international standards as the basis for U.S. standards.

Unfunded Mandates Reform Act

Title II of the Unfunded Mandates Reform Act of 1995 (the Act), codified in 2 U.S.C. 1532-1538, enacted as Public Law 104-4 on March 22, 1995, requires each Federal agency, to the extent permitted by law, to prepare a written assessment of the effects of any Federal mandate in a proposed or final agency rule that may result in the expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of $100 million or more (adjusted annually for inflation) in any one year.

This proposed rule does not contain a Federal intergovernmental or private sector mandate that exceeds $100 million in any year; therefore, the requirements of the Act do not apply.

What Other Assessments Has the FAA Conducted?

Executive Order 13132, Federalism

The FAA has analyzed this proposed rule and the principles and criteria of Executive Order 13132, Federalism. The FAA has determined that this action would not have a substantial direct effect on the States, on the relationship between the national Government and the States, or on the distribution of power and responsibilities among the various levels of government. Therefore, the FAA has determined that this notice of proposed rulemaking would not have federalism implications.

Paperwork Reduction Act

The Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)) requires that the FAA consider the impact of paperwork and other information collection burdens imposed on the public. We have determined that there are no new information collection requirements associated with this proposed rule.

International Compatibility

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to comply with International Civil Aviation Organization (ICAO) Standards and Recommended Practices to the maximum extent practicable. The FAA determined that there are no ICAO Standards and Recommended Practices that correspond to this proposed regulation.

Environmental Analysis

FAA Order 1050.1D defines FAA actions that may be categorically excluded from preparation of a National Environmental Policy Act (NEPA) environmental impact

statement. In accordance with FAA Order 1050.1D, appendix 4, paragraph 4(j), this proposed rulemaking action qualifies for a categorical exclusion.

Energy Impact

The energy impact of the proposed rule has been assessed in accordance with the Energy Policy and Conservation Act (EPCA) and Public Law 94-163, as amended (43 U.S.C. 6362), and FAA Order 1053.1. It has been determined that it is not a major regulatory action under the provisions of the EPCA.

Regulations Affecting Intrastate Aviation in Alaska

Section 1205 of the FAA Reauthorization Act of 1996 (110 Stat. 3213) requires the Administrator, when modifying regulations in Title 14 of the CFR in a manner affecting intrastate aviation in Alaska, to consider the extent to which Alaska is not served by transportation modes other than aviation, and to establish such regulatory distinctions as he or she considers appropriate. Because this proposed rule would apply to the certification of future designs of transport category airplanes and their subsequent operation, it could, if adopted, affect intrastate aviation in Alaska. The FAA therefore specifically requests comments on whether there is justification for applying the proposed rule differently to intrastate operations in Alaska.

Plain Language

In response to the June 1, 1998, Presidential memorandum regarding the issue of plain language, the FAA re-examined the writing style currently used in the development of regulations. The memorandum requires Federal agencies to communicate clearly with the public. We are interested in your comments on whether the style of this document is clear, and in any other suggestions you might have to improve the clarity of FAA communications that affect you. You can get more information about the Presidential memorandum and the plain language initiative at http://www.plainlanguage.gov.

List of Subjects in 14 CFR Part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

The Proposed Amendment

In consideration of the foregoing, the Federal Aviation Administration proposes to amend part 25 of Title 14, Code of Federal Regulations, as follows:

PART 25 - AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES

1. The authority citation for Part 25 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701, 44702 and 44704

2. Revise the title and text of section 25.1438 to read as follows:

25.1438 Pneumatic Systems

(a) This requirement applies to pneumatic systems and elements (components and ducting) served by gas storage devices such as, evacuation systems, water systems, accumulators, and/or pressurized gas from compressors such as engine and APU bleed air, air conditioning, pressurization, engine starting, ice-protection, and pneumatic actuation systems. Design compliance may be in the form of analysis, test, or a combination of analysis and test. All foreseen normal and failure mode combinations of environmental loads (installation, thermal, vibration, and aerodynamic), pressures, temperatures, material properties, and dimensional tolerances must be considered. This requirement is not applicable to portable gas storage devices.

(b) Each element of the system must be designed to operate without detrimental permanent deformation or increase in design leakage that would prevent the element from performing its intended function. For demonstrating compliance, the following factors are to be applied to the pressure at the associated temperature for the most critical of the

following conditions. The pressure must be applied long enough to ensure complete expansion of the test element. After being subjected to these conditions, below, and upon normal operating conditions being restored, the element should operate as designed.

(1) 1.5 times maximum normal operating pressure.

(2) 1.33 times the failure pressure occurring in the probability range between 10E-03 to 10E-05 failures per flight hour.

(3) 1.0 times the failure pressure occurring in the probability range less than 10E-05 failures per flight hour.

4) 1.0 times the maximum normal operating pressure in combination with the limit structural loads.

(c) Each element of the system must be designed to operate without rupture or increase in design leakage that is likely to endanger the airplane or its occupants. For demonstrating compliance, the following factors are to be applied to the pressure at the associated temperature for the most critical of the following conditions. The pressure must be applied long enough to ensure complete expansion of the test element. After being subjected to these conditions, below, and upon normal operating conditions being restored, the element need not operate.

(1) 3.0 times maximum normal operating pressure. Except for pressurization system elements, which shall use a factor of: 2.0 times maximum normal operating pressure.

(2) 2.66 times the failure pressure occurring in the probability range between 10E-03 to 10E-05 failures per flight hour.

(3) 1.5 times the failure pressure occurring in the probability range between 10E-05 to 10E-07 failures per flight hour is applicable to components. Except for ducting, which shall use a factor of: 2.0 times the failure pressure occurring in the probability range between 10E-05 to 10E-07 failures per flight hour.

(4) 1.0 times the failure pressure occurring in the probability range less than 10E-07 failures per flight hour.

(5) 1.5 times the maximum normal operating pressure in combination with the 1.0 times the ultimate structural loads.

(d) If the failure of an element can result in a hazardous condition, it must be designed to withstand the fatigue effects of all cyclic pressures, including transients, and associated externally induced loads. It also must perform as intended for the design life of the element under all environmental conditions for which the airplane is certified.

(e) In addition, each gas storage device installed on an airplane must meet the requirements of this rule and not cause hazardous effects by exploding.

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