

## 2. General Test Guidelines

(a) One test with the SID Anthropomorphic Test Dummy (ATD) or the EuroSID-1, as defined above, undeformed floor, no yaw, and with all lateral structural supports (armrest/walls).

Pass/fail injury assessments: TTI; and pelvic acceleration.

(b) One test with the Hybrid II ATD, or equivalent, deformed floor, with 10 degrees yaw, and with all lateral structural supports (armrest/walls).

Pass/fail injury assessments: HIC; and upper torso restraint system retention and pelvic acceleration.

(c) Vertical test to be conducted with modified Hybrid II ATD's with existing pass/fail criteria.

(d) G-loads used in 2(a), 2(b) and 2(c) are those defined in 14 CFR part 23, § 23.562(b), for first row (crew) and other rows (passenger) seats.

Issued in Kansas City, Missouri on December 11, 2000.

**Michael Gallagher,**

*Manager, Small Airplane Directorate, Aircraft Certification Service.*

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## DEPARTMENT OF TRANSPORTATION

### Federal Aviation Administration

#### 14 CFR Part 33

[Docket No. NE-123; Special Conditions No. 33-004-SC]

#### Special Conditions: Pratt & Whitney Canada, Inc. (Formerly United Aircraft of Canada, Limited), Model PT6T-9 Turboshaft Engine

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

**ACTION:** Final special conditions, request for comments.

**SUMMARY:** Pratt & Whitney Canada, Inc. (PWC) has applied for an amendment to type certificate (TC) #E22EA, to add a new model PT6T-9 turboshaft engine. The FAA has determined that this new model engine should be viewed as a derivative to the PT6T-3 engine. On June 8, 1970, the FAA issued Special Conditions (SC) No. 33-23-EA-6 for the PT6T-3 turboshaft engine model, and later amended those SC in 1970 to clarify a potential ambiguity in the vibration test requirements. In addition to the requirements contained in SC No. 33-23-EA-6, as amended, these new special conditions provide for 30-second one-engine-inoperative (OEI), 2-minute OEI, and continuous OEI ratings

to be included in the PT6T-9 turboshaft engine model power ratings. The special conditions will define the changes to the engine certification basis that are required to establish a level of safety equivalent to the current requirements of 14 CFR part 33, for the new PWC PT6T-9 turboshaft engine model.

**DATES:** The effective date of these special conditions is December 27, 2000. Comments must be received on or before January 26, 2001.

**ADDRESSES:** Comments on these special conditions may be mailed in duplicate to: Federal Aviation Administration (FAA), Office of the Regional Counsel, Attention: Docket No. NE-123; 12 New England Executive Park, Burlington, MA 01803-5299, or delivered in duplicate to the Office of Regional Counsel at the above address. Comments must be marked: Docket No. NE-123. Comments may be inspected at this location on weekdays, except Federal holidays, between 8 a.m. and 4:30 p.m.

**FOR FURTHER INFORMATION CONTACT:** Mr. Chung Hsieh, Aerospace Engineer, Engine and Propeller Standards Staff, ANE-110, Engine and Propeller Directorate, Aircraft Certification Service, FAA, 12 New England Region, 12 New England Executive Park, Burlington, Massachusetts 01803-5299; telephone 781-238-7115, Fax 781-238-7199. If you have access to the Internet, you may also obtain further information by writing to the following Internet address: "[chung.hsieh@faa.gov](mailto:chung.hsieh@faa.gov)".

#### **SUPPLEMENTARY INFORMATION:**

##### **Comments Invited**

The FAA has determined that good cause exists for making these special conditions effective upon issuance; however, interested persons are invited to submit such written data, views, or arguments, as they may desire. Communications should identify the docket number and special conditions number, and be submitted in duplicate to the address specified above, or, if you have access to the internet, you may make a submission to the following Internet address:

"[chung.hsieh@faa.gov](mailto:chung.hsieh@faa.gov)". All communications received on or before the closing date for comments will be considered by the Administrator. These special conditions may be changed depending on the comments received. All comments received will be available in the docket for examination by interested persons, both before and after the closing date for comments. A report summarizing each substantive public contact with FAA personnel concerning this rulemaking will be filed in the docket. Persons wishing the FAA to

acknowledge receipt of their comments submitted in response to this request must include a self-addressed, stamped postcard on which the following statement is made: "Comments to Docket No. NE-123." The postcard will be date stamped and returned to the commenter.

#### **Background**

On March 28, 2000, Pratt & Whitney Canada, Inc. applied for an amendment to type certificate (TC) E22EA for a new derivative engine, the PT6T-9 turboshaft engine model. The PT6T-9 turboshaft engine configuration is similar to the PT6T-3 series turboshaft engine models. These engines have two identical free-turbine power-sections coupled to a common mixing gearbox module with a single output shaft. The common mixing gearbox module reduces the turbine speed of the power-sections to a single output speed through a pair of overrunning clutches and reduction gearing. In addition, the common mixing gearbox contains a torquemeter for each power-section and a unique and unusual oil system configuration. The oil for engine components requiring continuous lubrication is provided by two independent lubrication systems, one for each of the power-sections, to ensure operation with any one power-section inoperative. The FAA issued Special Conditions (SC) for the PT6T-3 turboshaft engine, SC No. 33-23-EA-6 issued on June 8, 1970, and amended those SC on July 16, 1970 to clarify the vibration test requirements of engine furnished components for the aircraft rotor drive system. The PT6T-9 turboshaft engine model will have 30-second, 2-minute, and continuous one-engine inoperative (OEI) ratings. These OEI ratings will apply to a one power-section inoperative condition. The Special Conditions issued for the PT6T-3 turboshaft engine addressed, among other items, the 30-minute OEI power rating, but not the 30-second, 2-minute, and continuous OEI ratings. The 30-second, and 2-minute OEI power ratings were added to the airworthiness certification standards for aircraft engines, 14 CFR part 33, in 1996. Those new ratings were added to part 33 to enhance rotorcraft safety after an engine failure or precautionary engine shutdown by providing the availability of higher OEI power. The continuous OEI rating has been part of part 33 since 1988 and for the PT6T-9 engine will allow for the continuous operation of the remaining operative power-section at a higher power setting in the event one power-section fails.

The FAA has determined to issue these SC without prior notice and opportunity for comment. The ratings added to the PWC PT6T-9 engine model are substantially similar to ratings added to the PT6T-3 through SC 33-23-EA-6, as amended, and ratings added to part 33 since the original certification of the PT6T-3. An opportunity to comment on these ratings was previously available as part of those previous actions. These SC are required now because as a derivative to the PT6T-3 engine model the PT6T-9 engine will carry a certification basis that pre-dates the amendments to the aircraft engine certification standards that added these new ratings to part 33. Accordingly, these SC are issued to include the new ratings for the PWC PT6T-9 turboshaft engine model.

As part of these SC, the FAA will require PWC to perform two endurance tests on the PT6T-9 turboshaft engine model which are thermal endurance and mechanical endurance. The engine power-section thermal endurance test will be conducted to the power, speed, and temperature limitations as required by § 33.87(a), (d) and (f), as amended through Amendment 18 of part 33. The mechanical endurance test defined in the special conditions will be conducted to substantiate the PT6T-9 turboshaft engine model power train to the requested output speed and torque limitations. Lastly, teardown inspection requirements are added to all tests wherever applicable.

#### Type Certification Basis

Under the provisions of 14 CFR 21.101, PWC must show either that the PT6T-9 turboshaft engine model meets the requirements of the applicable regulations in effect on the date of the application, or meets the applicable provisions of the regulations incorporated by reference in Type Certificate No. E22EA. The regulations incorporated by reference in the type certificate are commonly referred to as the "original type certificate basis." The regulations incorporated by reference in Type Certificate No. E22EA are part 33, dated February 1, 1965, including Amendments 33-1 through 33-4.

The Administrator finds that the applicable airworthiness regulations in part 33, as amended, and the original type certification basis, do not contain adequate or appropriate safety standards for the PT6T-9 turboshaft engine model. Special conditions, as appropriate, are issued in accordance with § 11.38 after public notice, unless the FAA determines that notice would delay the delivery of the affected product or that notice has previously been afforded on

a substantially identical proposal. Special conditions become part of the type certification basis of a product in accordance with 14 CFR 21.101(b)(2).

#### Novel or Unusual Design Features

The Pratt & Whitney engine model PT6T-9 turboshaft engine model incorporates two power-sections coupled to a common gearbox, and will have engine ratings for 30-second OEI, 2-minute OEI, and continuous OEI operations when one power-section is inoperative. The requirements of the original type certification basis do not provide adequate or appropriate safety standards for these novel and unusual design features. Therefore, these special conditions are intended to establish a level of safety equivalent to the existing airworthiness standards. These special conditions provide additional safety standards for the PWC PT6T-9 turboshaft engine model in the following areas:

- a. Endurance test.
- b. Clutch engagement.
- c. Overspeed test.
- d. Maximum torque test.
- e. Oil Flow interruption.
- f. Power section isolation.
- g. Critical component reliability.

#### Applicability

These special conditions are applicable to the PWC PT6T-9 series turboshaft engine. Should PWC apply at a later date for an amended type certificate to add additional engine models to TC E22EA that are substantially similar to the PT6T-9 series engine and that have the same novel and unusual design features, these special conditions would apply to those models as well under the provisions of 14 CFR 21.101(a)(1), and be included in the type certification basis for those additional models.

#### Conclusion

This action affects only certain novel and unusual design features on one model of engines. It is not a rule of general applicability, and it affects only the applicant who applied to the FAA for approval of these features on the engine.

#### List of Subjects in 14 CFR Part 33

Air Transportation, Aircraft, Aviation Safety, Safety.

The authority citations for these special conditions is as follows:

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

#### The Special Conditions

Accordingly, the Federal Aviation Administration (FAA) proposes the

following special conditions as part of the type certification basis for the PWC PT6T-9 turboshaft engine model.

(a) *Definitions:* Unless otherwise approved by the Administrator and documented in the appropriate manuals and certification documents, for the purpose of these special conditions the following definitions apply to the PT6T-9 turboshaft engine model.

(1) One power-section (OPS): One of two free turbine turbomachines mounted to a combining gearbox of a turboshaft engine. The PWC PT6T-9 turboshaft engine model consists of two free turbine turbomachines coupled to a combining gearbox.

(2) OPS One Engine Inoperative (OEI) power: The rated engine power for operation with one power-section inoperative.

(b) *Mechanical test:* In addition to the requirements of § 33.87, the following mechanical test must be conducted: This test will substantiate the speed and torque limitations for the PT6T-9 turboshaft engine model drive train, from the power turbine rotor through the gearbox, to the engine output shaft. In place of the operating time cycles specified in § 33.87(a)(d) and (f), the engine must be subject to a mechanical endurance test as prescribed in paragraphs (b)(1) through (b)(8) of this section. This must include at least 232 hours and 20 minutes of operation, consisting of 20 cycles of 11 hours and 37 minutes each as follows:

(1) *Takeoff and ideling:* One hour of alternate 5 minute periods of takeoff torque, and 5 minutes at the lowest and most practicable engine idle speed. Output shaft speed must be maintained at rated rpm throughout. In complying with this paragraph, the power level must be moved from one extreme position to the other in no more than one second. Immediately following every 5-minute power-on-run, simulate a failure for each power section by applying the maximum torque and the maximum speed for use with 30-second OPS OEI power to the remaining reduction gearbox (RGB) power input for no less than 30 seconds. Each application of 30-second OPS OEI power must be followed by two applications of the maximum torque and the maximum speed for use with the 2-minute OPS OEI power for no less than 2 minutes each. The second application must follow a period at stabilized continuous OPS OEI power. At least one run sequence must be conducted from a simulated "flight idle" condition.

(2) *Rated maximum continuous:* three hours at rated maximum continuous

torque must be conducted at maximum continuous speed.

(3) *90 percent rate maximum continuous*: One hour at 90 percent rate maximum continuous torque must be conducted at maximum speed for use without maximum continuous torque.

(4) *80 percent rated maximum continuous*: One hour at 80 percent rated maximum continuous torque must be conducted at minimum speed for use with maximum continuous torque.

(5) *60 percent rated maximum continuous*: One hour at 60 percent rated maximum continuous torque must be conducted at minimum speed for use with maximum continuous torque.

(6) *Engine malfunctioning run*: It must be determined if a malfunction of engine components, such as the engine fuel or torque limiters, or if unequal power section power can cause dynamic conditions detrimental to the common gearbox parts and clutches. If a detrimental condition(s) exists, a suitable number of hours of operation must be accomplished under those conditions, 1 hour of which must be included in each cycle, and the remaining time must be accomplished at the end of the 20 cycles. If no detrimental condition results, an additional hour of operation must be conducted in compliance with paragraph (b)(1) excluding the OPS OEI power portions.

(7) *Overspeed run*: One hour of continuous operation at 110 percent of rated maximum continuous output speed must be conducted at maximum continuous torque. If the power sections are limited to an overspeed of less than 110 percent of maximum continuous speed, the speed used must be the highest speed allowable for those power sections.

(8) *Continuous OPS OEI power runs*: In sequence, and for each power section of the engine, a power section must be inoperative while the remaining power section is run for 1 hour and 14 minutes. The power section that is running must use continuous OPS OEI torque at maximum speed. The teardown inspection after completing the mechanical endurance test must comply with the requirements of § 33.93(a).

(c) *Clutch engagements*. In addition to the requirements of § 33.91, a minimum of 400 clutch engagements, including the engagements of paragraph (b)(1) of these special conditions must be made during the takeoff power runs. If it is necessary, engagements should be made at each change of power and speed throughout the test. In each engagement, the shaft on the driven side of the clutch must be accelerated from rest or an

unloaded condition that is representative of engine operation. This test may be conducted concurrently with the mechanical endurance test. The teardown inspection after completing the clutch engagement test must comply with the requirements of § 33.93(a).

(d) *Overspeed test*. The endurance test of paragraph (b) of these special conditions must be completed before performing this test under the requirements of § 33.89, and without intervening major disassembly. The output gearbox must be subjected to 50 overspeed runs, each  $30 \pm 3$  seconds in duration at 120 percent of rated maximum continuous speed. These runs must be conducted as follows:

(1) Overspeed runs must be alternated with stabilizing runs of 60 to 80 percent of maximum continuous speed.

(2) Acceleration and deceleration must be accomplished in a period not longer than 10 seconds, and the time for changing speeds may not be deducted from the specified time for the overspeed runs. If the power section are limited by the applicant to an overspeed of less than 120 percent of maximum continuous speed for the periods required, the highest allowable speed must be used for the power sections involved. The teardown inspection after completing the overspeed test must comply with the requirements of § 33.93(a).

(e) *Maximum torque test*. When performing the requirements of § 33.89 for maximum torque operation, the maximum power section output of the engine must be substantiated as follows:

(1) Under conditions associated with all power sections operating, perform 200 applications, for 10 seconds each, of torque that is, at a minimum, equal to the lesser of (i) and (ii):

(i) The maximum torque used in meeting the endurance test plus 10 percent or;

(ii) The maximum torque attainable under probable operating conditions, assuming that torque limiting devices, if any, function properly.

(2) With the critical power sections inoperative, apply the maximum torque attainable under probable operating conditions, assuming that torque limiting devices, if any, function properly. Each gearbox input must be tested at this maximum torque for at least 15 minutes. The teardown inspection after completing the maximum torque test must comply with the requirements of § 33.93.

(f) *Oil flow interruption*. In addition to the requirements of § 33.71, the mixing gearbox must be operated at zero oil

pressure and 100 percent output speed for at least 5 minutes without seizure.

(g) *Power section isolation*. The power sections and their systems, including fuel, oil and control systems, must be arranged and isolated from each other to allow operation, in at least one configuration. Consequently, the failure or malfunction of any power section, or the failure of any system that can affect any power section, will not prevent the continued safe operation of the remaining power section. For the purpose of these special conditions, a power section failure is interpreted to not include an uncontained failure, such as an uncontained power section rotor burst.

(h) *Critical component reliability*. In addition to the vibration tests specified in § 33.83, the vibration load/stress limits of engine-furnished critical components of the rotor drive system must be investigated. This investigation must include the following: (1) The gearbox case and each component in the mixing gearbox whose failure would cause an uncontrolled landing.

(2) Each component common to the two power sections.

(3) Components provided as a part of the engine necessary to transmit power from the power section shaft to and through the engine output shaft. This includes components such as gearboxes, shafting, couplings, rotor brake assemblies, clutches, supporting bearings for shafting, and any attendant accessory pads or drives.

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## DEPARTMENT OF TRANSPORTATION

### Federal Aviation Administration

#### 14 CFR Part 39

[Docket No. 99-NM-227-AD; Amendment 39-12050; AD 2000-15-17 R1]

RIN 2120-AA64

**Airworthiness Directives; McDonnell Douglas Model DC-9-81 (MD-81), DC-9-82 (MD-82), DC-9-83 (MD-83), and DC-987 (MD-87); Model MD-88 Airplanes; and Model MD-90-30 Series Airplanes**

**AGENCY:** Federal Aviation Administration, DOT.

**ACTION:** Final rule; correction.