throughout the declared flight envelope of the engine; (2) require that continued windmilling following engine shutdown must not create a hazard for the airplane; (3) expand the scope of vibration tests; (4) expand the applicability of rotor locking tests; and (5) clarify rotor locking and vibration test requirements.

Windmilling and Rotor Locking Test Requirements

Section 33.74 Windmilling

Parts 23 and 25 of title 14 of the CFR prescribe the airworthiness standards for airplanes. Sections 23.903(e)(2) and 25.903(c) in part, state that for turbine engine installations, the means for stopping the rotation of any engine need be provided only where continued rotation could jeopardize the safety of the airplane. JAR–E presently provides a safety objective for windmilling without oil.

This proposal would add a new section to state specific windmilling requirements that are consistent with the safety objectives of the airplane requirements in §§ 23.903(e)(2) and 25.903(c), which address control of engine rotation. The proposed new requirements would ensure that windmilling following engine shutdown in flight would not create a hazard for the airplane.

This proposal was developed and agreed to by the ARAC Propulsion Harmonization working group. The proposed change contains language that would be common to the language proposed for JAR-E, thereby establishing equivalency and creating consistency between the two regulations. In addition, because an engine manufacturer must show compliance to the proposed § 33.74 which has safety objectives consistent with the corresponding airplane requirements for windmilling engines identified in §§ 23.903(e)(2) and 25.903(c), the engine manufacturer can provide this information directly to the airplane manufacturers to reduce the amount of analysis performed by the airplane manufacturers under §§ 23.903(e)(2) and 25.903(c), which could result in potential cost savings for the airplane manufacturers.

Section 33.92 Rotor Locking Tests

Section 33.92 currently specifies engine test requirements for engines installed on supersonic aircraft and also specifies an endurance test for turbine engine rotor stopping and locking devices. This proposal would delete the test requirements in § 33.92(a) and clarify the endurance test for rotor stopping and locking devices, that is applicable to all turbine engines that incorporate such a device. This proposed requirement will also be proposed in JAR–E, thereby harmonizing with part 33 and facilitating the harmonization of part 25 with JAR 25, by allowing deletion of JAR 25.903(c)(1), which addresses continued windmilling after loss of engine oil.

The proposed deletion of current § 33.92(a) is based on the service experience of the world's only supersonic commercial transport. The British/French Concorde has experienced a number of inflight engine shutdowns at supersonic speeds since 1974. In each of these incidents, because of the aerodynamic effect of drag and loss of thrust, speed was rapidly reduced to subsonic levels. Therefore, requirements for conducting prolonged engine windmilling tests at supersonic speeds are unnecessary.

The proposal would move the requirement that each engine incorporating a rotor locking device be shut down while operating at rated maximum continuous thrust from \S 33.92(b)(1) to proposed \S 33.92. Proposed revision \S 33.92 would also require that the means for stopping and locking the rotor(s) must be operated as specified in the engine operating instructions.

The proposed revision to § 33.92 would clarify the endurance test requirements currently identified in § 33.92(b) by establishing that following rotor locking, the rotor(s) must be held stationary for five minutes while being subjected to the maximum torque that could result from continued flight in this condition. The harmonization review has established that the current requirement does not provide adequate information on how to run the test. Clarification is provided by the addition of a five minute test to confirm the durability of the system.

Vibration and Vibration Test Requirements

Section 33.63 Vibration

Section 33.63 currently contains vibration design and construction standards for aircraft engines. This proposal would clarify the existing text by adding the term "declared flight envelope" to ensure that excessive vibration stresses are not induced at all intended airborne and non-airborne conditions of operation. This proposal would harmonize the vibration requirements.

Section 33.83 Vibration Test

Section 33.83 prescribes the testing requirements that turbine engines must undergo to establish the aerodynamically induced system vibration (flutter) as well as the mechanically induced vibration characteristics of components that could induce failure. This proposal would delete the existing text and replace it with harmonized requirements. The harmonized requirements address some conditions that are currently being addressed by analysis in § 33.75.

Section 33.83(a). This proposal would replace the current text with new harmonized text to clarify the existing requirement that all components in each engine that may be subject to mechanically or aerodynamically induced vibratory excitations must undergo vibration surveys. These engine surveys shall be based upon an appropriate combination of experience, analysis, and component test and should address, as a minimum, blades, vanes, rotor discs, spacers, and rotor shafts. Substantive pre-certification activity (tests and analyses) is necessary for determining which engine components require verification by the engine certification process. The proposal retains the current practice of the FAA and JAA of limiting formal certification test requirements to only the final engine or major assembly rig vibration test.

The proposal would replace the phrase "at the maximum inlet distortion limit" with "throughout the declared flight envelope" to clarify that the engine must be tested to cover all intended airborne and non-airborne conditions of operation. Using the term "declared flight envelope" better describes the airworthiness objective of this section. This change results in no foreseen additional burden on applicants because industry practice has been to conduct vibration surveys throughout the declared flight envelope. This proposal would also move the requirement specifying the range of rotor speeds and power or thrust of the vibration surveys from current § 33.83(a) to proposed revised § 33.83(b).

Section 33.83(b). This proposal would revise this paragraph to reorganize and elaborate on existing requirements, introduce terminology relevant to flutter vibration, and achieve harmonization where differences currently exist between Part 33 and JAR–E. The proposed paragraph (b) would require the vibration tests to cover the ranges of physical rotor speeds, corrected rotor speeds, and engine power or thrust corresponding to operations throughout