Extract from Joint Airworthiness Requirements JAR 25 LARGE AEROPLANES

JAR 25.939 Turbine engine operating characteristics

(a) Turbine engine operating characteristics must be investigated in flight to determine that no adverse characteristics (such as stall, surge, or flame-out) are present, to a hazardous degree, during normal and emergency operation within the range of operation limitations of the aeroplane and of the engine. (See ACJ 25.939(a).)

(b) Reserved.

(c) The turbine engine air inlet system may not, as a result of air flow distortion during normal operation, cause vibration harmful to the engine. (See ACJ 25.939 (c).)

(d) It must be established over the range of operating conditions for which certification is required that the powerplant installation does not induce engine carcase vibration in excess of the acceptable levels established during engine type certication under JAR-E, C3-4, paragraph 3.4. (See ACJ 25.939 (d).)

ACJ 25.939(a)
Turbine Engine Operating Characteristics (Interpretative Material)
See JAR 25.939(a)

1 The wording 'in flight' should be interpreted to cover all operating conditions from engine start until shut-down.

2 If the airflow conditions at the engine air intake can be affected by the operating conditions of an adjacent engine, the investigation should include an exploration of the effects of running the adjacent engine at the same and at different conditions over the whole range of engine operating conditions, including reverse thrust. An investigation of the effect of malfunctioning of an adjacent engine should also be included.

ACJ 25.939(c)
Turbine Engine Operating Characteristics (Acceptable Means of Compliance and Interpretative Material)
See JAR 25.939(c)

1 The investigation should cover the complete range, for which certification is required, of aeroplane speeds attitudes, altitudes and engine operating conditions including reverse thrust, and of steady and transient conditions on the ground and in flight, including crosswinds, rotation, yaw and stall. Non-critical conditions of operation which need not be considered should be agreed with the Authority.

2 If the airflow conditions at the engine air intake can be affected by the operating conditions of an adjacent engine, the investigation should include an exploration of the effects of running the adjacent engine at the same and at different conditions over the whole range of engine operating conditions, including reverse thrust. An investigation of the effect of malfunctioning of an adjacent engine should also be included.

3 Compliance with the requirement may include any suitable one or combination of the following methods; as agreed with the Authority.

a. Demonstration that the variations in engine inlet airflow distortion over the range defined in 1 are within the limits established for the particular engine type.

b. An investigation of blade vibration characteristics by the method and of the scope indicated in JAR-E, C3-4 para 3.3 (except that Maximum Take-off rpm need not be exceeded) carried out on:-

i a representative installation on the ground using test equipment where the actual conditions of operation in the aeroplane are reproduced, or

ii a representative aeroplane on the ground and in flight as appropriate to the conditions being investigated.

c. The completion of sufficient flying with representative installations prior to certification such as to demonstrate that the vibration levels are satisfactory.

d. Any other method acceptable to the Authority.

ACJ 25.939(d)
Turbine Engine Operating Characteristics (Acceptable Means of Compliance)
See JAR 25.939(d)

Compliance with JAR 25.939(d) may consist of flight tests using vibration measuring equipment on which engine test bed vibration levels were established, or the equipment intended to be supplied on production engines provided the Authority considers the equipment sensitive enough for the purpose of showing compliance with the requirements.