Federal Aviation Administration, DOT

§ 25.625

through (d) of this section must be applied in addition to those necessary to establish foundry quality control. The inspections must meet approved specifications. Paragraphs (c) and (d) of this section apply to any structural castings except castings that are pressure tested as parts of hydraulic or other fluid systems and do not support structural loads.

(b) Bearing stresses and surfaces. The casting factors specified in paragraphs (c) and (d) of this section—

1. Need not exceed 1.25 with respect to bearing stresses regardless of the method of inspection used; and
2. Need not be used with respect to the bearing surfaces of a part whose bearing factor is larger than the applicable casting factor.

(c) Critical castings. For each casting whose failure would preclude continued safe flight and landing of the airplane or result in serious injury to occupants, the following apply:

1. Each critical casting must—
   (i) Have a casting factor of not less than 1.25; and
   (ii) Receive 100 percent inspection by visual, radiographic, and magnetic particle or penetrant inspection methods or approved equivalent nondestructive inspection methods.
2. For each critical casting with a casting factor less than 1.50, three sample castings must be static tested and shown to meet—
   (i) The strength requirements of § 25.305 at an ultimate load corresponding to a casting factor of 1.25; and
   (ii) The deformation requirements of § 25.305 at a load of 1.15 times the limit load.
3. Examples of these castings are structural attachment fittings, parts of flight control systems, control surface hinges and balance weight attachments, seat, berth, safety belt, and fuel and oil tank supports and attachments, and cabin pressure valves.

(d) Noncritical castings. For each casting other than those specified in paragraph (c) of this section, the following apply:

1. Except as provided in paragraphs (d)(2) and (3) of this section, the casting factors and corresponding inspections must meet the following table:

<table>
<thead>
<tr>
<th>Casting factor</th>
<th>Inspection</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0 or more ..........</td>
<td>100 percent visual.</td>
</tr>
<tr>
<td>Less than 2.0 but more than 1.5.</td>
<td>100 percent visual, and magnetic particle or penetrant or equivalent nondestructive inspection methods.</td>
</tr>
<tr>
<td>1.25 through 1.50 ..........</td>
<td>100 percent visual, magnetic particle or penetrant, and radiographic, or approved equivalent nondestructive inspection methods.</td>
</tr>
</tbody>
</table>

2. The percentage of castings inspected by nonvisual methods may be reduced below that specified in paragraph (d)(1) of this section when an approved quality control procedure is established.
3. For castings procured to a specification that guarantees the mechanical properties of the material in the casting and provides for demonstration of these properties by test of coupons cut from the castings on a sampling basis—
   (i) A casting factor of 1.0 may be used; and
   (ii) The castings must be inspected as provided in paragraph (d)(1) of this section for casting factors of “1.25 through 1.50” and tested under paragraph (c)(2) of this section.

§ 25.623 Bearing factors.

(a) Except as provided in paragraph (b) of this section, each part that has clearance (free fit), and that is subject to pounding or vibration, must have a bearing factor large enough to provide for the effects of normal relative motion.

(b) No bearing factor need be used—

§ 25.625 Fitting factors.

For each fitting (a part or terminal used to join one structural member to another), the following apply:

(a) For each fitting whose strength is not proven by limit and ultimate load tests in which actual stress conditions are simulated in the fitting and surrounding structures, a fitting factor of at least 1.15 must be applied to each part of—
   (1) The fitting;
   (2) The means of attachment; and
   (3) The bearing on the joined member.

(b) No fitting factor need be used—
§ 25.629 Aeroelastic stability requirements.

(a) General. The aeroelastic stability evaluations required under this section include flutter, divergence, control reversal and any undue loss of stability and control as a result of structural deformation. The aeroelastic evaluation must include whirl modes associated with any propeller or rotating device that contributes significant dynamic forces. Compliance with this section must be shown by analyses, wind tunnel tests, ground vibration tests, flight tests, or other means found necessary by the Administrator.

(b) Aeroelastic stability envelopes. The airplane must be designed to be free from aeroelastic instability for all configurations and design conditions within the aeroelastic stability envelopes as follows:

(1) For normal conditions without failures, malfunctions, or adverse conditions, all combinations of altitudes and speeds encompassed by the \( V_{D}M_{0} \) versus altitude envelope enlarged at all points by an increase of 15 percent in equivalent airspeed at both constant Mach number and constant altitude. In addition, a proper margin of stability must exist at all speeds up to \( V_{D}M_{0} \) and, there must be no large and rapid reduction in stability as \( V_{D}M_{0} \) is approached. The enlarged envelope may be limited to Mach 1.0 when \( M_{0} \) is less than 1.0 at all design altitudes, and

(2) For the conditions described in § 25.629(d) below, for all approved altitudes, any airspeed up to the greater airspeed defined by:

(i) The \( V_{D}M_{0} \) envelope determined by § 25.335(b); or,

(ii) An altitude-airspeed envelope defined by a 15 percent increase in equivalent airspeed above \( V_{C} \) at constant altitude, from sea level to the altitude of the intersection of 1.15 \( V_{C} \) with the extension of the constant cruise Mach number line, \( M_{C} \), then a linear variation in equivalent airspeed to \( M_{C}+0.05 \) at the altitude of the lowest \( V_{C}M_{C} \) intersection; then, at higher altitudes, up to the maximum flight altitude, the boundary defined by a .05 Mach increase in \( M_{C} \) at constant altitude.

(c) Balance weights. If concentrated balance weights are used, their effectiveness and strength, including supporting structure, must be substantiated.

(d) Failures, malfunctions, and adverse conditions. The failures, malfunctions, and adverse conditions which must be considered in showing compliance with this section are:

(1) Any critical fuel loading conditions, not shown to be extremely improbable, which may result from mismanagement of fuel.

(2) Any single failure in any flutter damper system.

(3) For airplanes not approved for operation in icing conditions, the maximum likely ice accumulation expected as a result of an inadvertent encounter.

(4) Failure of any single element of the structure supporting any engine, independently mounted propeller shaft, large auxiliary power unit, or large externally mounted aerodynamic body (such as an external fuel tank).

(5) For airplanes with engines that have propellers or large rotating devices capable of significant dynamic forces, any single failure of the engine structure that would reduce the rigidity of the rotational axis.

(6) The absence of aerodynamic or gyroscopic forces resulting from the most adverse combination of feathered propellers or other rotating devices capable of significant dynamic forces. In addition, the effect of a single feathered propeller or rotating device must be coupled with the failures of paragraphs (d)(4) and (d)(5) of this section.