AD/AC-112/15 Rudder Spar 6/95

Applicability: Models 112 and 112B aircraft with serial numbers 13000 and 3 to 544, inclusive. Models 112TC and 112TCA aircraft with serial numbers 13001 to 13309, inclusive.

Requirement:

1. Visually inspect the rudder spar near the upper hinge fitting for signs of cracking. Check for excessive movement by attempting to move the rudder tip fore and aft and left to right.

2 (a). Remove the rudder assembly from the aircraft as outlined in the Maintenance Manual, Section VII. Remove the rudder tip assembly and the upper hinge fitting. Inspect the forward face of the rudder spar web, bend radius, flanges and angle doublers P/N 44006-RE3, if installed, for cracks in the area of the upper hinge fitting attachment. Inspect using the dye penetrant method in accordance with Rockwell Service Letter SL-112-46 and CAO 108.10.

Cracks, including stop drilled cracks, which extend beyond installed angle doublers, P/N 44006-RE3, must be repaired by replacement of the rudder spar before further flight.

2 (b). Modify the rudder spar upper hinge attachment area by installing angle doublers P/N 44006-RE3 in accordance with Rockwell SL-112-46, Figure 1. The rudder spar must be free of cracks before modification.

Any spar with angle doublers installed shall be regarded as cracked unless it can be positively confirmed that the rudder spar was crack free when the angle doublers were installed.

Compliance:

1. Inspect in accordance with Requirement 1 within 10 hours time in service after 25 May 1995.

2. Initially inspect in accordance with Requirement 2(a) before 100 hours time in service after 25 May 1995. Re-inspect at intervals not to exceed 200 hours time in service until modified in accordance with Requirement 2(b).

Background: The Authority has received reports of cracking of the rudder spar on a model 114 in the region of the upper hinge fitting. Substantial cracking was found on one aircraft 1500 hours time in service after compliance with AD/ROCK-114/10 with no defects found. The rudder structure on the model 112 is of similar design. This Directive requires repeat inspections of the hinge fitting area until the rudder spar is modified to the later production standard.

Australian Government

Civil Aviation Safety Authority

I, WILLIAM BRUCE BYRON, Director of Aviation Safety, on behalf of CASA, make this instrument under subregulation 38 (1) of the *Civil Aviation Regulations 1988*.

[Signed Bruce Byron]
Bruce Byron
Director of Aviation Safety and
Chief Executive Officer

11 December 2007

Civil Aviation Order 108.10 Instrument 2007

1 Name of instrument

This instrument is the *Civil Aviation Order 108.10 Instrument 2007*.

2 Commencement

This instrument commences on the day after it is registered.

3 New Civil Aviation Order 108.10

Civil Aviation Order 108.10 is repealed and a new Civil Aviation Order 108.10 substituted as set out in Schedule 1.

Schedule 1 Civil Aviation Order 108.10

Process control — dye penetrant inspection

1 Application

1.1 This Civil Aviation Order specifies procedures relating to the inspection of aircraft, aircraft components and aircraft materials for flaws by dye penetrant methods, and is applicable in such circumstances as may be directed by the Director or an authorised person under the *Civil Aviation Regulations 1988*.

2 Definitions

In this Order:

dye penetrate material means any material which forms part of a dye penetrant system and may be a cleaner, emulsifier or developer in addition to a dye penetrant.

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dye penetrant process means complete inspection procedure which defines the manner in which a dye penetrant system is used.

dye penetrate system means any combination of dye penetrant materials used in conjunction one with another to effect a dye penetrant inspection.

3 Approved dye penetrant systems

3.1 Dye penetrant inspections must be performed only using approved dye penetrant systems. The following dye penetrant systems are approved:

(a) all penetrant systems which are qualified by their manufacturers as satisfying the requirements of the United States of America Military Specification Mil-125135, latest issue;

(b) all penetrant systems which are qualified as being approved types in accordance with the requirements of the United Kingdom Specification D.T.D. 929, latest issue;

(c) all penetrant systems which are approved by the Royal Australian Air Force Quality Control Branch; and

(d) all penetrant systems approved for the purposes by the airframe, engine or component manufacturer in an overhaul manual, process specification or other approved maintenance document.

3.2 Penetrant systems, other than those specified in paragraph 3.1 of this subsection, will be approved if it can be demonstrated to the Director that their sensitivities and non-corrosive properties are at least equal to those of a system specified in that paragraph.

3.3 When, for a given application, no dye penetrant system is specified in the relevant Civil Aviation Order or approved maintenance document, Appendix I to this Order specifies the means by which an approved system must be selected.

4 Selection of dye penetrant processes

4.1 When, for a given application, a dye penetrant process is specified in Civil Aviation Orders or an approved maintenance document, a process of equal or greater sensitivity may be used.

4.2 When no dye penetrant process is specified for a given application in Civil Aviation Orders or an approved maintenance document, Appendix II to this Order constitutes an approved dye penetrate process.

5 Control of penetrant materials and equipment

5.1 A dye penetrant inspection must not be made unless the dye penetrant materials and equipment have been checked within the time and according to the procedures specified in Appendix III to this Order.

Appendix I

This Appendix specifies the means of selecting suitable dyes penetrate systems for given applications.

1 The classification of dye penetrant systems

1.1 Dye penetrant systems (as defined in Civil Aviation Order 108.10) may be classified in the following 7 groups:

Group 1 Consisting of a solvent-removable colour contrast penetrant, a penetrant remover (solvent), and a liquid suspended or liquid soluble developer.

Group 2 Consisting of a post-emulsifiable colour contrast penetrant, an emulsifier, and a liquid suspended or liquid developer.

Group 3 Consisting of a water-washable colour contrast penetrant and a liquid suspended or liquid soluble developer.

Group 4 Consisting of a water-washable fluorescent penetrant and a dry, liquid suspended or liquid soluble developer.

Group 5 Consisting of a post-emulsifiable fluorescent penetrant, an emulsifier and a dry, liquid suspended or liquid soluble developer.

Group 6 Consisting of a high-sensitivity, post-emulsifiable fluorescent penetrant, an emulsifier and a dry, liquid suspended or liquid soluble developer.

Group 7 Consisting of a solvent-removable fluorescent penetrant, a remover (solvent) and a dry, liquid suspended or liquid soluble developer.

Note The above groupings are similar to those given in the US Military Specification Mil-25135C. This specification defines a minimum sensitivity requirement for each group. A given system may, however, be of a sensitivity considerably higher than this minimum. Thus, it is possible, for instance, for a Group 4 system to be of Group 6 sensitivity.

1.2 Solvent removers and emulsifiers may be used in a liquid or foamed form.

2 Choice of system

2.1 The use of colour contrast penetrant systems (Groups 1, 2 or 3) is acceptable:

(a) where the flaws to be located are relatively, large and open at the surface such as would be normally the case in sheet metal parts; or

(b) when the roughness of the surface to be inspected is such as to negate the greater sensitivity of fluorescent penetrants.

2.2 When the flaws located are small fatigue or stress corrosion cracks, or cracks which are ‘tight’ by reason of imposed or residual compressional stresses, fluorescent penetrant systems (Groups 4, 5, 6 or 7) must normally be used. The sensitivity of the system used must be, when the surface condition permits, equal to, or better than, that of a Group 6 system.

2.3 Post emulsification systems (Groups 2, 5 or 6) must not be used on surfaces which contain abrupt changes of section which would retain excess surface penetrant of varying depth.

2.4 The choice of method of developer must be based on the necessity to provide a thin even coating of developer over the surface to be inspected. Liquid suspended developers must not be used when the surface to be inspected contains abrupt changes of section (e.g. threads, splines, keyways or any abrupt concavity) at which the developer powder will be retained in excessive quantity. In such cases, dry developer powder must be used in conjunction with a fluorescent penetrant.

2.5 Only sulphur and chlorine free penetrant systems must be used on titanium and nickel based alloys.

Appendix II

This Appendix constitutes an approved dye penetrate process.

1 Surface preparation

1.1 Before application of penetrant, parts should be dry and clean. Every precaution must be taken to ensure that any flaws present will be free from foreign materials which would prevent the entry of penetrant or react with the penetrant in a manner detrimental to its efficiency.

Note Strong acids such as chromic acid used in anodising and strong alkalis as used in some paint or carbon removers will reduce the fluorescent properties of dyes.

1.2 Where there is a danger of moisture being retained within flaws, the part must be thoroughly dried by heating to a temperature of not less than 70°C nor more than 110°C. The time at temperature must be not less than 40 minutes at 70°C or 5 minutes at 110°C.

1.3 Trichlorethylene vapour degreasing must be used to clean parts where possible. Where this is not possible, parts must be cleaned using solvent sufficiently volatile at ambient temperature to minimise the danger of cleaning fluid remaining in a flaw, e.g. kerosene or gasoline must not be used.

1.4 Cleaning of parts should not be undertaken by mechanical means which cause surface openings to be sealed (e.g. shot or glass bead peening, sand blasting etc.). If such mechanical treatment is unavoidable, it should be followed by a light cutting action such as that provided by hand sanding with sharp “wet and dry” papers, well-lubricated with cleaning solvent of a type described in paragraph 1.3.

2 Application of penetrant

2.1 The method of application of penetrant is not critical and may be by dip, spray, brush or any other method which ensures complete coverage of the surface under inspection.

2.2 The temperature of the surface to which penetrant is applied must be within the range 2°-50°C unless the penetrant used has been qualified by the manufacturer as being effective outside this temperature range.

2.3 The penetrant must remain in contact with the surface of the part for not less than 20 minutes.

2.4 Where post-emulsification is to be used, the penetrant must be drained from the part in such a way as to ensure that the coating of excess penetrant remaining is of uniform thickness on the surfaces to be inspected.

3 Removal of excess penetrant

3.1 When a solvent remover is used, great care must he taken to avoid overcleaning. A lint-free, clean cloth moistened (not soaked) with the solvent must be used. On no account must the solvent be applied directly to the surface unless it is in a foamed form.

3.2 When a water-washable penetrant is used, excess penetrant must be removed by water spray. The water temperature must be in the range of 10-45°C. Detergents must not be used. Whenever possible, washing must be accomplished with a hand-held nozzle, on a hose, at standard water mains pressure. The water jet should be directed at the surface at a glancing angle and must not be allowed to remain stationary on any part of the surface. Washing must be discontinued immediately the surface is sufficiently free from excess penetrant to provide an acceptable "background" allowing flaw indications to be clearly visible after development.

3.3 If a post-emulsifiable penetrant is used, emulsifier must be applied to the surface before water washing. Application of the emulsifier must be such that all surfaces are evenly covered in 1 operation. Application must be by immersion or by gently flow coating. Emulsifier must not be applied by brush or forceful spray. Draining of parts during emulsification must be effected in such a way as to ensure that the emulsifier remains evenly dispersed over the surface of the part. Emulsification time is critical and must be obtained experimentally by determining the minimum time required for a given part at a given temperature to achieve an acceptable "background" allowing indications to be clearly visible after development. After emulsification, parts must be washed with water as described in paragraph 3.2.

4 Application of developer

4.1 Liquid suspended developers must be applied by spray or dip. Dry developer powders may be applied by any method which ensures that the powder remains in stationary intimate contact with the surface of the part during the development time, after which, excess powder must be shaken from the part or removed by gentle blowing or tapping.

4.2 Dry developer powders must be used only in conjunction with fluorescent penetrants.

4.3 Parts must be thoroughly dried after water washing and before the application of solvent suspended or dry developer after application of water suspended or water soluble developer powders. Drying may be facilitated by using warm air at a temperature not exceeding 80°C provided that the temperature of the surface of the part is not raised above 50°C.

5 Inspection

5.1 Following application of solvent suspended or dry developer powders or, in the case of water suspended or water soluble developers, after drying is complete, a period of 10 minutes or half the penetration time, whichever is the greater, must elapse before final inspection of the part.

5.2 When colour contrast dye penetrants have been used, inspection must be effected under good conditions of white light illumination providing an intensity at the surface under inspection of not less than 1080 lumen m² or 100 foot candle when measured with a Weston Light Meter Model 703 type 51 or equivalent.

5.3 When fluorescent dye penetrants have been used, parts must be inspected with ultraviolet light under conditions of darkness or near-darkness. Inspection lamps must contain a filter to minimise the intensity of visible light transmitted and to eliminate harmful ultraviolet light of wave length less than 3,000A while permitting maximum transmission of ultraviolet light of approximately 3650A. The

intensity of ultraviolet light at the surface to be inspected must be not less than 970 lumen m^2 (735µ Wcm^2 or 90 foot candles) when measured with the instruments described in paragraph 3.1 of Appendix III to this Order.

6 Cleaning of parts after penetrant inspection

All traces of penetrant materials should be removed from parts within 4 hours after the application of developer. Final cleaning must be particularly expedited in the case of magnesium alloys which are very susceptible to corrosion in the presence of developer powders.

7 Repeat inspections

7.1 If it is necessary to undertake a repeat inspection of a part, the same process and materials from the same source of manufacture as used in the initial inspection must be used unless it has been established that the subsequently applied materials are compatible with those used in the original inspection.

7.2 Fluorescent dye penetrants must not be used to repeat an inspection where a colour contrast penetrant was used originally.

Note Repeat inspection in this context means an inspection being repeated on a part, the integrity of which has not been established by the first inspection and where there is a danger of penetrant materials being retained with a flaw. When an inspection of a part is being repeated after some elapsed period in service (e.g. as may be required by a Service Bulletin or Airworthiness Directive), and it can be confidently assumed that the part was free from defects at the last inspection, the limitations of paragraphs 4.1 and 4.2 do not apply.

Appendix III

This Appendix specifies procedures to be adopted for the control of penetrant materials and equipment.

1 Penetrant materials

1.1 Penetrant materials which may be subject to contamination must be checked periodically for deterioration of their properties which would adversely affect their performance. The materials may be tested separately using tests similar to those specified in the United States Military Specification Mil-I-25135, but as a minimum requirement the process as a whole must be subjected to a functioning test for overall sensitivity.

1.2 A functioning test must consist of subjecting a sample containing natural or artificially induced cracks to the inspection process as a whole and assessing whether there has been any deterioration in any of the following:

(a) the contrast of the crack indications with the background surface;

(b) the clarity with which the crack indications are delineated;

(c) the absence of spurious indications resulting from difficulty in removing excess penetrant;

(d) the ease with which all traces of penetrant materials may be removed after inspection.

1.3 Before use, the reference samples used for the functioning test must be thoroughly cleaned to ensure that no materials from previous tests remain within the cracks.

2 Equipment

2.1 Ultraviolet lamps together with their filters must be tested not less than once every 3 months for the intensity of ultraviolet light output. The intensity must be not less than 1350 lumen m^2 (1,020µ Wcm^2) or 125 foot candle when measured with a Weston Light Meter model 703, type 51 or equivalent, or an Ultraviolet Products Inc. Ultraviolet Meter model J-221 or equivalent, placed 380 mm from the surface of the filter.