SUPPLEMENTAL INSPECTION DOCUMENT

1. Supplemental Inspection Document

A. Introduction

(1) The Supplemental Structural Inspection Program for the Cessna Models 208 and 208B airplane is a result of the Models 208 and 208B airplane's current usage and state-of-the-art analysis, testing and inspection methods. Analysis methods include durability, fatigue, and damage tolerance assessments. A practical state-of-the-art inspection program is found for each Principal Structural Element (PSE). The FAA has defined a PSE in AC25.571:

(a) A PSE is an element that contributes significantly to carrying flight, ground or pressurization loads, and whose integrity is essential in maintaining the overall structural integrity of the airplane.

(2) The Supplemental Structural Inspection Program was made with the combined efforts of Cessna Aircraft Company and Model 208 and 208B operators. The inspection program is the current structural maintenance inspection, plus supplemental inspections for continued airworthiness of the airplane as years of service are collected. The primary function of the Supplemental Structural Inspection Program is to find fatigue damage which will increase with time. In addition to the supplemental inspections, we started a Corrosion Prevention and Control Program (CPCP) to prevent or control corrosion that can have an effect on the continued airworthiness of the airplane.

(3) **The Supplemental Structural Inspection Program is valid for airplanes with less than 50,000 hours. Beyond this the continued airworthiness of the airplane can no longer be assured. Retirement of the airframe is recommended when 50,000 flight hours have been accumulated.**

B. Function

(1) The function of the Supplemental Structural Inspection Program is to find damage from fatigue, overload or corrosion through the use of the Nondestructive Inspections (NDI), and visual inspections. This Supplemental Inspection Document (SID) is only for primary and secondary airframe components. Engine, electrical items and primary and secondary systems are not included in this document.

(a) A list is included to show the requirements for the SID program for primary and secondary airframe components.

1 The airplane maintenance agrees with Cessna's recommendations or the equivalent.

2 If the SID is for a specific part or component, you must examine and evaluate the surrounding area of the parts and equipment. If problems are found outside these areas, report them to Cessna Aircraft Company on a reporting form. Changes can then be made to SID program, if necessary.

3 The SID inspections are for all Cessna Models 208 and 208B airplanes. The inspection intervals are for unmodified airplanes, and represent the maximum approved inspection times. On airplanes that changed the airplane design, gross weight, or airplane performance, it can be necessary to do inspections more frequently. Examples of some Supplemental Type Certification (STC) installations, which will require modified inspection intervals include vortex generators and non-standard engines. The owner or the maintenance organization should contact the STC holder(s) or modification originator to get new FAA approved inspection information.

2. Principal Structural Elements

A. Principal Structural Elements Description

(1) An airplane component is classified as a Principal Structural Element (PSE) if:

(a) The component contributes significantly to carrying flight and ground loads.

(b) And, if the component fails, it can result in a catastrophic failure of the airframe.

(2) The monitoring of these PSEs is the main focus of this Supplemental Structural Inspection Program.

(3) Typical examples of PSEs, as listed in FAA Advisory Circular 25.571, are listed in Table 1.

Table 1. Typical Examples of Principal Structural Elements (PSEs)

Wing and Empennage	
	Control surfaces, flaps and their mechanical systems and attachments (hinges, tracks and fittings)
	Primary fittings
	Principal splices
	Skin or reinforcement around cutouts or discontinuities

Skin-stringer combinations

Spar caps

Spar webs

Fuselage

Circumferential frames and adjacent skin

Door frames

Pilot window posts

Bulkheads

Skin and single frame or stiffener element around a cutout

Skin or skin splices, under circumferential loads

Skin or skin splices, under fore-and-aft loads

Door skins, frames and latches

Window frames

Landing Gear and their Attachments

Engine Support Structure and Mounts

B. Selection Criteria

(1) The factors used to find the PSEs in this document include:

(a) Service Experience

1 Two sources of information were used to find the service discrepancies.

a Cessna Service Bulletins and Service Information Letters issued to repair common service discrepancies were examined.

b FAA Service Difficulty Records were examined.

2 The data collected was also used to find a component's susceptibility to corrosion or accidental damage as well as its inspectability.

(b) Fatigue And Damage Tolerance Analysis

1 Fatigue and damage tolerance analyses were conducted for the critical areas of the PSEs. Details of these analyses are presented in Section 3, Durability - Fatigue And Damage Tolerance.

(c) Testing

1 Test results from previous static tests and fatigue cyclic tests were reviewed to identify the critical areas of the PSEs.

3. Durability - Fatigue And Damage Tolerance

A. Airplane Usage

(1) Airplane usage data for the SID program is from the analysis of the in-service use of the airplane. Operational data for the SID is from operator surveys and from CESCOM (Computerized Maintenance Program). This information was used to make the fatigue loads spectra.

(2) Usage results from inspection of typical flight lengths, takeoff gross weights, payloads and fuel. One flight profile was made to represent each usage. Different usages are mixed to make a fatigue loads spectrum.

(3) The flight profile has the applicable facts of the flight. The profile gives the gross weight, payload, fuel, altitude, speed, distance, etc., necessary to find the pertinent flight and ground parameters to develop the fatigue loads. The flight is then divided into operational segments, where each segment represents the average values of the parameters (speed, payload, fuel, etc.) that are used to calculate the fatigue loads spectrum.

B. Stress Spectrum

(1) A fatigue loads spectrum, which is the gross area stress, was made for each PSE to be analyzed. This analysis is based on the usage-flight profile.

(2) The spectrum represents the loading environments, they are:

(a) Flight loads (gust and maneuver)

(b) Landing impact

(c) Balancing tail loads

(d) Thrust loads

(e) Ground loads (taxi, turning, landing, braking, pivoting, etc.),

(f) Ground-air-ground cycles

(3) The spectrum is representative of a flight-by-flight, cycle-by-cycle random loading sequence that gives a reflection of the applicable and important airplane response characteristics.

(4) After an examination of the airplane usage data and the ways in which the surveyed airplanes were flown, two sets of stress profiles were developed, one for each flight profile.

(a) The first flight profile represents a typical usage with an average flight length of approximately one hour.

(b) The second flight profile represents severe usage, which includes flight lengths of less than 35 minutes, flights at low altitudes or operations in high humidity climates.

C. Classification for Types of Operation

(1) To find the frequency of inspections, first find the total number of hours and the total number of landings on the airplane, then find an average flight length over the life of the airplane, whichever is less.

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$$\frac{\text{Number of Flight Hours}}{\text{Number of Flights}} = \text{Average Flight Length}$$

or

$$\frac{\text{Number of Flight Hours}}{\text{Number of Landings}} = \text{Average Flight Length}$$

(2) If the average flight length is less than or equal to 35 minutes, then use the Severe Flight Profile for inspections.

(3) For airplanes with an average flight length greater than 35 minutes you must determine the severity of the operating environment. If the airplane operates thirty percent or more of its flight time in severe environments, you must use the severe operation inspection times found in section 4-10-01, Severe Operation Inspection and 5-14-00, Listing Of Supplemental Inspections. Examples of severe environments would include floatplane operations, flight operations at low altitude (i.e., less than 5,000 ft. above ground level) such as pipeline patrol, sight-seeing, training flights, traversing mountainous terrain or flying near coastal areas identified in section 51-11-00, Corrosion Severity Maps - Description and Operation.

(4) Airplanes operated in all other environmental conditions will use the typical operation inspection times found in 4-10-00, Typical Inspection Time Limits and 5-14-00,Listing Of Supplemental Inspections.

(5) Make an airplane logbook entry that gives the applicable inspection schedule after it has been found.

(6) If an operator is currently following the "Typical" operation inspection time limits and determines that, based on the requirements above, they should follow the "Severe" operation inspection time limits, the operator must comply with any inspection that is past due under the "Severe" operation inspection time limits within 200 hours of operation.

D. Damage Tolerance and Fatigue Assessments

(1) The damage tolerance and fatigue analysis gives the information used to set the inspection frequency requirements for each PSE. The analysis includes the possible fatigue failure locations and types of damage. Required inspections are set using analytical results, available test data and service experience. The analysis includes standard fatigue analyses, the crack growth time history and the strength that remains. Linear elastic fracture mechanics are used for the damage tolerance analysis, while fatigue analyses use the "Palmgren-Miner" linear cumulative damage theory.

(2) In the analysis, the possible structural condition areas related to the airplanes as they are used more frequently, are carefully examined. Examples include:

(a) Large areas of structure working at the same stress level, which can start widespread fatigue damage.

(b) A number of small (less than detection size) adjacent cracks suddenly connected into a long crack (as in a line of rivet holes).

(c) A load supplied from adjacent damaged parts that can cause faster damage to nearby parts (the "domino" effect).

(d) Failure of multiple load path structure at the same time (crack arrest structure).

(3) Initial inspections of a selected area of structure are set by both crack growth and fatigue analysis results, as well as test results.

(a) The structures which were found to be fail-safe, use the fatigue life to set the initial inspections.

(b) The locations with long fatigue life, the maximum initial inspection has a limit of 20,000 flight hours.

(c) Structure which was found to be fail-safe includes the Models 208 and 208B wing, fuselage and empennage.

(4) For locations that were identified as very important by tests, the initial inspection time was set by crack growth. The crack growth for each PSE is calculated from the initial crack size c_o to the crack length at instability/failure, c_{crit}, because of limit load. The crack's growth during time is shown by crack length versus time in flight hours. All inspections that were done again and again were derived from crack growth.

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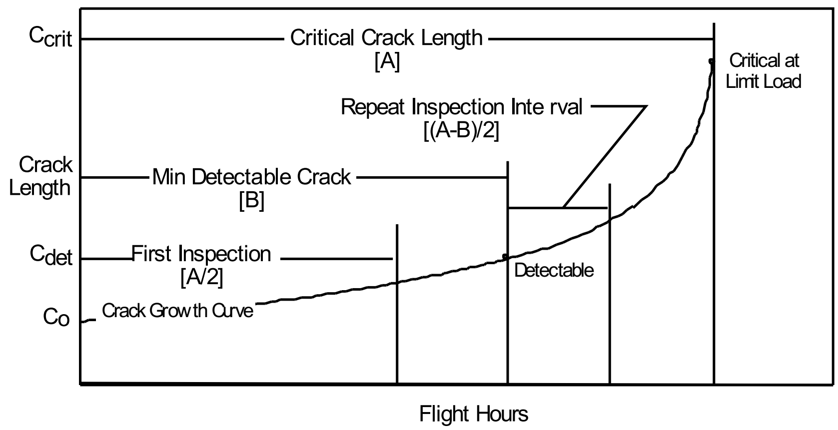

4. Reporting - Communications

A. Discrepancies

(1) For the SID to continue to stay applicable, it is necessary to have a free flow of information between the operator, the FAA and Cessna Aircraft Company. The important information about the inspection results, repairs and modifications done must be supplied to Cessna Aircraft Company to let the effect of the recommended inspection procedures and inspection intervals to be calculated.

(2) Also, the operator's inspections and reports can find items not included in the SID before. These items will be examined by Cessna Aircraft Company and will be added to the SID for all of the operators, if applicable.

(3) Cessna Propeller Aircraft Product Support has a system to collect the reports. The applicable forms are included in this document. Copies of these forms are also available from a Cessna Service Station or Cessna Field Service Engineer.

B. Discrepancy Reporting

(1) Discrepancy reporting is very important to let the inspection start times and repeat times be adjusted as well as to add or remove PSEs. It can be possible to make the inspection methods, repairs, and modifications better for the PSEs from the reported data.

(2) All cracks, multiple cut off fasteners, and corrosion found during the inspection must be reported to Cessna Aircraft Company within ten days. The PSE inspection results are to be reported on a form as shown on the pages that follow.

C. Send the Discrepancy Form

(1) Send all available data, which includes forms, repairs, photographs, sketches, etc., to:

Textron Aviation
Attn: SID Program
Maintenance Engineering
Dept. 753
2121 S Hoover Road
Wichita, KS 67209
USA
Fax: 316-942-9006

NOTE: This system does not replace the normal channels to send information for items not included in the SID.

D. Cessna Aircraft Company Follow-Up Action

(1) All SID reports will be examined to find if any of the steps are necessary:

(a) Complete a check of the effect on the structural or operational condition.

(b) Complete a check of other high-time airplanes to find if a service bulletin shall be issued.

(c) Find if a reinforcement is required.

(d) Change the SID if required.

5. Inspection Methods

A. Selection of inspection method.

(1) A very important part of the SID program is to select and evaluate the state-of-the-art nondestructive inspection (NDI) methods applicable to each PSE, and to find a minimum detectable crack length, c_{det}, for each NDI method.

(2) The selection of NDI method uses crack direction, location, c_{crit}, part thickness and access as criteria. The size of the inspection task, human factors (such as qualifications of the inspection), equipment used, and access will effect an inspection. Visual, radiographic, liquid penetrant, eddy current and magnetic particle methods are used. A complete description of each of these methods is given in the Model 208 Nondestructive Testing Manual.

6. Applicability/Limitations

A. This SID is applicable to the Models 208 and 208B airplanes.

B. STC Installations

(1) The Cessna Models 208 and 208B airplanes can have modifications that were done by STCs by other organizations without Cessna Engineering approval. The inspection intervals given in this SID are for unchanged airplanes, and are the maximum approved inspection times.

(2) On airplanes that changed the airplane design, gross weight, or airplane performance, it can be necessary to do inspections more frequently.

(a) Examples of common STCs not applicable in this SID document include vortex generators and non-standard engines. The owner and/or maintenance organization must contact the STC holder(s) or modification originator to get new FAA approved inspection requirements.

(3) The SID inspection times use total airframe hours/landings in service. If a specific airframe component has been replaced, the component is examined for the total component hours/landings requirements. However, any attachment structure that was not replaced when the component was replaced must be examined and use the total airframe hour/landings requirements.

7. PSE Details

A. Details

(1) This section contains the important instructions selected by the rationale process described in Section 2, Principal Structural Elements. These items are considered important for continued airworthiness of the Cessna Models 208 and 208B airplane. Service Information Letters and Service Bulletins about the PSEs are available from Cessna Aircraft Company.

(2) A summary of the PSEs is presented in the 5-14-00,Listing Of Supplemental Inspections. This can be used as a checklist by the operators. A summary of the inspections by flight hours is also given.

B. Repairs, Alterations and Modifications (RAM)

(1) Repairs, Alterations and Modifications (RAM) made to PSEs can have an effect on the inspection times and

methods necessary for the SID. The flowchart in Figure 1 can be used to find if a new damage tolerance assessment and FAA approved supplemental inspection criteria are necessary.

(2) For repairs that are not included in the recommendations of this SID document or the Model 208 Structural Repair Manual, contact Team Structures; (316) 517-6061, or Email csstructures@txtav.com.

(a) All repairs supplied by Cessna Aircraft Company since January 2003 meet the damage tolerance assessment requirements.

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DISCREPANCY REPORT

SID NO: ______ AIRPLANE LOCATION: ________________ S/N OF AIRPLANE: ______

INSPECTION CONDUCTED: Date ______ Airplane Total Hours ______ Cycles ______

Component Total Hours ______ Cycles ______

OWNER NAME ________________ OWNER PHONE NUMBER ______

OWNER ADDRESS ________________________

SERVICE HISTORY:

INSPECTION METHOD/LIMITS:

ACCESS REQUIRED:

REPAIR DESCRIPTION:

COMMENTS:

Enclose all available data including photos, sketches, etc., to:
Textron Aviation
Attn: SID Program
Maintenance Engineering
Dept 753
2121 S Hoover Road
Wichita KS 67209
Email: maintenanceengineering@txtav.com