

International Maintenance Review Board Policy Board (IMRBPB)
Issue Paper (IP)

Initial Date (DD/MMM/YYYY):

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DRAFT

Title: SSI Selection

Submitter: EASA, MRB Section

Issue: When assemblies are selected SSI, the items taken into account are often limited to the major structural parts, while the “Nuts and Bolts” are often not analysed.
This results in frequent findings of corroded parts, secondary damage to significant structure, costly repairs and potentially unsafe conditions.

Problem: During zonal inspections there is still a high number of corrosion findings on items like bushings, fasteners, nutplates etc. that have not been included in the according SSI. Therefore these items are not covered by the CPCP.



Example: Carbon steel bushing (not SSI) corrodes and causes the fitting (SSI) to crack. Early detection of corrosion and replacement of the bushing would have prevented the lug from failing.

Even if not carrying significant loads, fasteners can heavily affect corrosion of significant structure. One effect is that corroding fasteners (i.e. carbon steel bushings) do expand when corroding, adding local loads to the structure and damaging surface protection.

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Additionally a local galvanic couple could be formed:

First the carbon steel fastener corrodes due to inadequate protection, i.e. cadmium plated only fasteners outside of dry areas. The material in contact with the environment in that case changes to Fe_2O_3 , or red rust. This material is much more noble than aluminium (the combination of aluminium and Fe_2O_3 is famous as “thermit”, a spectacular exotherm reaction used traditionally to weld rail tracks), so if the expanding, rusting fastener damages the surface protection around it (cracking the paint) and an electrolyte can therefore become effective in the contact area, rapid corrosion of the aluminium structure will occur. This situation can be found on almost every aircraft after some time. When using stainless steel fasteners, no corrosion would occur on the fastener and on the primary aluminium structure.

It is also a well known phenomena, that deteriorated fasteners or bushings can promote fatigue damage to the primary structure, which is much more expensive to repair, than just timely replacement of the according fasteners or bushings.

When defining the items to be included in an assembly selected as SSI, engineering judgement and common sense should allow to include all relevant items when following the SSI definition of MSG-3. Nevertheless often those items are not included in the SSI, based on tradition.

By adding one sentence to highlight the importance of single elements (bolts, bushings etc.) and another sentence to give some guidance, should improve the understanding of the SSI definition.

All bushings are transferring 100% of the load from the bolt or pin to the housing, so all bushings should be included in the SSI. For tension bolts, which are designed to carry significant tension load, this load is also carried by nuts and washers, hence those items should be also included in the SSI analysis. For tapered joints, the tensioning element (typically a nut) that provides free-of-play load transfer needs to be included.

For shear bolts, nuts and washers are not carrying significant loads, but only act as a retention device, so they do not need to be included. It is good engineering practice to design rivet joints with the connected parts being the critical items, not the fasteners. Therefore it is not necessary to include rivets to the according SSI.

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Recommendation (including Implementation):

Add two sentences to chapter 2-4-1-1 as follows:

1. Significant and Other Structure

Structure can be subdivided into items according to the consequences of their failure to aircraft safety as follows

- a. A **Structural Significant Item (SSI)** is any detail, element or assembly, which contributes significantly to carrying flight, ground, pressure or control loads, and whose failure could affect the structural integrity necessary for the safety of the aircraft.

If assemblies are selected to be SSI, all relevant load bearing elements need to be included and analyzed, this may include bearings, bushings, bolts, fasteners, retainers etc. based on the amount of load carried by this element and the effect of failure.

Therefore multiple standard fasteners like standard rivets attaching a stringer to the skin do not need to be taken into account, while single load path fasteners (i.e. single bolt attaching a pylon diagonal brace) need to be included.

SSIs must not be confused with Principal Structural Elements, PSE (FAR 25.571); however, all PSEs must be addressed by the SSIs.

- b. **Other Structure** is that which is judged not to be a Structural Significant Item. It is defined both externally and internally within zonal boundaries.

IMRBPB Position:

Date:

Position:

Status of Issue Paper (when closed state the closure date):

Recommendation for implementation:

Important Note: The IMRBPB positions are not policy. Positions become policy only when the policy is issued formally by the appropriate National Aviation Authority.