AIRWORTHINESS BULLETIN

Cessna 400 Series Electro-Hydraulic Undercarriage Emergency "Blow Down" Systems

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1. Effectivity

Aircraft equipped with a retractable undercarriage employing a pneumatic system to lower the undercarriage in an emergency. The information provided here may also be useful in the maintenance of any cable operated pneumatic emergency system.

Note: This AWB was originally published in 2001 as AWB 32-30, it is being republished to amend the title and correct the numbering sequence.

2. Purpose

This Bulletin is issued in order to make maintainers aware of problems associated with pneumatic emergency undercarriage "blow down" systems. The following information and recommendations are provided in order to contribute to even greater reliability of these systems.

3. Background

A survey of the CASA Major Defect Reports for hydraulically operated undercarriages with pneumatic emergency extension systems, identified several instances where the emergency system was either difficult or impossible to operate.

The most common cause of system malfunction reported was the discharge valve either jamming, or being very stiff to operate. The types of discharge valve under discussion here, are those associated with the re-chargeable high-pressure bottle systems. The valve typically consists of a poppet, which is held against the pressure inside the bottle by a pin, or piston at right angles to the poppet. When the emergency handle is pulled, the piston is moved slightly to one side. The poppet is then released and due to the gas pressure behind it, moves off its seat to discharge the gas, (typically dry air or nitrogen) into the "down" side of the hydraulic system, to lower the undercarriage.

Summary of Major Defect Reports

The following information is a summary of defect reports on this type of system, arranged into two groups. The first group relates to the high-pressure bottle valve, the second group relates to the operating cable.

High-pressure bottle valve jamming

When the valve jams or becomes very difficult to move, the operating cable outer housing may slip under the clamps. Typical problems include the following.

a. The Teflon bushing holding the firing pin or piston swells internally, eliminating any clearance between the piston and the guide, causing the piston to bind or seize.

One defect report suggests the swelling of the bushing was due to hydraulic oil contamination.

b. Seals fitted in the poppet or the piston had fragmented, causing the valve to jam.

c. A worn piston bushing or guide, in the valve head.

Since the piston is only moved during a test or emergency, it seems possible that the wear, or excessive clearance may have been caused by faulty bushing material.

The constant side-load of the firing pin or piston holding back the poppet may slowly deform the guide hole in a "soft" bush.

d. The poppet in the bottle valve was corroded.

In this last instance, it is most probable that difficulty in operation during routine maintenance may have lead to disassembly of the valve to determine the cause, even though valve jamming was not mentioned in the report.

Excessive Cable friction causes lock-up or outer cable housing to slip

Problems related to the operating cable alone, which either prevented the system operating, or made it extremely difficult to operate included the following.

e. Slippage of the cable outer housing when the operating handle was pulled. This slippage typically occurred under the clamp nearest the bottle valve.

The operating cable housing must be securely clamped. Clamps must allow the inner to move freely, yet be firm enough to resist the reactive force developed in the outer casing when the system is operated. If the clamps are loose, the cable outer housing can slip inside the clamps, so as to absorb the movement or force applied to the inner cable, and prevent the emergency valve from operating when the handle is pulled.

f. Binding or total lock-up between the cable and the cable outer housing.

Attention should be paid to the cable internal friction. Excessive friction may be caused by a number of problems, including notching of the inner wire (caused by the inner wire vibrating against the casing) and tight bends in the cable route from the handle to the valve.

The path the operating cable takes from the handle to the valve should conform to the requirements of the original type design, applicable Airworthiness Directives, Service Bulletin or STC .

4. Recommendations

Routine preventive maintenance notes

Manufacturers' service information typically calls for the pneumatic emergency system to be functionally tested by performing a "blow down" test every 12 months.

a. Perform the "blowdown" test (or deflate the bottle) in accordance with the aircraft manufacturers information, taking care to observe all the manufacturers cautions.

Caution

Extreme caution is required when operating the emergency pneumatic undercarriage deployment system while the aircraft is on jacks, as the action is typically quite vigorous. This is because the design parameters of the emergency "blow down" system include a factor to account for a leaking hydraulic line, internal jamming or excessive friction in the undercarriage mechanism that has, so far, prevented lowering the gear using the normal system. This means that extra energy to that normally used to operate the system must be available in an emergency. This is supplied via the high-pressure bottle of (typically) dry air or nitrogen. When the high-pressure gas is introduced, the undercarriage moves far more rapidly than when under normal system hydraulic power.

b. After the "blow down" test is performed, carry out a functional test / inspection on the emergency blowdown system actuating cable, by disconnecting the actuating cable from the bottle, and performing a pull test to determine if there is excessive friction in the cable system. Re-clamp, or replace the cable, as required.

c. Check the condition of the components, seals, and internal friction of the emergency valve mechanism any time the system has been depleted.

d. With reference to those emergency blow-down bottle valves that must be dismantled to be re-set; - take this opportunity to perform an internal inspection on the valve mechanism. Inspect for excessive valve spindle guide bush clearances or excessive friction, valve spindle or poppet for corrosion, and general seal deterioration. Replace defective parts as required, and apply the aircraft manufacturer approved lubricant (if any) for this application during re-assembly, after the inspection, as applicable.

e. It is suggested that the requirements of (a), and (b) be carried out every 12 months, or at the frequency recommended by the manufacturer, unless such an inspection is already being performed more frequently under an Approved Maintenance Program.

Re-charging the high pressure bottle

When the "blow down" test is completed, the bottle is usually either replaced, or re-filled, depending on the type of system. There are two instances on the CASA database of the high-pressure bottle failing during re-filling. In one instance the bottle exploded during re-filling, and the reporter suggests that oxygen may have been used to attempt to fill the bottle instead of the recommended nitrogen or dry air.

Aircraft service manuals are usually quite specific about eliminating any hydraulic oil from the pneumatic bottle and the operating valve. The presence of hydraulic oil in this part of the system may indicate a malfunction in the system. However, since the bottle is connected to a hydraulic system, maintenance personnel must always assume that oil will be present, even if only in minute quantities.

Caution

Oxygen and oil provide an explosive combination. Never use oxygen, only use the manufacturers' recommended gas to re-fill the system.

6. Enquiries

Enquiries with regard to the content of this Airworthiness Bulletin should be made via the direct link e-mail address:

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