



1. Effectivity

All aircraft.

2. Purpose

To alert maintenance personnel and operators to be vigilant whenever installing or adjusting any aircraft control system using the classic two cables in tension, closed-loop cable design, including primary flight control systems.

3. Background

Recent reports have been received by CASA which serve to highlight once again the importance of paying critical attention to both detail in assembly and correct overall function of cable operated control systems.

Control System Design

While aircraft designers are required to ensure that it is very difficult to install a control system incorrectly, there is ample evidence to suggest that such design safeguards are not entirely fool-proof and can be circumvented. Flight control cables have been inadvertently “crossed” or reversed during installation, and in other instances cables were miss-routed. In all cases it appears the systems had received a duplicate inspection which met the requirements of CAR 42G.

Control Reversal

A reversed flight control system usually results in immediate loss of aircraft attitude control at the point where the flight controls first begin to become effective, usually at take-off. A “stick back - nose up” control input for example, becomes a “nose down” response as the aircraft reacts in the opposite sense to standard control inputs, with many examples of tragic results.

To arrive at the take-off point with the controls rigged in reverse means that both the maintenance personnel and the pilot did not properly check that the control surface moved in the correct sense in response to control inputs. It is acknowledged that in some cases it is difficult, if not impossible, for the pilot alone to perform a final pre-takeoff check for correct control surface movement when they are not visible from the cockpit. Rudder surface movement in response to rudder pedal input for example.

Incorrect Installation.

Control sense reversal in these systems is frequently due to the two control cables which operate the same control surface (or any aeronautical product) and running essentially “parallel” to each other, becoming “crossed” during installation.



A similar example is where two cables in the same control system, running in parallel have been “double crossed” over each other. When control cables become “double crossed”, the flight controls operate in the normal sense, albeit with higher system friction.

In both cases, the control cables, moving in opposite directions and twisted together under full cable tension results in very rapid wear which, undetected, can lead to catastrophic cable failure and loss of control.

Very rapid cable wear also results when cables are not inserted into the correct series of bulkhead holes; over the correct fair leads for that cable run, or not placed in their designated pulley grooves and under their respective pulley/cable ‘keepers’.

One such instance was discovered only a few flight hours after installation, by an engineer who felt that the rudder pedals were stiff and the system slightly noisy. Upon further investigation one rudder cable was found to have been routed over the cable pulley keeper (instead of under it). The result was that the cable was severely damaged with complete failure and loss of control imminent. See Figure1.

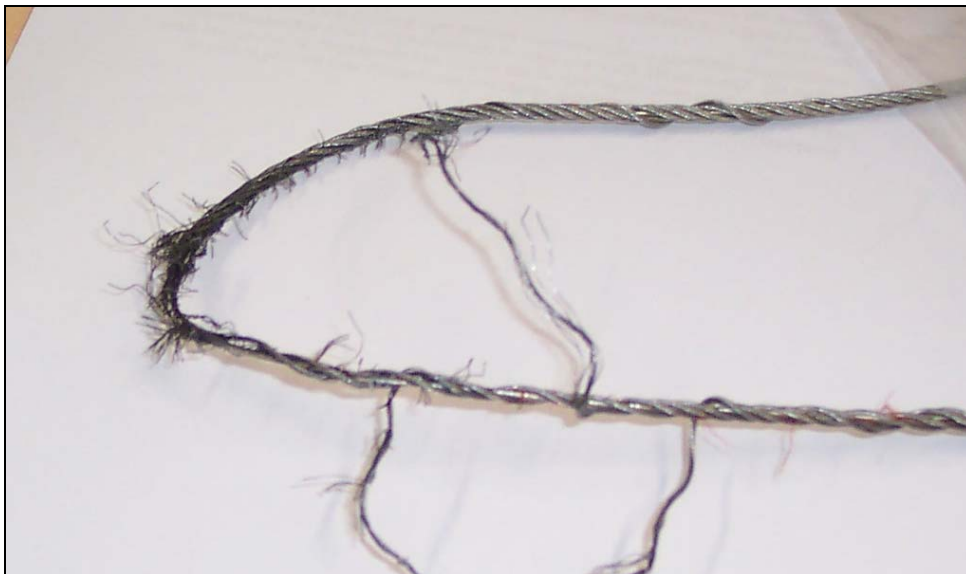


Figure1. Result of a rudder cable running over a “keeper” or guard.

Warning signs

Common indications of incorrect control system installation include; control system reversal, and for example, both ailerons going “up” and “down” at the same time; restricted control surface movement; a cable being too short or too long; unusual control system friction accompanied by noisy, rough operation and loss of cable tension.



4. Recommendations

It is strongly recommended that:

- (a) All maintenance personnel follow manufacturer's published approved data and approved installation procedures when installing and maintaining any aircraft control system.
- (b) Flight control duplicate inspections are completed in accordance with CAR 42G on the entire portion of the control system which has been disturbed. This inspection is not only for correct locking at control cable turnbuckles and terminations, but for correct cable tension, and correct routing throughout as well. This also means that each person independently confirms that the control surfaces move through the correct distance, in the correct direction in response to control inputs (that is, move in the correct sense) so as to achieve the intended dynamic response from the aircraft.
- (c) Any abnormal control system friction, noise or loss of control cable tension should be treated with suspicion and investigated as it may well be an indication of incorrect assembly and impending failure.
- (d) Operators and pilots should also be vigilant when participating in duplicate control system inspections and when conducting pre-flight checks, particularly whenever maintenance has been conducted on the control system, to ensure that flight controls move freely throughout the entire control range, in the correct sense and with no unusual noises.

5. 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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