AIRWORTHINESS BULLETIN

Rotorcraft Underslung Loads
Non-Human External Cargo (NHEC)

AWB 25-006 **Issue** : 2
Date : 30 July 2015

1. Effectivity

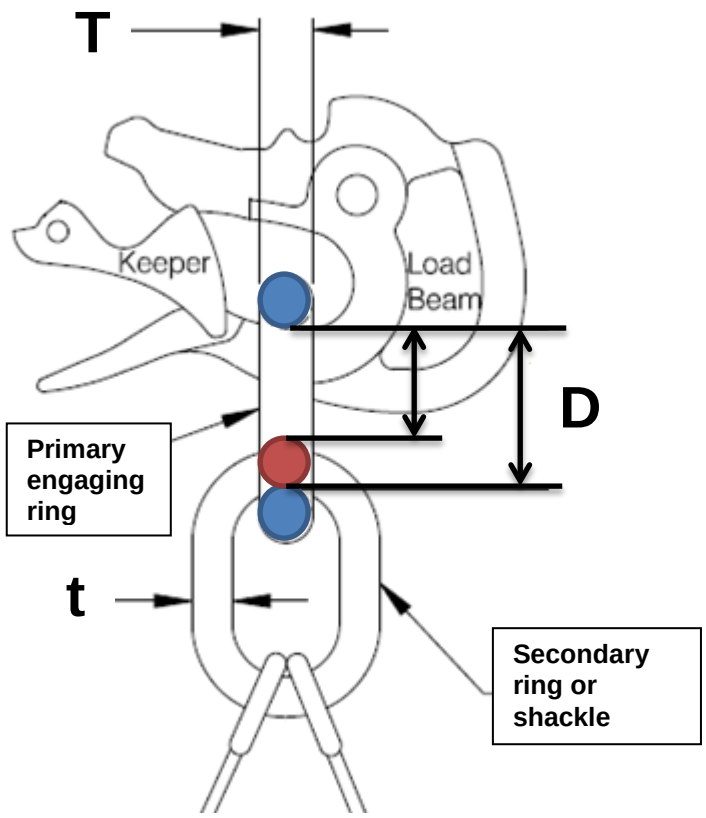
All rotorcraft engaged in underslung load / non-human external cargo (NHEC) operations.

2. Purpose

This AWB was initially issued in response to Australian Transport Safety Bureau (ATSB) Investigation Number 200300011, a near-fatal accident during rotorcraft firebombing operations and has been revised to notify operators and maintainers of additional safety information and current design standards for cargo hooks installed in helicopters.

3. Background

Rapid development in helicopter and role equipment technology and the increasing range of uses to which such equipment is being used has led to the need to develop higher safety standards and to better define the requirements for two different kinds of operation; Human external cargo (HEC) operations, (Refer AWB 25-030 - Helicopter Personnel Winching) and non-human external cargo operations (NHEC), typically using a cargo hook (or hooks) attached to the structure underneath the helicopter.



Adapted from: Robinson R44 Rotorcraft Flight Manual Supplement for the Onboard Systems Talon LC Cargo

The internal diameter **'D'** and thickness **'T'** of the primary engaging ring is critical and will be different for each hook design.

Note that the effective internal diameter of the primary ring '**D- t'** can be severely reduced by the addition of a secondary ring or shackle.

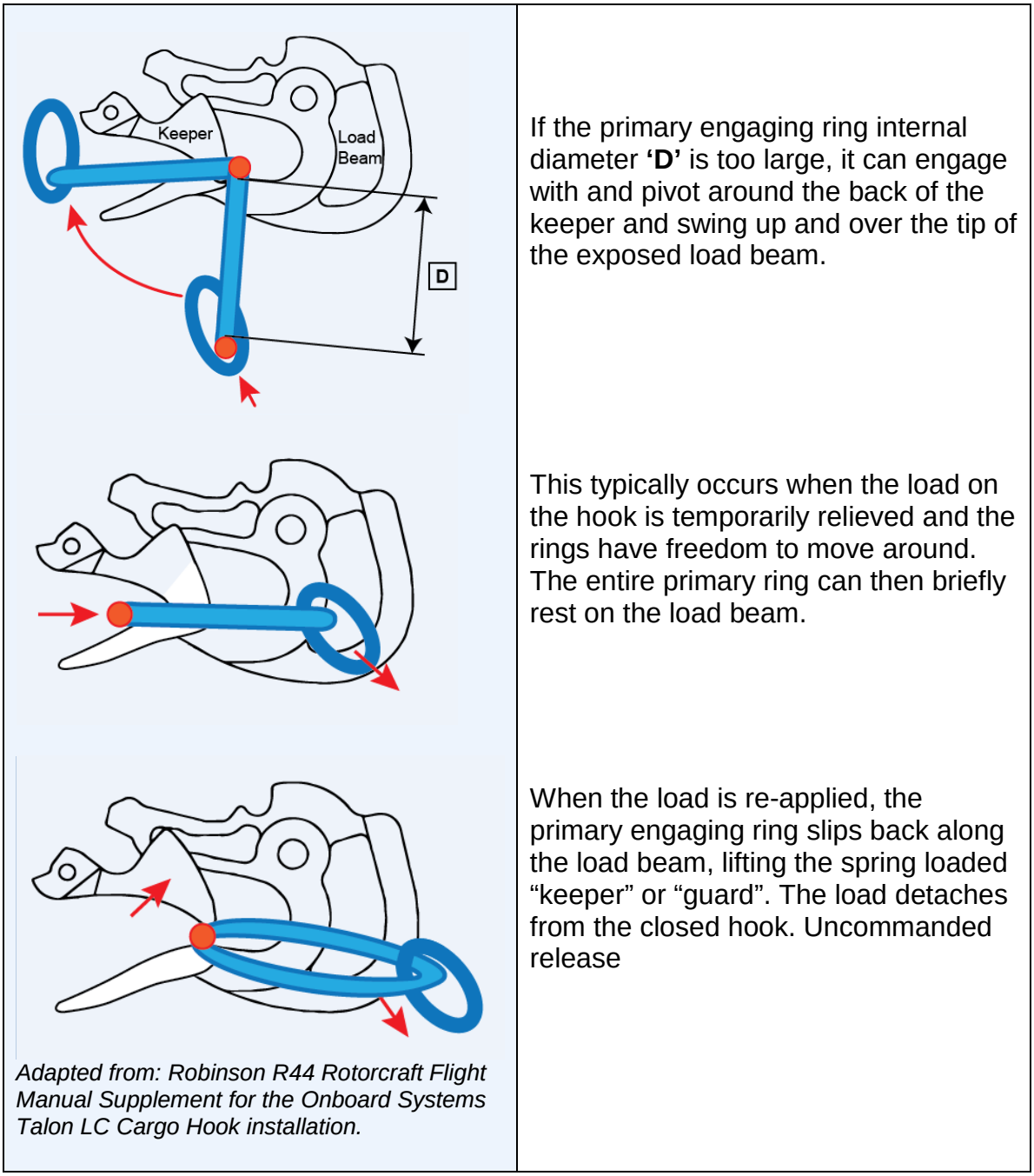
The minimum and maximum **'T'** and '**D'** dimensions of the primary engaging ring and the secondary ring or shackle should be specified in the Rotorcraft Flight Manual Supplement.

Figure 1. Primer - classic cargo hook and primary engaging ring notation

If the combination of the primary ring and secondary ring is less than specified in the RFM, the load may not release, even though the hook is open. (Fig 3). If the primary engaging ring is too large, uncommanded load release can occur. (Fig 2)

(a) Dynamic Rollout or Ring reversal.

Uncommanded load release can occur when the internal diameter of the primary engaging ring is big enough to engage with the back of the keeper and pass over the tip of the hook, or load beam. (Fig.2)



If the primary engaging ring internal diameter **'D'** is too large, it can engage with and pivot around the back of the keeper and swing up and over the tip of the exposed load beam.

This typically occurs when the load on the hook is temporarily relieved and the rings have freedom to move around. The entire primary ring can then briefly rest on the load beam.

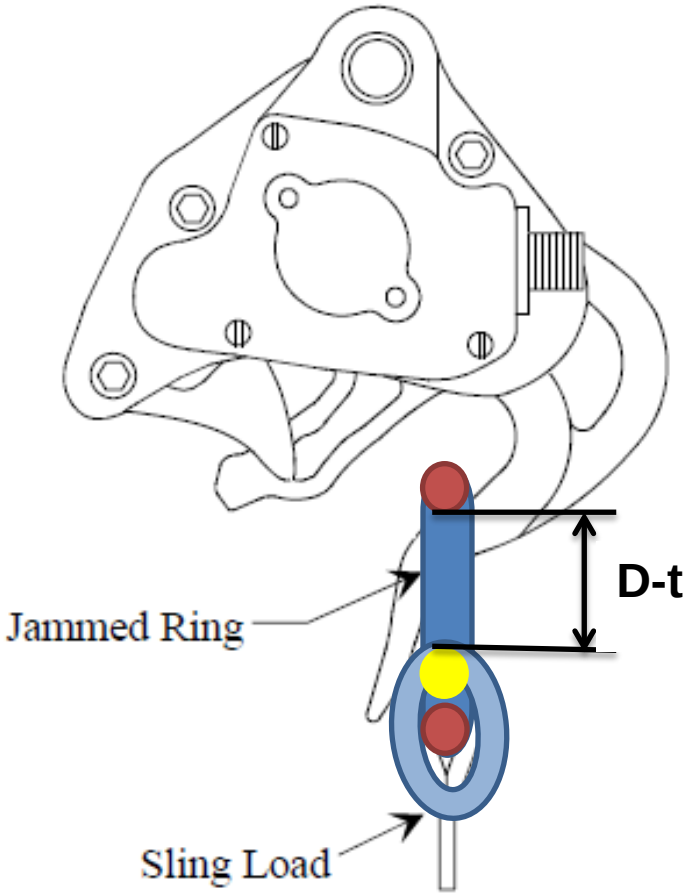
When the load is re-applied, the primary engaging ring slips back along the load beam, lifting the spring loaded "keeper" or "guard". The load detaches from the closed hook. Uncommanded release

Adapted from: Robinson R44 Rotorcraft Flight Manual Supplement for the Onboard Systems Talon LC Cargo Hook installation.

Fig.2. Classic cargo hook dynamic roll-out / ring reversal sequence.

(b) Jammed Load / hook

Should the internal diameter '**D**' of the primary engaging ring or the combination of the primary and secondary ring result in '**D**' being too small, (See Fig. 3) then the load rings can easily jam on the load beam.



The load rings can become jammed on the hook load beam and prevent the load from releasing, despite the pilot commanding release and the hook opening fully.

Adapted from: Robinson R44 Rotorcraft Flight Manual Supplement for the Onboard Systems Talon LC Cargo Hook installation

Fig 3. Load does not release from an open hook.

All personnel should ensure the correct size and configuration of hook engaging rings is maintained in accordance with the approved data contained in the rotorcraft flight manual supplement for the hook installed throughout all external cargo operations.

Uncommanded release / inadvertent cargo hook opening

In addition to Dynamic-Rollout / Ring reversal resulting in uncommanded load release, two more common causes of uncommanded load release have been identified.

(i) Incorrect mechanical release cable rigging

The final free length of unsecured release cable between the fuselage and the hook assembly should allow the hook to swing freely. When the cable assembly is left too short, under certain hook and sling angles, the hook can swing beyond the limit of the release cable assembly length and operate the mechanical release, mechanically opening the hook and releasing the load without the pilot's action.

(ii) Electromagnetic Radiation (EMI)

Uncommanded release can occur when unshielded hook release control wires between the back of the cyclic control switch and the release solenoid in the belly mounted cargo hook are exposed to electromagnetic radiation (EMI) from on-board or external radio transmitters, high voltage transmission lines or microwave towers. Unshielded cargo hook control wires in electromagnetic fields can easily generate enough electrical potential to trigger cargo hook release.

Protection against potential internal and external sources of EMI which includes lightning strikes, stray electromagnetic signals, and static electricity generated by the helicopter during flight, is therefore necessary. To prevent inadvertent load release, hook systems should be certificated to the accepted standard for electrical shielding requirements for NHEC operations which are found in FAR 27.865 External Loads (automatically adopted by CASR (1998) Part 27). Guidance material is provided in FAA AC 27-1B.

(a) External Non-human Cargo Hook Maintenance

CAR (1988), Regulation 39 (1) which is applicable to Class A aircraft, and Regulation 41 (2) applicable to Class B aircraft, require that either a System of Maintenance or approved maintenance program include provisions for carrying out maintenance to all aircraft components from time to time included in, or fitted to, the rotorcraft. CASR (1998), Regulation 42.310 (1) requires that an aeronautical product be maintained in accordance with current maintenance data for the maintenance. The cargo hook is considered included in these regulations.

Operators should have procedures in place to ensure the cargo hook assembly, its plugs, wiring and the attaching structure is configured and maintained in accordance with approved data at appropriate intervals while installed on the rotorcraft, including monitoring cargo hook fatigue lifed components.

Hook release systems, both manual, and electrical, should be checked and functionally tested each time the hook assembly is fitted to a helicopter and before commencing operations each day. The hook should be electrically "armed" during all operations, ready for quick release in an emergency.

(b) Fire suppression operations

Rotorcraft engaged in firebombing operations typically use underslung buckets of fixed or selectable capacity. It is possible to inadvertently operate with a bucket of fixed or variable capacity, which, when full, will contain more water (and fire suppressant chemical) than the rotorcraft can lift.

This can lead to severe operational difficulties, particularly in the event of an engine failure, where the bucket release mechanism fails and the water cannot be jettisoned from the bucket, and/or the full overweight bucket cannot be released from the hook.

The full or selected capacity of the water bucket should be compatible with the performance of the rotorcraft with which it is to be used, carefully considering the actual or real-time conditions under which the rotorcraft will be operating.

4. References

UK CAA CAP 426 – Helicopter External Load Operations.

EASA AD No. 2009-0122R1 (or subsequent revision).

FAA FAR 27.865 – External Loads

FAA AC 27-1B – Certification of Normal Category Rotorcraft

5. Recommendations

CASA strongly recommends that operators, pilots and maintenance personnel ensure that:

1. The cargo hook system is certificated in accordance with FAR 27.865 External Loads.
2. The Rotorcraft Flight Manual Supplement is correct for the helicopter type and the installed cargo hook(s).

3. The primary and secondary engaging rings or the device used to connect the helicopter mounted hook to the load are the correct dimensions and tolerances as indicated in the applicable rotorcraft flight manual with regard to the particular helicopter cargo hook to prevent loss of load due to dynamic roll-out and jamming to ensure load release upon command.

4. Prohibit use of any ring or shackle which is beyond the tolerances indicated in the applicable Rotorcraft Flight Manual Supplement, in accordance with the helicopter type.

5. The cargo hook, helicopter structure and hook operating systems are installed, operated and maintained in accordance with approved data.
6. The helicopter mounted cargo hook release systems and mechanisms are fully operational before flight.
7. The load, including the load to be carried on the cargo hook, will not inadvertently exceed the rotorcraft's operational capability.

6. Reporting

Report all defects in relation to cargo hook malfunctions, failures and operational difficulties experienced during external cargo operations to CASA via the SDR system.

7. Enquiries

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

AirworthinessBulletin@casa.gov.au

or in writing, to:

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Civil Aviation Safety Authority
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