Fundamentals
M7
MAINTENANCE PRACTICES

Rev.-ID: 1
Author: DiO
For Training Purposes Only
©LTT Release: Jun. 13, 2013

M7.19
Abnormal Events

EASA Part-66
CAT B1

Training Manual

Lufthansa Technical Training

For training purposes and internal use only.

© Copyright by Lufthansa Technical Training (LTT).

LTT is the owner of all rights to training documents and training software.

Any use outside the training measures, especially reproduction and/or copying of training documents and software – also extracts there of – in any format at all (photocopying, using electronic systems or with the aid of other methods) is prohibited.

Passing on training material and training software to third parties for the purpose of reproduction and/or copying is prohibited without the express written consent of LTT.

Copyright endorsements, trademarks or brands may not be removed.

A tape or video recording of training courses or similar services is only permissible with the written consent of LTT.

In other respects, legal requirements, especially under copyright and criminal law, apply.

Lufthansa Technical Training

Dept HAM US
Lufthansa Base Hamburg
Weg beim Jäger 193
22335 Hamburg
Germany

Tel: +49 (0)40 5070 2520
Fax: +49 (0)40 5070 4746
E-Mail: Customer-Service@LTT.DLH.DE

www.Lufthansa-Technical-Training.com

Revision Identification:

- The date given in the column "Revision" on the face of this cover is binding for the complete Training Manual.
- Dates and author's ID, which may be given at the base of the individual pages, are for information about the latest revision of that page(s) only.
- The LTT production process ensures that the Training Manual contains a complete set of all necessary pages in the latest finalized revision.

© Lufthansa Technical Training

M7 MAINTENANCE PRACTICES

M7.19 ABNORMAL EVENTS

FOR TRAINING PURPOSES ONLY!

© Lufthansa Technical Training

INSPECTIONS FOLLOWING LIGHTNING STRIKES AND HIRF PENETRATION

GENERAL

In the flight operation it can occur that, caused e.g. by environmental effects like wind, wetness, fog, thunderstorms or also technical reasons, the operational limits of the aircraft, for which it has been designed, are exceeded.

This means that it is flown or rolled with e.g.:

- too high g−forces,
- overspeed,
- low speed,

or overweight..

In the type certificate data sheet (TCDS), which results from the design specification CS25 & FAR25, these operational limits are specified.

To start a particular maintenance action it is necessary that a as detailed as possible failure description is at hand.

Also a consultation with the cockpit crew might be necessary, to request more information about the flight condition e.g.:

- weather,
- air speed and flight attitude
- aircraft weight and fuel distribution
- was the landing in line or out of line,
- hanging wing, aircraft nose too high or too low
- were impact or impinge noises hearable and
- what showed the flight displays.

Also phrases from the AIDS, CMS, ACMS, FMC are very helpful.

When working at the problem the chapter 05 time limits/maintenance checks has always to be consulted.

the content is e.g.

- Inspection after hard/overweight landing,
- Inspection after lightning strike,
- Inspection after tail runway impact
- Inspection after NLG steering angle exceeded.

Objections which count to abnormal events, can be underlying the notification requirement § 5 of the air traffic order.

FOR TRAINING PURPOSES ONLY!

© Lufthansa Technical Training

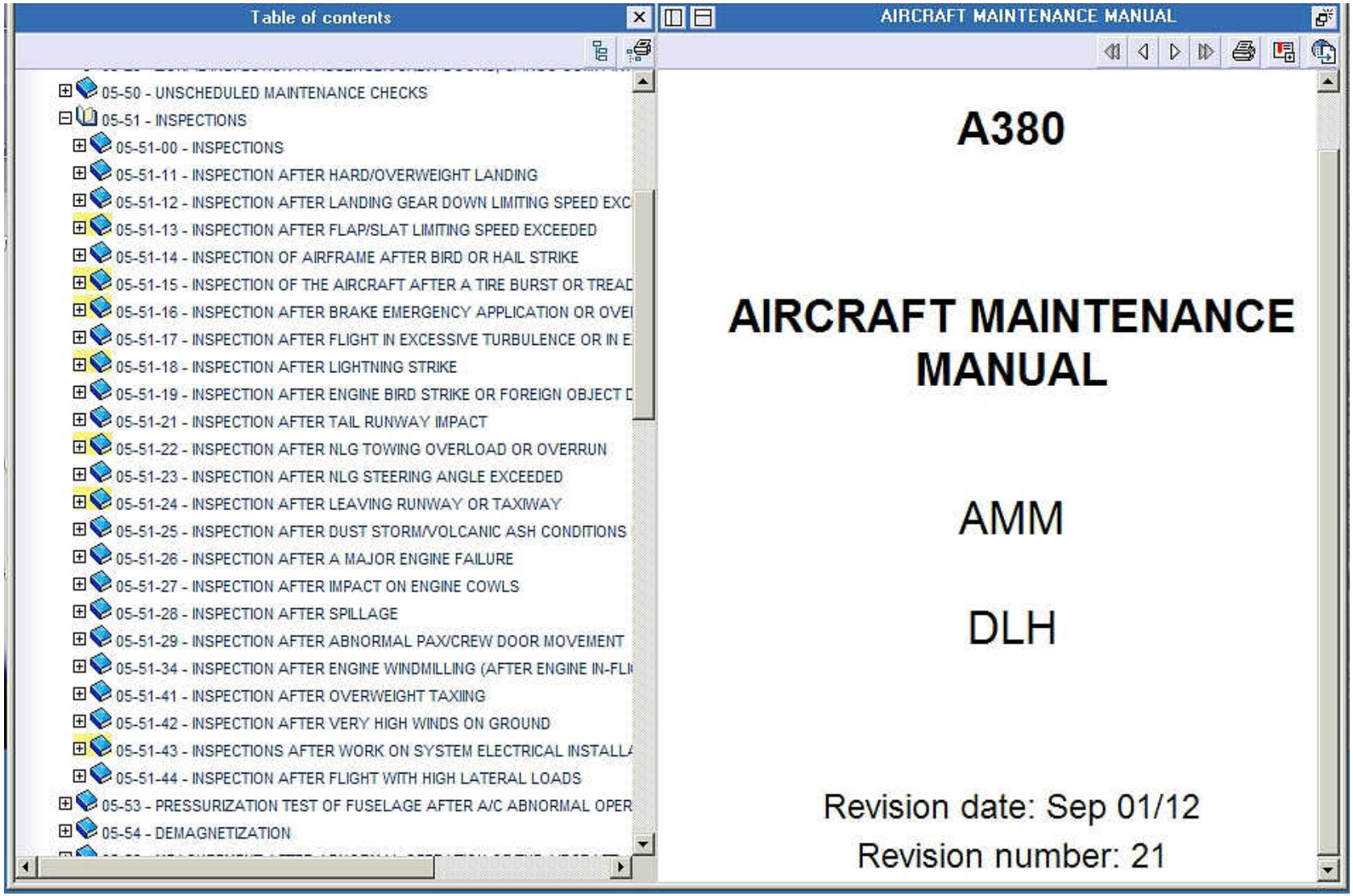


Figure 1 AMM Chapter 05 Overview

FOR TRAINING PURPOSES ONLY!

© Lufthansa Technical Training

Lightning Strikes

Aircrafts are protected by all necessary and approved protective devices against lightning strikes.

The external fuselage structure, which consists mainly out of metal, has an important protective function. The fuselage structure is designed like a protective shield, which protects the in-cabin room against lightning strikes. Also it secures the electronic and the wiring against electromagnetic disturbances.

the following points have to be observed and obeyed after an lightning strike:

1. A general visual inspection has to be carried out, to find the lightning entrance and exit location.
2. After finding damages, the damaged area has to be inspected accurately, to determine the measure of damage.

Lightning strikes cause normally to different types of damages:

- Direct damage, burning, melt out or deformation of the surface at two or more attachment points.
- Indirect damage, strong electric transients on signal lines, which can cause damages to the electrical systems and components.

If a lightning strike is reason for an system failure, a general testing of the entire defect system has to be carried out. (Ref. AMM)

A lightning strike normally leaves a circular melting mark with a diameter of ca. 3mm (1/8 inch). The melting marks can either be restricted to a small location or randomly distributed over a large area. Very strong lightning strikes can cause holes over 6mm (1/4 inch) diameter. Other marks of lightning strikes can be a burned or discolored place at the external skin or at rivets. (Ref. SRM)

The following areas are contained in inspection list after a lightning strike:

- External skin
- Static dischargers
- Valves of the fuel system
- Generators (IDG) and the wiring
- Hydraulic fittings in the aft area
- Radio systems
- Navigation devices
- Bonding Jumpers

The front area (aircraft nose) and the trailing edge tips are the most common places for a lightning strike. The most likely struck external components of the aircraft are listed below:

- Radome
- Engine nacelles
- Wing tips
- Vertical stabilizer tips
- Elevator
- Horizontal stabilizer tips
- Tips of the slats
- Fairing of the flap track
- Landing Gear
- Water waste masts
- Pitot tubes
- External lightning

Lightnings normally move from the point of the lightning entrance at the fuselage and the area of the engine nacelle, which is behind the engine inlet, backwards.

There were events at which aircraft components were highly magnetized by the lightning. Due to the lightning a very strong electric current can flow through the metal structure of the aircraft. This current produces a magnetic field, which magnetizes parts of the aircraft.

Possible internal damage to the airplane due to lightning strike could be to electrical power systems and external light wire. While the electrical system is designed to be resistant to lightning strikes, a high intensity lightning strike could damage these components:

- Fuel valves
- Generators
- Power Feeders
- Electric power system

FOR TRAINING PURPOSES ONLY!

© Lufthansa Technical Training



Figure 2 Lightning Strike

FOR TRAINING PURPOSES ONLY!

© Lufthansa Technical Training

High Intensity Radiated Fields (HIRF)

Introduction

Modern aircraft use digital control systems to perform critical functions. Such control units installed on aircraft are vulnerable to external phenomena such as high intensity electromagnetic fields. Electromagnetic interference from external sources can cause an upset of the digital system's control unit and major damage to the aircraft.

HIRF Protection

Aircraft have been required to comply with HIRF requirements since early 1992. They have therefore been certificated to various HIRF standards, which range from no requirement through to the current policies and standards.

The basic concern for better identification and protection from HIRF has arisen for the following reasons:

A. Operation of modern aeroplanes is increasingly dependent upon electrical/electronic systems, which can be susceptible to electromagnetic interference.

B. The increasing use of non–metallic materials like carbon or glass fibre in the construction of the aeroplane reduces their basic shielding capability against the effects of radiation from external emitters.

C. Emitters are increasing in number and in power. They include ground–based systems (military systems, communication, television, radio, radars and satellite uplink transmitters), as well as emitters on ships or other aircraft.

Modifications to aircraft should be assessed by the manufacturer for the effects that could be caused by exposure to HIRF, irrespective of the original certification basis.

New aircraft designs must be tested, before being certified, against electromagnetic penetration. If a problem is identified, the aircraft must be redesigned to effectively reduce the intensity level of the penetrating fields.

FOR TRAINING PURPOSES ONLY!

© Lufthansa Technical Training

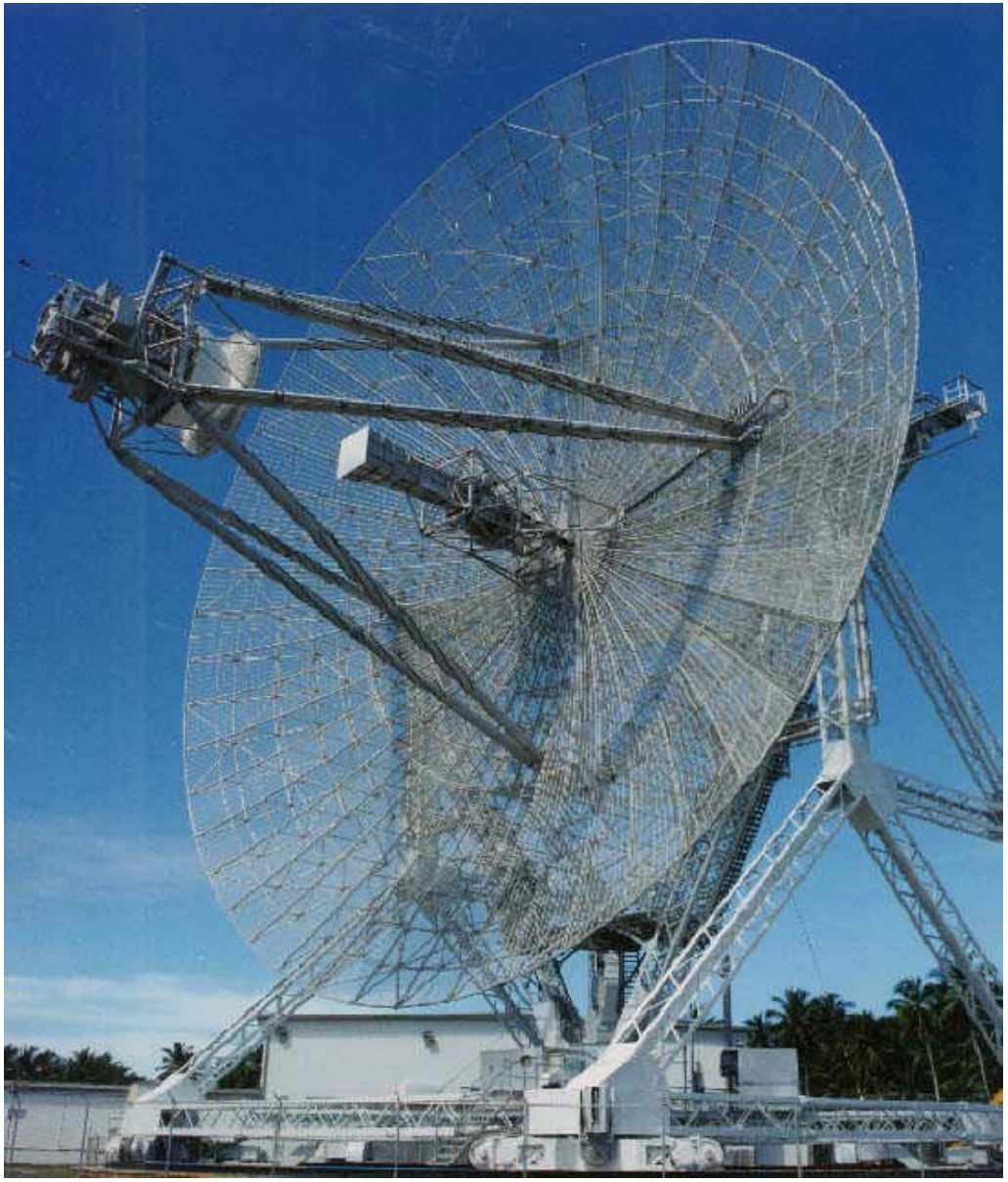


Figure 3 Radiation Source

FOR TRAINING PURPOSES ONLY!

© Lufthansa Technical Training

INSPECTIONS FOLLOWING ABNORMAL EVENTS

Hard Landing

General

The inspection is divided into two phases:

The Phase I inspection is applicable when a Hard Landing or a High Drag/Side Load Landing occurs.

If the inspection during Phase I does not indicate that damage has occurred, no further inspections are necessary.

If, however, the Phase I inspection indicates that damage *has* occurred, the Phase II inspection is necessary.

Hard Landing

The **hard landing** procedure is for hard landings at or below the maximum design landing weight limits.

The pilot is responsible for making the decision whether a structural inspection is necessary.

If the landing is also overweight, the *Overweight Landing Inspection*, not the *Hard Landing Inspection*, must be done.

High Drag/Side-Load Landing

A high drag/side-load landing occurs if the airplane makes a landing with one or more of the following conditions:

- The airplane skidded or overran the prepared surface
- The airplane made a landing short of the prepared surface
- The airplane made a landing and two or more tyres were blown
- The airplane skidded on the runway sufficiently to make you think damage occurred.

When the conditional inspection tells you to examine a component, check for the following faults and replace or repair components (if necessary) :

- Breakage
- Cracks
- Loose paint (paint flakes)
- Twisted parts (distortion)
- Bent components
- Loose fasteners
- Fasteners that have pulled out or are missing
- Delaminations
- Misalignment
- Interference
- Other signs of damage.

FOR TRAINING PURPOSES ONLY!

© Lufthansa Technical Training



Figure 4 Hard Landing

FOR TRAINING PURPOSES ONLY!

© Lufthansa Technical Training

Severe or unusual Turbulence

The structural inspection in this task is applicable after a severe turbulence or buffet condition.

It also applies to stalls (after the initial buffet or stick shaker condition) or airplane speeds above the design speed.

When the conditional inspection tells you to ”examine” a component, look for these conditions (replace or repair components, if it is necessary).

- Breakage
- Cracks
- Loose paint (paint flakes)
- Twisted parts (distortion)
- Bent components
- Wrinkles or buckles in the structure
- Fastener holes that became larger or longer
- Loose fasteners
- Fasteners that have pulled out or are missing
- Delaminations (a component with one or more Layers pulled apart)
- Parts that are not aligned correctly
- Fibre breakouts
- Misalignment
- Interference (clearance that is not sufficient between the parts)
- Discoloration (heat damage)
- Nicks or gouges
- Other signs of damage.

Inspection after exceeding the Limits

Severe or unusual turbulence, stall or speeds in excess of the design limits conditional inspection.

General

The data that follows applies to a severe or unusual turbulence condition.

ATTENTION: Severe turbulence is identified as turbulence which causes large, abrupt changes in altitude and/or attitude. The airplane could be out of control for short periods. It usually causes large variations in airspeed. passengers and crew are moved violently against their seat belts and loose objects are moved around the airplane.

FOR TRAINING PURPOSES ONLY!

© Lufthansa Technical Training

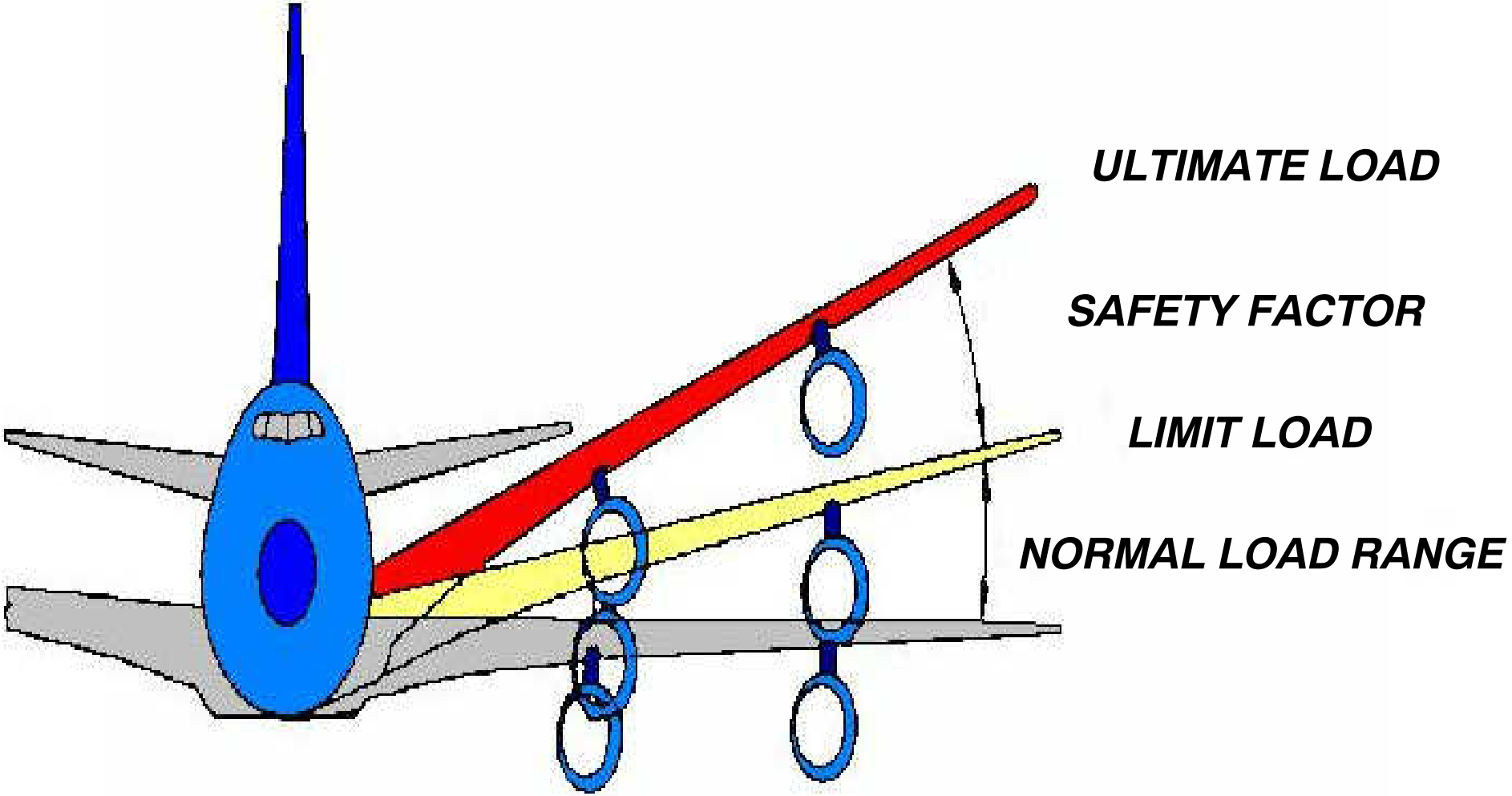


Figure 5 Example for passive Safety during severe Turbulence

FOR TRAINING PURPOSES ONLY!

© Lufthansa Technical Training

Overweight Landing

Large aircraft often have a higher maximum starting mass than the maximum landing mass, during an emergency fuel is dumped from the tanks via special outlets.

If this is not possible the aircraft has to land with a higher weight than the manufacturer has intended. At this structural damages can occur.

An inspection according to AMM chapter 05 has to be carried out.

FOR TRAINING PURPOSES ONLY!

© Lufthansa Technical Training

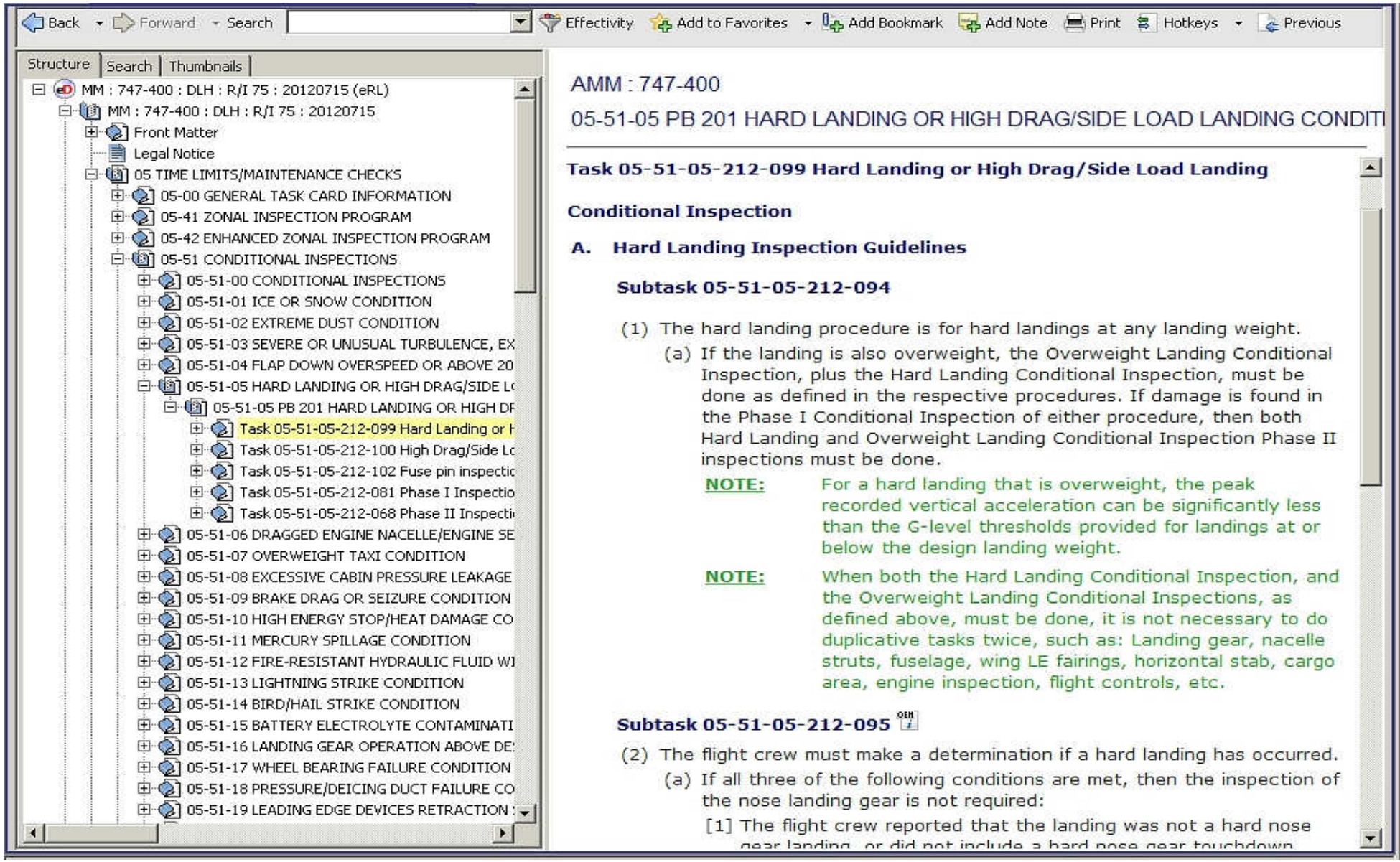


Figure 6 Overweight Landing

FOR TRAINING PURPOSES ONLY!

© Lufthansa Technical Training

Bird Strike

Especially during start and landing contact with birds can occur.
The structure is often damaged due to the high speed of the airplane.
An inspection according to AMM chapter 05 has to be carried out.

FOR TRAINING PURPOSES ONLY!

© Lufthansa Technical Training



Figure 7 Bird Strike

FOR TRAINING PURPOSES ONLY!

TABLE OF CONTENTS

M7 MAINTENANCE PRACTICES 1

M7.19 ABNORMAL EVENTS 1

INSPECTIONS FOLLOWING LIGHTNING STRIKES AND HIRF PENETRATION 2
LIGHTNING STRIKES 4
HIGH INTENSITY RADIATED FIELDS (HIRF) 6
INSPECTIONS FOLLOWING ABNORMAL EVENTS .. 8
HARD LANDING 8
SEVERE OR UNUSUAL TURBULENCE 10
OVERWEIGHT LANDING 12
BIRD STRIKE 14

TABLE OF FIGURES

Figure 1 AMM Chapter 05 Overview 3
Figure 2 Lightning Strike 5
Figure 3 Radiation Source 7
Figure 4 Hard Landing 9
Figure 5 Example for passive Safety during severe Turbulence 11
Figure 6 Overweight Landing 13
Figure 7 Bird Strike 15