Fundamentals
M7
MAINTENANCE PRACTICES

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M7.12
Transmissions

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Training Manual

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M7 MAINTENANCE PRACTICES

M7.12 TRANSMISSIONS

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INSPECTION OF GEARS, BELTS AND SCREW JACKS

Control Chains and Chain Wheels

Introduction

Chains provide strong, flexible and positive connections and are generally used wherever:

- A large distances between the connected axes exist
- it becomes necessary to change the direction of control runs in systems where considerable force is exerted.

The change of direction is achieved by the use of chain wheels or pulleys.

Applications

Chains may be found in:

- control column installations
- aileron and elevator controls
- trim control systems.

Chains may be used solely in control runs or in conjunction with cable assemblies.

Incorrect assembly of chains should be rendered impossible by the use of non-reversible chains in conjunction with the appropriate types of wheels, guards and connectors.

Specifications

Chains used for aircraft purposes are generally of the simple roller type.

Chain assemblies are produced to aircraft standards. These standards provide a range of chains built up in various combinations with standard fittings, e.g. end connectors with internal or external threads, bi-planer blocks for changing the articulation of a chain through 90° and cable spools for connecting chains to cables having eye-splices.

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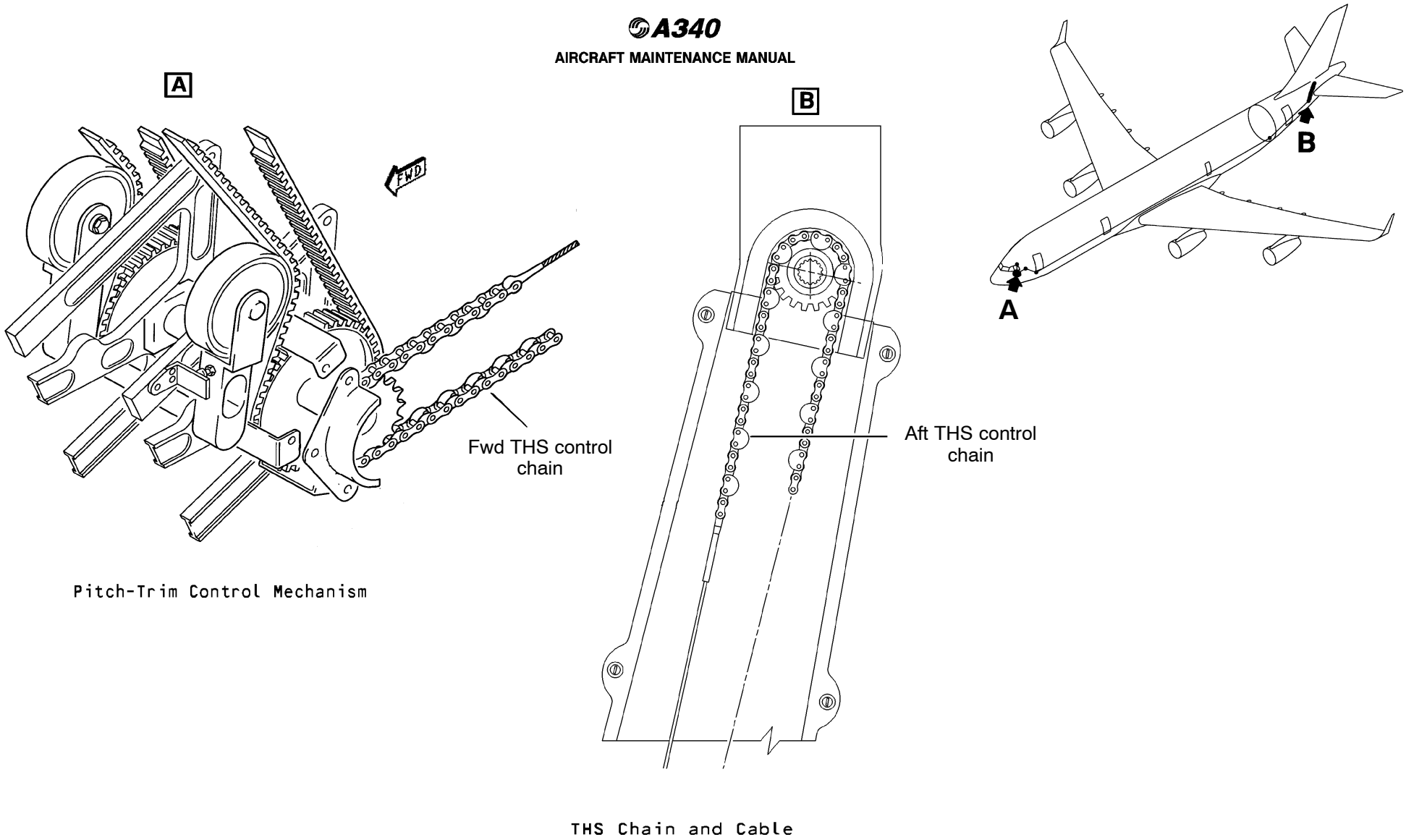


Figure 1 Location of Control Chains

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Installation of Chains

General

A range of non-interchangeable end fittings is available as a safeguard against the crossing of controls. However, these connectors do not always prevent the possibility of reversing the chain end to end on its wheel. Neither do they prevent the possibility of the chain being assembled to gear on the wrong face where two wheels are operated by the same chain.

Such contingencies can be overcome by the use of non-reversible chains.

Installation of Chain Wheels and Pulleys

During installation, chain wheels and pulleys should be checked to ensure that they are attached in the manner and method specified by the relevant drawings.

The correct positioning of chain wheels is of particular importance when non-reversible chains are used.

Inspection after Assembly

After installation in the aircraft, the chain should be examined for freedom from twist, particularly in instances where the attachment is made to threaded rods by means of screwed end connectors or where a twist may inadvertently be applied to the chain during the locking of the assembly.

Care should also be taken to ensure that the chain is not pulled out of line by the chain wheel; the chain should engage smoothly and evenly with the wheel teeth and there should be no tendency for the chain to ride up the teeth.

The pre-tensioning of chains should not be excessive, as this will cause wear, but should be just sufficient to prevent any backlash in the system.

The guarding should be checked to ensure that jamming cannot occur and that the chain will not come off the wheel should it become slack.

The security of end connections should be checked, care being taken to ensure that split-pins in the chain connecting bolts are correctly locked.

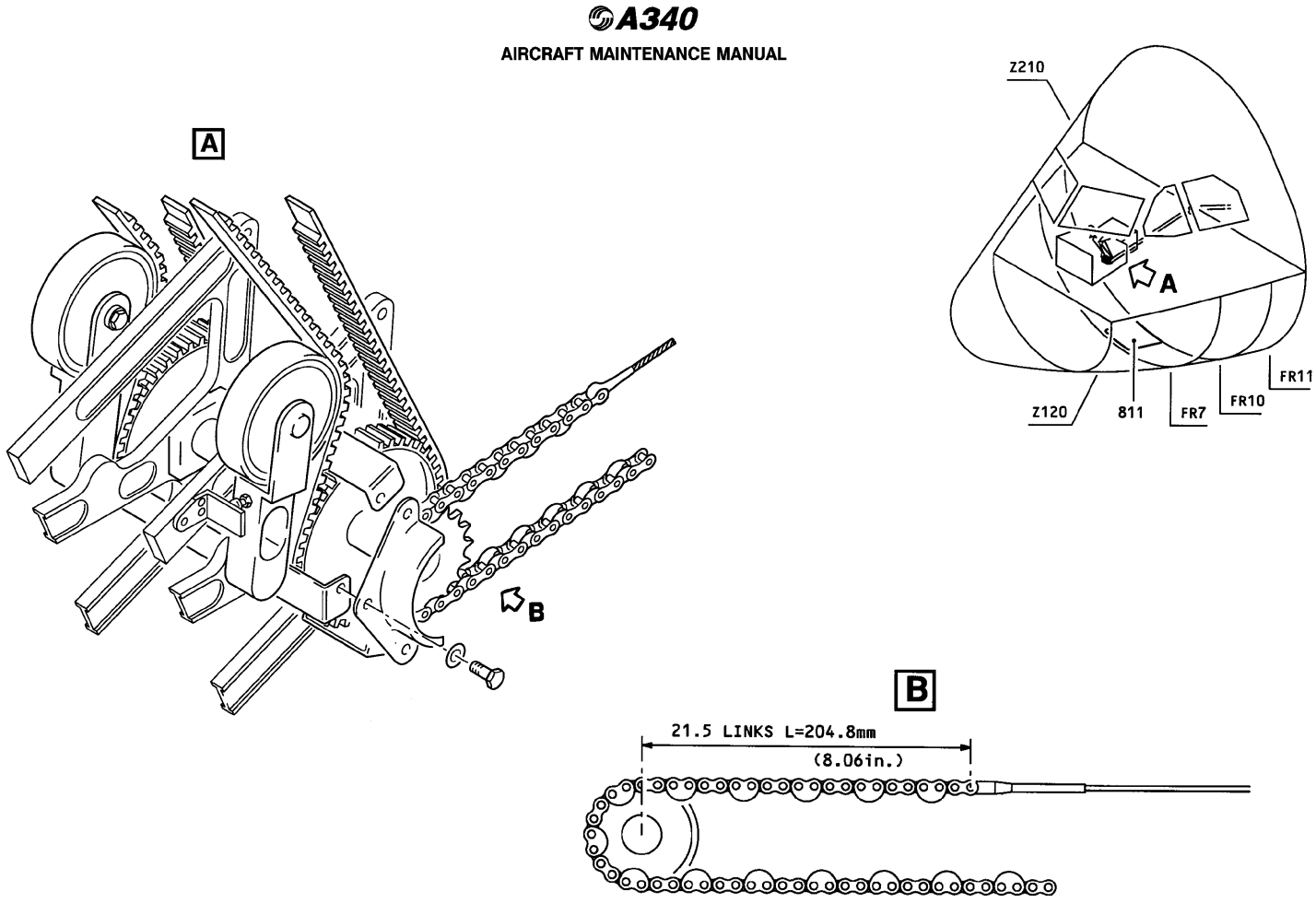
The lubricant present on new chains should not be removed and the chains should be further lubricated after assembly. Use lubricant complying the specifications.

The wheel or pulley mountings should be examined to ensure that

- the wheels or pulleys are firmly secured to the shafts or spindles
- that they are correctly located and
- are running freely.

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Forward THS Chain - Adjustment
Figure 504/TASK 27-41-00-991-005

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Figure 2 Installation of Chains

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Inspection of Chains

Maintenance Inspection

Chain assemblies should be inspected for serviceability at the periods specified in the relevant Maintenance Schedule.

Recommended methods for checking chains is as follows:

- The continued smoothness of operation between the chain and the chain wheel or pulley should be checked. If the chain does not pass freely round the wheel or pulley, it should be removed and checked. The proper function of the all bearings has to be assured.

ATTENTION: No attempt should be made to break and reassemble riveted links or attachments. If it is necessary to disconnect a chain, this should be undertaken only at the bolted or screwed attachments.

ATTENTION: The use of spring clip connecting links is prohibited and the attachment of chains to other parts of the system should be effected by positive methods such as pre-riveted or bolted joints.

- The chain should be checked for wear. If it is worn so that the links are loose and can be lifted away from the wheel teeth, it should be removed and checked for excessive elongation.
- The chain should be checked for damage, cleanliness, adequacy of lubrication and freedom from corrosion. If the inspection reveals the chain to be corroded or otherwise defective, it should be replaced.
- In instances where it becomes necessary to adjust the tension of the chain in systems incorporating turnbuckles or screwed end connectors, care should be taken to ensure that the chain itself is not twisted during adjustment. The connectors should be held firmly while the locknuts are being slackened or tightened.

ATTENTION: The use of cranked links for the attachment of the chain to end fittings, etc, is not permitted.

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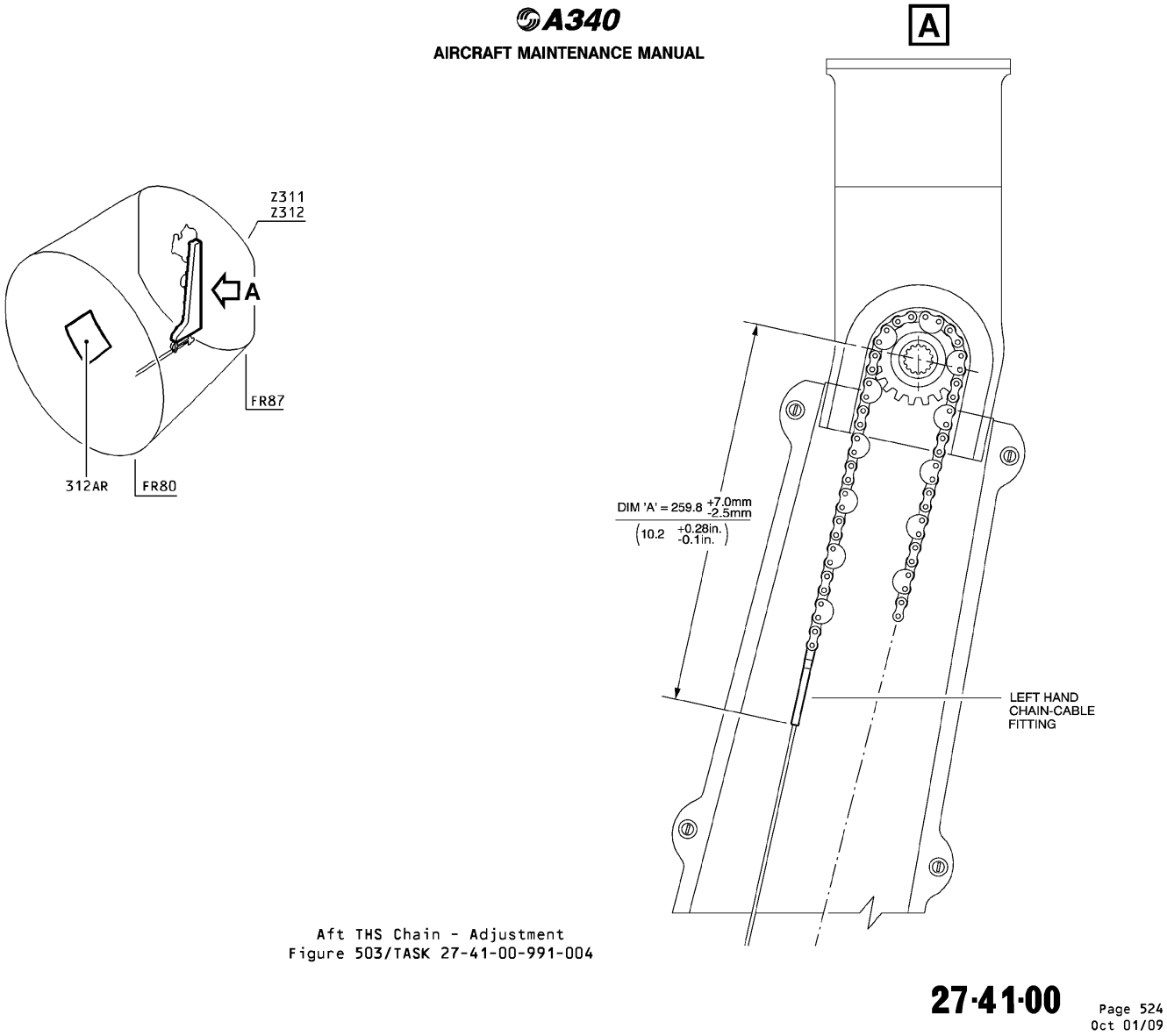


Figure 3 Inspection of Chains

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Maintenance of chains

General

Chain assemblies should be removed from the aircraft for complete inspection at the periods specified in the appropriate Maintenance Schedule.

Removal

When it is necessary to disconnect the chains, the assemblies must be removed at design breakdown points.

Checking Joints

The chain should be checked for tight joints by articulating each link through approximately 180°.

Checking for Deterioration

The chain should be examined for damage, cracks and wear to plates and rollers and for evidence of corrosion and pitting.

Proof-Loading

It is not necessary to proof-load a chain after removal for routine examination. However, if it is desired to replace a portion only of the assembly, proof-loading of the complete assembly is necessary. The proof-load table should be evenly applied and, unless this can be assured, it is considered preferable to fit a complete new assembly.

Checking Elongation

If elongation through wear is suspected, the following procedure is to be followed:

1. The chains should be cleaned by immersion in clean paraffin and brushed with a stiff brush. After cleaning, they should be immediately dried by hot air to ensure that no paraffin remains, otherwise corrosion will occur. The chains should be measured when clean but before any oil is applied.
2. The chains should be placed on a flat surface and stretched by the application of a tensile load. The length should then be measured between the centers of the bearing pins.
3. If the extension is in excess of 2% on any section of the chain the whole run should be replaced.

Protection and Storage

After the chain has been cleaned, inspected and found to be acceptable, it should be thoroughly soaked in an appropriate oil, time being allowed fro the lubricant to penetrate to the bearing surfaces.

If not required for immediate use, the chain should be laid on a flat surface, carefully coiled and wrapped in grease proof paper, care being taken to ensure the exclusion of dirt and the prevention of distortion, during storage.

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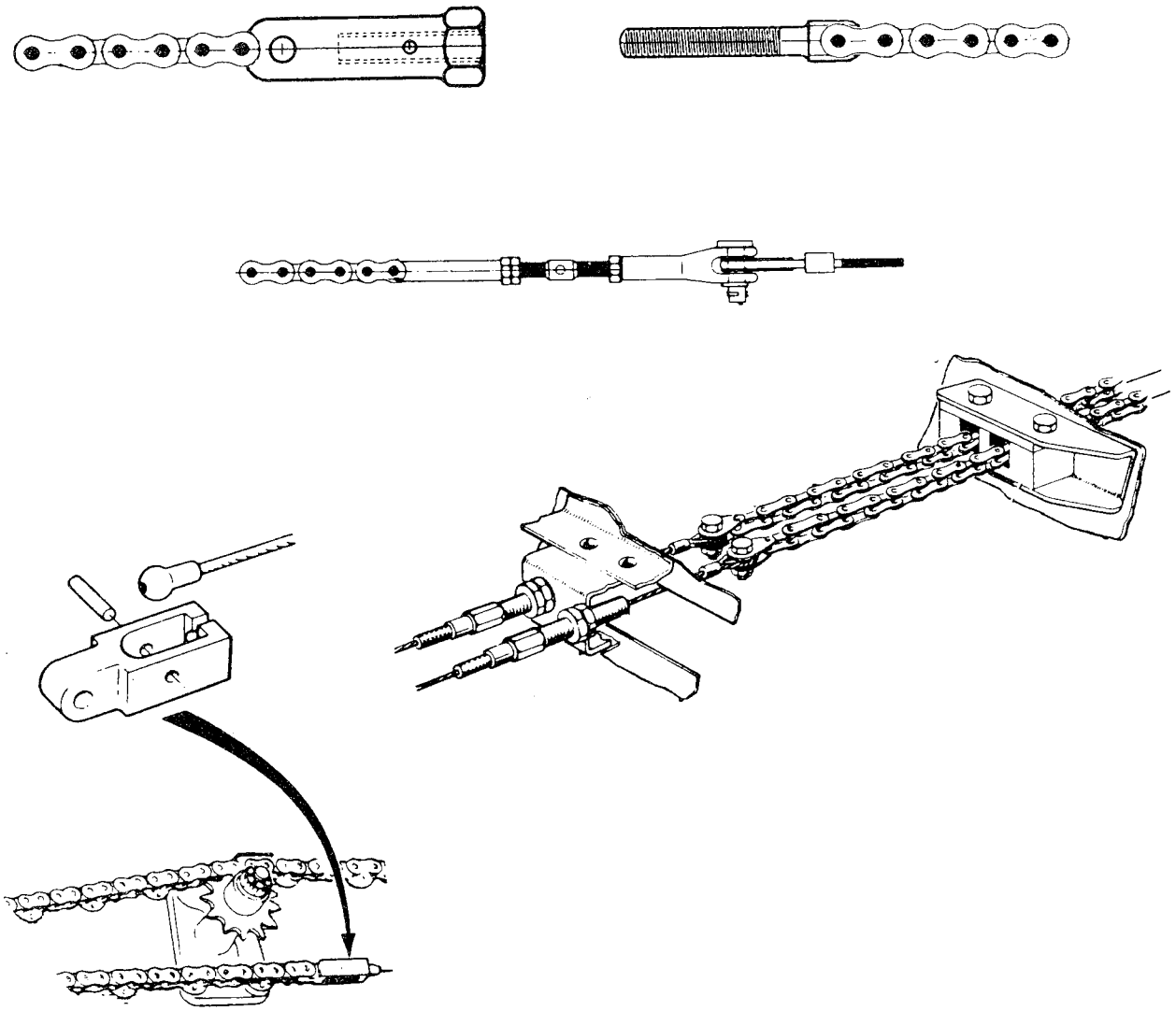


Figure 4 Control Chains, End Fittings and Connectors

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Inspection of Belts, Chains and Cables

EXAMPLE A340: Detailed Visual Inspection of the Trimmable Horizontal Stabilizer (THS) Mechanical Control Loop.

Background

The hydromechanical operation system of the THS (referred to as THS actuator) is controlled electrically (by the Flight Control Primary Computers (FCPC)) and mechanically.

The THS has a mechanical control system which has the function of a standby system. The pilots can use two control wheels, which are installed in the cockpit center pedestal, to operate the THS mechanically.

Cables transmit the mechanical commands from the control wheels to the mechanical input shaft of the THS actuator. An override mechanism ensures that the mechanical pitch trim commands cancel the electronic pitch trim commands.

Inspection

The following is a precis from the Aircraft Maintenance Manual detailing the inspection of the system belts, chains and cables:

1. Ensure that the following components of the mechanical pitch–trim control loop are in the correct condition:
   - pitch–trim control mechanism
   - chains and gears of the pitch–trim control mechanism and of the THS actuator
   - pulleys
   - cable tension regulator
   - control cables
   - THS input shaft.
2. In the cockpit, slowly turn the pitch trim control wheels from one stop to the opposite stop.
3. In the avionics compartment, ensure that the toothed belts have no cracks, delaminating of teeth and no wear marks over the full length.
4. Ensure that the chain and the cable can move freely.

ATTENTION: Ensure that the flight surfaces are clear; movement of flight controls can cause damage and/or personal injury!

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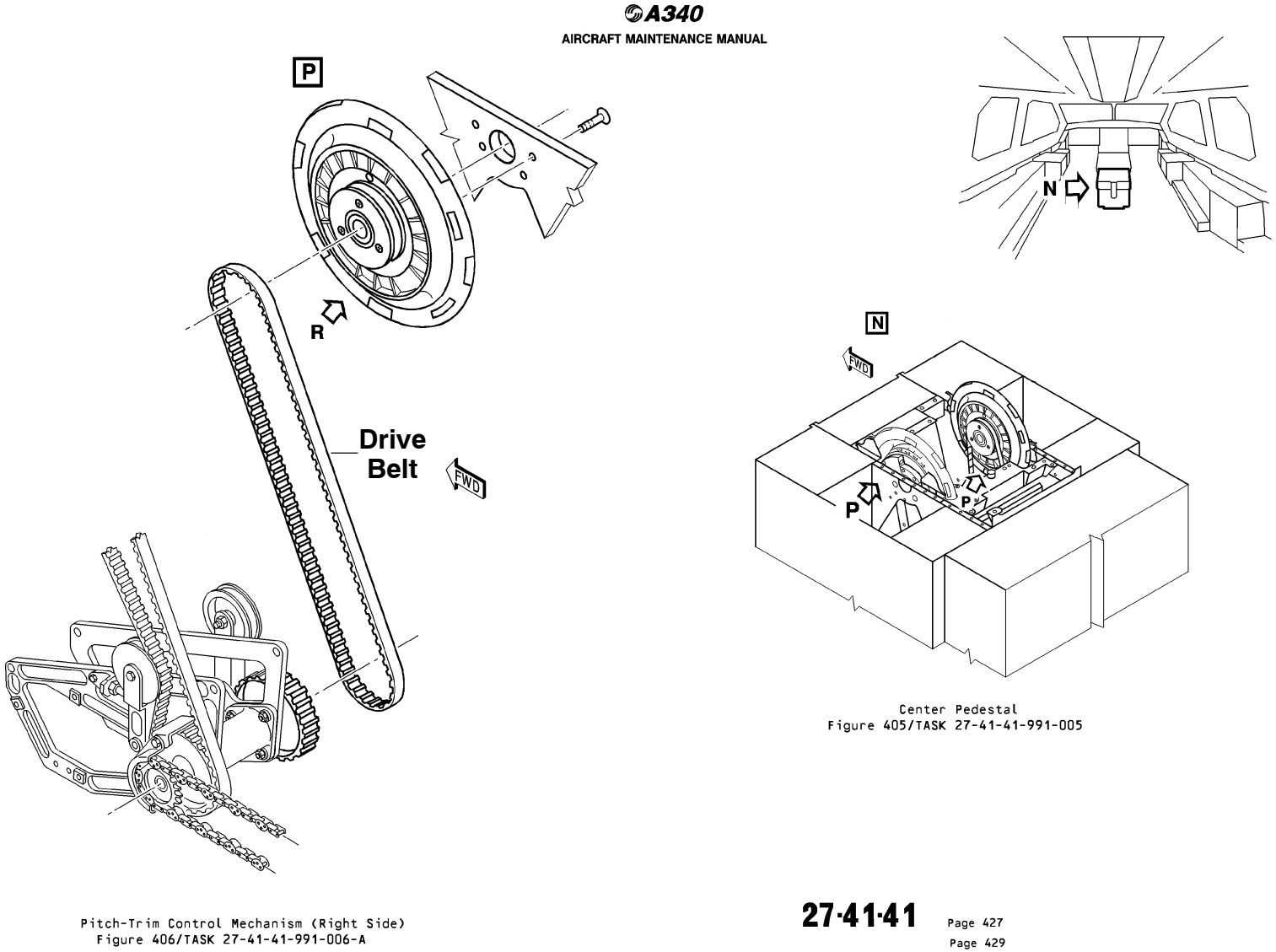


Figure 5 Location of THS Drive Belts

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Inspection of Screw Jacks

B737 Stabilizer Ball Nut and Jackscrew Inspection

Since the the thread system of the ball screw of the Trimmable Horizontal Stabilizers is mechanically heavily loaded, all related components have to be checked on scoring and wear according to the maintenance schedules.

This is done with a micrometer and a slide gauge. The result of the measured values is compared with the acceptable tolerances according to the AMM.

All parts have to be removed, if the meausred values exeed the thresholds recorded in the AMM.

Weal Limits B737 Gimbal Fitting

The following tabular with the wear limits of the Gimbal Fitting has been taken out the B737 AMM and use is only permitted for information!

INDEX NO.	PART NAME	DIM.	DESIGN LIMITS DIAMETER MIN	DESIGN LIMITS DIAMETER MAX	WEAR LIMITS PERMITTED WEAR DIM.	WEAR LIMITS MAX DIA CLEARANCE	REPLACE WORN PART	REPAIR WORN PART	REPAIR INSTR
1	YOKE	ID	1.000	1.001	1.002	0.005		X	1
	BUSHING	OD	0.998	0.999	0.996		X		
2	FITTING	ID	1.000	1.001	1.002	0.005		X	1
	PIN	OD	0.998	0.999	0.997			X	1
3	BUSHING	ID	1.000	1.001	1.003	0.005	X		
	PIN	OD	0.998	0.999	0.997			X	1

1 YOU CAN REPAIR A WORN PART. REFER TO THE OVERHAUL MANUAL FOR REPAIR INFORMATION.

Gimbal Wear Limits
Figure 601 (Sheet 2)

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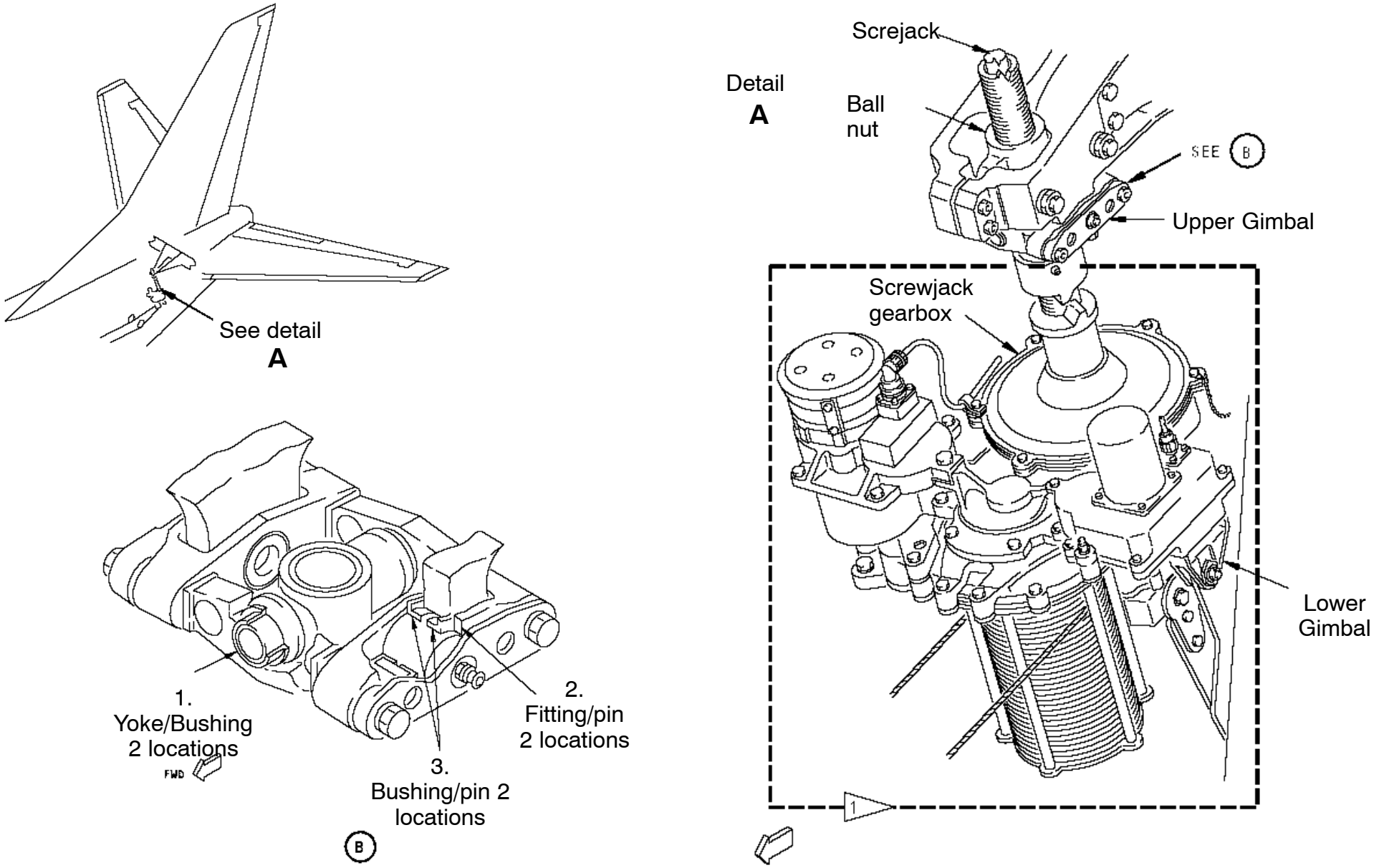


Figure 6 B737 Stabilizer Ball Nut and Jackscrew Inspection

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Inspection of Gears considering backlash

Introduction

Backlash means:

- Deviation (B) between the width of a tooth space and the engaging tooth on the pitch circle (D).
- The play between mating tooth surfaces at the tightest point of mesh in a direction normal to the tooth surface when the gears are mounted in their specified positions.

The amount of backlash in a pair of mating gears can be affected by:

- changes in center distance
- variance in tooth thickness
- temperature ranges

Temperature ranges have different consequences:

- of the gears and mountings.

Definitions

Minimum backlash: occurs when all tolerances give the shortest center distance and the thickest teeth at the highest point of pitch line runout.

Maximum backlash: occurs when all tolerances give the greatest center distance and the thinnest teeth at the lowest point of pitch line runout.

Backlash Tolerance: the allowable amount of backlash.

Backlash Variation: the difference between the maximum and minimum backlash occurring in a whole revolution of the larger of a mating pair of gears.

Purpose of Backlash

The general purpose of backlash is to prevent gears from jamming and making contact on both sides of their teeth simultaneously. A small amount of backlash is also desirable to provide for lubricant space and differential expansion between the gear components and the housing.

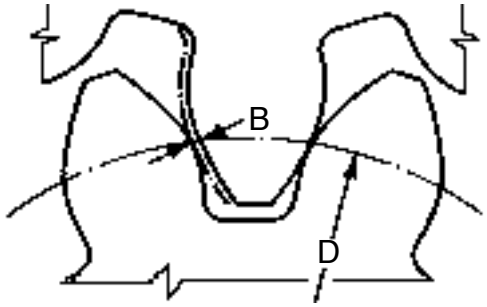
On the other hand, excessive backlash is objectionable, particularly if the drive is frequently reversing or if there is an overrunning load.

Backlash Checks

Checks of backlash are normally carried out in the workshop on components once they have been removed from the aircraft.

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Backlash (B)
between two teeth

Figure 7 Checking of Backlash

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