

Maintaining rotor drive systems on rotorcraft

Overview

This standard identifies the competences you need to carry out maintenance activities on rotorcraft main and/or tail drive systems, in accordance with the approved rotorcraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers the main and tail rotor drive, and includes all components transmitting power to the rotors, such as engine coupling components, drive shafts and bearings, drive supports, clutch and freewheel units, gearboxes and their components, accelerometers, vibration monitoring equipment and indicating systems which show operation or activation of the rotor systems. The maintenance activities will include the removal, fitting and testing of a range of main and/or tail rotor drive system components. You will remove the required components and fit approved replacements, as appropriate. You will then need to test and adjust the completed system to meet the rotorcraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.

Your responsibilities will require you to comply with the specific practices and procedures identified in the rotorcraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that you cannot personally resolve, or that are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to rotorcraft main and/or tail rotor drive systems. You will understand the component removal, fitting and testing methods and procedures, and their application, along with the rotor drive systems maintenance requirements. You will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the main and tail rotor drive systems are maintained to the required standard.

You will understand the safety precautions required when working on the rotor drive systems, especially those for ensuring that the power system is safely and correctly isolated. You will be required to demonstrate safe working practices throughout, and will understand your responsibility for taking the necessary safeguards to protect yourself and others in the workplace.

Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 63

Maintaining rotor drive systems on rotorcraft

Main Rotor Drives and ATA Chapter 65 Tail Rotor Drive.

2. To display competence in this standard, it is necessary to both remove and fit rotor drive system components. You must remove components; however, you may fit a replacement component where the original was previously removed by another person. You should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

Maintaining rotor drive systems on rotorcraft

Performance criteria

You must be able to:

1. work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
2. follow the relevant maintenance schedules to carry out the required work
3. carry out the maintenance activities within the limits of your personal authority
4. carry out the maintenance activities, and replace components in the specified sequence and in an agreed timescale
5. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
6. complete relevant documentation in accordance with organisational requirements
7. dispose of waste materials in accordance with safe working practices and approved procedures
8. leave the aircraft and system in a safe and appropriate condition, free from foreign object debris on completion of the activities

Maintaining rotor drive systems on rotorcraft

Knowledge and understanding

You need to know and understand:

1. the specific safety practices and procedures that you need to observe when working on rotorcraft main and tail rotor systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
2. the importance of maintenance on rotorcraft rotor drive systems, and impact upon legislation and local procedures
3. the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
4. the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
5. the hazards associated with carrying out maintenance activities on rotorcraft main and tail rotor systems, and with the tools and equipment used (such as handling oils, greases, traps from moving parts, lifting and moving heavy and bulky components, hot parts of engines, misuse of tools), and how to minimise them and reduce any risk
6. the protective equipment that you need to use for both personal protection (PPE) and protection of the rotorcraft
7. the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
8. how to extract and use information from rotorcraft manuals, log books, flight logs, charts, system and physical layouts, specifications, symbols used in rotorcraft main and tail rotor systems, and other documents needed in the maintenance activities
9. how to carry out currency/issue checks on the specifications you are working with
10. terminology used in rotorcraft power transmission systems, and the use of system diagrams and associated symbols
11. the principles of operation of the main and/or tail rotor drive system being worked on, and the function of the units that make up the system (such as main, intermediate, tail and nose gearboxes, clutch/freewheel mechanisms, braking equipment, couplings and drive shafts and indicating systems)
12. the techniques used to remove components from rotorcraft main and/or tail rotor systems without damage to the components or surrounding structure (such as release of pressures/force, draining of fluids, removal of components and the need to protect the system integrity by fitting blanking plugs and ensuring that exposed components are correctly covered/protected)
13. the various mechanical fasteners that will need to be removed and

Maintaining rotor drive systems on rotorcraft

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- replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
 - 14. the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
 - 15. methods of lifting, handling and supporting the components/equipment during the maintenance activities
 - 16. the importance of ensuring that any exposed components or pipe ends are correctly covered/protected
 - 17. the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
 - 18. how to replace and reconnect components into the rotor power transmission system (such as the use of gaskets/seals and jointing/sealing compounds; ensuring correct orientation, position and alignment; tightening securing devices to the required torque; replacing locking and securing devices; eliminating stress on pipework/connections; ensuring that pipework and cables are correctly supported at suitable intervals; carrying out visual checks of all components)
 - 19. why electrical bonding is critical, and why it must be both mechanically and electrically secure
 - 20. how to make adjustments to components to ensure that they function correctly (such as travel, working clearance)
 - 21. why securing devices need to be correctly torque loaded, locked and labelled, and the different methods that are used
 - 22. the tools and equipment used in the maintenance activities, and their calibration/care and control procedures
 - 23. why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
 - 24. how to carry out routine checks and servicing of the rotorcraft main and/or tail rotor system
 - 25. the tests to be carried out on the rotorcraft power transmission system, and the test equipment to be used
 - 26. the methods and procedures to be used to carry out the various tests on the rotor power transmission systems
 - 27. the importance of carrying out the tests in the specified sequence, checking all readings/movements at each stage
 - 28. how to record the results of each individual test and the documentation that must be used
 - 29. how to analyse the test results, and how to make valid decisions about the acceptability of the rotor power transmission system
 - 30. the procedures to be followed if the equipment or system fails to meet the test specification
 - 31. the recording documentation to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

Maintaining rotor drive systems on rotorcraft

- 32. the procedure for the safe disposal of waste materials, scrap components and fuel/fluids
- 33. the extent of your own authority and to whom you should report if you have problems that you cannot resolve

Maintaining rotor drive systems on rotorcraft

Scope/range related to performance criteria

1. Carry out all of the following during the maintenance of the rotorcraft main and/or tail rotor drive system:
 1. ensure that appropriate authorisation to work on the rotorcraft is obtained, and observe all relevant isolation and safety procedures
 2. obtain and use the correct documentation (such as job instructions, technical instructions, rotorcraft manuals and maintenance documentation)
 3. obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
 4. adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
 5. ensure that the relevant safety devices and mechanical/physical locks are in place (where appropriate)
 6. use approved removal, fitting and testing techniques and procedures at all times
 7. return tools and equipment to the correct storage location on completion of the activities
 8. ensure that work carried out is correctly documented and recorded
 9. ensure that any outstanding tests are correctly documented
2. Carry out maintenance on three of the following parts of the rotorcraft rotor drive system:
 1. main rotor gearbox/transmission
 2. aft vertical shaft
 3. rotor braking system
 4. intermediate gearbox/transmission
 5. drive shaft/high speed shaft
 6. rotorcraft cooling fan
 7. combining gearbox/transmission
 8. engine/gearbox couplings
 9. accelerometer
 10. nose gearbox/transmission
 11. clutch/freewheel units
 12. indicating system
 13. tail rotor gearbox
 14. other specific gearbox/transmission in the drive train

Maintaining rotor drive systems on rotorcraft

3. Remove and fit six different rotor drive system components (at least two must be from group A):

Group A

1. clutch assembly
2. bearings
3. control valves
4. freewheel units
5. dynamic seals
6. vibration bars
7. clutch operating mechanisms
8. housings
9. suspension units
10. flexible couplings
11. lubricating pumps
12. mounts/attachments
13. drive shaft support
14. brake mechanisms
15. accessory drive casing
16. drive shafts

Group B

17. levers/linkages
18. accelerometers
19. mechanical controls (plungers, springs, rollers)
20. static seals/gaskets
21. drive belts and pulleys
22. anti-ice heater mats
23. bolt assemblies
24. pipes and hoses
25. cable harness/wiring/switches/plugs
26. support brackets
27. rotor drive fairings
28. electrical controls (solenoids, motors, switches)
29. chip detectors
30. gearbox covers
31. indicators and warning devices
32. control units
33. locks and stops
34. sensors
35. other specific components

4. Carry out fifteen of the following maintenance activities:

1. removing fairings and covers to expose components to be removed
2. carrying out fault diagnosis and system checks

Maintaining rotor drive systems on rotorcraft

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3. preparing the system for maintenance (such as isolating, draining fluids)
 4. disconnecting electrical connections
 5. refitting components in the correct position, orientation and alignment
 6. disconnecting/removing hoses and pipes
 7. removing securing devices and mechanical fasteners
 8. setting and adjusting replaced components (such as travel, working clearance)
 9. supporting equipment to be removed
 10. dismantling equipment to an appropriate level
 11. making mechanical connections
 12. covering (protecting) exposed components, wires, pipework or vents
 13. making electrical connections
 14. disconnecting/reconnecting bonding leads
 15. torque loading as required
 16. checking components for serviceability
 17. replenishing fluid systems
 18. replacing damaged/defective components
 19. carrying out system functional checks
 20. replacing single use items such as seals, filters, gaskets
 21. ensuring that replacement components have the correct part numbers
 22. fitting blanks, labelling (and storing in the correct location) components that require repair or overhaul
 23. applying bolt locking methods (such as split pins, wire locking, lock nuts)
 24. carrying out area inspections prior to task close down
5. Service/check rotorcraft main and tail rotor drive systems, to include carrying out three of the following:
 1. visually checking gearboxes and drive system for damage and leaks
 2. checking gearbox chip detectors
 3. carrying out oil drain rotor tune adjustments
 4. checking and adjusting clutch mechanisms
 5. checking indicating and warning systems
 6. checking and adjusting braking mechanisms
 6. Carry out three of the following tests on the rotorcraft rotor drive system:
 1. visual inspection
 2. built in test equipment (BITE) test
 3. ground run tests
 4. gearbox alignment (main, tail, intermediate)
 5. timings

Maintaining rotor drive systems on rotorcraft

6. leak test
7. tension adjuster check
8. vibration analysis
9. drive shaft/high speed shaft alignment
10. freedom and range of movement
11. phasing check
12. 'special-to-type' tests
13. safety interlock test
14. checking gearboxes and drive systems for correct oil levels
15. static or dynamic balancing of drive shafts

Using three of the following:

16. built in test equipment (BITE)
17. use of safety locks
18. special-to-type' test equipment
19. dial test indicator
20. plumb and bob
21. optical sight instruments
22. laser alignment
23. feeler/slip gauges
24. jigs/fixture
25. clinometers
26. go/no go' gauge
27. wrenches/'special-to-type' appliances
28. lay straight wires
29. vibration analysis equipment

7. Complete the relevant paperwork, to include one from the following and pass it to the appropriate people:

1. job cards/work sheets
2. rotorcraft cabin log
3. computer records
4. rotorcraft log book
5. rotorcraft technical log

8. Carry out maintenance on rotorcraft main and tail rotor systems in compliance with one of the following:

1. Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
2. Ministry of Defence (MoD)
3. Military Aviation Authority (MAA)
4. Aerospace Quality Management Standards (AS)
5. Federal Aviation Authority (FAA)
6. rotorcraft maintenance manual/approved change documentation (service bulletin)
7. manufacturers standards and procedures

Behaviours

You will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as:

- strong work ethic
- positive attitude
- team player
- dependability
- responsibility
- honesty
- integrity
- motivation
- commitment

Maintaining rotor drive systems on rotorcraft

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