SEMAE3341

# Maintaining bleed air systems on aircraft

## Overview

This standard identifies the competences you need to carry out maintenance activities on aircraft engine bleed air systems, in accordance with the approved aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and covers the units and components which go together to conduct air to the extension shaft and torquemeter assembly. It includes compressor bleed systems used to control flow of air through the engine, cooling air systems and heated air systems for engine anti-icing. It does not include aircraft anti-icing, engine starting systems, or exhaust supplementary air systems, which are covered in other standards/ATA chapters. The maintenance activities will include the removal, fitting and testing of a range of engine bleed air 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 aircraft 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 aircraft 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 aircraft engine bleed air systems. You will understand the removal, fitting and testing methods and procedures, and their application, along with the bleed air 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 equipment is maintained to the required standard.

You will understand the safety precautions required when working on aircraft bleed air systems, especially those for isolating the equipment. 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 75 Bleed Air.
2. To display competence in this standard, it is necessary to both remove and fit aircraft engine bleed air 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.

## 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

## Knowledge and understanding

*You need to know and understand:*

1. the specific safety practices and procedures that you need to observe when working on aircraft bleed air systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
2. 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)
3. the importance of maintenance on aircraft bleed air systems, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
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 aircraft bleed air systems, and with the tools and equipment used (such as hot parts of engines, traps from moving parts, 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 aircraft
7. what constitutes a hazardous voltage and how to recognise victims of electric shock
8. how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
9. 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
10. how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft pneumatic systems, and other documents needed in the maintenance activities
11. how to carry out currency/issue checks on the specifications you are working

with

12. terminology used in aircraft bleed air systems, and the use of system diagrams and associated symbols
13. the principles of operation of the aircraft bleed air system being worked on (such as system layout, engine cooling, engine anti-icing, compressor control and indication and warning)
14. the techniques used to remove components from aircraft bleed air systems without damage to the components or surrounding structure (such as release of pressures/force, removal of components and the need to protect the circuit integrity by ensuring that exposed components and pipe ends are correctly covered/protected)
15. the various mechanical fasteners to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
16. the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
17. why electrical bonding is critical, and why it must be both mechanically and electrically secure
18. 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
19. how to fit components into the circuit (such as ensuring correct position and orientation; correct the tightness of fittings and connections; eliminating stress on pipework, cables and connections; carrying out visual checks of all components)
20. the tools and equipment used in the maintenance activities, and their calibration/care and control procedures
21. 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
22. how to make adjustments to components/assemblies to ensure that they function correctly (such as setting travel and freedom of movement; governor settings and their effect on the bleed air system)
23. why securing devices need to be tightened to the correct torque, locked and labelled, and the different methods that are used
24. how to carry out routine checks and servicing of the aircraft bleed air system (including checking the engine anti-icing system, the compressor bleed governor and the variable stator blades)
25. the types of test to be carried out on the aircraft bleed air system and the test

equipment to be used

26. the methods and procedures to be used to carry out the various tests on the bleed air system

27. how to record the results of the tests and the documentation that must be used

28. how to analyse the test results and how to make valid decisions about the acceptability of the aircraft bleed air system

29. the procedures to be followed if the equipment or system fails to meet the test specification

30. 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

31. the procedure for the safe disposal of waste materials and scrap components

32. the extent of your own authority and to whom you should report if you have problems that you cannot resolve

## Scope/range related to performance criteria

1.

Carry out all of the following during the maintenance of the aircraft engine bleed air system:

1.1 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
1.2 obtain and use the correct documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
1.3 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
1.4 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
1.5 ensure that the relevant safety devices and mechanical/physical locks are in place (where appropriate)
1.6 use approved removal, fitting and testing techniques and procedures at all times
1.7 return tools and equipment to the correct storage location on completion of the activities
1.8 ensure that work carried out is correctly documented and recorded
1.9 ensure that any outstanding tests are correctly documented

2.

Carry out maintenance on two of the following parts of the aircraft engine bleed air system:

2.1 engine anti-icing
2.2 compressor bleed valve
2.3 engine cooling
2.4 bleed air indicating
2.5 compressor bleed control
2.6 bleed air system wiring
2.7 compressor bleed governor
2.8 nozzle control system

3.

Remove and fit four different aircraft engine bleed air system components (at least one must be from group A):

Group A

1. jet pump
2. valves
3. vortex spoiler
4. compressor

5. actuators
6. air motor servo units (AMSU)
7. governor
8. regulator

Group B

9. levers and linkages
10. air filters
11. cables/harness/wiring
12. control mechanisms
13. sensors/transmitters
14. plugs/sockets/switches
15. ducting
16. warning devices (temperature, pressure)
17. pipes and hoses
18. other specific components

1.

Carry out fifteen of the following maintenance activities:

1.1 removing access panels and covers to expose components to be removed
1.2 carrying out fault diagnosis and system checks
1.3 preparing the system for maintenance (such as isolating)
1.4 disconnecting electrical connections (where applicable)
1.5 refitting components in the correct position, orientation and alignment
1.6 disconnect/removing hoses and pipes
1.7 removing securing devices and mechanical fasteners
1.8 setting and adjusting replaced components (such as travel, working clearance)
1.9 supporting equipment to be removed
1.10 dismantling equipment to an appropriate level
1.11 making mechanical connections
1.12 covering (protecting) exposed components, wires, pipework or vents
1.13 making electrical connections
1.14 disconnecting/reconnecting bonding leads
1.15 torque loading as required
1.16 checking components for serviceability
1.17 replacing all damaged/defective components
1.18 replacing single use items such as seals, filters, gaskets
1.19 carrying out system functional checks
1.20 ensuring that replacement components have the correct part numbers
1.21 fitting blanks, labelling (and storing in the correct location) components that require repair or overhaul
1.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)

1.23 carrying out area inspections prior to task close down

2.

Service/check the aircraft bleed air system, to include carrying out four of the following:

2.1 inspecting engine anti-icing system
2.2 inspecting variable stator blades
2.3 checking and adjusting compressor bleed governor
2.4 checking and adjusting pressure regulator
2.5 checking bleed air indicating systems (such as pressure, temperature, control positions)
2.6 checking blow-off valve (BOV)
2.7 checking compressor control bleed valves/mechanisms

3.

Carry out two of the following tests on the aircraft bleed air system:

3.1 leak test
3.2 reduced system test
3.3 pressure test
3.4 movement tests (such as range, timing, sequencing)
3.5 'special-to-type' tests
3.6 built in test equipment (BITE) test

Using one of the following:

7. aircraft power source/system
8. ground test rig

1.

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

1.1 job cards/work sheets
1.2 computer records
1.3 aircraft technical log
1.4 aircraft cabin log
1.5 aircraft log book

2.

Carry out maintenance on aircraft engine bleed air systems in compliance with one of the following:

2.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
2.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
2.3 Ministry of Defence (MoD)
2.4 Military Aviation Authority (MAA)
2.5 Aerospace Quality Management Standards (AS)
2.6 Federal Aviation Authority (FAA)
2.7 aircraft maintenance manual/approved change documentation (service

bulletin)
2.8 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 bleed air systems on aircraft

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