SEMAE3213

# Rebuilding aircraft gas turbine engine assemblies after overhaul

## Overview

This standard identifies the competencies you need to carry out the reassembly of aircraft gas turbine engine overhauled modules, into part and final engine assemblies, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft engines. In carrying out the reassembly operations, you will be required to follow laid-down procedures and specific engine assembly techniques in order to assemble the various sub-assembly units and components.

You will be required to obtain all the required tools and equipment for the assembly operations, and to check that they are in a safe and usable condition. You will then rebuild the gas turbine engine assembly, which will involve fitting new replacement or overhauled sub-assembly units such as fan case, front fan, compressor module, combustor module, turbine module and gearbox. The rebuilding activities will include making all necessary checks and adjustments to ensure that components are correctly replaced, positioned, aligned, adjusted, torque loaded, locked and fastened, and that the correct sealants are used.

Your responsibilities will require you to comply with organisational policy and procedures for the reassembly of the aircraft gas turbine engine, and to report any problems with the reassembly activities or with the tools and equipment used 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 in the assembly activities are correctly accounted for and removed from the work area on completion of the activities, and that all necessary job/task documentation is completed 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 appropriate reassembly techniques and procedures to aircraft gas turbine engines. You will understand the assembly methods and procedures used, and their application. You will know how the engine functions, the purpose of the individual modules, relevant components and fastening devices, in adequate depth to provide a sound basis for carrying out the reassembly activities to the required specification.

You will understand the safety precautions required when carrying out the reassembly

activities associated with aircraft gas turbine engines, especially those for lifting, handling and supporting the equipment being assembled. 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.

## 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 instructions, assembly drawings and any other specifications
3. ensure that the specified components are available and that they are in a usable condition
4. use the appropriate methods and techniques to reassemble the components in their correct positions
5. secure the components using the specified connectors and securing devices
6. check the completed assembly to ensure that all operations have been completed and the finished assembly meets the required specification of the rebuild
7. deal promptly and effectively with problems within your control and report those that cannot be solved
8. leave the work area and engine in a safe and appropriate condition on completion of the activities
9. complete the relevant documentation, in accordance with organisational requirements

## Knowledge and understanding

*You need to know and understand:*

1. the specific safety precautions to be taken whilst carrying out the aircraft gas turbine engine reassembly (including any specific legislation, regulations or codes of practice relating to the activities, equipment or materials)
2. the health and safety requirements of the work area in which you are carrying out the reassembly activities, and the responsibility these requirements place on you
3. COSHH regulations with regard to the substances used in the assembly process
4. the hazards associated with producing aircraft gas turbine engine assemblies, and with the tools and equipment used, and how to minimise them and reduce any risks
5. 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
6. the personal protective equipment and clothing (PPE) to be worn during the reassembly activities
7. the various types of drawing/overhaul manual and specification that are used during the reassembly activities
8. how to identify the modules and components to be used; component identification systems (such as codes and component orientation indicators)
9. preparations to be undertaken on the modules and components, prior to fitting them into the assembly
10. the reassembly methods and procedures to be used, and the importance of adhering to these procedures
11. methods of reassembling the aircraft gas turbine engine, using new or previously overhauled components (such as replacing assemblies requiring pressure/force, ensuring correct orientation, bedding in bearings and components, replacing mechanical locking and securing mechanisms/devices, torque setting components)
12. how the components are to be positioned and aligned prior to securing them, and the tools and equipment to be used (such as use of jigs and fixtures, micrometers, Verniers, laser alignment techniques)
13. how to make adjustments to the replaced modules/assemblies to ensure that they function correctly (such as checking alignment, balancing of rotating

components such as turbines, setting working clearance, setting travel, and pre-loading bearings)
14. the various mechanical fasteners that will be used and their method of installation (such as rivets, threaded fasteners, special securing devices)
15. the importance of using the specified mechanical fastening devices for the reassembly and why you must not use substitutes
16. how to complete fitting practices, meeting regulatory and organisational requirements (such as torque tightening, wire locking, fitting wire thread inserts, fitting O-ring seals, fitting lock nuts, blue bedding, tab washers, cup washers and swage nuts)
17. dealing with components or fastening devices incorrectly assembled, damaged or having other faults
18. the application of sealants and adhesives within the reassembly activities, and the precautions that must be taken when working with them
19. why electrical bonding is critical and why it must be both mechanically and electrically secure
20. the quality control procedures to be followed during the reassembly operations
21. how to conduct any necessary checks to ensure the accuracy and quality of the gas turbine engine assemblies
22. how to detect assembly defects and what to do to rectify them (such as ineffective fasteners, foreign object damage)
23. how to lift and move large engine modules and sub-assemblies; the methods and equipment used to transport, handle and lift the assemblies during the rebuilding activities
24. the need to ensure that lifting and handling equipment is within its current certification dates
25. how to check that the tools and equipment to be used are correctly calibrated and are in a safe and serviceable condition
26. the importance of ensuring that all tools are used correctly and within their permitted operating range
27. the importance of ensuring that the completed assembly is free from dirt, swarf and foreign objects
28. the importance of ensuring that all tools, equipment and components are accounted for and returned to their correct location on completion of the assembly activities
29. problems with the reassembly operations and the importance of informing appropriate people of non-conformances

30. the procedure for the safe disposal of waste materials
31. the recording documentation to be completed for the aircraft gas turbine engine rebuilding activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
32. the extent of your own responsibility 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 reassembly of the aircraft gas turbine engine:

- 1.1 obtain and use the correct issue of engine assembly drawings, overhaul manual and planning documentation
- 1.2 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
- 1.3 provide and maintain safe access and working arrangements for the assembly area
- 1.4 ensure that all the required modules and components are available and have the correct part numbers
- 1.5 ensure that all tools and measuring instruments to be used are within current calibration dates
- 1.6 ensure that the engine/modules are suitably supported
- 1.7 use lifting and slinging equipment in accordance with health and safety guidelines and procedures
- 1.8 carry out the reassembly activities, using approved techniques and procedures
- 1.9 ensure that components and surrounding structures are maintained free from damage and foreign objects
- 1.10 return all tools and equipment to the correct location on completion of the activities
- 1.11 ensure that all work carried out is correctly documented and recorded

2.

Carry out the reassembly of one of the following types of aircraft gas turbine engine:

- 2.1 turbo prop
- 2.2 turbo jet
- 2.3 turbo-fan
- 2.4 ducted fan
- 2.5 turbo-shaft
- 2.6 ground turbine start (GTS)

3.

Reassemble aircraft gas turbine engines, to include refitting five of the following:

- 3.1 fan case
- 3.2 compressor module
- 3.3 turbine
- 3.4 front fan
- 3.5 combustor module
- 3.6 gearbox

3.7 exhaust/reheat assembly
3.8 bypass duct

4.

Carry out ten of the following reassembly methods and techniques on the engine being rebuilt:

4.1 cleaning parts/mating faces prior to assembly
4.2 correctly positioning and orienting the modules to be assembled
4.3 fitting gaskets and applying sealant/adhesives
4.4 aligning components
4.5 assembly of components by pressure
4.6 assembly of components by expansion or contraction
4.7 'blue bedding' components (where applicable)
4.8 setting and adjusting replaced components (such as shimming and packing)
4.9 torque setting of bolts, fasteners, clips, sub-assemblies
4.10 electrical bonding of components
4.11 securing components using mechanical fasteners and threaded devices
4.12 applying locking and retaining devices (such as circlips, pins, wire locking, lock nuts, stiff nuts, swage nuts)
4.13 applying protection to openings to prevent entry of contaminating debris

5.

Carry out checks for accuracy, using the correct inspection and testing equipment, to include all of the following:

5.1 dimensions
5.2 alignment
5.3 positional accuracy
5.4 completeness
5.5 freedom of movement
5.6 visual inspection for completeness and freedom from damage or foreign objects
5.7 operating/working clearance
5.8 bearing end float (as applicable)
5.9 `special-to-type' test rig checks
5.10 orientation

6.

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

6.1 job cards
6.2 computer records
6.3 aircraft log books
6.4 engine overhaul logs or reports
6.5 work authorisation documents
6.6 shift handover documentation

7.

Rebuild aircraft gas turbine engine assemblies in compliance with one of the following:

7.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
7.2 extended twin operations procedures (ETOpS) (where appropriate)
7.3 Ministry of Defence (MoD)
7.4 Military Aviation Authority (MAA)
7.5 Aerospace Quality Management Standards (AS)
7.6 Federal Aviation Authority (FAA)
7.7 BS, ISO or BSEN standards and procedures
7.8 customer standards and requirements
7.9 company standards and procedures
7.10 engine manufacturer's requirements

## 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

SEMAE3213

# Rebuilding aircraft gas turbine engine assemblies after overhaul

| | |
|---|---|
| **Developed by** | Enginuity |
| **Version Number** | 3 |
| **Date Approved** | 30 Mar 2021 |
| **Indicative Review Date** | 01 Mar 2024 |
| **Validity** | Current |
| **Status** | Original |
| **Originating Organisation** | Enginuity |
| **Original URN** | SEMAE3213 |
| **Relevant Occupations** | Engineer, Engineering, Engineering and Manufacturing Technologies, Engineering Technicians |
| **Suite** | Aeronautical Engineering Suite 3 |
| **Keywords** | engineering; aeronautical; aircraft; engine; assemblies; gas turbine; rebuild; refit; reassemble; turbo; prop; jet; shaft; fan; ducted; ground turbine start; GTS; exhaust; reheat; combustor; compressor; gearbox |