SEMMME3111

Overhauling piston engines

Overview

This standard identifies the competences you need to carry out a complete overhaul of piston engines, such as naturally or mechanically aspirated two-stroke and four-stroke internal combustion engines or compression ignition engines, in accordance with approved procedures. The piston engine to be overhauled will have been removed from its operating environment, and the overhauling activities will take place in a maintenance environment or manufacturer's workshop.

In carrying out the overhauling operations, you will be required to follow laid-down procedures and to use specific dismantling and rebuilding techniques. The activities will involve removing all ancillary equipment and components, and dismantling the engine down to the various sub-assembly units such as cylinder block, cylinder heads and pistons. You will then strip the various subassemblies down to their component parts and examine the various components for damage and wear, making decisions on which components can be reused and which will need replacing.

You will then be expected to rebuild the engine, which will involve fitting replacement or overhauled sub-assembly units and the replacement of all damaged, worn and `lifed' components. The overhaul 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 overhaul of the piston engine, and to report any problems with the overhauling 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 overhauling activities are 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 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 overhauling techniques and procedures to piston engine assemblies. You will understand the dismantling and

reassembly methods and procedures used, and their application. You will know how the piston engine assembly functions, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the overhauling activities to the required specification. In addition, you will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out the reassembly to the required specification.

You will understand the safety precautions required when carrying out the overhauling activities associated with piston engine assemblies, especially those for lifting, handling and supporting the equipment being removed and replaced. 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 overhauling schedules to carry out the required work
3. establish the components to be removed and, where appropriate, mark components to aid re-assembly
4. ensure that any stored energy or substances are released safely and correctly
5. carry out the overhaul to the agreed level, using the correct tools and techniques
6. ensure that all removed components are correctly identified and stored in the correct location
7. report any instances where the overhauling activities cannot be fully met or where there are identified defects outside the planned overhauling schedule
8. complete the relevant documentation in accordance with organisational requirements
9. dispose of unwanted components, waste materials and substances, in accordance with safe working practices and approved procedures
10. deal promptly and effectively with problems within your control and report those that cannot be solved

Knowledge and understanding

You need to know and understand:

| --- | |

1. how to work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
2. the hazards associated with overhauling piston engines and how to minimise them and reduce any risks
3. the importance of wearing protective clothing (PPE) and other appropriate safety equipment during the overhaul
4. how to obtain and interpret drawings, specifications, manufacturers' manuals, history/maintenance reports, and other documents needed in the overhaul process
5. how to carry out currency/issue checks on the specifications you are working with
6. the quality control procedures to be followed during the overhauling operations
7. the importance for obtaining the correct specification replacement parts, materials and other consumables necessary for the overhaul
8. company policy on the repair/replacement of components during the overhauling process
9. terminology used in piston engines and engine modules
10. the basic principles of how the engine functions, its operating sequence, the working purpose of individual units/components and how they interact
11. the extent to which the equipment is to be dismantled
12. the sequence to be adopted for the dismantling/reassembling of various types of engine assembly
13. the techniques used to dismantle the piston engines without damage to the components or surrounding structure
14. the need to protect the system integrity by ensuring that exposed components are correctly covered/protected
15. how to lift and move large components and assemblies; the methods and equipment used to transport, handle and lift the components during the overhauling activities
16. the need to ensure that lifting and handling equipment is within its current

certification dates
17. methods of checking that components are fit for purpose, how to identify defects and wear characteristics, and the need to replace `lifed' and consumable items
18. the uses of measuring equipment
19. methods of reassembling the piston engine using new or previously overhauled subassemblies
20. how to make adjustments to replaced components/assemblies to ensure that they function correctly
21. the various mechanical fasteners that are used, and their method of removal and replacement
22. the various types of electrical connectors that are used, methods of unlocking, orientation indicators and locating and locking in of the connections
23. the tools and equipment used in the overhauling activities, and how to check that they are in a safe and usable condition
24. the importance of ensuring that all tools are used correctly and within their permitted operating range
25. the importance of ensuring that all tools, equipment and components are accounted for and returned to their correct location on completion of the overhauling activities
26. the procedure for the safe disposal of waste materials
27. the need to complete overhauling documentation and/or reports following the overhauling activity
28. the problems that can occur during the stripping and rebuilding activity, and how they can be overcome
29. the extent of your own authority and to whom you should report if you have a problem that you cannot resolve

Scope/range related to performance criteria

| --- | |

1. Carry out all of the following during the overhaul of the piston engine:
   1.1 obtain and use the appropriate documentation for the overhauling activities
   1.2 adhere to procedures or systems in place for risk assessment, 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 work area
   1.4 ensure all oils, fluids and fuel have been drained/removed before breaking into the system (where applicable)
   1.5 ensure that the engine assembly is suitably supported, and that appropriate lifting and handling equipment is available
   1.6 carry out the overhauling activities, following good practice/approved procedures
   1.7 ensure that components and surrounding structures are maintained free from damage and foreign objects
   1.8 return all tools and equipment to the correct location on completion of the activities
   1.9 leave the work area in a clean and safe condition on completion of the activities
   1.10 leave the engine in a condition ready for testing
2. Carry out the overhaul of one of the following types of piston engine:
   2.1 two-stroke internal combustion engine
   2.2 compression ignition engine
   2.3 four-stroke internal combustion engine
3. Carry out all of the following activities on the engine being overhauled:
   3.1 cleaning parts prior to dismantling
   3.2 carrying out pre-disassembly checks
   3.3 supporting the equipment to be removed
   3.4 draining/removing any remaining fluids
   3.5 disconnecting and removing wires/cables and attaching suitable cable identification markers
   3.6 applying protection to openings to prevent entry of contaminating debris
   3.7 proof-marking/labelling of components to aid reassembly
   3.8 disconnecting and removing pipework
   3.9 removing all ancillary components
   3.10 dismantling equipment to unit/sub-assembly level
   3.11 dismantling units to component level
   3.12 replacing all damaged or defective components

3.13 replacing all `lifed' and consumable items (such as seals, bearings, locknuts)
3.14 lapping in of components (such as valves, bearings) where appropriate
3.15 re-assembling components to sub-assembly level
3.16 re-assembling sub-assemblies to unit level
3.17 applying correct lubrication during assembly
3.18 applying gaskets and sealant/adhesives
3.19 setting and adjusting replaced components(such as liner protrusion, crankshaft float)
3.20 securing components using mechanical fasteners and threaded devices (such as nuts, bolts, circlips, pins)
3.21 tightening fastenings to the required torque
3.22 applying bolt locking methods (such as split pins, wire locking, lock nuts, stiff nuts, swage nuts)

4. Rebuild piston engines, to include fitting seventeen of the following:
4.1 cylinder block
4.2 connecting rods
4.3 balancing mechanisms
4.4 gearbox (where applicable)
4.5 camshaft assemblies
4.6 sensing devices
4.7 cylinder liners
4.8 timing mechanisms
4.9 shims
4.10 cylinder heads
4.11 injector mechanisms
4.12 inlet manifolds
4.13 crank shafts
4.14 seals and gaskets
4.15 exhaust manifolds
4.16 fly wheel
4.17 pulleys and sprockets
4.18 pipe fittings/connectors
4.19 torque converters
4.20 belt, chains and gears
4.21 filters
4.22 clutch assembly
4.23 levers and linkages
4.24 spark plugs/heaters
4.25 pistons and rings
4.26 bearings(such as shell, ball and race, thrust)
4.27 pumps (such as pressure, scavenge, fuel, oil, water)
4.28 charging/starting components (such as alternators, starter motors, solenoids, magnetos)
4.29 valve mechanisms (such as valves, guides, springs, collets)
4.30 mechanical fasteners and mounting studs
4.31 other specific components

5. Carry out checks and tests during the rebuilding of the engine, to include eight of the following:
    5.1 orientation
    5.2 timing (such as valve, ignition, fuel injection)
    5.3 alignment
    5.4 operating/working clearance (such as valves)
    5.5 freedom of movement
    5.6 belt/chain tension
    5.7 end float (such as crankshaft, camshaft, bearing)
    5.8 torque loading of bolts
    5.9 gear backlash
    5.10 visual inspection for completeness and freedom from damage or foreign objects
    5.11 cylinder liner protrusion
    5.12 checking for system blockages (such as oil, fluid and airways)
6. Overhaul piston engines in compliance with one of the following:
    6.1 BS, ISO or BSEN standards and procedures
    6.2 customer standards and requirements
    6.3 company standards and procedures
    6.4 engine manufacturer's requirements

SEMMME3111

Overhauling piston engines

Developed by	Enginuity
Version Number	3
Date Approved	30 Mar 2023
Indicative Review Date	31 Mar 2028
Validity	Current
Status	Original
Originating Organisation	Enginuity
Original URN	SEMMME3111
Relevant Occupations	Engineering, Engineering and Manufacturing Technologies, Engineering Technicians
Suite	Mechanical Manufacturing Engineering Suite 3
Keywords	Mechanical engineering; overhaul; piston engine; two stroke; four stroke; internal combustion; compression ignition; orientation; alignment; freedom of movement; end float; gear backlash; system blockage; timing; clearance; belt tension; chain t