SEMAUT3140

Stripping and rebuilding prototype engines for test

Overview

This standard identifies the competences you need to strip down, examine and rebuild prototype engines, in accordance with approved procedures. The engine to be dismantled and rebuilt will have been previously subjected to test activity either in vehicle on static test, in a vehicle on road test or on a dynamometer. The activities will take place in a workshop environment linked to the test facility. In carrying out the stripping and rebuilding operations, you will be required to follow laid-down procedures and 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 sub-assemblies down to their component parts and examine the various components for damage and wear. You will measure specific component dimensions so that data analysis can be carried out. You will then be expected to rebuild the engine, which will involve fitting the majority of the original components (such as cylinder block, piston assemblies, cylinder heads, torque converters, oil pump) so that the test can resume and further data can be collected. The stripping and rebuilding activities will include making all necessary checks and adjustments to ensure that components are correctly replaced, positioned, aligned, adjusted, torque loaded and fastened, and that the correct sealants are used.

Your responsibilities will require you to comply with organisational policy and procedures for the stripping and rebuilding of the prototype vehicle engine, and to report any problems with the 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 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 as a member of a team, 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. Where team working is involved, you must demonstrate a significant personal contribution during the team activities in order to satisfy the requirements of the standard, and competence in all the areas required by the standard must be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying appropriate stripping and rebuilding techniques and procedures to prototype vehicle engines. You will understand the dismantling and reassembly methods and procedures used, and their application. You will know how the engine functions, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the activities. 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 stripping and rebuilding activities associated with prototype vehicle engines, 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 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 stripping and rebuilding activities to overhaul the engine 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. deal promptly and effectively with problems within your control and report those that cannot be solved
9. ensure that work records are completed, stored securely and available to others, as per organisational requirements
10. leave the work area in a safe condition on completion of the activities, as per organisational and legal requirements

Knowledge and understanding

You need to know and understand:

1. the specific safety precautions to be taken whilst carrying out the activities (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 and the activities, and the responsibility these requirements place on you
3. the hazards associated with the activities, and how to minimise them and reduce risks
4. the personal protective equipment and clothing (PPE) to be worn during the activities
5. how to obtain and interpret drawings, specifications, manufacturers' manuals, history/maintenance reports, and other documents needed in the stripping and rebuilding process
6. how to carry out currency/issue checks on the specifications you are working with
7. the quality control procedures to be followed during the stripping and rebuilding operations
8. the importance for obtaining the correct specification replacement parts, materials and other consumables necessary for the stripping and rebuilding
9. company policy on the repair/replacement of components during the stripping and rebuilding process
10. terminology used in prototype engines and engine modules
11. the basic principles of how the engine functions, its operating sequence, the working purpose of individual units/components and how they interact
12. the extent to which the equipment is to be dismantled
13. the sequence to be adopted for the dismantling/reassembling of various types of engine assemblies
14. the techniques used to dismantle the prototype vehicle engines without damage to the components or surrounding structure (suh as release of energy (pressures/force), draining of fluids, making electrical disconnections, proof-marking components to aid reassembly, removing assemblies requiring pressure/force, removing mechanical locking and securing mechanisms/devices), and 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 dismantling 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' items (filters, seals and gaskets)
18. the uses of measuring equipment (micrometers, Verniers, expansion indicators and other measuring devices)
19. methods of reassembling the prototype engine using new or previously overhauled subassemblies (such as replacing assemblies requiring pressure/force, ensuring correct orientation and location of subassemblies, replacing mechanical locking and securing mechanisms/devices, reconnecting pipes and electrical connectors)
20. how to make adjustments to replaced components/assemblies to ensure that they function correctly (checking alignment, balancing of rotating components (flywheels and torque converters), setting working clearance, setting travel, and pre-loading bearings)
21. the various mechanical fasteners that are used, and their method of removal and replacement (including rivets, threaded fasteners, special securing devices)
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, tested 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 problems that can occur during the stripping and rebuilding activity, and how they can be overcome
27. the extent of your own authority and to whom you should report if you have a problem that you cannot resolve
28. how to access, use and maintain information to comply with organisational requirements and legislation

Scope/range related to performance criteria

1.

Strip and rebuild the prototype vehicle engine, carrying out all of the following:

1.1 obtain and use the appropriate documentation (such as job instructions, engine manuals/drawings, vehicle manuals, specifications, quality control and other related documentation)
1.2 adhere to procedures or systems in place for risk assessment, hazardous substances, 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, and ensure that any appropriate environmental conditions can be met
1.4 ensure that all oils, fluids and fuel have been drained/removed before breaking into the system
1.5 ensure that the engine is suitably supported and that appropriate lifting and handling equipment is available
1.6 carry out the stripping and rebuilding activities, using appropriate techniques and 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 stripping and rebuilding of one of the following types of prototype vehicle engine:

2.1 petrol vee
2.2 diesel vee
2.3 hybrid (such as electric, LPG)
2.4 petrol inline
2.5 diesel inline
2.6 rotary

3.

Dismantle the prototype engine, to include removing seventeen of the following:

3.1 cylinder blocks
3.2 pistons and rings
3.3 seals and gaskets
3.4 gearboxes
3.5 connecting rods
3.6 sensing devices
3.7 cylinder liners

3.8 timing mechanisms
3.9 shim buckets and shims
3.10 cylinder heads
3.11 injector mechanisms
3.12 levers and linkages
3.13 crank shafts
3.14 pulleys and sprockets
3.15 inlet manifolds
3.16 fly wheels
3.17 belt, chains and gears
3.18 pipe fittings/connectors
3.19 torque converters
3.20 balancing mechanisms
3.21 filters
3.22 camshaft assemblies
3.23 bearings (such as shell, ball and race, thrust)
3.24 pumps (such as pressure, scavenge, fuel, oil, water)
3.25 charging/starting components (such as alternators, starter motors, solenoids, magnetos)
3.26 valve mechanisms (such as valves, guides, springs, collets)
3.27 mechanical fasteners and mounting studs

4.

Carry out all of the following activities on the equipment being stripped and rebuilt:

4.1 pre-disassembly checks
4.2 disconnecting and removing wires/cables and attaching suitable cable identification markers
4.3 disconnecting and removing pipework
4.4 setting and adjusting replaced components (such as liner protrusion, crankshaft float)
4.5 removing all ancillary components
4.6 dismantling equipment to unit/sub-assembly level
4.7 supporting the equipment to be removed
4.8 dismantling units to component level
4.9 lapping in of components (such as valves, bearings), where appropriate
4.10 re-assembling sub-assemblies to unit level
4.11 earth bonding of components
4.12 proof-marking/labelling of components to aid reassembly
4.13 applying gaskets and sealant/adhesives
4.14 replacing all `lifed' items (such as seals, bearings, locknuts)
4.15 tightening fastenings to the required torque
4.16 replacing all damaged or defective components
4.17 re-assembling components to sub-assembly level
4.18 securing components using mechanical fasteners and threaded devices (such as circlips, pins)
4.19 applying bolt locking methods (such as split pins, wire locking, lock nuts, stiff nuts, swage nuts)

5.

Inspect all removed components for wear and serviceability, using appropriate instrumentation, to include checking ten of the following:

5.1 cylinder head for flatness, signs of damage and condition of valve seats and guides
5.2 cylinder bores/liners for size/wear/distortion
5.3 crankshaft bearings and journals for size/wear
5.4 camshaft bearings and cam lobes for size/wear
5.5 pistons for cracks, detonation, scoring, ring grooves for wear/damage
5.6 connecting rods for small and big end bearing wear, and freedom from twisting and heat damage
5.7 valves for pitting, cracks and valve stem wear
5.8 flywheel for wear to clutch face, and starter ring gear for damage to teeth
5.9 chain/belt mechanisms for wear to drive teeth
5.10 pumps for damage and excessive movement in bearings
5.11 valve springs for height/tension and signs of damage
5.12 clutch assembly for wear to pressure plate and drive plate(s), release bearing for wear/damage
5.13 pipes for damage and hoses for cuts, cracks and general deterioration
5.14 oil galleries for blockages
5.15 crankshafts, flywheels, connecting rods, pistons for balance
5.16 transfer port alignment
5.17 manifolds for cracks/leakage
5.18 cylinder block for flatness
5.19 power valves/reed valves for wear and damage

6.

Rebuild prototype engines, to include fitting seventeen of the following:

6.1 cylinder blocks
6.2 seals and gaskets
6.3 gearboxes
6.4 pulleys and sprockets
6.5 cylinder liners
6.6 belt, chains and gears
6.7 cylinder heads
6.8 levers and linkages
6.9 crank shafts
6.10 balancing mechanisms
6.11 fly wheels
6.12 sensing devices
6.13 torque converters
6.14 shim buckets and shims
6.15 pistons and rings
6.16 inlet manifolds
6.17 connecting rods
6.18 pipe fittings/connectors
6.19 camshaft assemblies
6.20 filters

6.21 timing mechanisms
6.22 injector mechanisms
6.23 bearings (such as shell, ball and race, thrust)
6.24 pumps (such as pressure, scavenge, fuel, oil, water)
6.25 charging/starting components (such as alternators, starter motors, solenoids, magnetos)
6.26 valve mechanisms (such as valves, guides, springs, collets)
6.27 mechanical fasteners and mounting studs

7.

Carry out inspections and tests during the rebuilding of the engine, to include eight of the following:

7.1 orientation
7.2 timing (such as valve, ignition, fuel injection)
7.3 alignment
7.4 operating/working clearance (such as valve)
7.5 freedom of movement
7.6 belt/chain tension
7.7 end float (such as crankshaft, camshaft, bearing)
7.8 torque loading of bolts
7.9 gear backlash
7.10 visual inspection for completeness and freedom from damage or foreign objects
7.11 cylinder liner protrusion
7.12 checking for system blockages (such as oil and airways)

8.

Check overhauled prototype vehicle engines comply with one of the following:

8.1 current industry standards, codes of practice and procedures
8.2 customer standards and requirements
8.3 engineer developed procedures
8.4 specific engine requirements

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