
Overview

This standard identifies the basic competences that you need to re-build a motorsport engine in a recognised sequence and to a high standard, prior to a competition. It will prepare you for entry into the motorsport sector, creating a progression between education and employment, or it will provide a basis for the development of additional skills and occupational competences in the working environment.

The activities will involve the dismantling and removal of components, inspection and checking for faults, excessive wear and potential problems, replacement of components, and rebuilding the engine using hand tools, specialist tools and test equipment, in accordance with approved procedures. It covers motorsport engines fitted into motorsport vehicles such as single seater, rally cars, sports cars, karts, historic vehicles, motorcycles and other specific approved competition vehicles.

The stripping and re-building activities will include carrying out all necessary safety activities, to lift and support the engine and its ancillary components. You will need to lift and remove the engine from any transportation containers and place it onto an approved holding device, ready for removing all ancillary components and the stripping and rebuilding of the engine. You will need to ensure that all removed components are stored safely, prior to inspection and re-building. You will also be expected to use recognised methods for crack testing ferrous and non-ferrous materials/components, and to be able to inspect a motorsport engine within the team's or organisation's guidelines.

Your responsibilities will require you to comply with recognised procedures for the stripping and rebuilding activities undertaken, to take account of any potential difficulties or problems that may arise, and to seek appropriate help and advice in determining and implementing a suitable solution. You will be expected to work with either a high level of supervision or as a member of a team. 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.

On completion of the activities, you must show that you can competently clean the work area that you are responsible for, including tidying up bays or garages to a standard that will reflect the professional image of the team. You must show that you can use and maintain the tools and equipment needed for the stripping and rebuilding activities, and return them to their recognised storage area ready for further use.

Your underpinning knowledge will be sufficient to provide a broad understanding of your work, and will enable you to apply the appropriate stripping, inspection and rebuilding procedures. You will know how the equipment functions, the common faults that can occur, the purpose of the individual components and associated defects, in adequate depth to carry out the stripping and rebuilding activities, correct faults and to ensure that the equipment is replaced to the required standard. You will also have

sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications.

You will understand the safety precautions required when carrying out the stripping and rebuilding activities, especially those for lifting and supporting 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.

Performance criteria

You must be able to:

1. work safely at all times, complying with health and safety legislation, regulations, directives and other relevant guidelines
2. obtain all the information you need for the motorsport engine stripping and re-building activities to be carried out
3. establish and, where appropriate, mark component orientation for re-assembly
4. ensure that the motorsport engine is correctly mounted in the correct work area
5. carry out the engine stripping and re-building activities, within the limits of your personal authority
6. remove and replace the required components, using approved tools and techniques
7. take suitable precautions to prevent damage to components and surrounding systems.
8. report any instances where the engine stripping and re-building activities cannot be fully met, or where there are identified defects outside the planned activities
9. complete the relevant documentation, in accordance with organisational requirements
10. label and store (in an appropriate location) components that require repair or overhaul
11. dispose of waste materials and scrap components, in accordance with safe working practices and approved procedures

Knowledge and understanding

You need to know and understand:

1. the specific safety practices and procedures that you need to observe when stripping and rebuilding motorsport engines and when using lubricants and fluids (including lifting and handling techniques; safe working practices with regard to dismantling motorsport vehicles; procedures which satisfy current regulations - such as HASAWA, COSHH, PUWER and other related legislation and guidelines)
2. the hazards associated with stripping and re-building motorsport engine components, and with the tools and equipment used (such as the safe support of the engine at the correct working height and position, the safe release of fuel and other liquids, misuse of tools), and how they can be minimised
3. the protective equipment that you need to use for both personal protection (PPE) and protection of the engine
4. the importance of good housekeeping within the working area (such as leaving the work area free of debris and used materials, cleaning and maintaining tools and equipment, returning equipment to designated storage area, leaving the work area in a safe and tidy condition), and of good personal presentation to ensure quality representation of the team or organisation
5. preparations to be carried out on the engine (such as removing transportation containers, cleaning away dirt, dust, oil or track debris; making visual checks of the systems and components for obvious signs of damage or excessive wear - such as leaking coolant or oil, chafing, cracks, excessive clearances; ensuring suitable storage space is readied once the systems have been removed from the engine and providing suitable containers for the storage of fasteners and other small components)
6. how to use and extract information from motorsport engine building documentation (such as engine manuals, system diagrams, engineering drawings, engineer's records)
7. the importance of ensuring that you use the correct and up-to-date documentation
8. the techniques used to remove components from motorsport engines without damage to the components or surrounding systems (such as release of spring pressures/force, draining of fluids, proof marking, extraction of components and the need to protect the system integrity by fitting blanking plugs to exposed pipes)
9. how to use a range of hand tools (such as spanners, sockets, screwdrivers, punches, drifts) to remove a range of components (such as studs, pins, circlips, seals and gaskets, bearings, gears), and how to use release agents to help free joined parts where seizure or damage may have occurred
10. the various mechanical fasteners to be removed and replaced, and

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- their method of removal and replacement (such as threaded fasteners, special securing devices)
11. the various types of electrical connectors that are used, methods of unlocking, orientation indicators and locating and locking-in of connections
 12. methods of lifting, handling and supporting the components/equipment during the stripping and re-building activities
 13. methods of checking the components for damage or wear (using visual methods, measurements, and crack detection techniques)
 14. the need to use new components where checks during stripping revealed such needs; fitting together new or prototype components where a degree of initial fitting may be needed (such as filing, fettling, reaming, tapping, shimming, polishing and adjusting to achieve the required assembly specification); sealing and securing components (such as using nuts, bolts and associated fasteners, rivets, circlips, sealants and locking compounds); checking for correctness of fit and accuracy at critical stages during the rebuild and on completion of the assembly
 15. how to make adjustments to components/assemblies to ensure that they function correctly (such as travel and working clearance, timing and sequence)
 16. why securing devices need to be tightened to the correct torque and locked, and the different methods used
 17. the tools and equipment used in the engine stripping and re-building activities, and their calibration/care and control procedures, and the need to control and account for all tools and equipment used during the stripping and re-building activities
 18. how to deal with problems (such as what to do when components are damaged or worn in some way, the correct equipment or parts not available, components do not come apart as readily as expected)
 19. 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
 20. the procedure for the safe disposal of waste materials, scrap components, contaminated oil and fuel
 21. when to act on your own initiative and when to seek help and advice from others
 22. the importance of leaving the work area and equipment in a safe and clean condition on completion of the stripping and rebuilding activities (such as returning tools and equipment to the designated location, cleaning the work area, and removing and disposing of waste)

Scope/range related to performance criteria

1. Carry out **all** of the following in preparation for the stripping and rebuilding of the motorsport engine:
 1. remove engine from its transportation container, and remove dirt, oil and track debris from engine externals
 2. visual check for damage and wear to engine externals
 3. mount the engine on the correct mounting stand
 4. drain all coolants and lubricants from the engine
 5. obtain all stripping and re-building documentation, prior to disassembly
 6. obtain suitable storage bins for the removed components
2. Use **three** of the following to aid the stripping and rebuilding of the motorsport engine:
 1. system diagrams
 2. engine strip check sheets
 3. engineering drawings
 4. lifting records
 5. engineer's records
 6. engine re-build sheets
3. Rebuild engines for **one** of the following types of motorsport vehicle:
 1. single seater
 2. karts
 3. motorcycles (such as circuit and off-road)
 4. rallying
 5. historic
 6. sports cars
 7. other specific approved competition vehicle
4. Carry out **eleven** of the following stripping and rebuilding activities:
 1. removing covers and cowlings
 2. disconnecting and removing hoses and pipes
 3. disconnecting electrical connections
 4. proof marking/labelling of components to aid reassembly
 5. separation of components by means of removing mechanical fasteners (such as nuts, bolts, circlips, quick-release fasteners, rivets)
 6. inspecting components for damage and wear, and identifying all components and fasteners that require replacement.
 7. arranging and storing components in a manner that makes re-

- assembly as straightforward as possible
- 8. labelling (and storing in the correct location) components that require repair or overhaul
- 9. replacing damaged/defective and 'lived' components
- 10. reassembly of components, using mechanical fastening devices (such as nuts, bolts, quick-release fasteners, circlips, rivets)
- 11. checking of bearing clearances (such as using engineer's blue or compressible strip)
- 12. lapping in valves and valve seats
- 13. replacement of sealing devices (such as 'O' rings, seals, gaskets, sealing compounds)
- 14. torque setting cylinder-head bolts, in the correct sequence
- 15. positioning, aligning, setting, and adjusting replaced components (such as valve spring heights, cam timing, ring gaps, torque angles)
- 16. tightening fastenings to the required torque, and applying bolt locking methods (such as split pins, wire locking, lock nuts, engineering adhesives)

5. Remove and refit motorsport engine components from **three** of the following areas:

- 1. engine ancillary components (such as exhaust primaries and silencers, airboxes, engine mounts, filters)
- 2. clutch (such as clutch covers, driven plates, thrust bearings)
- 3. cam timing (such as pulleys, belts, gears, adjusters)
- 4. electrical (such as generation, ignition, engine management, data control boxes, ECUs, wiring looms)
- 5. system components (such as sensors, regulators, safety devices, gauges)

Plus assist in the stripping and re-building of motorsport engine components from three of the following areas:

- 6. cylinder head (such as valves, valve springs, valve spring heights, rockers, valve stem seals, spark plugs)
- 7. engine block (such as crankshafts, connecting rods, pistons, rings, main bearings, big end bearings)
- 8. lubrication system (such as oil pumps, oil filters, scavenge pumps, oil tanks, pressure relief valves)
- 9. fuel system (such as carburettors, fuel pumps, fuel filters, metering units, fuel rails, pressure relief valves)

6. Carry out **three** of the following inspection and testing techniques:

- 1. ferrous metal crack detection
- 2. sensory testing (such as sight, sound, smell or touch)
- 3. non-ferrous crack detection
- 4. connecting and setting engine to dynamometer installation

5. mechanical measurements

Plus **two** more of the following test procedures:

6. compression testing
7. ignition timing
8. leak down cylinder leakage testing
9. electrical charging tests
10. carburettor vacuum testing
11. other specific tests

7. Strip and re-build motorsport engine equipment and components, in compliance with **one** of the following standards:

1. BS or ISO standards and procedures
2. vehicle manufacturer's specification
3. customer standards and requirements
4. team/company standards and procedures
5. specific engine system requirements

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

1. post-competition stripdown sheets
2. engineer's/team's records
3. engine re-build sheet
4. formal risk assessment

Behaviours

Additional Information

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

SEMPEO260

Stripping and rebuilding motorsport engines (pre-competition)



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