



SURFACE VEHICLE RECOMMENDED PRACTICE

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Performance Engine Building Recommended Practices

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Foreword—The practice of building and rebuilding gasoline and diesel engines has been around since the introduction of the first automobile. Since then, the procedures have been refined and updated to keep pace with present day technology.

This document is aimed at those individuals building an engine to tolerances other than intended by the original equipment manufacturer in order to achieve greater horsepower, durability, and comply with applicable emissions standards, while developing a minimum of one horsepower per cubic inch.

Assumption—The components being used are of a fit for purpose design, based upon the degree of service. It must also be understood that the individual choosing these parts is well versed in the application of these parts for the intent in which the engine is meant.

1. **Scope**—This SAE Recommended Practice applies to the function of building reciprocating spark-ignition engines which are used in conjunction with standard and high-performance ancillary components in applications intended to achieve a minimum of 1 hp/in³.

This document does not apply to rebuilt engines which may only be partially repaired with little or no machining, nor does it apply to second-hand or used engines.

2. **References**—Once completed, the entire document will be contained in this document. Presently several additions need to be made.

3. **Definitions**—For the purpose of this document, the definitions following apply.

- 3.1 **Short-Block Assembly**—A cylinder block and all those components contained within the limits of the block deck or decks, the pan rail, the block rear face, and the timing cover, where fitted, including bearings, crankshaft, camshaft and lifter assemblies, connecting rods, pistons assemblies, timing components, oil pump and drive assembly, oil pump pickup screen, oil pan, damper, and flywheel.

- 3.2 **Cylinder Head Assembly**—A cylinder head fitted with guides, seals, valves and associated springs, shims, cups, retainer assemblies and on overhead camshaft cylinder heads (OHC), camshaft, camshaft bearings, lash adjusters, tappets, and rockers.

- 3.3 **Long-Block Assembly**—A short-block assembly together with a cylinder head assembly and all those components fitted within the rocker or cam cover, and timing cover presented as an assembly.

3.4 Complete Engine Assembly—A long-block assembly together with all of the components required to dynamometer test the engine to simulate the final operating environment.

3.5 Performance Built—Describes an engine which has been:

Dismantled, cleaned, inspected, i.e., crack testing, pressure testing, or visual examination, whichever is applicable;

All components have been inspected, and machined when necessary to achieve the proper dimensions and finishes per the practices and specifications as presented or referenced in this document;

New parts, as defined in this document, have been installed as required after inspection for fit-for-purpose; and

The engine has been assembled to appropriate clearances and component manufacturer's specified fastener tightening procedures.

3.6 Fit-for-Purpose—A component or procedure that fits the intended performance level and application.

3.7 Reclaimed Components—A component which has been found to be within specifications and can demonstrate fitness for purpose for the intended application.

3.8 Replacement Components—Replacement components are defined as items which are sourced from manufacturers or suppliers who can demonstrate fitness for purpose and who can support their products.

3.9 Shall—Indicates that a statement is mandatory.

3.10 Should—Indicates a recommendation.

3.11 Inspection—Non-destructive testing and measurement, including all new replacement components as well as all reclaimed components.

4. Short Block

4.1 Cylinder Block—Cylinder block shall be disassembled, all bearings, oil and water galley plugs removed, and thoroughly cleaned inside and out.¹ The cylinder block, including all threaded holes, shall be inspected as appropriate to ensure suitability.

4.1.1 Main-bearing caps shall be checked for fit and all main-bearing bores shall be measured for size, checked for roundness, taper and alignment, and remachined if required to ensure the correct fit of the replacement bearings. Thrust locations shall be checked and if out of tolerance, machined as required. Seal locations shall be checked and if out of tolerance, machined as required.

4.1.2 Camshaft bearing bores shall be measured for size, checked for roundness, taper, location and alignment, and remachined if required to ensure correct fit of the replacement bearings or oversize journal service camshaft.

4.1.3 Camshaft lifter bores shall be measured for size, checked for roundness, location, alignment, and taper. Remachine if required to ensure correct fit of the lifter assembly and valve event timing.

1. A complete document on up-to-date cleaning procedures and required equipment.