Engine Terminology and Nomenclature—General—SAE J604d

SAE Recommended Practice
Completely Revised June 1979

THIS IS A PREPRINT WHICH IS SUBJECT TO REVISIONS AND CORRECTIONS. THE FINAL VERSION WILL APPEAR IN THE 1980 EDITION OF THE SAE HANDBOOK.

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ENGINE TERMINOLOGY AND NOMENCLATURE—GENERAL—SAE J604d

SAE Recommended Practice

Report of Engine Committee approved May 1958 and completely revised June 1979.

1. This SAE Recommended Practice is applicable to all types of reciprocating engines including two-stroke cycle and free piston engines, and was prepared to facilitate clear understanding and promote uniformity in nomenclature.

Modifying adjectives in some cases were omitted for simplicity. However, it is good practice to use adjectives when they add to clarity and understanding.

2. Geometry Terminology

2.1 Compression Ratio = $\frac{\text{Maximum cylinder volume}}{\text{Minimum cylinder volume}}$

2.2 Valve or Port Areas—Full open areas measured immediately adjacent to the cylinder.

EXAMPLE: For poppet valves

Area = (π) X (head outer diameter) X (full lift)

EXAMPLE: For rectangular port in the cylinder wall

Area = (height at cylinder surface) X (width, developed at cylinder surface)

2.3 Valve or Port Timing—Geometric positions at which ports or valves open or close.

2.4 Top Center—The geometric position at which piston motion reverses direction and the cylinder volume is at, or near, a minimum.

2.5 Bottom Center—The geometric position at which piston motion reverses direction and the cylinder volume is at, or near, a maximum.

2.6 Combustion Chamber Surface-to-Volume Ratio[1]—Area of chamber divided by volume at top center. Fig. 1 illustrates the surface area and the volume of a typical combustion chamber. Figs. 2–4 and the following list define the chamber area in detail:

Include:

1. Head cavity area.
2. Head flat or quench area within head gasket outline.
3. Cylinder block top surface area within head gasket outline.
4. Side area of head gasket outline.
5. Valve side areas, including cylindrical side of valve head and that part of the face projecting into the chamber.
6. Valve head surface area.
7. Piston top surface area.
8. Piston top ring land area.
9. Area of top surface of top piston ring exposed between top land diameter and cylinder bore diameter.
10. Cylinder bore surface area above top ring.
11. Spark plug cavity area.

Exclude:

1. Area behind top ring.
2. Gasket area inside first bead.
3. Chamfer less than 0.040 in (1 mm).

3. Performance Terminology

3.1 Delivery Ratio[2,3] = $\frac{\text{Mass of delivered air}}{\text{Displaced volume X Ambient density}}$

3.2 Delivered Air-Fuel Ratio = $\frac{\text{Mass of delivered air}}{\text{Mass of delivered fuel}}$

3.3 Trapped Air-Fuel Ratio = $\frac{\text{Mass of delivered air retained}}{\text{Mass of delivered fuel retained}}$

3.4 Trapping Efficiency[2] = $\frac{\text{Mass of delivered air retained}}{\text{Mass of delivered air}}$

3.5 Scavenging Efficiency[2] = $\frac{\text{Mass of delivered air retained}}{\text{Mass of trapped cylinder charge}}$

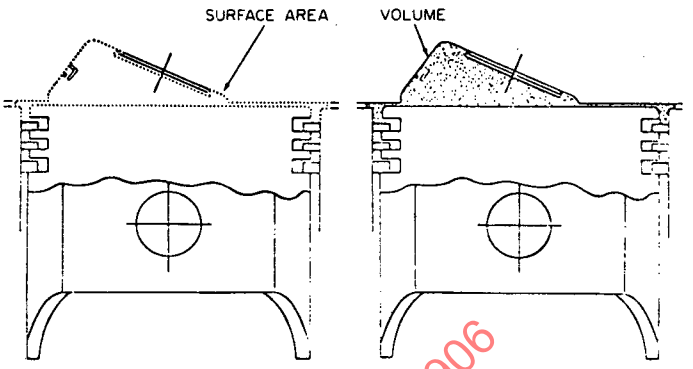

FIG. 1 — TYPICAL COMBUSTION CHAMBER

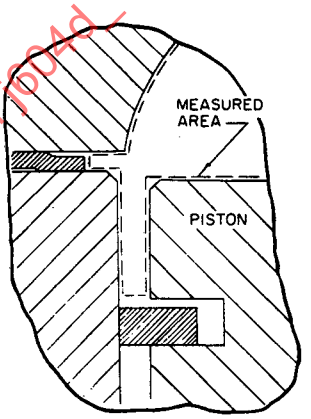

FIG. 2 — HEAD GASKET AND TOP RING LAND AREA

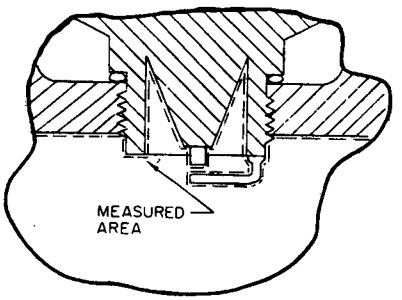

FIG. 3 — SPARK PLUG AREA

[1] A major source of unburned hydrocarbons in the exhaust gas of spark ignition engines is the quenching of the flame by the relatively cold combustion chamber walls. A useful way to compare different engine designs as to their potential for low exhaust emission values is to compare their combustion chamber surface-to-volume ratios.

[2] If scavenging is done with air-fuel mixture (example given, carburetor engine) "mixture" is to be substituted for "air" and "Mixture density at ambient pressure and temperature" is to be substituted for "Ambient density".

[3] When ambient density is unknown, the density of dry air at standard atmosphere (0.0764 lb/ft^3) (1.2238 kg/m^3) is to be used.

The ϕ symbol is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. If the symbol is next to the report title, it indicates a complete revision of the report.