SAE International

SURFACE VEHICLE RECOMMENDED PRACTICE

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Engine Terminology and Nomenclature - General

RATIONALE

The technical report covers technology, products, or processes which are mature and not likely to change in the foreseeable future.

STABILIZED NOTICE

This document has been declared "Stabilized" by the SAE Powertrain Systems Group and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist.

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Foreword—This Reaffirmed Document has been changed only to reflect the new SAE Technical Standards Board Format.

1. Scope—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. References—There are no referenced publications specified herein.

3. Geometry Terminology

3.1

$$\text{Compression Ratio} = \frac{\text{Maximum cylinder volume}}{\text{Minimum cylinder volume}} \qquad \text{(Eq. 1)}$$

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

Example: For poppet valves

$$\text{Area} = (\pi) \times (\text{head outer diameter}) \times (\text{full lift}) \qquad \text{(Eq. 2)}$$

Example: For rectangular port in the cylinder wall

$$\text{Area} = (\text{height at cylinder surface}) \times (\text{width, developed at cylinder surface}) \qquad \text{(Eq. 3)}$$

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

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

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

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

a. 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 piston ring exposed between top land diameter and cylinder bore diameter
10. Cylinder bore surface area above top ring
11. Spark plug cavity area

b. Exclude:

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

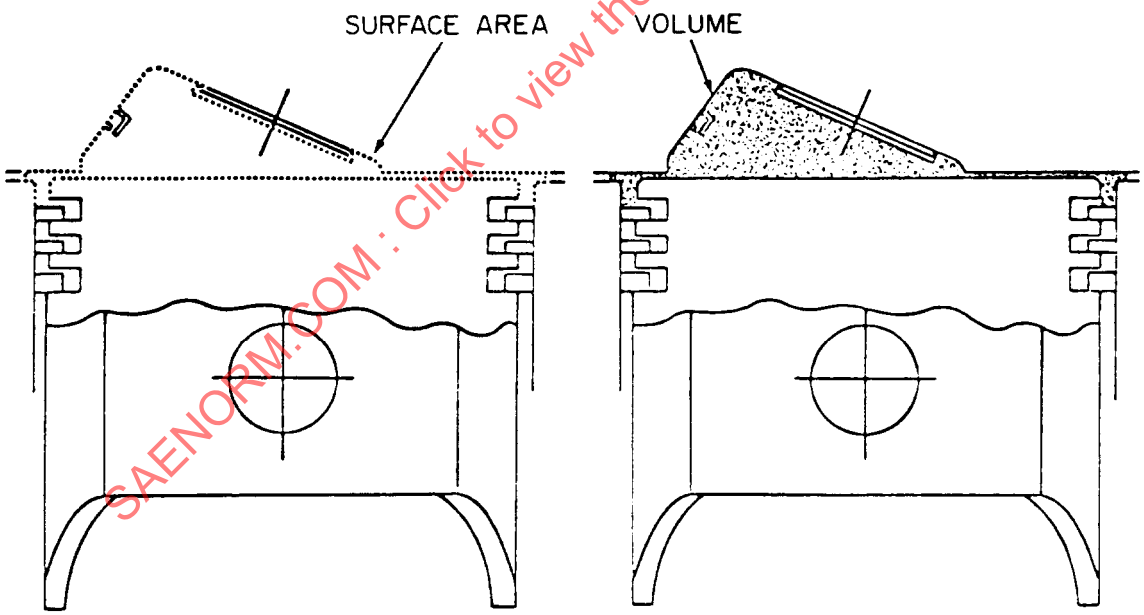

FIGURE 1—TYPICAL COMBUSTION CHAMBER

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.

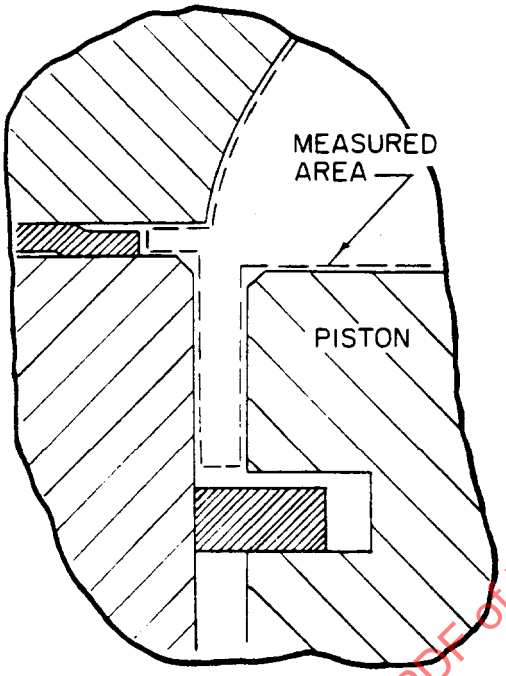

FIGURE 2—HEAD GASKET AND TOP RING LAND AREA

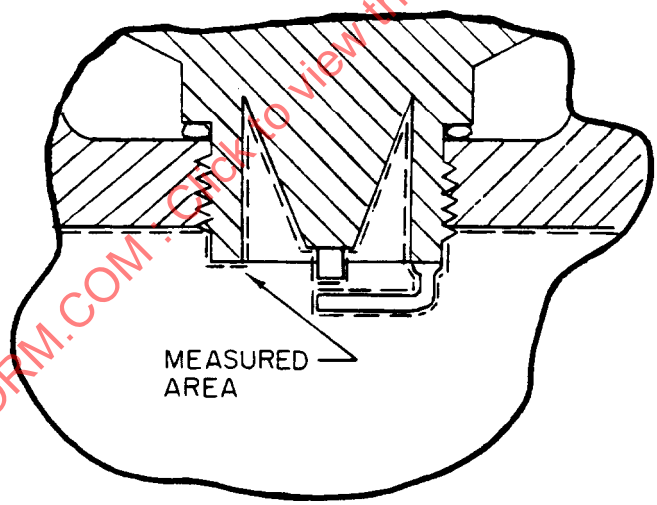

FIGURE 3—SPARK PLUG AREA

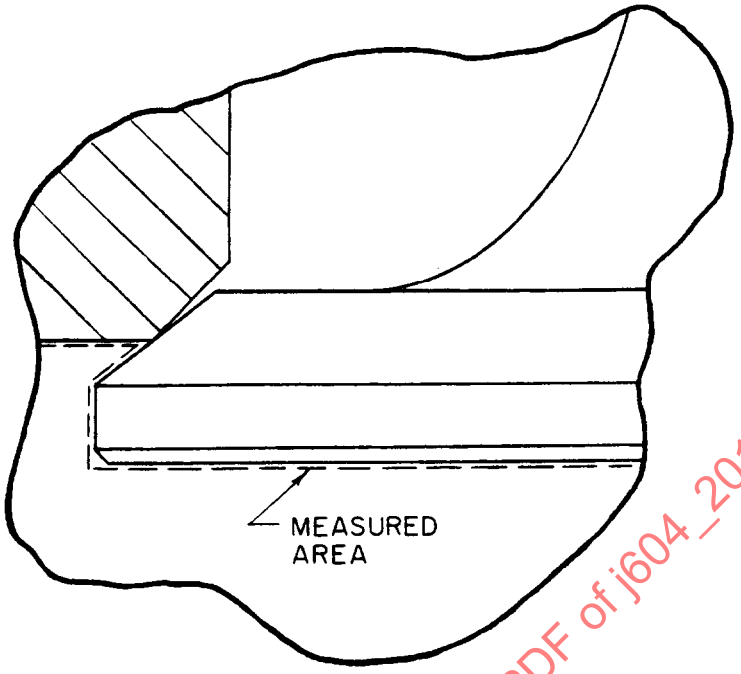

FIGURE 4—VALVE AREA

4. *Performance Terminology*

4.1 See Equation 4.[2,3]

$$\text{Delivery Ratio} = \frac{\text{Mass of delivered air}}{\text{Displaced volume} \times \text{Ambient density}} \quad \text{(Eq. 4)}$$

4.2 See Equation 5.

$$\text{Delivered Air} - \text{Fuel Ratio} = \frac{\text{Mass of delivered air}}{\text{Mass of delivered fuel}} \quad \text{(Eq. 5)}$$

4.3 See Equation 6.

$$\text{Trapped Air} - \text{Fuel Ratio} = \frac{\text{Mass of delivered air retained}}{\text{Mass of delivered fuel retained}} \quad \text{(Eq. 6)}$$

4.4 See Equation 7.[2]

$$\text{Trapping Efficiency} = \frac{\text{Mass of delivered air retained}}{\text{Mass of delivered air}} \quad \text{(Eq. 7)}$$

4.5 See Equation 8.[2]

$$\text{Scavenging Efficiency} = \frac{\text{Mass of delivered air retained}}{\text{Mass of trapped cylinder charge}} \quad \text{(Eq. 8)}$$

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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 SAE standard reference atmospheric conditions (1.1517 kg/m^3) (0.0719 lbm/ft^3) is to be used.