



SURFACE VEHICLE INFORMATION REPORT

J1682™

DEC2017

Issued 1993-09
Stabilized 2017-12

Superseding J1682 SEP1993

Valve Guide Information Report

RATIONALE

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

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Foreword—This Document has not changed other than to put it into the new SAE Technical Standards Board Format.

Valve guides are installed in internal combustion engine heads as axial bearings for the valve stem, and they hold the valve face coaxial to the head or block seat. They also serve as heat sinks to cool the valves.

Valve guides are typically hollow metallic cylinders. Other materials such as ceramic and ceramic-coated metals have been used on an experimental basis.

The most common installation practice is to retain the valve guide through an interference fit between it and the mating counterbore. In addition to retaining the guide, the fit promotes efficient heat transfer from the guide to the mating counterbore material.

1. Scope—This SAE Information Report provides:

- a. Types of valve guides and their nomenclature
- b. Valve guide alloy designations and their chemistries
- c. Valve guide alloy metallurgy
- d. Typical mechanical and physical properties of guide alloys
- e. Typical dimensional tolerances of valve guides and their counterbores
- f. Recommended interference fits
- g. Installation procedures
- h. Application considerations

2. References—There are no referenced publications specified herein.

3. Types of Valve Guides

3.1 Standard Valve Guides—Figure 1 shows the most common types of valve guides. Smooth bore guides are most common in passenger car operations. For heavy-duty engines, helical grooves are often machined, as shown in Figure 1B, into the valve guide bore for oil retention. However, heavy-duty engine manufacturers are abandoning this practice because of emission concerns. Figure 1C shows a guide with a retaining flange which can be used for location as well as retention. A typical valve guide installation showing the relationship of the valve guide to other components is illustrated in Figure 2.

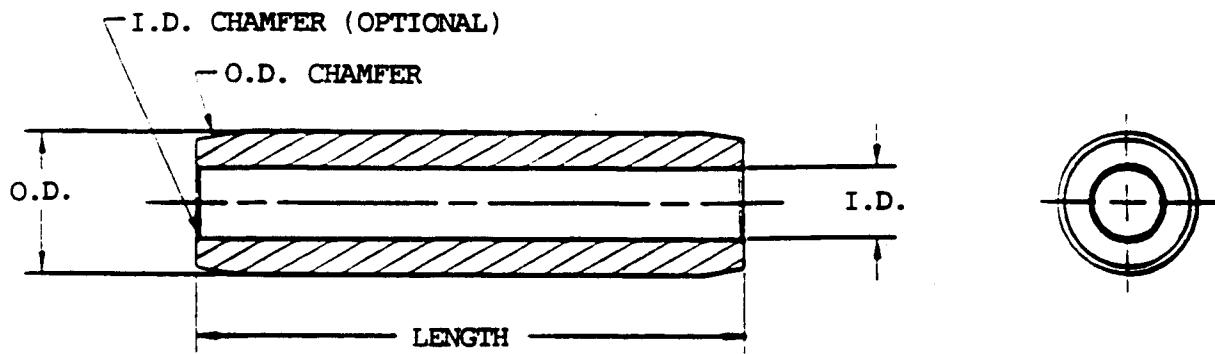


FIGURE 1A—SMOOTH BORE

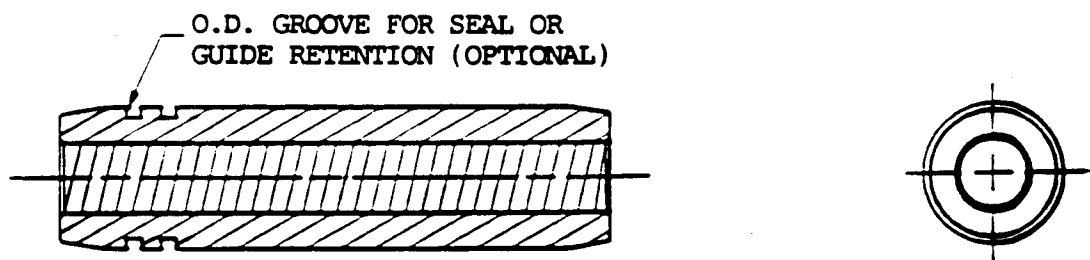


FIGURE 1B—HELICAL GROOVED BORE

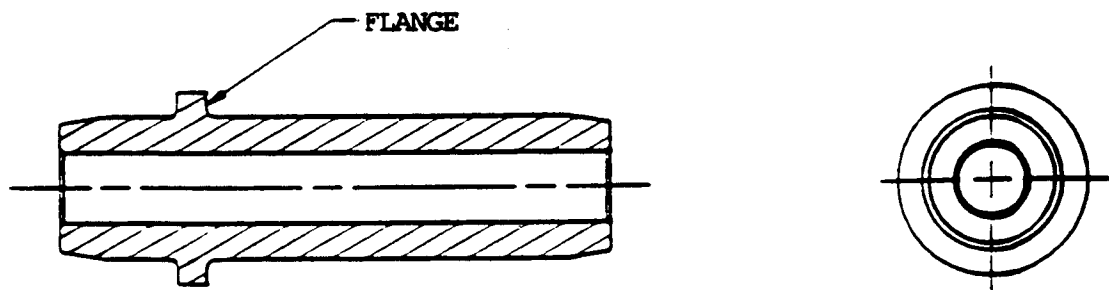


FIGURE 1C—FLANGED ON OUTSIDE DIAMETER SURFACE

FIGURE 1—CROSS SECTION OF VALVE GUIDES

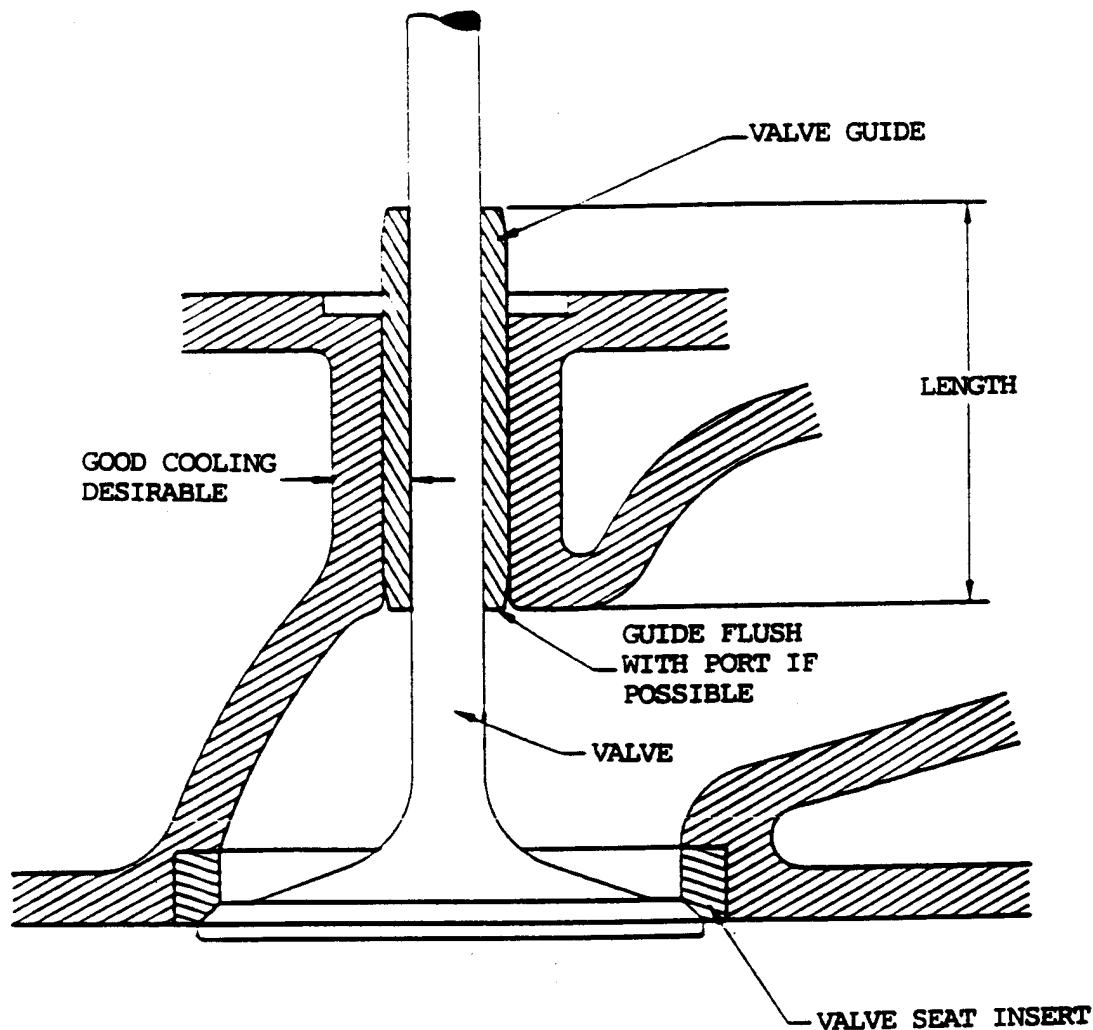


FIGURE 2—CROSS-SECTIONAL VIEW OF CYLINDER HEAD SHOWING INSTALLED VALVE GUIDE

4. **Valve Guide Alloy Designations**—Table 1 enumerates typical valve guide materials and chemical compositions. Table 2 lists the manufacturers and their usage. All tabular data is submitted by the manufacturers as typical.
5. **Valve Guide Alloy Metallurgy**
 - 5.1 **General**—Valve guides are manufactured using cast, wrought, or sintered powder metal (P/M) processes. Wear resistance is generally related to bulk hardness and volume fractions of soft and hard phases present, as well as to lubrication. Valve guides may be heat treated or surface coated for wear resistance. Table 3 describes the typical microstructural constituents of the valve guide materials enumerated in this document. Table 4 lists typical valve guide processing information.
 - 5.2 **Cast Alloys**—Valve guides are most frequently made from pearlitic cast iron. The microstructure of these guides should consist primarily of type A and B graphite, size 4 to 7. Type D and E graphite should be held to a minimum. The graphite morphology should be evaluated at 100X magnification. The matrix structure after etching shall consist of a pearlitic matrix with a maximum of 5% free ferrite. The phosphide constituent should be uniformly distributed as a noncontinuous network.