

Submitted for recognition as an American National Standard

Issued 1974-01
Revised 1977-02
Editorial Change
Superseding J1072-JAN74

(R) SINTERED TOOL MATERIALS

Foreword—This Document has also changed to comply with the new SAE Technical Standards Board Format.

1. **Scope**—This SAE Recommended Practice covers the identification and classification of ceramic, sintered carbide, and other cermet tool products.

Its purpose is to provide a standard method for designating the characteristics and properties of sintered tool materials.

2. **References**

- 2.1 **Applicable Publications**—The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated the latest revision of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J439—Sintered Carbide Tools

2.1.2 ASTM PUBLICATIONS—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM B 406—Test Method for Transverse Rupture Strength of Cemented Carbides

3. **Description**—The method is a typical letter-number "line call out" system which consists of two parts:

1. Basic Classification—which identifies the type of sintered tool product.
2. Suffix Requirements—which provide quantitative values for the properties or characteristics of a specific material.

NOTE—Only pertinent properties or characteristics should be included. Alpha-numeric combinations which describe commercially unavailable products must be avoided.

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4. Basic Classification—A sequence of five digits is used to type each sintered tool product. The first digit indicates the type of compound. The second digit indicates the binder metal. The third digit indicates the *predominating* base metal, while the fourth and fifth digits indicate *other* base metals. See Table 1.

Example:

- SAE J1072 23200—tungsten carbide with a cobalt binder
- SAE J1072 30600—aluminum oxide ceramic
- SAE J1072 23234—tungsten, titanium, tantalum carbide with a cobalt binder

TABLE 1—BASIC CLASSIFICATION

Material Compound	Binder Metal	Base Metal
1-Nitride	0-None	0-None
2-Carbide	1-Nickel	1-Columbium
3-Oxide	2-Iron	2-Tungsten
9-Other ⁽¹⁾	3-Cobalt	3-Titanium
	9-Other ⁽¹⁾	4-Tantalum
		5-Chromium
		6-Aluminum
		9-Other ⁽¹⁾

1. Shall be described by suffix Z.

5. Suffix Requirements—A letter designating the property or characteristic to be specified is followed by numbers which designate the level of the property or characteristic. (Note: Suffix Z shall be used to describe any property or characteristic for which an appropriate suffix letter has not been assigned.)

5.1 Suffix A—Binder Metal Quantity—A three-digit number following the letter "A" designates the specified percentage by weight of binder metal to the nearest 0.1%. The product range shall be $\pm 5\%$ of the specified quantity.

Example: A045 specifies 4.5% of binder metal described by the basic classification or a product range of 4.3–4.7%.

5.2 Suffix B—Base Metal Quantity—A three-digit number following the letter "B" designates the specified percentage by weight of base metal to the nearest 0.1%. The product range shall be $\pm 5\%$ of the specified quantity. Each base metal described by the fourth and fifth digits of the basic classification shall be included.

Example: B096B047 specifies 9.6% of base metal described by the fourth digit of the basic classification and 4.7% of base metal described by the fifth digit of the basic classification. The product ranges would be 9.1–10.1% and 4.5–4.9%, respectively.

NOTE—The Basic Classification provides for two base metals other than the *predominating* base metal. Any additional base metal and its quantity must be described by suffix Z.

5.3 Suffix C—Hardness per SAE J439—A three-digit number following the letter "C" designates the specified Rockwell A hardness to the nearest 0.1 Rockwell A. The hardness range of the product shall be ± 0.3 Rockwell A for products specified 89.9 Rockwell A or softer and ± 0.2 Rockwell A for products specified 90.0 Rockwell A or harder.

Example: C922 specifies 92.2 Rockwell A or a product hardness range of 92.0–92.4 Rockwell A.

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- 5.4 Suffix D—Specific Gravity per SAE J439**—A three-digit number following the letter "D" designates the specified specific gravity or density in g/cm^3 to the nearest 0.1 g/cm^3 . The density range of the product shall be $\pm 0.1 \text{ g/cm}^3$ from that specified.

Example: D126 specifies a density of 12.6 g/cm^3 and a product density range of $12.5\text{--}12.7 \text{ g/cm}^3$.

- 5.5 Suffix E—Grain Size per SAE J439**—One to three digits following the letter "E" designate the specified grain size.

Example: A grain size rating of 231 per SAE J439 shall be specified E231.

- 5.6 Suffix F—Apparent Porosity per SAE J439**—Three digits following the letter "F" specify the maximum amount of each type porosity allowable, as depicted by the photographs of SAE J439. The first digit indicates the amount of type A porosity, the second digit indicates the amount of type B porosity, and the third digit the amount of type C porosity.

Example: F421 specifies a maximum apparent porosity rating of A-4, B-2, and C-1.

- 5.7 Suffix G—Transverse Rupture Strength per ASTM B 406**—A three-digit number following the letter "G" designates the specified minimum transverse rupture strength in $\text{psi} \times 1000$ ($\text{MPa} \times 6.9$).

Example: G095 specifies a minimum transverse rupture strength of 95,000 psi (656 MPa).

- 5.8 Suffix Z—Other Properties**—Properties not described by listed suffix designations and those which require more explicit description shall be written out.

Examples:

Z1—thermal expansion from room temperature to $1500 \text{ }^\circ\text{F}$ ($816 \text{ }^\circ\text{C}$) shall be $3.46 \times 10^{-6}/^\circ\text{F}$ ($6.23 \times 10^{-6}/^\circ\text{C}$).

Z2—titanium carbide coated.

6. Notes

- 6.1 Marginal Indicia**—The change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. An (R) symbol to the left of the document title indicates a complete revision of the report.

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