SAE International	SURFACE VEHICLE RECOMMENDED PRACTICE	SAE J121 JAN2013
		Issued 1969-09 Cancelled 2013-01 Superseded by ASTM F2328

Decarburization in Hardened and Tempered Unified Threaded Fasteners

RATIONALE

To advance the goal of harmonization, SAE J121 is cancelled and superseded by ASTM F2328.

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Foreword—The changes to this document were made to comply with the new SAE Technical Standards Board format. They include making Definitions Section 3. All other section numbers have changed. Also Figure 2, measurement was changed from 0.0006 in to 0.005 in. This is the correct measurement.

1. Scope—This SAE Recommended Practice covers methods for measuring, classifying, and specifying decarburization in the threaded section of hardened and tempered steel bolts, screws, studs, and similar parts. It is not intended to cover products which are specifically carburized to achieve special properties.

2. References

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

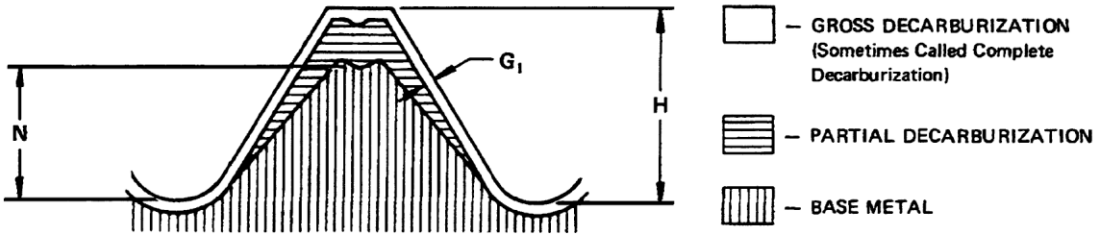
2.1.1 SAE PUBLICATION—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J419—Methods of Measuring Decarburization

3. Definitions—According to SAE J419, "decarburization" is the loss of carbon at the surface of commercial ferrous materials which have been heated to facilitate fabrication or heated to modify mechanical properties. SAE J419 defines also "complete decarburization," "partial decarburization," and "effective decarburization," as related to unhardened steels. This document extends these definitions, as follows, to cover more specifically hardened and tempered steel bolts, screws, studs, and similar products.

3.1 Partial Decarburization—Decarburization with loss of carbon sufficient to cause a lighter shade of tempered martensite than that of the immediately adjacent base metal, when examined metallographically by the method outlined in 5.1, but insufficient carbon loss to show clearly defined ferrite grains. (The hardness traverse method, outlined in 5.2, is the referee method for determining that partial decarburization is not present at a point below that shown in Figure 1 for each classification.

3.2 Gross Decarburization—Decarburization with sufficient carbon loss to show only clearly-defined ferrite grains under metallographic examination by the method outlined in 5.1. This is sometimes called "Complete Decarburization."



Limits for Unified Threads[4] — in				
Threads Per in	Thread Height H[1]	Decarburization Class C (1/2 H)[2] N min	Decarburization Class B (2/3 H)[2] N min	G[4] max
28	0.02191	0.011	0.015	0.0006
24	0.02556	0.013	0.017	0.0006
20	0.03067	0.015	0.020	0.0006
18	0.03408	0.017	0.023	0.0006
16	0.03834	0.019	0.025	0.0006
14	0.04382	0.022	0.029	0.0006
13	0.04719	0.024	0.032	0.0006
12	0.05112	0.026	0.035	0.0006
11	0.05577	0.028	0.037	0.0006
10	0.06134	0.031	0.041	0.0006
9	0.06816	0.034	0.045	0.0006
8	0.07668	0.038	0.051	0.0006
7	0.08763	0.044	0.059	0.0006
6	0.10224	0.051	0.068	0.0006

All dimensions are inches.

1. H is height of external thread at its maximum boundary nonplated condition.
2. Decarburization Class C (1/2 H) and Class B (2/3 H) were formerly referred to as X and 4/3 X, respectively (were X equals one-half thread height).
3. G shall be measured perpendicular to the flank of the thread midway between crest and root. (The additional depth of gross decarburization shown at thread crest is due to "thread enfoliation" caused by thread rolling.)
4. See Section 3 for limits applicable to other threaded products.

FIGURE 1—DECARBURIZATION LIMITS FOR COMMONLY USED ISO MODIFIED THREADS

3.3 Carbon Restoration—A process of restoring surface-carbon loss by heat-treating in an atmosphere furnace of properly controlled carbon potential. (This process is permitted but not recommended for threaded fasteners unless furnace atmosphere is adequately controlled.)

3.4 Carburization—A darker shade of tempered martensite than that of the immediately adjacent base metal, when examined metallographically by the method outlined in 5.1, and harder by at least 30 points (Knoop or Vickers DPH) than the hardness at root diameter when checked by the method outlined in 5.2. (The limits established by this document exclude this condition.)

3.5 Base-Metal Hardness—For purposes of this document, hardness at root diameter on a line bisecting the included angle of the thread (Position 1 in Figure 2) is considered "base-metal hardness."

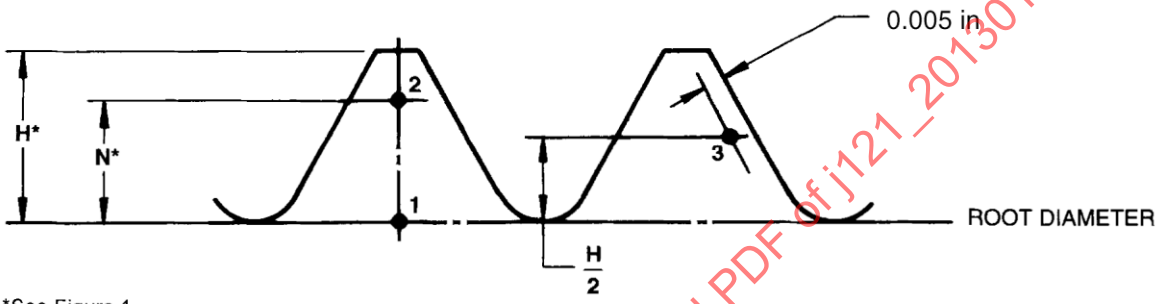


FIGURE 2—POSITIONS FOR DETERMINING HARDNESS

4. Classes of Decarburization—This document establishes two classes of decarburization for inch-series threaded products. Each class is characterized by dimensional limits for decarburized zone, gross-decarburized zone, and/or base-carbon zone (as applied to longitudinal sections through the thread axis). Decarburization limits applicable to the more commonly used Unified Threads (in) are shown in Figure 1. Limits applicable to other threaded products are as follows:

a. For Class C (1/2 H)—N = 0.50 H; G = 0.0006 in
b. For Class B (2/3 H)—N = 0.67 H; G = 0.0006 in

NOTE—This document recognizes that the surface may vary in carbon content from the base-metal carbon content, and stipulates that this variation shall be either "partial decarburization" or "gross decarburization" or a "carbon-restored surface" to the extent allowed in Figure 1 for the different classes. "Carburization" is not permitted in the surface zone.

5. Methods for Measuring Decarburization—Two methods for measuring decarburization are provided. The microscopic method is intended primarily for routine inspection purposes. The hardness method is intended primarily for referee purposes. In the case of gross decarburization, however, only the microscopic method is applicable.