Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE RECOMMENDED PRACTICE

ARP 1341

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DETERMINING DECARBURIZATION AND CARBURIZATION IN FINISHED PARTS OF CARBON AND LOW-ALLOY STEELS

1. SCOPE: This document provides a recommended practice for determining decarburization and carburization in heat treated carbon and low-alloy steel parts other than case hardened parts. It is not applicable to raw materials.

2. APPLICABLE DOCUMENTS: The following publications form a part of this recommended practice to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, Pennsylvania 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

ASTM E3 - Preparation of Metallographic Specimens
ASTM E384 - Microhardness of Materials
ASTM E407 - Microetching Metals and Alloys

3. PROCEDURE:

3.1 Test Specimens:

3.1.1 Integral Specimens: A metallographic specimen shall be removed from the part after the part has been completely heat treated. Care should be taken in removing the specimen to avoid overheating the specimen.

3.1.2 Specimens from Separate Samples: A metallographic specimen shall be taken from a sample processed with the part. The sample shall be of the same grade of steel as the part, have the same surface condition as the part, and preferably be from the same heat of steel as the part. The sample shall be hardened and tempered with the part, using the specified procedure, except that, when specified, the sample shall be hardened but not tempered (See 5.1).

3.2 Preparation of Test Samples: The metallographic specimen shall be taken transverse to the surface of the part of sample and shall be at least 0.250 in. (6.35 mm) thick. The specimen shall be prepared in accordance with ASTM E3 and E407.

3.3 Examination:

3.3.1 Visual: The etched specimen shall be examined under a microscope at 100X magnification, using a calibrated eyepiece.

3.3.2 Microhardness Survey: A microhardness traverse shall be made with a Knoop indenter and 200 g load in accordance with ASTM E384. A minimum of three hardness readings shall be taken to establish the specimen base hardness in an area at least 0.125 in. (3.18 mm) from the outside surface or at midradius or midthickness, whichever is less. Readings shall be taken at 0.001 in. (0.03 mm) intervals starting at 0.002 in. (0.05 mm) from the outside surface in a staggered pattern until the pre-established base hardness is reached. The hardness readings shall be plotted versus distance from the outside surface as shown in Fig. 1.

4. DECARBURIZATION AND CARBURIZATION DETERMINATION:

4.1 Complete Decarburization (Free Ferrite): Shall be determined by visual examination as in 3.3.1. The maximum and average depths shall be reported.

4.2 Total Decarburization (Complete plus partial): Shall be determined by microhardness survey as in 3.3.2. The depth of total decarburization shall be as follows:

4.2.1 Hardened and Tempered Specimens: That depth below the surface at which the hardness is no more than 20 units on the Knoop scale lower than the base hardness, as illustrated in Fig. 1.

4.2.2 Hardened Specimens: That depth below the surface at which the hardness is no more than 30 units on the Knoop scale lower than the base hardness.

4.3 Carburization: Any hardness reading near the edge which is more than 10 units on the Knoop scale higher than the base hardness shall be evidence of carburization.

5. NOTES:

5.1 Condition of Sample: Testing of hardened specimens (4.2.2) will result in a greater apparent depth of decarburization than similar testing of hardened and tempered specimens (4.2.1). Testing of hardened specimens may be specified when a more sensitive test is desired.

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