



BORONIZING OF GEARS

WSS-M99A5-A

1. SCOPE

This specification outlines the approved process for producing a wear resistant surface based on a phase compound, which consists of Fe₂B mainly.

This process standard defines the method of boronizing and the subsequent hardening and tempering of ferrous parts. The boronizing process is a diffusion process by which one or more intermetallic phases are obtained by diffusing Boron into the surface of metallic materials.

The Boron can be diffused into the surface of a material by means of a paste or powder.

2. APPLICATION

This process is used on components, such as gears, for gasoline and diesel engines produced from unalloyed/low alloyed steel with the exception of Si-alloyed steel, where the wear resistance shall be solved mainly.

3. REQUIREMENTS

3.0 STANDARD REQUIREMENTS FOR PRODUCTION MATERIALS

Material suppliers and part producers must conform to the Company's Standard Requirements For Production Materials (WSS-M99P1111-A).

3.2 BORIDE LAYER

3.2.1 Structure of Layer

The structure of the layer should consist of a single compound of Fe₂B, continuous compounds of FeB are not permissible.

3.2.2 Thickness

The thickness of the boride layer shall be 0.03 - 0.06, unless otherwise specified on the engineering drawing.

The thickness of the boride layer shall be measured perpendicular to the surface where the boride zone contrasts with the matrix. The measurement of thickness shall be determined by metallographical method. The value of the layer thickness is defined as the mean depth which is calculated from the average of the teeth penetration and the minimum distance of the matrix from the surface. (Etching with 2 - 3% nitric acid, recommended magnification 200x)

Date	Action	Revisions
2005 02 04	Revised	Inserted 3.0; Deleted 3.1, 3.4, 4
1996 08 05	Revised	Completely Revised and Updated
1995 05 10	Released	EP00E10517874000



3.3 HARDNESS (ISO 4545/ISO 6507)

Unless otherwise specified, the hardness shall be checked in the cross section as following:

According to ISO 6507	1500 - 2000 HV 0.025
According to ISO 4545	1500 - 2000 HV 0.025

5. GENERAL INFORMATION

The information given below is provided for clarification and assistance in meeting the requirements of this specification.

5.1 RECOMMENDED PROCESS

5.1.1 Prior Microstructure

Prior to boronizing, the parts have to be normalized in a controlled atmosphere. The normalizing temperature should be in agreement with the boronizing temperature.

5.1.2 Surface Condition

Parts to be boronized must be completely dry, free of oil, grease, rust and scale and must not be plated with copper, zinc, or tin.

5.1.3 Furnace Atmosphere

The boronizing process has to be carried out in a protective atmosphere. As a protective atmosphere the inert gas like Argon, NH₃-cracked gas or N₂-gas has to be used.

The using of an oxygen-containing compound such as CO-, CO₂-gas, endo- or exogas or methanol-cracked gas is not allowed, caused by reaction with boron responsive ferricboride.

5.1.4 Temperature

The temperature shall be controlled within +/- 5 °C of set point, as evidenced by continuous recording pyrometers. Also, the mean isothermal shall not differ by more than 15 °C from one part of the load and another as measured by use of thermocouple within the load.

5.2 PROCESS: BORONIZING

5.2.1 Boronizing Medium

The process is such that the boronizing shall be carried out with Boron-paste or Boron-powder being composed of Silicon- and Boroncarbids and suitable activators.

The application of used powder is not allowed.

5.2.2 Loading of Charge

The parts must be bedded in a boronizing powder or coated by boronizing paste in such a way that the area, which has to be boronized, is guaranteed.