



American
Gear Manufacturers
Association

ANSI/AGMA ISO 14104-A17
(Identical to ISO 14104:2017)

American National Standard

Gears – Surface Temper Etch Inspection After Grinding, Chemical Method

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[Identical to ISO 14104:2017]

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ABSTRACT

This document explains the materials and procedures necessary to determine, evaluate and describe localized overheating on ground surfaces. A system to describe and classify the indications produced during this inspection is included. However, specific acceptance or rejection criteria are not contained.

An industry-wide survey was conducted to establish common solutions in time that were acceptable to the greatest number of users. The safety and environmental precautions were included therein for those not familiar with storage, handling, use and disposal of concentrated acids, alkalis and solvents. These precautions, however, do not supersede the latest applicable requirements.

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Foreword

[The foreword, footnotes and annexes, if any, in this document are provided for informational purposes only and are not to be construed as a part of ANSI/AGMA ISO 14104-A17, *Gears – Surface Temper Etch Inspection After Grinding, Chemical Method.*]

AGMA 230.01 was written to standardize a process of surface temper inspection.

An industry-wide survey conducted by the committee indicated a wide variation in solution strengths and times used, which gave rise to that standard. The safety and environmental precautions included therein were a caution for those not familiar with the storage, handling, use, and disposal of concentrated acids, alkalis, and solvents. Those precautions, however, did not supersede the latest OSHA, EPA, and DOT requirements. The solutions and times stated therein work and were acceptable to the greatest number of users.

The safety precautions no doubt are superfluous to many. However, due to the difference of this inspection from ordinary shop practice, it is felt that some caution should be directed to those manufacturers without benefit of personnel trained in the proper use and handling of these materials.

The first committee draft of AGMA 230.01 was prepared in September 1963. It was approved by the Surface Temper Inspection Process Task Committee as of September 1964. AGMA 230.01 was approved by the AGMA membership as of April 13, 1967.

The revision of AGMA 230.01, designated ANSI/AGMA 2007-B92, was begun in May 1989. It was renamed Surface Temper Etch Inspection After Grinding, for better definition, the contents reorganized, and obsolete procedures deleted. Type 1 (hot bleach) etching was published in AGMA 230.01 as Table 2A in an appendix. This table was not included in the revision; the use of Type 2 or Type 3 etching was recommended instead.

ANSI/AGMA 2007-B92 was approved by the AGMA membership in February 1992.

Another specification covering temper etch inspection is MIL-STD-867A, Temper Etch Inspection.

International Standard (ISO 14104:1995) was later developed by ISO TC 60/SC 2/ WG 14 using ANSI/AGMA 2007-B92 as the base with the following changes:

- scope was rewritten to exclude the first paragraph;
- clause 2, “Requests, Approval and Certification” was deleted;
- in the last paragraph of subclause 4.2, “Etching,” recommended time for elevated temperature bake was indicated;
- in table 3, “Type 3 etching,” the recommended time for step 4, nitric acid etch, in alcohol, was changed from 1.5 to 2.5 minutes to 1.5 to 3.5 minutes;
- subclause 5.1, additional paragraph recommending that users of the standard set their own reference standards was added;
- in clause 5.2, “allowable contact stress, s_{ac} ,” was changed to “allowable stress number (contact), $\sigma_{H\ lim}$ ”;
- in Table 4 of ISO 14104, the “AGMA 2007” designation was removed from the “Sample classification callouts”;
- clause 9, “Safety and environmental precautions,” was revised to delete reference to specific U.S. regulatory agencies;
- clause 10 “References” was deleted;
- the standard used metric units only;
- minimal editorial changes were also incorporated.

During adoption of ISO 14104:1995, the following changes were introduced into the standard, resulting in the creation of ANSI/AGMA 2007-C00:

- clause 10, “Specifications and documentation” was added;
- in clause 5.2, “allowable stress number (contact), $\sigma_{H\ lim}$ ” was changed to “allowable stress number (contact), σ_{HP} ”;
- minimal editorial changes were also incorporated.

The first draft of ANSI/AGMA 2007-C00 was made in August 1998. It was approved by the AGMA membership on March 2, 2000. It was approved as an American National Standard on November 2, 2000.

ANSI/AGMA ISO 14104-A17 is a direct adoption of ISO 14104:2017 which canceled and replaced ISO 14104:1995. The new adopted standard replaced ANSI/AGMA 2007-C00.

Some of the main changes in the new document include:

- scope was expanded to include surface anomalies that result from post-heat treatment machining such as hard turning, milling and edge breaking (deburring) processes, and surface metallurgical anomalies caused by carburization or decarburization are also readily detectable with this process;
- clause 2, “Normative references” and clause 3, “Terms and definitions” were added;
- a note about local regulation requirements added to clause 4.1;
- light intensity was changed to “2 200 lx (~200 foot candles)” from “3 200 lx (300 foot candles)”;
- use of a grey scale card to qualify varying degrees of surface temper damage added;
- sample photographs of typical surface temper damage added;
- clause 5.5 added a recommendation for the use of distilled water;
- removed the recommendation “or 13% to 17% ammonium hydroxide in alcohol, should be used” for the “Alkaline solution” sub-clause;
- nitric acid solution recommendations changed to “1.5% to 5%” from “3% to 5%” in step 1 of table 2;
- hydrochloric acid solution recommendations changed to “2% to 6%” from “4% to 6%” in step 4 of table 2;
- footnote a) of table 2 added “Multiple rinses can be used in steps 2,5, and 7”;
- footnotes e) and g) are new;
- footnote f) changed the procedure to “Typical procedures include alcohol dip or hot water rinse at 65°C minimum, followed by contaminant-free air blast” from “Optional procedure: hot water rinse at 65°C minimum, followed by a dry air blast, may be used in lieu of alcohol dip;”
- in steps 1 and 7 of table 3, the hydrochloric acid solution recommendations was changed to “2% to 6%” from “4% to 6%”;
- in step 4 of table 3, the nitric acid solution recommendations was changed to “1.5% to 5%” from “3% to 5%”;
- added a bibliography;
- rewording of text in other parts of the document as needed as the result of the addition of the grayscale and sample photographs.

The first draft of ANSI/AGMA ISO 14104-A17 was made in July 2017. It was approved by the AGMA membership in July 2018. It was approved as an American National Standard on October 24, 2018.

Suggestions for improvement of this standard will be welcome. They should be sent to the tech@agma.org.

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American National Standard –

Gears – Surface temper etch inspection after grinding, chemical method

1 Scope

This document specifies procedures and requirements for the detection and classification of localized overheating on ground surfaces by chemical etch methods.

The process described in this document is typically used on ground surfaces; however, it is also useful for the detection of surface anomalies that result from post-heat treatment machining such as hard turning, milling and edge breaking (deburring) processes. Surface metallurgical anomalies caused by carburization or decarburization are also readily detectable with this process.

Some methods which have been used in the past are no longer recommended. Specifications are intended to be changed to use the methods in this document. These etching methods are more sensitive to changes in surface hardness than most hardness testing methods.

This document applies to steel parts such as gears, shafts, splines and bearings. It is not applicable to nitrided parts and stainless steels.

NOTE This process, although at times called “nital etch”, is not intended to be confused with other processes also known as “nital etch”.

The surface temper etch procedure is performed after grinding and before additional finishing operations such as superfinishing, shot peening and honing.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>