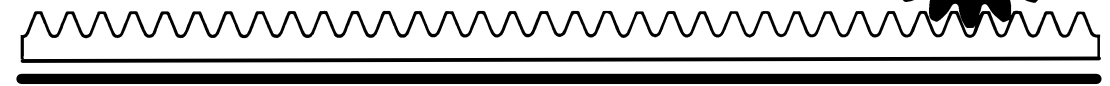


AMERICAN GEAR MANUFACTURERS ASSOCIATION

*Calculated Bending Load Capacity of
Powder Metallurgy (P/M) External Spur
Gears*

AGMA 930-A05



AGMA INFORMATION SHEET

(This Information Sheet is NOT an AGMA Standard)

American
Gear
Manufacturers
Association

Calculated Bending Load Capacity of Powder Metallurgy (P/M) External Spur Gears

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[Tables or other self-supporting sections may be referenced. Citations should read: See AGMA 930-A05, *Calculated Bending Load Capacity of Powder Metallurgy (P/M) External Spur Gears*, published by the American Gear Manufacturers Association, 500 Montgomery Street, Suite 350, Alexandria, Virginia 22314, <http://www.agma.org>.]

Approved January 19, 2005

ABSTRACT

This information sheet describes a procedure for calculating the load capacity of a pair of powder metallurgy (P/M) external spur gears based on tooth bending strength. Two types of loading are considered: 1) repeated loading over many cycles; and 2) occasional peak loading. In a separate annex, it also describes an essentially reverse procedure for establishing an initial design from specified applied loads. As part of the load capacity calculations, there is a detailed analysis of gear teeth geometry. These have been extended to include useful details on other aspects of gear geometry such as the calculations for defining gear tooth profiles, including various fillets.

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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 AGMA Information Sheet 930-A05, *Calculated Bending Load Capacity of Powder Metallurgy (P/M) External Spur Gears*.]

This information sheet was prepared by the AGMA Powder Metallurgy Gearing Committee as an initial response to the need for a design evaluation procedure for powder metallurgy (P/M) gears. The committee anticipates that, after appropriate modification and confirmation based on application experience, this procedure will become part of a standard gear rating method for P/M gears. As such, it will serve the same function for P/M gears as the rating procedure in ANSI/AGMA 2001-C95 for wrought metal gears. Toward this end, the design evaluation procedure described here closely follows ANSI/AGMA 2001-C95, with changes made for the special properties of P/M materials, gear proportions, and types of applications. These design considerations have made it possible to introduce some simplifications in comparison to the above mentioned standard.

The first draft of AGMA 930-A05 was made in June 1996. It was approved by the AGMA Technical Division Executive Committee in January 2005.

Suggestions for improvement of this document will be welcome. They should be sent to the American Gear Manufacturers Association, 500 Montgomery Street, Suite 350, Alexandria, Virginia 22314.

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American Gear Manufacturers Association -

Calculated Bending Load Capacity of Powder Metallurgy (P/M) External Spur Gears

1 Scope

1.1 General

1.1.1 Calculation

This information sheet describes a procedure for calculating the load capacity of a pair of powder metallurgy (P/M) gears based on tooth bending strength. Two types of loading are considered: 1) repeated loading over many cycles; and 2) occasional peak loading. This procedure is to be used on prepared gear designs which meet the customary gear geometry requirements such as adequate backlash, contact ratio greater than 1.0, and adequate top land. An essentially reverse procedure for establishing an initial design from specified applied loads is described in annex D.

1.1.2 Strength properties

Fatigue strength and yield strength properties used in these calculations may be taken from previous test experience, but may also be derived from published data obtained from standard tests of the materials.

1.1.3 Application

This procedure is intended for use as an initial evaluation of a proposed design prior to preparation of test samples. Such test samples might be machined from P/M blanks or made from P/M tooling based on the proposed design after it passes this initial evaluation. Final acceptance of the proposed design should be based on application testing and not on these calculations. If samples made from

tooling fall short in testing, it may be possible to use the same tooling for a design adjusted for greater face width.

1.1.4 Limitations

Gears made from all materials and by all processes, including P/M gears, may fail in a variety of modes other than by tooth bending. This information sheet does not address design features to resist these other modes of failure, such as excessive wear and other forms of tooth surface deterioration.

CAUTION: The calculated load capacity from this procedure is not to be used for comparison with AGMA ratings of wrought metal gears, even though there are many similarities in the two procedures.

1.2 Types of gears

This calculation procedure is applied to external spur gears, the type of gear most commonly produced by the P/M process.

1.3 Dimensional limitations

This procedure applies to gears whose dimensions conform to those commonly produced by the P/M process for load carrying applications:

- Finest pitch: 0.4 mm module;
- Maximum active face width: 15Φ module, with a 65 mm maximum;
- Minimum number of teeth: 7;
- Maximum outside diameter: 180 mm;
- Pressure angle: 14.5° to 25°.

1.4 Gear mesh limitations

Some of the calculations apply only to meshing conditions expressed as a contact ratio greater than one and less than two. This translates into the requirement that there is at least one pair of contacting teeth transmitting load and no more than two pairs.

2 Definitions and symbols

2.1 Definitions

The terms used, wherever applicable, conform to ANSI/AGMA 1012-F90.