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Gear Manufacturers
Association

Technical
Division

ANSI/AGMA 6114-B15
(Revision of ANSI/AGMA 6114-A06)

American National Standard

Gear Power Rating for Cylindrical Shell and Trunnion Supported Equipment (Metric Edition)

ANSI/AGMA 6114-B15

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National
Standard**

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(Metric Edition)***

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[Revision of ANSI/AGMA 6114-A06]

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ABSTRACT

This standard specifies a method for rating the pitting resistance and bending strength of open or semi-enclosed gearing for use on cylindrical shell and trunnion supported equipment such as grinding mills, kilns, coolers, and dryers. This includes spur, self-aligning spur, single helical, double helical, and herringbone gears made from steel, ductile iron, and austempered ductile iron. Annexes cover installation, alignment, maintenance, combination drives, and lubrication.

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Contents

Foreword	v
1 Scope.....	1
1.1 Applicability.....	1
1.2 Rating formulas	1
1.3 Limitations	2
1.4 Exceptions	2
2 Normative references	3
3 Definitions and symbols.....	4
3.1 Definitions.....	4
3.1.1 Self-aligning pinion.....	4
3.2 Symbols	4
4 Application	6
4.1 Manufacturing quality	6
4.1.1 Geometric quality	6
4.1.2 Metallurgy.....	7
4.1.3 Residual stress.....	7
4.2 Lubrication	7
4.3 Temperature extremes	7
4.3.1 Cold temperature operation	7
4.3.2 Temperature gradient.....	7
4.4 Other considerations	7
4.4.1 Service damaged teeth	8
4.4.2 Misalignment and deflection of foundations.....	8
4.4.3 Deflection due to external loads.....	8
4.4.4 System dynamics	8
4.4.5 Corrosion.....	8
5 Criteria for tooth capacity.....	8
5.1 Relationship of pitting resistance and bending strength ratings.....	8
5.2 Pitting resistance	8
5.3 Surface conditions not covered by pitting resistance formula	9
5.4 Bending strength	9
5.5 Conditions not covered by the bending strength formula	9
6 Rating formulas.....	9
6.1 Pitting resistance	9
6.1.1 Pitting resistance power rating	9
6.2 Bending strength	10
6.2.1 Bending strength power rating	10
6.2.2 Rim thickness factor, K_{Bm}	10
7 Geometry factors, Z_I and Y_J	11
7.1 Pitting resistance geometry factor, Z_I	11
7.2 Bending strength geometry factor, Y_J	11
7.3 Calculation method.....	12
8 Dynamic factor, K_{vm}	12
8.1 Dynamic factor considerations	12
8.2 Approximate dynamic factor, K_{vm}	12
8.2.1 Curves labeled $A_v = 7$ through $A_v = 11$	13
9 Elastic coefficient, Z_E	14
10 Service factor	14
11 Hardness ratio factor, Z_W	15

12	Load distribution factor, K_{Hm}	17
12.1	Values for load distribution factor, K_{Hm}	17
12.2	Face load distribution factor, $K_{H\beta}$	17
12.3	Self-aligning pinions	19
13	Allowable stress numbers, σ_{HP} and σ_{FP}	20
13.1	Guide for case depth of carburized and induction hardened pinions	39
14	Momentary overloads	40
14.1	Yield strength for steel pinions and gears	40
14.2	Yield strength of ductile iron gears	41
14.3	Yield strength of ADI pinions and gears	41
15	Stress cycle factors, Z_N and Y_N	41
15.1	Load cycles.....	42
15.2	Stress cycle factors for steel and ductile iron gears.....	42
15.3	Stress cycle factors for ADI gears	42

Annexes

Annex A (informative)	New equipment installation and alignment.....	44
Annex B (informative)	Multiple motor drive characteristics	47
Annex C (informative)	Rim thickness/deflection	50
Annex D (informative)	Open gearing lubrication	52
Annex E (informative)	Sample problems	58
Annex F (informative)	Material mechanical properties	65
Annex G (informative)	Operation and maintenance	67
Annex H (informative)	Service factors	69
Annex I (informative)	Method for determination of dynamic factor with AGMA 2000-A88 [6]	71
Annex J (Informative)	Considerations for use of combination drives	73
Annex K	Bibliography.....	75

Figures

Figure 1	– Rim thickness factor, K_{Bm}	11
Figure 2	– Dynamic factor, K_{vm}	12
Figure 3	– Hardness ratio factor, Z_W	16
Figure 4	– Pinion proportion factor, K_{Hpf}	18
Figure 5	– Mesh alignment factor, K_{Hma}	19
Figure 6	– Allowable contact stress number for through hardened steel gears, σ_{HP}	36
Figure 7	– Allowable bending stress number for through hardened steel gears, σ_{FP}	36
Figure 8	– Allowable contact stress number for ductile iron gears, σ_{HP}	37
Figure 9	– Allowable bending contact stress number for ductile iron gears, σ_{FP}	37
Figure 10	– Allowable contact stress number for ADI gears, σ_{HP}	38
Figure 11	– Allowable bending stress number for ADI gears, σ_{FP}	38
Figure 12	– Hardening pattern obtainable on pinion teeth with induction hardening.....	39
Figure 13	– Minimum effective case depth for carburized and induction hardened pinions, $h_{e\ min}$	39
Figure 14	– Steel and ductile iron pitting resistance stress cycle factor, Z_N	42
Figure 15	– Steel and ductile iron bending strength stress cycle factor, Y_N	43
Figure 16	– ADI pitting resistance stress cycle factor, Z_N	43
Figure 17	– ADI bending strength stress cycle factor, Y_N	43
Figure C.1	– Tee section gearing.....	50
Figure C.2	– Box (Y or delta) section gearing.....	51
Figure C.3	– Pinions	51
Figure I.1	– Dynamic factor, K_{vm}	71
Figure J.1	– Typical combination drive	73

Tables

Table 1 – Symbols and definitions	5
Table 2 – Empirical constants: A , B , and C	19
Table 3 – Allowable contact stress number, σ_{HP} , for steel, ductile iron and ADI	20
Table 4 – Allowable bending stress number, σ_{FP} , for steel, ductile iron, and ADI	20
Table 5 – Metallurgical characteristics for through hardened steel pinions and gears	21
Table 6 – Metallurgical characteristics for ductile iron gears	22
Table 7 - Metallurgical characteristics for wrought carburized and hardened pinions	26
Table 8 – Metallurgical characteristics for wrought induction hardened pinions	28
Table 9 – Metallurgical characteristics for cast ADI pinions and gears	32
Table D.1 – Minimum viscosity recommendations for open gearing – continuous lubricant application ...	56
Table D.2 – Minimum viscosity recommendations for open gearing – intermittent lubricant application ...	56
Table D.3 – Residual type lubricant quantity guidelines	57
Table F.1 – Alloy steel	65
Table F.2 – Ductile iron	66
Table F.3 – ADI	66
Table G.1 – Inspections	68
Table H.1 – Minimum service factors (for a duty cycle of 24 hours per day)	69

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 Standard 6114-B15, *Gear Power Rating for Cylindrical Shell and Trunnion Supported Equipment (Metric Edition)*.]

This standard presents formulas and information using ISO symbology and SI units.

AGMA 321.01 was originally developed to cover gears used primarily for ball and rod mills, and for kilns and dryers. It was approved in October 1943, and later modified in June 1946. In June 1951, AGMA 321.03 was approved as a standard. Further changes and additions were approved in June 1959, and AGMA 321.04 was issued in March 1960. AGMA 321.05 was approved in March 1968 and issued in March 1970.

In February 1979, the Mill Gearing Committee was reorganized to review AGMA 321.05 and revise it in accordance with AGMA 218.01, *Rating the Pitting Resistance and Bending Strength of Spur and Helical Involute Gear Teeth*. With AGMA 218.01 as a guide, the committee submitted the first draft of ANSI/AGMA 6004-F88 in March 1984.

ANSI/AGMA 6004-F88 superseded AGMA 321.05, *Design Practice for Helical and Herringbone Gears for Cylindrical Grinding Mills, Kilns, Coolers, and Dryers*. It was approved by the AGMA membership in January 1988 and approved as an American National Standard on May 31, 1988.

ANSI/AGMA 6004 was not widely accepted by the industry and many continued to use AGMA 321.05. As such, the AGMA Mill Gearing Committee began work on ANSI/AGMA 6114-A06 in November 2001. Changes to the standard include a new dynamic factor analysis as a function of transmission accuracy number, revised allowable stress numbers, the use of the stress cycle factor in the rating practice, and ratings for gears made from ductile iron. Extensive discussions on new equipment installation and alignment, lubrication, and use of ausferritic ductile iron (ADI) were added to the annex.

The AGMA Mill Gearing Committee began work on AGMA 6114-B15 in February 2011. Changes to the standard, based on committee experience and field performance of gear sets, include:

- added load distribution factor for self-aligning pinions;
- modified values of σ_{FP} for ductile iron and ADI;
- reformatted graph of minimum effective case depth for carburized and induction hardened pinions, $h_{e \min}$;
- moved austempered (formerly ausferritic) ductile iron from Annex H to the body of the standard;
- revised Annex D to include information taken from ANSI/AGMA 9005-E02 [8];
- changed references to extreme pressure (EP) additives to antiscuff (AS) additives in Annex D. Users are encouraged to transition their terminology away from the term extreme pressure, or EP, and toward antiscuff, or AS;
- updated material mechanical property information in Annex F;
- added Annex J to provide information on combination drives.

Values for factors assigned in other standards are not applicable to this standard, nor are the values assigned in this standard applicable to other standards. The ability to design gears, and the knowledge and judgment required to properly evaluate the various rating factors comes primarily from years of accumulated experience in gearing. The detailed treatment of the general rating formulas for specific applications is best accomplished by those experienced in the field.

The first draft of AGMA 6114-B15 was made in September, 2012. It was approved by the AGMA membership in August 2015 and approved as an American National Standard on October 21, 2015.

Suggestions for improvement of this standard will be welcome. They may be submitted to tech@agma.org.

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American National Standard—

Gear Power Rating for Cylindrical Shell and Trunnion Supported Equipment (Metric Edition)

1 Scope

1.1 Applicability

This standard provides a method to determine the power rating of gear sets with spur and helical conventional pinions and spur self-aligning pinions for cylindrical grinding mills, kilns, coolers, and dryers. The formulas are applicable to steel, ductile iron (spheroidal graphitic iron), and austempered ductile iron (ADI) with machined spur, single helical, double helical, or herringbone gear teeth. Calculations determine the allowable rating for pitting resistance and bending strength of external involute gear teeth.

1.2 Rating formulas

This standard provides a method by which different gear designs can be rated and compared. It is not intended to assure the performance of assembled gear drive systems.

These rating formulas are applicable for rating the pitting resistance and bending strength of external involute gear teeth operating on parallel axes with adjustable center distances. The formulas evaluate gear tooth capacity as influenced by the major factors which affect gear tooth pitting and gear tooth fracture at the fillet radius.

This standard is intended for use by experienced gear designers, capable of selecting reasonable values for the rating factors. It is not intended for use by the engineering public at large.

Rating formulas are valid only when components are installed according to gear manufacturer or original equipment supplier's recommendation.

Values for factors assigned in other standards are not applicable to this standard nor are the values assigned in this standard applicable to other standards. Mixing values from other standards with those from this standard could lead to erroneous ratings.

The gear designer or manufacturer is not responsible for the total system unless such a requirement is clearly identified in the contractual agreement.

It is imperative that the system designer be satisfied that the system of connected rotating parts is compatible, free from critical speeds and from torsional or other vibrations within the specified speed range, no matter how induced.

Where empirical values for rating factors are given by curves, curve-fitting equations are provided to facilitate computer programming. The constants and coefficients used in curve fitting often have significant digits in excess of those inferred by the reliability of the empirical data. Experimental data from actual gear unit measurements are seldom repeatable within a plus or minus 10 percent band. Calculated gear ratings are intended to be conservative, but the scatter in actual results may exceed 20 percent.

CAUTION: Compliance with this standard does not constitute a warranty of the rating of the gear set under installed field service conditions.