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AGMA 945-2-B20

AGMA Information Sheet

Splines – Design and Application (Inch Edition)

AGMA 945-2-B20

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**American Gear
Manufacturers
Association** ***Splines – Design and Application (Inch Edition)***
AGMA 945-2-B20

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ABSTRACT

This information sheet covers inch based parallel straight sided and involute splines. It provides information relating to geometry, fit types, materials, manufacturing, rating, inspection, lubrication, and failure of splined elements. For metric based splines see AGMA 945-1-B20.

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Contents

Foreword	vi
1 Scope.....	1
2 Normative references	3
3 Symbols and nomenclature	3
3.1 Terms.....	6
4 Geometry	9
4.1 Basic elements of a spline	9
4.2 Involute splines	11
4.3 Parallel straight sided splines	13
4.4 Tooth size	14
4.5 Effective pressure angle for parallel straight sided splines.....	15
4.6 Spline end geometry	16
4.7 Shaper cut or blind broaching clearance grooves	21
4.8 Modifications	21
4.9 Root configuration.....	24
5 Spline fits	25
5.1 Loose fit splines	26
5.2 Transition and interference fits	27
5.3 Parallel straight sided spline fits	28
5.4 Effective vs. actual tooth thickness and space width.....	28
6 Drawing.....	28
6.1 Involute tooth form	29
6.2 Parallel straight sided splines	30
7 Inspection/measurement	32
7.1 Functional quality for assembly	33
7.2 Two categories of measurement methods	33
7.3 Functional measurement	33
7.4 Dimension over/under pins or balls	33
7.5 Concentricity or runout method.....	35
7.6 Effective tooth thickness/space width	35
7.7 The "effective fit" concept	35
7.8 Analyzing elemental errors	37
7.9 Go, no-go plugs & rings	37
7.10 Variable spline gaging	39
7.11 Analytical-elemental measurement.....	40
7.12 Inspection of large splines	42
8 Materials and manufacturing	43
8.1 Spline manufacturing processes – generating action.....	43
8.2 Non-generating spline manufacturing processes	44
8.3 Heat treatment prior to spline forming	46
8.4 Heat treating after spline forming.....	46
8.5 Other secondary processing.....	47
9 Spline lubrication	47

9.1	Purpose of spline lubrication.....	47
9.2	Types of spline lubrication	48
9.3	Selection criteria for lubrication type	49
9.4	Lubrication techniques	50
10	Rating	52
10.1	Stress and life factors	53
10.2	Involute spline stress formulas	56
11	Troubleshooting	65
11.1	Characteristics affecting spline stress	65
11.2	Surface distress	66
11.3	Tooth breakage.....	67
11.4	Shaft / hub breakage	67
11.5	Difficult to assemble.....	69

Annexes

Annex A (informative) Bibliography.....	70
Annex B (informative) Acknowledgments	71

Tables

Table 1 – Document scope	1
Table 2 – Symbols and terms	4
Table 3 – Basic spline pitch	14
Table 4 – Effective pressure angle of external parallel straight sided splines per SAE J501.....	16
Table 5 – Spline rack typical values.....	18
Table 6 – Spherical rolled spline falloff	21
Table 7 – Involute and parallel straight sided spline fits	26
Table 8 – Quality Features.....	32
Table 9 – Typical manufacturing processes and applicable materials	45
Table 10 – Recommended spline application factors, K_a	53
Table 11 – Face load distribution factor, K_m	54
Table 12 – Fatigue life factor, L_f for splines.....	55
Table 13 – Life factor, L_w , for splines.....	55
Table 14 – Dudley allowable compressive stresses with corresponding stress ratios	57
Table 15 – Tabular values for crown contact stress factors	59
Table 16 – Dudley allowable shear stresses with corresponding stress ratios	61

Figures

Figure 1 – Basic elements of involute splines.....	9
Figure 2 – Basic elements of parallel straight sided splines	10
Figure 3 – Involute and parallel straight sided splines.....	10

Figure 4 – External involute spline	11
Figure 5 – Internal involute spline	11
Figure 6 – Working depth.....	12
Figure 7 – External parallel straight sided spline	13
Figure 8 – External parallel straight sided spline	13
Figure 9 – Parallel straight sided spline effective pressure angle	15
Figure 10 – Tool relief	16
Figure 11 – Lead in geometry	17
Figure 12 – Rolled spline root runout and tool geometry	17
Figure 13 – Cross section of the spline rack tool	18
Figure 14 – Rolled splines vs. cut splines.....	18
Figure 15 – Spline hobbing, generated.....	19
Figure 16 – Lead-in chamfer	19
Figure 17 – Spline flank chamfer	20
Figure 18 – Rolled major diameter falloff	20
Figure 19 – Spherical rolled spline falloff	21
Figure 20 – Tapered tooth.....	22
Figure 21 – Tip chamfering	22
Figure 22 – Block tooth	24
Figure 23 – Typical internal root and fit configurations	25
Figure 24 – Spline potential pilot features.....	25
Figure 25 – Low detail specification	29
Figure 26 – High detail specification	30
Figure 27 – Internal parallel straight sided spline specification	31
Figure 28 – External parallel straight sided tooth specification.....	32
Figure 29 – Measurement over/under balls/pins for even number of teeth	34
Figure 30 – Measurement over/under balls/pins for odd number of teeth	34
Figure 31 – Concentricity plug & ring gages	35
Figure 32 – Effective vs. actual tooth thickness.....	35
Figure 33 – Breakdown of deviation allowance and machining allowances	36
Figure 34 – Go spline plug gage	38
Figure 35 – Go, no-go spline ring gages.....	39
Figure 36 – Tapered master plug.....	39
Figure 37 – Hand held variable actual tooth/space spline gage	40
Figure 38 – Variable effective tooth/space spline gages	40
Figure 39 – Pistol grip style variable spline gages.....	40
Figure 40 – Analytical-elemental measurement chart	41
Figure 41 – Large go, no-go spline plug gages for large part.....	42
Figure 42 – Dimension between balls inspection of large parts	42

Figure 43 – Ball span mics..... 43

Figure 44 – Fully submerged 52

Figure 45 – Dudley wear life factor 64

Figure 46 – Dudley fatigue life factors 64

Figure 47 – Ductile torsional failure (plane of shaft cross section) 68

Figure 48 – Brittle torsional failure (helicoid)..... 68

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 AGMA 945-2-B20, *Splines – Design and Application (Inch Edition)*].

Several documents exist relating to various aspects of spline design and manufacture. For example, spline geometry is well covered in other standards and rather than repeating those standards, this document makes reference to each one. Even the term *spline* can refer to a multitude of part shapes. This document is an attempt to augment other spline standards and consolidate information on spline types, geometry, assembly, inspection, materials, manufacturing processes, lubrication, rating, and failure modes.

Although involute splines of 30° pressure angle are very popular, this information sheet also covers involute splines of 37.5° and 45° pressure angle, parallel straight sided splines and modifications to spline geometry such as lead modification, missing tooth, and end geometry from the manufacturing process.

This information sheet is an extension of AGMA 945-1-B20 to cover inch based splines. Heat treatment requirements were updated, the rating and troubleshooting clause was separated, and new references were added. The committee began work on this information sheet in August 2019.

The first draft of AGMA 945-2-B20 was created in May 2020. It was approved by the membership in August 2020 and approved for publication by the Technical Division Executive Committee (TDEC) on August 20, 2020.

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

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1 Scope

The scope of this information sheet includes involute splines (some of which are governed by ANSI B92.1), plus variants such as modifications to helix, lead crown, form diameters, root geometry, tooth thickness, and fits and straight sided splines with parallel teeth in the external spline (some of which are governed by SAE J499 or SAE J501). It also includes longitudinal effects such as the washout of the minor diameter in splines that are formed or cut into a shaft and hoop strength effects of hollow splined sections. A limited range of materials is included: hard steel, soft steel, powdered metal steel (PM), and cast iron. Manufacturing processes discussed include: rolling, hobbing, shaping, milling, broaching, grinding, net formed PM, and cold forming. Rating for compressive, shear, bending, and hoop stresses are covered, as are tolerances, lubrication, and failure modes. Both elemental and attribute inspection of splines are included. It also describes drawing requirements, and a troubleshooting guide. Table 1 provides a summary of the scope.

Table 1 – Document scope

Category	In Scope	Not in scope
Geometry:		
Shape:	a. Cylindrical b. Involute 30°, 37.5°, 45° pressure angle c. Straight sided with parallel teeth in external spline	a. Non-parallel straight sided b. Castle c. Other involute pressure angle d. Serration e. Face including Curvic
Modifications:	a. Crowned b. Tapered c. Reduced form clearance d. Modified tooth thickness e. Tip chamfer or internal corner clearance f. Splines with some teeth intentionally missing	a. Modified tooth height
Tooth Size:	a. Involute: 2.5 to 48 diametral pitch	a. Finer than 48 diametral pitch b. Coarser than 2.5 diametral pitch
Tooth count:	a. Involute: Equal to or more than 6 teeth b. Parallel straight sided: 4, 6, 8, 10, 16 teeth	a. Involute: Less than 6 teeth b. Parallel straight sided: other tooth counts
Location:	a. Internal b. External	a. Face
Spline standard:	a. English involute stub pitch: ANSI B92.1-1996 b. Metric involute: ISO 4156, DIN 5480 c. English parallel straight sided: SAE J499 or SAE J501 d. Metric parallel straight sided: ISO 14	
Lead:	a. Straight, or spur b. Slight helix on shaft for interference fit	a. Spur or helical; continuation of gear tooth b. Helix splines for locking > 1 degree
Root geometry:	a. Flat root b. Full fillet c. Undercuts in internal spline major diameter d. Net formed root shape	