ASABE/ISO 500-3:2014 MAR2015 (R2019)
Agricultural tractors — Rear-mounted power take-off types 1, 2, 3 and 4 — Part 3: Main PTO dimensions and spline dimensions, location of PTO

American Society of Agricultural and Biological Engineers

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Agricultural tractors — Rear-mounted power take-off types 1, 2, 3 and 4 — Part 3: Main PTO dimensions and spline dimensions, location of PTO

This standard was reviewed and approved for adoption by the ASABE Power and Machinery Tractors and Tractor Implement Interface/PTO Technical subcommittees. This adoption, along with the adoption with deviations of ISO 500-1:2004/Cor. 1:2005, ISO 8759-1:1998, and ISO 8759-2:1998 and the identical adoptions of ISO 500-2:2004 replaced ASAE S203.14 and ASAE S513. Rear mounted PTOs are addressed in the ISO 500 adoptions, front mounted in the ISO 8759 adoptions. Identical adoption of ISO 500-3:2004 approved by ASABE and ANSI as an American National Standard January 2011; replaced with identical adoption of ISO 500-3:2014 March 2015; reaffirmed May 2019.

Keywords: Dimensions, Location, Master shield, Power take-off, Safety, Spline, Tractors

0 Foreword

0.1 ASABE/ISO 500-3:2014, Agricultural tractors — Rear-mounted power take-off types 1, 2, 3 and 4 — Part 3: Main PTO dimensions and spline dimensions, location of PTO, is an adoption without modification of the identically titled ISO standard ISO 500-3:2014, Agricultural tractors — Rear-mounted power take-off types 1, 2, 3 and 4 — Part 3: Main PTO dimensions and spline dimensions, location of PTO.

0.2 ASABE/ISO 500-3:2014 Specifies manufacturing requirements for, and the location of, rear-mounted power take-offs (PTOs) of types 1, 2, 3 and 4 on agricultural tractors.

0.3 One normative reference is listed in ISO 500-3:2014. This reference has been reviewed and accepted as part of the adoption of ASABE/ISO 500-3:2014.

0.4 This standard has been approved as an American National Standard by ANSI (American National Standards Institute). The original content of ISO 500 and ISO 8759 was based on ASAE S203.

Text of ISO 500-3:2014; Agricultural tractors — Rear-mounted power take-off types 1, 2, 3 and 4 — Part 3: Main PTO dimensions and spline dimensions, location of PTO, follows.

1 Scope

1.1 This part of ISO 500 specifies manufacturing requirements for, and the location of, rear-mounted power take-offs (PTOs) of types 1, 2, 3 and 4 on agricultural tractors.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

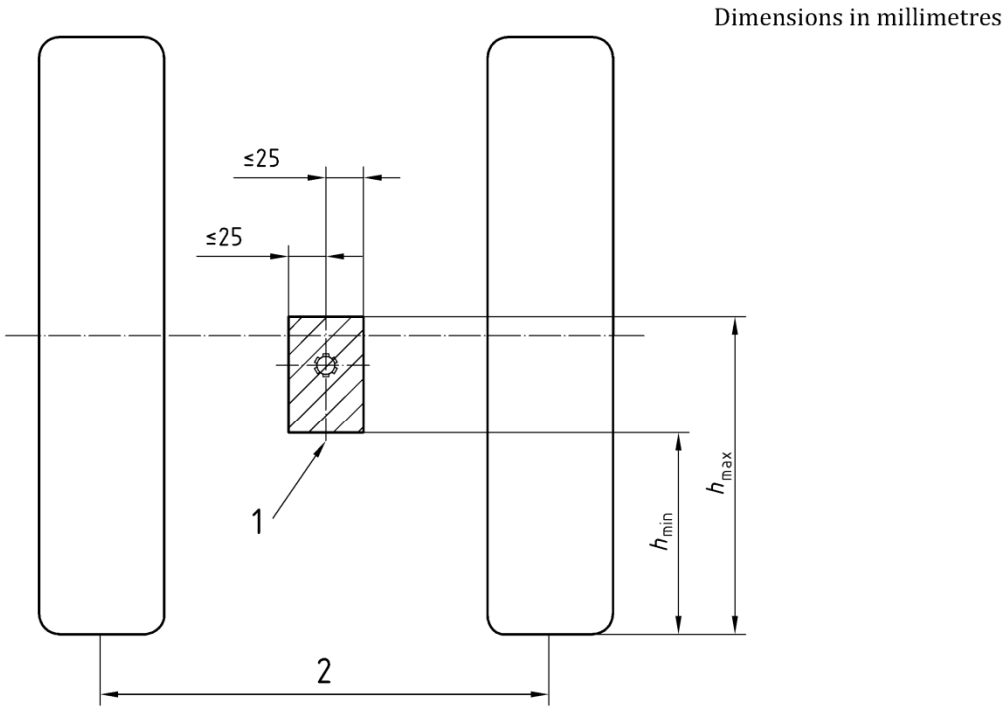
ISO 6508 (all parts), *Metallic materials — Rockwell hardness test*

3 PTO location

The location of the PTO axis shall lie within the shaded rectangle shown in Figure 1 and in accordance with Table 1, parallel to the longitudinal axis of the tractor and should be parallel to the ground within ±3°.

The values of the dimension h are for normal agricultural applications (see Figure 1 and Table 1). On tractors especially designed for high ground clearance, such as working in standing vegetable crops or sugar cane, h_{max}, can exceed the given values. On agricultural tractors designed for low ground clearance, such as lawn mowing or ground care which require a low centre of gravity, for narrow-track tractors, and for track-laying tractors, h_{min}, can be less than the given values.

For tractors that can accommodate multiple PTO types, h_{max} shall be the value for the largest PTO type specified for the tractor.



Key

1 centre line of tractor

2 track width

Figure 1 – PTO location

Table 1 – PTO location

Dimensions in millimetres

PTO Type	h_{min}	h_{max}
1	480	800
2	530	900
3	600	1 000
4	600	1 000

4 Manufacturing requirements — Main PTO and spline dimensions

The dimensions of the rear PTO on agricultural tractors and the mating part of the PTO drive shaft shall comply with:

— Figure 2 and Table 2, for PTO dimensions;

— Figure 3 and Table 3, for external, straight-sided spline dimensions — Type 1;

— Figure 4 and Table 4, for internal straight-sided spline dimensions — Type 1;

— Figure 5 and Table 5, for external, involute spline dimensions — Type 2;

— Figure 6 and Table 6, for internal, involute spline dimensions — Type 2;

— Figure 7 and Table 7, for external, involute spline dimensions — Type 3;

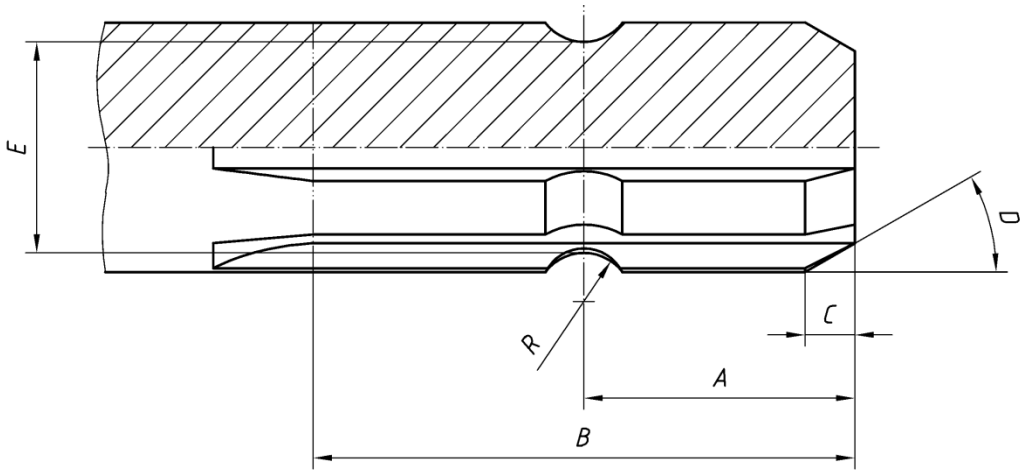
— Figure 8 and Table 8, for internal, involute spline dimensions — Type 3;

— Figure 9 and Table 9, for external, involute spline dimensions — Type 4;

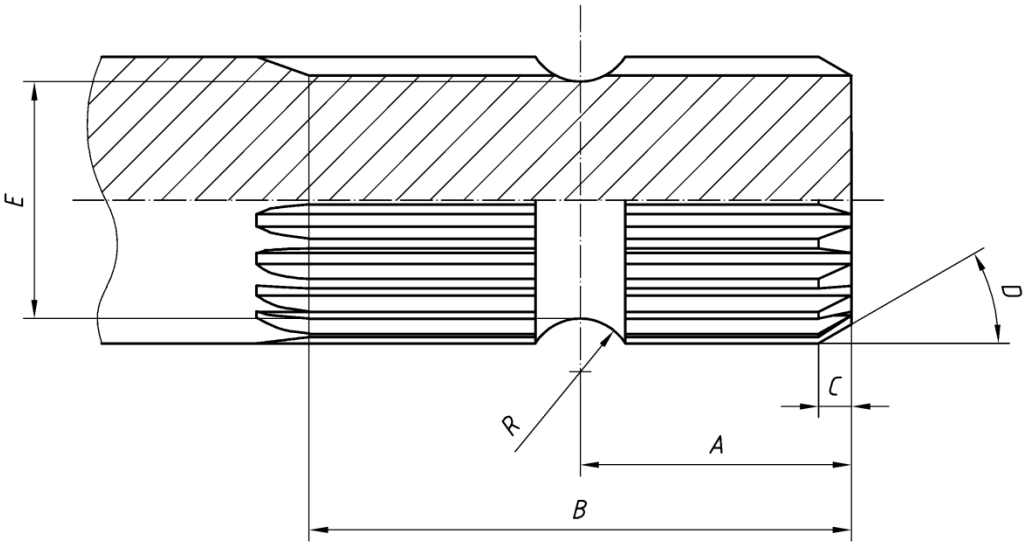
— Figure 10 and Table 10, for internal, involute spline dimensions — Type 4.

The hardened portion of the splines shall have a minimum surface hardness of 48 HRC when tested in accordance with ISO 6508 (all parts).

NOTE: For general spline information, including inspection, see ISO 4156 (all parts).



a) Type 1



b) Types 2, 3, and 4

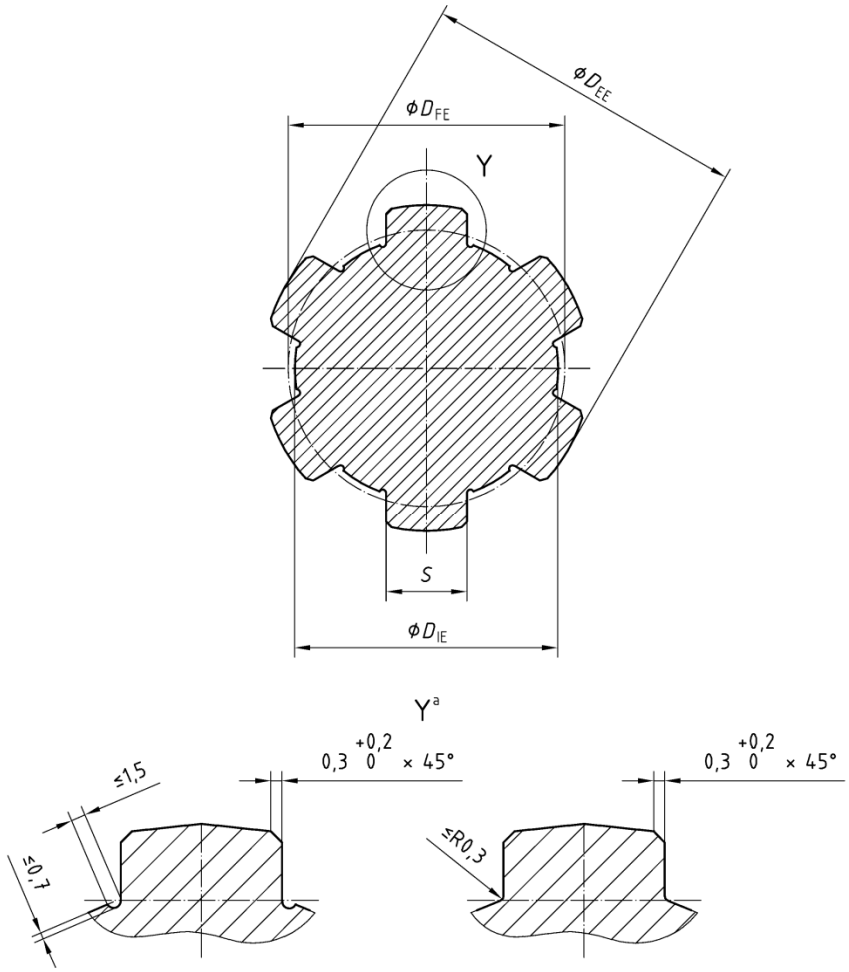
Figure 2 – PTO dimensions

Table 2 – PTO dimensions

Dimensions in millimetres

	Dimension	Type 1	Type 2	Type 3	Type 4
A	Groove to end of shaft	38 ± 0,8	25,5 ± 0,8	38 ± 0,8	50 ± 0,8
B	Effective spline length and hardened portion	≥76	≥64	≥89	≥100
C	Chamfer	6^{+1}_{0}	5^{+1}_{0}	6^{+1}_{0}	8^{+1}_{0}
D	Chamfer angle	30 ± 3	30 ± 3	30 ± 3	30° ± 3°
E	ID of groove	29,40 ± 0,1	29,40 ± 0,1	37,25 ± 0,1	48 ± 0,1
R	Radius of groove	6,8 ± 0,25	6,8 ± 0,25	8,4 ±0,25	10,4 ± 0,25

Dimensions in millimetres



Key

[a] Optional.

Figure 3 – External, straight-sided spline dimensions — Type 1

Table 3 – External, straight-sided spline dimensions — Type 1

		Dimensions in millimetres
Dimension	**Symbol**	**Value**
Number of teeth	Z	6
Major diameter	D_{EE}	$34{,}87^{0}_{-0{,}12}$
Form diameter	D_{FE}	≤30,00
Minor diameter	D_{IE}	$29{,}00^{0}_{-0{,}10}$
Tooth thickness max. eff.	S_{Vmax}	8,64
Tooth thickness max. act. REF	S_{max}	(8,60)
Tooth thickness min. act.	S_{min}	8,51
Allowed from variations	Composite GO gage has priority	
Total profile variation	F_F	0,020
Total lead variation	F_B	0,015
Total index variation	F_P	0,040

Dimensions in millimetres

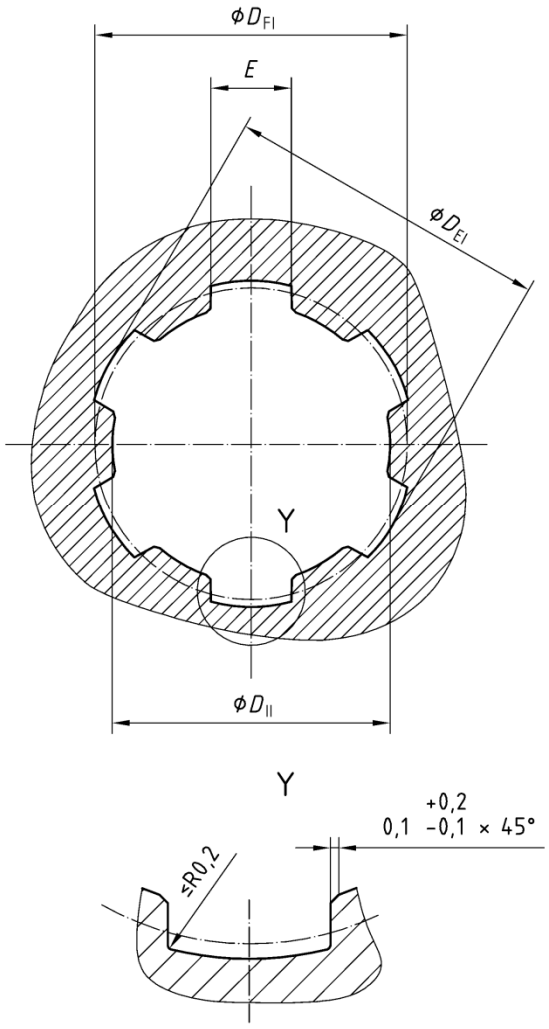


Figure 4 – Internal, straight-sided spline dimensions – Type 1

Table 4 – Internal, straight-sided spline dimensions – Type 1

Dimensions in millimetres

Dimension	Symbol	Value
Number of teeth	Z	6
Major diameter	D_{EI}	$34{,}95^{0}_{-0{,}05}$
Form diameter	D_{FI}	≥34.50
Minor diameter	D_{II}	$29{,}80^{0}_{-0{,}15}$
Space width max. act.	E_{max}	8,76
Space width min. act. REF	E_{min}	(8,71)
Space width min. eff.	E_{Vmin}	8,69
Allowed from variation	Composite GO gage has priority	
Total profile variation	F_F	0,020
Total lead variation	F_B	0,015
Total index variation	F_P	0,040

Dimensions in millimetres

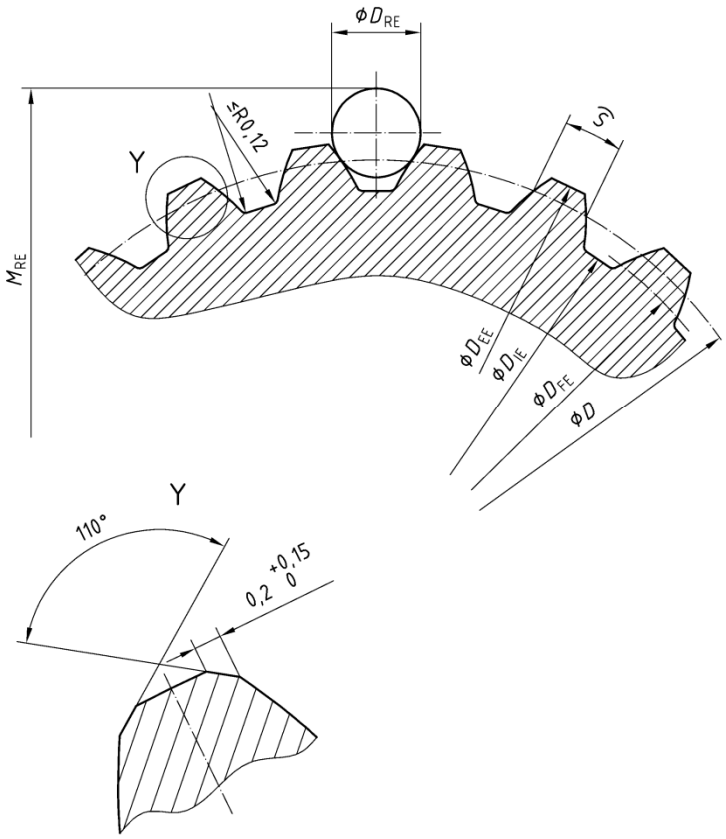


Figure 5 – External, involute spline dimensions – Type 2

Table 5 – External, involute spline dimensions – Type 2

Dimension in millimetres

Dimension	Symbol	Value	For Alternative Imperial Pin Size
Number of teeth	Z	21	-
Module	M	1,587 5	-
Pressure angle	α	30°	-
Pitch diameter	D	33,338	-
Base diameter	D_B	28,871 1	-
Major diameter	D_{EE}	$34{,}874^{0}_{-0{,}025}$	-
Form diameter	D_{FE}	≤31,65	-
Minor diameter	D_{IE}	$31{,}100^{0}_{-0{,}025}$	-
Tooth thickness max. eff.	S_{Vmax}	2,406	-
Tooth thickness max. act. REF	S_{max}	(2,369)	-
Tooth thickness min. act.	S_{min}	2,306	-
Pin diameter	D_{RE}	3,50	3,048
Dim. over pins max. REF	M_{REmax}	(39,00)	(37,759)
Dim. over pins min.	M_{REmin}	38,906	37,662
Allowed form variations	Composite GO gage has priority		
Total profile variation	F_F	0,020	-
Total lead variation	F_B	0,013	-
Total index variation	F_P	0,040	-
Concentricity	D_{EE} to D	0,03	-

Dimensions in millimetres

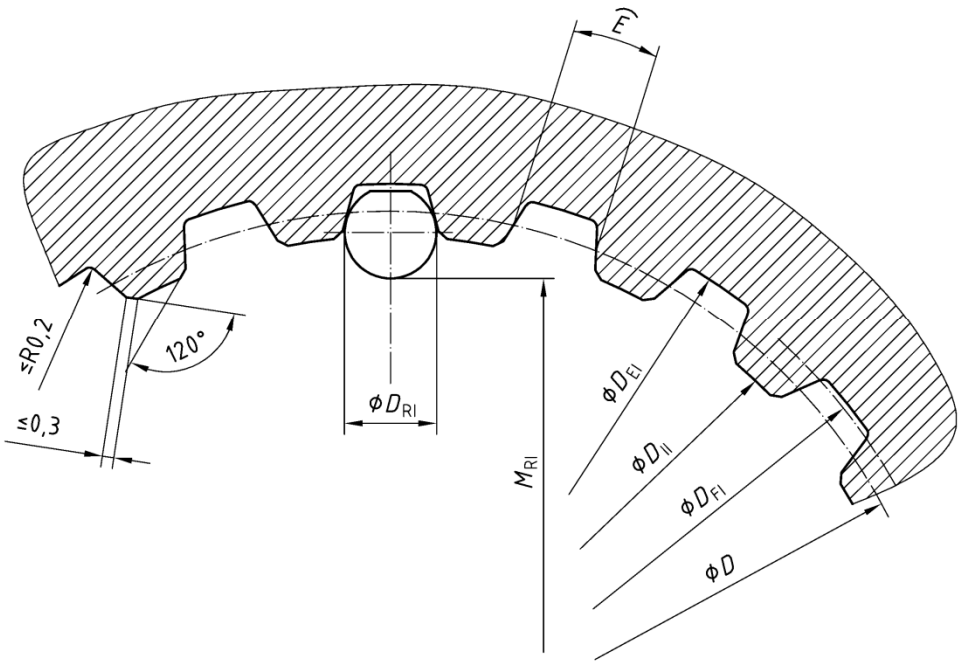


Figure 6 – Internal, involute spline dimensions – Type 2

Table 6 – Internal, involute spline dimensions – Type 2

Dimension in millimetres

Dimension	Symbol	Value	For Alternative Imperial Pin Size
Number of teeth	Z	21	-
Module	M	1,587 5	-
Pressure angle	α	30°	-
Pitch diameter	D	33,338	-
Base diameter	D_B	28,871 1	-
Major diameter	D_{EI}	$34{,}925^{+0{,}036}_{0}$	-
Form diameter	D_{FI}	≥34,62	-
Minor diameter	D_{II}	$31{,}750^{+0{,}150}_{0}$	-
Space width max. act.	E_{max}	2,565	-
Space width min. act. REF	E_{min}	(2,520)	-
Space width min. eff.	E_{Vmin}	2,494	-
Pin diameter/flattened	D_{RI}	2,75/2,60	2,743/2,60
Dim. between pins max.	M_{RImax}	29,380	29,403
Dim. betw. pins min. REF	M_{RImin}	(29,290)	(29,315)
Allowed form variations	Composite GO gage has priority		
Total profile variation	F_F	0,020	-
Total lead variation	F_B	0,013	-
Total index variation	F_P	0,040	-
Concentricity	D_{EE} to D	0,02	-

Dimensions in millimetres

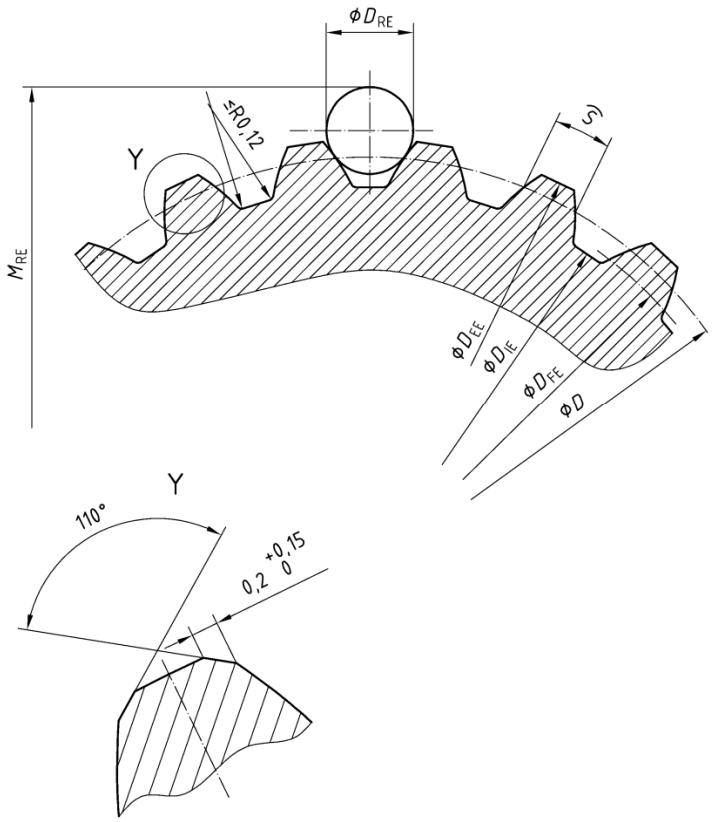


Figure 7 – External, involute spline dimensions – Type 3

Table 7 – External involute spline dimensions – Type 3

Dimension in millimetres

Dimension	Symbol	Value	For Alternative Imperial Pin Size
Number of teeth	Z	20	-
Module	M	2,116 7	-
Pressure angle	α	30°	-
Pitch diameter	D	42,333	-
Base diameter	D_B	36,661 7	-
Major diameter	D_{EE}	$44{,}425^{0}_{-0{,}025}$	-
Form diameter	D_{FE}	≤40,10	-
Minor diameter	D_{IE}	$39{,}210^{0}_{-0{,}250}$	-
Tooth thickness max. eff.	S_{Vmax}	3,237	-
Tooth thickness max. act. REF	S_{max}	(3,200)	-
Tooth thickness min. act.	S_{min}	3,137	-
Pin diameter	D_{RE}	4,000	4,064
Dim. over pins max. REF	M_{REmax}	(48,239)	(48,418)
Dim. Over pins min.	M_{REmin}	~~(48,142)~~	48,321
Allowed form variations	Composite GO gage has priority		
Total profile variation	F_F	0,020	-
Total lead variation	F_B	0,013	-
Total index variation	F_P	0,040	-
Concentricity	D_{EE} to D	0,03	-

Dimensions in millimetres

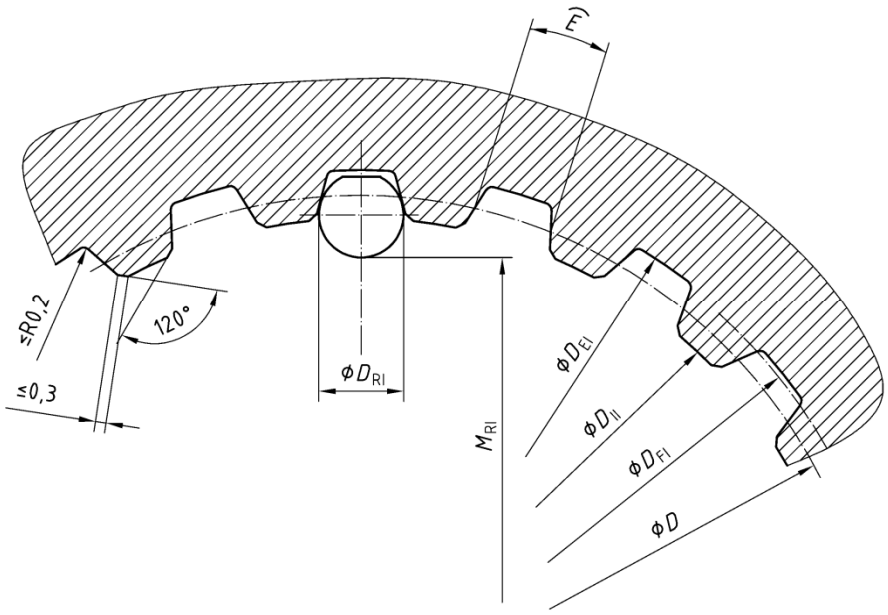


Figure 8 – Internal, involute spline dimensions – Type 3

Table 8 – Internal, involute spline dimensions – Type 3

Dimension in millimetres

Dimension	Symbol	Value	For Alternative Imperial Pin Size
Number of teeth	Z	20	-
Module	M	2,116 7	-
Pressure angle	α	30°	-
Pitch diameter	D	42,333	-
Base diameter	D_B	36,661 7	-
Major diameter	D_{EI}	$44{,}450^{+0{,}038}_{0}$	-
Form diameter	D_{FI}	≥44,044	-
Minor diameter	D_{II}	$40{,}200^{+0{,}150}_{0}$	-
Space width max. act.	E_{max}	3,396	-
Space width min. act. REF	E_{min}	(3,351)	-
Space width min. eff.	E_{Vmin}	3,325	-
Pin diameter	D_{RI}	3,75	3,658
Dim. between pins max.	M_{RImax}	36,850	37,153
Dim. betw. pins min. REF	M_{RImin}	(36,758)	(37,064)
Allowed form variations	Composite GO gage has priority		
Total profile variation	F_F	0,020	-
Total lead variation	F_B	0,013	-
Total index variation	F_P	0,040	-
Concentricity	D_{EI} to D	0,02	-

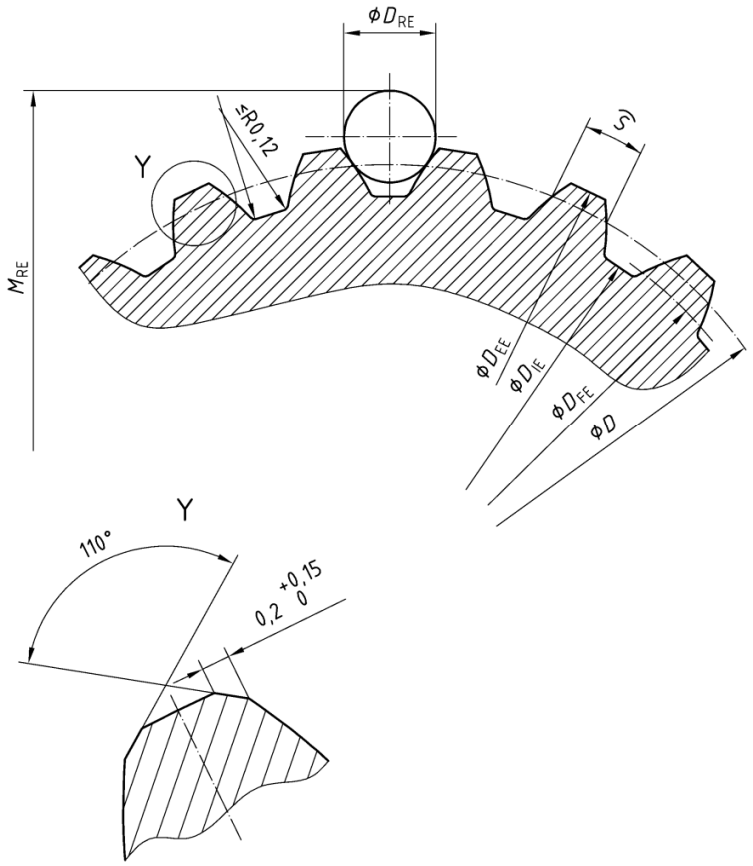


Figure 9 – External, involute spline dimensions – Type 4

Table 9 – External, involute spline dimensions – Type 4

Dimension in millimetres

Dimension	Symbol	Value	For Alternative Imperial Pin Size
Number of teeth	Z	22	-
Module	M	2,50	-
Pressure angle	α	30°	-
Pitch diameter	D	55,000	-
Base diameter	D_B	47,631 4	-
Major diameter	D_{EE}	$57{,}500^{0}_{-0{,}025}$	-
Form diameter	D_{FE}	≤52,26	-
Minor diameter	D_{IE}	$51{,}18^{0}_{-0{,}250}$	-
Tooth thickness max. eff.	S_{Vmax}	3,842	-
Tooth thickness act. REF.	S_{max}	(3,805)	-
Tooth thickness min. act.	S_{min}	3,742	-
Pin diameter	D_{RE}	5,300	5,309
Dim. over pins max.REF	M_{REmax}	(63,618)	(63,641)
Dim. over pins min	M_{REmin}	63,523	63,548
Allowed form variations	Composite GO gage has priority		
Total profile variation	F_F	0,020	-
Total lead variation	F_B	0,013	-
Total index variation	F_P	0,040	-
Concentricity	D_{EE} to D	0,03	-

Dimensions in millimetres

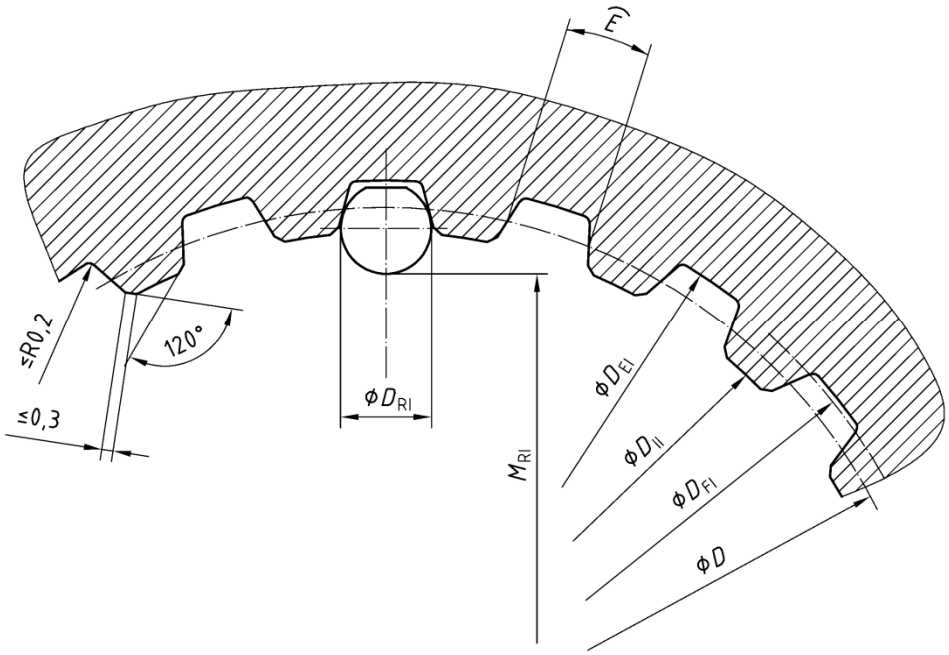


Figure 10 – External, involute spline dimensions – Type 4

Table 10 – Internal, involute spline dimensions – Type 4

Dimension in millimetres

Dimension	Symbol	Value	For Alternative Imperial Pin Size
Number of teeth	Z	22	-
Module	M	2,500	-
Pressure angle	α	30°	-
Pitch diameter	D	55,000	-
Base diameter	D_B	47,631 4	-
Major diameter	D_{EI}	$57{,}525^{+0{,}038}_{0}$	-
Form diameter	D_{FI}	≥57,000	-
Minor diameter	D_{II}	$52{,}760^{+0{,}150}_{0}$	-
Space width max. act.	E_{max}	4,001	-
Space width min. act. REF	E_{min}	(3,955)	-
Space width min. eff.	E_{Vmin}	3,927	-
Pin diameter	D_{RI}	4,50	4,496
Dim. between pins max.	M_{RImax}	48,284	48,311
Dim. betw. pins min. REF	M_{RImin}	(48,191)	(48,209)
Allowed form variations	Composite GO gage has priority		
Total profile variation	F_F	0,020	-
Total lead variation	F_B	0,013	-
Total index variation	F_P	0,040	-
Concentricity	D_{EI} to D	0,02	-

Bibliography

[1] ISO 4156 (all parts), *Straight cylindrical involute splines — Metric module, side fit*