IS 7657-2 (1975): Starter Ring Gears for Internal Combustion Engines, Part II: Gears for Axial and Coaxial Starters [TED 2: Automotive Primemovers]

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UDC 621·43-571·7 : 621·833

Indian Standard (Reaffirmed 1999)

SPECIFICATION FOR STARTER RING GEARS FOR INTERNAL COMBUSTION ENGINES

PART II GEARS FOR AXIAL AND COAXIAL STARTERS

Internal Combustion Engines Sectional Committee, EDC 14; Panel for Flywheel Ring Gears, EDC 14 : P1 [Ref : Doc : EDC 14 (2319)]

1. Scope — Specifies gear profile, dimensions, material and other requirements for involute spur gears for axial and coaxial starters having aluminium bronze or hardened steel pinions for use on heavy duty commercial vehicles, marine engines and heavy duty stationary engines.

2. Terminology — Definitions given in IS : 7657 (Part I)-1975 ' Specification for starter ring gears for internal combustion engines: Part I Gears for inertia and solenoid pre-engaged starters ' and the following definition shall apply.

2.1 *Axial Pre-engagement* — Engagement of the pinion effected by axial movement of the motor shaft or by the operation of a mechanism coaxial with it which is within the motor.

3. Dimensions — These gears are generally used with 3 and 4 module involute spur gears. The tolerances shall be specified according to any one of the methods given in Table 1.

TABLE 1 RECOMMENDED METHODS OF MEASUREMENTS FOR STARTER RING GEARS

All dimensions in millimetres.

		METHOD I	METHOD II	METHOD III	
		Span Over Given Number of Teeth* Base Tangent Length	Dimensions Over Roller Using ϕ Roller	Chordal Measurement	
				Chordal Height	Chordal Thickness
Before shrink fit	*Max*				
	Min				
After shrink fit† (For a nominal shrinkage of 0·5 mm)‡	*Max*				
	Min				

*Given number of teeth depends on total number of teeth on ring gear and pressure angle.

†Not applicable for bolted type of ring gears.

‡Recommended practice is to have 0·028 mm shrinkage allowance per 25 mm of inside diameter (to maintain a hoop stress of not more than 227·5 N/mm²).

3.1 *Face Width of Teeth* — This shall be as follows:

Axial starters — 22 mm (*Max*)

Coaxial starters — 16 mm (*Max*)

3.2 *Tooth Chamfer* — Teeth should not be rounded or chamfered, but shall have all sharp edges removed.

3.3 *Working Clearance* — Shall be 0·6 to 0·8 mm backlash under adverse working conditions. For shrunk-on type ring gears an additional diametral allowance of 0·5 mm shall be provided.

Adopted 29 April 1975

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4. Material — Steel C40 or C45 according to IS : 5517-1969 ' Specification for steels for hardening and tempering ' for use with hardened steel pinions.

4.1 For use with aluminium bronze pinions, 31Ni3Cr$\underline{65}$Mo$\underline{55}$ steel according to IS : 1570-1961 ' Schedules for wrought steels for general engineering purposes ' shall be used.

4.2 Any other material which would give hardness conditions specified in **6** could be used subject to agreement between the purchaser and the manufacturer.

5. Designation — Shall include:

a) Name,

b) Symbol A or CA for axial or coaxial type,

c) Module,

d) Whether used with soft or hard pinion — Symbol S or H respectively, and

e) No. of this standard.

Example:

A ring gear for axial type starters of module 3 and to be used with hard pinion shall be designated as:

Ring Gear A 3 H IS : 7657 (Part II)

6. Hardness — The hardness of the tooth engaging face on the pitch line shall be as follows:

Type of Ring Gear	*Hardness (HV)*
Ring gears used with hardened pinions	470 to 550
Ring gears used with soft pinions	200 to 262

6.1 The minimum depth of hardness shall be 2·5 mm over the whole profile.

7. Assembly on Flywheel

7.1 *Manual Gear Box Vehicles* — The gear ring can be bolted on to the flywheel or can be shrunk-on. With shrunk-on gear rings this operation is sometimes combined with tempering. If tempering has been done separately, the ring should not be heated to more than 200°C to avoid softening of gear teeth. This is of special importance when replacement rings are fitted by service stations. A shoulder or step on the flywheel is recommended to ensure that the ring is located equally with the correct out of mesh clearance when fitted to the engine.

7.2 *Automatic Gear Box Vehicles* — The ring gear can be bolted or shrunk-on, but it is also common practice for the ring gear to be welded to a flexible plate. In the latter case, the ring gear is made to the finished size since there is no expansion of the ring during fitting. It should be noted that the inherently more flexible location unusually results in a higher noise level, although wear rates can be similar to that of the other methods. Particular attention should be paid to accuracy of location.

EXPLANATORY NOTE

This standard covers ring gears for heavy duty commercial vehicle applications and for marine engines and heavy duty stationary engines used with axial and coaxial starters. It does not cover ring gears for inertia or pre-engaged starters which are covered in Part I of this standard.

Requirements of this standard are so chosen that they meet the requirements of starter endurance test specified in IS : 3141-1965 ' Specification for starters for automobiles '.

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