GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

SPECIFICATION
FOR
ALTERNATOR PULLEY AND AXLE PULLEY
OF BRUSHLLESS ALTERNATORS

SPECIFICATION No. ELPS/SPEC/TL/13
MARCH, 1998

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A3 - 300
3 A2 - 250/-

EMU & PS DIRECTORATE
RESEARCH, DESIGNS AND STANDARDS ORGANISATION
MANAK NAGAR, LUCKNOW - 226 011.

Cost - ~~Rs 2220/-~~

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INDIAN RAILWAYS STANDARD SPECIFICATION FOR ALTERNATOR PULLEY AND AXLE PULLEY OF BRUSHLESS ALTETRNATORS

SCOPE

This Specification covers the requirements of material and Quality Assurance tests to be conducted on Brushless Alternator Pulley and Axle Pulley used for AC as well as Conventional Coaches to RDSO's Drawing No. SKEL - 3882 (Alt.4), SKEL – 3883 (Alt.2), SKEL - 3645 & SKEL – 3652 (Alt.1).

In case of any other drawing mentioned in the Contract, RDSO's specific approval shall be necessary.

REFERENCE DOCUMENTS

This document refers to the following Indian Standards :-

Indian Standards No.	T I t l e
IS - 210	Specification for Grey Iron Casting
IS - 1500	Method for Brinell hardness testing.
IS - 2078	Method for tensile testing
IS - 5699	Method for chill test.

Whenever any IS Specification is mentioned in this document, reference shall always be made to the latest version.

The specific provisions in this Specification will overside those mentioned in the above IS Specifications where these are not in conformity with each other.

Dimensional details and tolerances of the pulley shall be in accordance with the relevant RDSO drawing mentioned in the Contract / Purchase Order.

SUPPLY OF MATERIAL

General requirements relating to supply of pulleys shall conform to IS – 2387, "General Requirements for supply of Metallurgical Materials".

MATERIAL

4.1 The material for pulley shall generally conform to the requirements of Grade FG – 260 of IS – 210-78 .(Specification for Grey Iron Castings).

5. RAW MATERIALS

5.1 Pulley castings shall be made from properly classified foundry returns, pig iron and steel scrap. Quality of limestone coke and Ferro alloys shall be checked before their addition and only acceptable quality raw materials shall be used for producing pulley castings.

5.2 Proper record of the raw material quality and the test results shall be maintained.

6. PATTERN

6.1 The pattern shall be made of metal, epoxy resin or seasoned wood (duly coated with protective layer).

6.2 The pattern(s) shall be suitably numbered with unique identification number and shall be checked for its conformance to dimensional tolerance at least once in 3 months. Proper record shall be maintained to this effect. In the event off dimensional inaccuracy observed, the pattern shall not be used.

6.3 In case, the pattern needs rectification, the same may be carried out and details thereof properly maintained.

7. MOULDING

7.1 The details of running, Gating and rising, system employed shall be arrived at based on sound foundry practices, proven through adequate trials and system standardised. Details of methoding shall be maintained to facilitate scrutiny by the Inspecting Officer.

7.2 The sand mould used shall be of pre-determined composition and characteristics to ensure quality casting manufacture. Parameters of the sand mix i./e. green compressive strength, moisture, permeability etc. shall be checked through laboratory tests and record maintained. Composition meeting the specified values shall only be used to prepare moulds.

7.3 Mould hardness for each mould shall be measured and recorded.

7.4 Suitable arrangements shall be made in the mould to obtain manufacturers name, pulley serial number, month and year of manufacture on the casting.

7.5 All moulds shall be given a suitable mould wash to ensure appropriate surface finish.

MELTING

8.1 Melting shall be carried out in induction, furnace, oil fired furnace, electric furnace cupola.

8.2 The charge composition and chemical composition aimed at (C, Mn, Si, S & P) shall be arrived at in advance and the same shall be strictly adhered to. Complete record regarding charge, composition and ferro-alloy addition shall be maintained for each heat/batch of molten metal.

8.3 Taping and pouring temperature of the molten metal shall be recorded in the log book for each pulley casting.

8.4 For each heat representing the pulley casting, standard test bars specified in IS – 210 shall be cast such that sufficient test bars are available for conducting mechanical tests.

8.5 Fracture test shall be conducted for each heat by using standard chill test piece (IS – 5699) to ensure freedom from chilling tendencies. Depth of chill shall be measured and record to this effect shall be maintained. The Inspecting Officer shall preserve sample of chill tests duly levelled for scrutiny.

8.6 Carbon equivalent value of each shall be determined using an appropriate co-efficient and record maintained.

9. FINISHING

9.1 All pulley castings shall be thoroughly dressed, risers, runners, gates removed and shot blasted to ensure freedom from any loosely adherent sand, metal particles, slag or foreign matter.

9.2 Finishing operation shall be carried out in cold state by using abrasive cutters and under no circumstances oxy-acetylene flame shall be used for dressing / finishing operation.

10. VISUAL EXAMINATION

10.1 100% of these pulley castings duly finished and shot blasted shall be subjected to visual examination with the help of a magnifying glass (x5) to detect the presence of any casting defect e.g. crack, blow hole, porosity, slag inclusions, sand fusion, shrinkage etc. In the event of any doubt, dye penetrant test shall be carried out to confirm the presence of defect.

10.2 Observations made during visual examination shall be recorded. For type approval, the Inspecting Officer shall conduct this test also.

10.3 All castings having harmful surface defects, or defects not likely to be eliminated during subsequent machining operation shall be rejected.

11. SECTIONIZING

11.1 One casting from the first batch of production shall be sectionized into three equal parts transversely to facilitate examination of internal defects. The casting shall be free from any internal casting defect.

11.2 At the time of type approval this test shall be conducted in the presence of the Inspecting Officer and approval shall be subject to satisfactory casting quality. Manufacture of further casting shall not be undertaken until type approval is granted.

11.3 In the event of defects observed in the sectionalizing test full batch of casting shall stand rejected and entire manufacturing process shall be repeated till satisfactory results are obtained.

12. TYPE APROVAL

12.1 Once the procedure of manufacture is perfected and the manufacturer is confident of producing consistently acceptance quality, a call letter shall be issued by them to the Inspecting Officer.

12.2 The Inspecting Officer shall scrutinize all the manufacturing records and samples mentioned from Para 3 to Para 11 and shall satisfy himself towards compliance of all provisions. Visual examination and scrutinizing test shall be carried out by the Inspecting Officer himself (in addition to the Quality Assurance tests specified at Para 14).

12.3 If the casting is found to have any unacceptable defect or if the manufacturing records are found deficient, type approval shall not be granted.

13. PRODUCTION OF CASTINGS AND MACHINING

13.1 The manufacturer after obtaining satisfactory type approval shall produce further castings in accordance with the same procedure as practiced for the initial casting.

13.2 Such castings which are found acceptable in visual examination and sectionalizing shall be finished machined to drawing dimensions.

13.3 The machined castings shall be checked for conformance to dimensional tolerance mentioned in the drawing and record maintained.

13.4 Call letter shall be issued to the Inspecting Officer for detailed inspection.

14. ACCEPTANCE TESTS

14.1 Batch : Castings produced from the same heat shall compromise of one batch.

ANNEXURE - I

SUMMARY OF TESTS

Nature of Tests (Para reference)	Quality control	Type Approval	Acceptance
Composition of raw materials(5.1)	Yes	No	No
Pattern dimensions (6.2)	Yes	No	No
Sand mix characteristics (7.2)	Yes	No	No
Mould hardness (7.3)	Yes	No	No
Tapping and pouring temp. (8.3)	Yes	No	No
Fracture test (chill test) (8.5)	Yes	No	No
Carbon equivalent Test (8.6)	Yes	No	No
Visual examination of castings (10.1)	Yes	Yes	Yes
Sectionalizing Test (11.1)	Yes	Yes	(1st batch casting)
Surface defects examination of finished castings (14.2)	Yes	Yes	Yes
Dimensional check (14.3)	Yes	Yes	Yes
Chemical composition (14.4)	(all elements only)	(only S&P)	(only S&P)
Tensile Test (14.5)	Yes	Yes	Yes
Hardness Test (14.6)	Yes	Yes	Yes
Dynamic Balance of the pulley (14.7)	Yes	Yes	Yes

14.2 Surface defects : 100% castings shall be examined visually (with the help of magnifying glass, 5x) to detect presence of any harmful casting defects, such as, cracks, shrinkage, blow holes, mis-run and such harmful defects shall not be accepted. Minor porosities and inclusions may be allowed.

14.3 Dimensional Check : 100% pulley castings in fully machined condition shall be checked for compliance to drawings dimensions with the help of gauges and other measuring instruments. Castings not meeting the drawing dimensions shall be rejected.

14.4 Chemical composition : The detailed chemical composition as mentioned at Para 8.2 shall be checked by the manufacturer for its conformance to the aimed chemistry in respect of —-heat. Only sulphur and phosphorus shall be checked by the Inspecting Officer. When checked in accordance with IS – 228, sulphur and phosphorus content shall not exceed 0.12% each.

14.5 Tensile Test : One tensile test shall be conducted for each heat/batch of castings. When tested in accordance with IS – 2078 the minimum value observed shall be 260N/mm2.

14.6 Hardness Test : Brinell hardness test shall be conducted on the samples cut from test bar in accordance with IS – 1500. The values of BHN shall lie within the range 180 – 220.

14.7 Dynamic Balance of the Pulley : The rotor and alternator pulleys shall be dynamically balanced separately. The residual unbalance shall not be more than 2.5gm-cm per kg.

14.8 Retest : Retest shall be conducted as per provisions of IS – 210.

14.9 Rejection : Castings not meeting the specified parameters shall be rejected and defaced. No efforts shall be made to reclaim these castings.

14.10 Summary of Tests : Tests to be conducted by the manufacturer (Quality Control Tests), type approval tests and acceptance tests have been tabulated at Annexure – I for quick appraisal.

15. PACKAGING

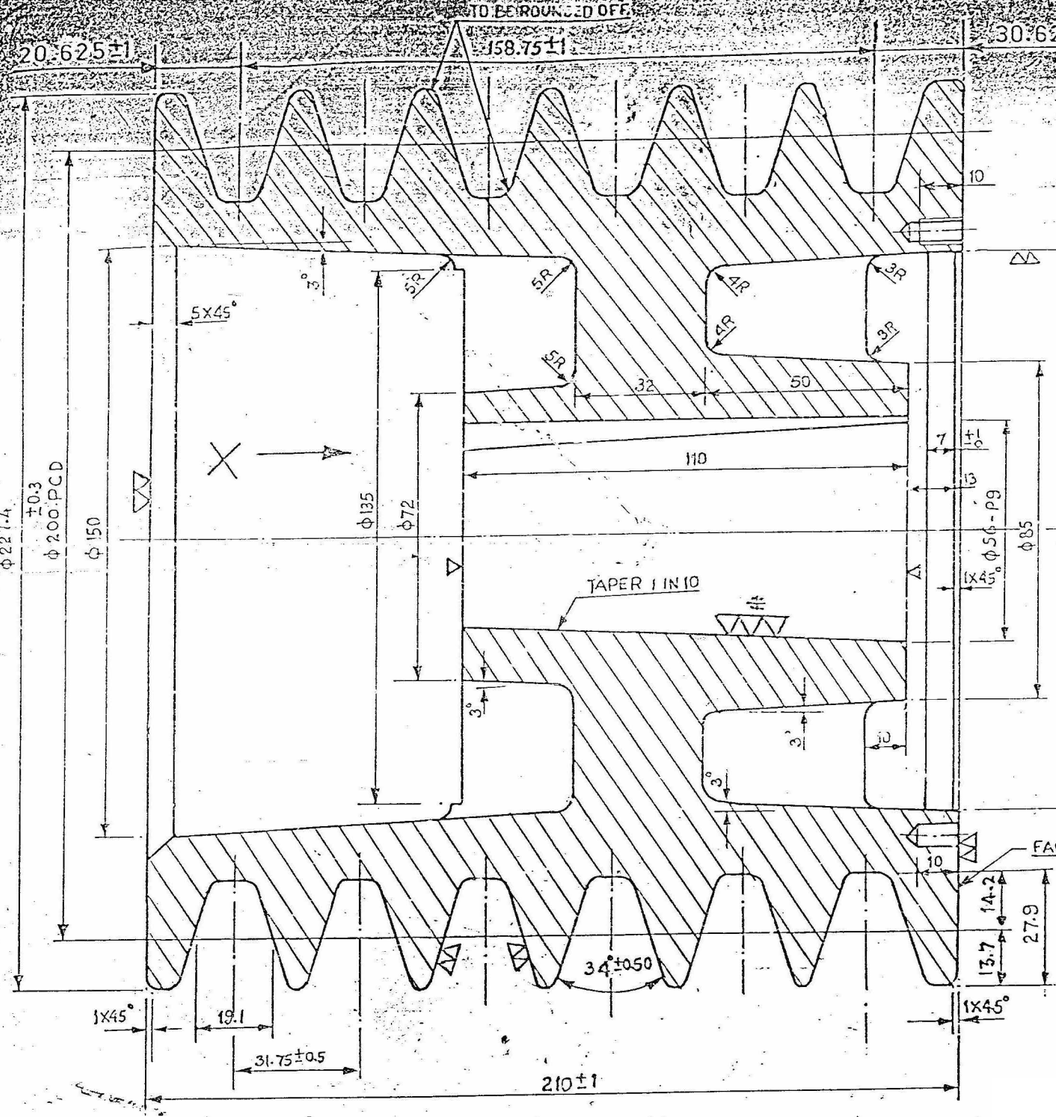
15.1 The castings duly protected against transit damage shall be packed in wooden boxes.

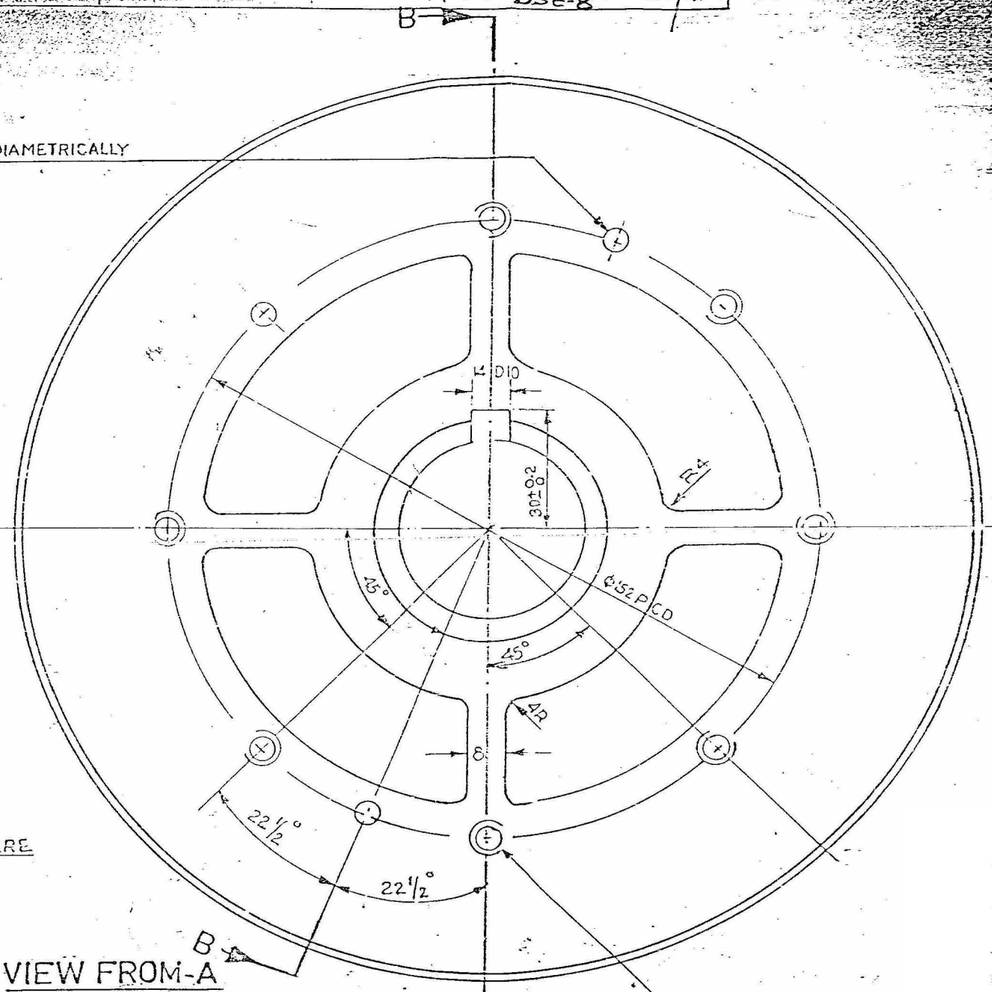
16. INSPECTING AUTHORITY

16.1 The type test as per Clause 12 of Specification shall be conducted by the representative of RDSO/Lucknow (M&C Directorate) at the Works of Manufacturers for which all testing facilities shall be made available by the Manufacturer at their cost. The acceptance test as per Clause 14 shall be conducted by the authority as mentioned by the Purchasers in their Purchase Order.

17. The Manufactures shall supply two sets of manufacturing drawing to RDSO for approval / record.

LT	DATE	DESCRIPTION	SIGNATURE
A	06.07.04	25KW ADDED IN TITLE	DSE-8





VIEW FROM-A

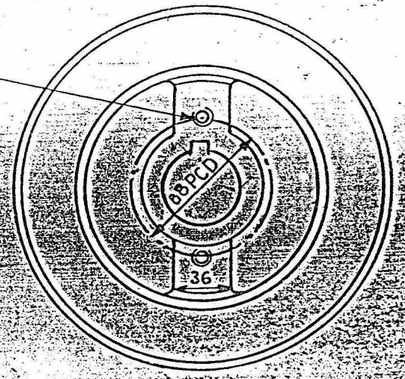
NOTE:-

#1. FINE FINISH MACHINING WITH MATING SURFACE OF NOT LESS THAN 60% OF MATING AREA WITH ALTERNATOR SHAFT SHOULD BE ENSURED.

DIMENSIONS AND TOLERANCE OF KEY WAY IN THE SHAFT AND THE PARALLEL KEY SHOULD BE ADHERED TO IS:2048-75 AND AS FOLLOW. KEY WIDTH 14h9, KEY WIDTH IN SHAFT 14H9

SECTION-B B

M 12 X 35 DEEP-
-2 HOLES



VIEW FROM-X

▽ ROUGH MACHINED
▽▽ FINISH MACHINED
▽▽▽ FINE FINISH MACHINED

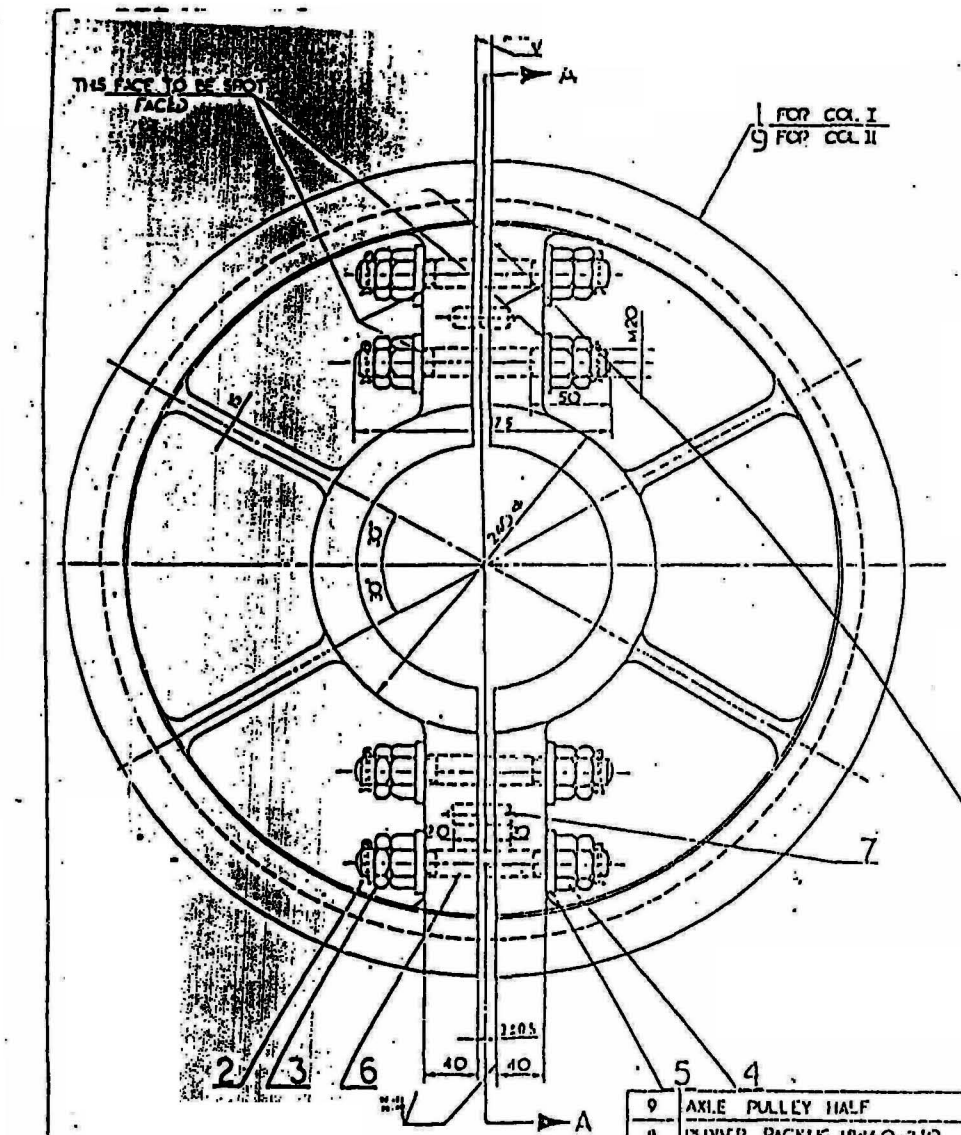
TOLERANCE DIMENSION	VALUES
140 H6	140 +0.025 +0
30 H11	30 +0.2 -0
56 P9	56 -0.032 -0.106
14 D10	14 +0.120 +0.050
14 H9	14 +0.043 -0
14 h9	14 +0 -0.43

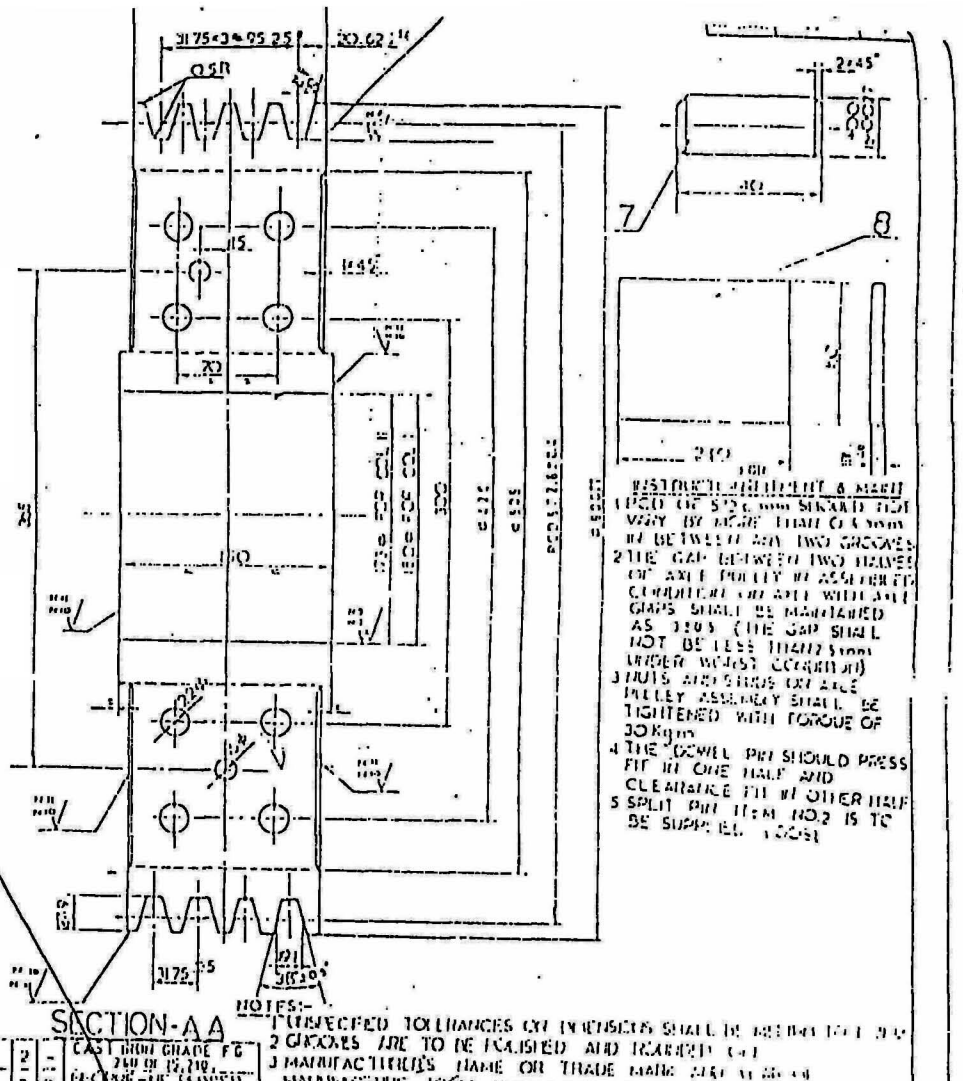
ITEM	DESCRIPTION	No. OFF	MATL & SPEC.	REMARKS
1	ALTERNATOR PULLEY	2	IS: 210, FG-260	

REF: | SCALE: | APPROVED: FOR D.G. 15-5-91

V DEEP GROOVE PULLEY FOR 18/25 KW BRUSHLESS ALTERNATOR

RDSO. ELECT. DTE. | SKEL. 3645





9	AXLE PULLEY HALF	2	-	CAST IRON GRADE FG 260 OF IS:210,	
8	RUBBER PACKING 1860-230	2	2	RECOMMENDED MAKES	
7	DOWEL PIN	2	2	IS:2393	
6	STUD ϕ20 x 2.5 x 375	8	8	IS:2073 GR.C45 (GALVD)	
5	PLAIN WASHER (PUNCHED) ϕ22	16	16	IS:1977, St 32 (GALVD)	
4	NUT M20 x 2.5	16	16	IS:2073, C20 (GALVD)	
3	LOCK NUT M20 x 2.5	16	16	IS:2073, C35 (GALVD)	
2	SPLIT PIN ϕ4 x 40	10	10	IS:549 TABLE 1	
1	AXLE PULLEY	-	2	IS:210, Gr FG 260	
PART	DESCRIPTION	QTY/ASSY	QTY/SET	MATL/SPEC	

4			
3			
2	REVISED	11.2.88	
1	BUDGET RE-DESIGNED FOR POWER GROOVES	7-8-0	
	DESCRIPTION	SIGN	DATE

NOTES:-
1 UNSPECIFIED TOLERANCES ON DIMENSIONS SHALL BE AS PER IS:2709
2 GROOVES ARE TO BE FINISHED AND HARDENED (C)
3 MANUFACTURER'S NAME OR TRADE MARK AND YEAR OF MANUFACTURE TO BE PUNCHED ON EACH ITEM (LETTERS SIZE 8mm)
4 COL-I FOR 16.25 T AXLE.
5 COL-II FOR 17 T AXLE.

REF:- | SCALE:- N.T.S | APPROVED

V-DEEP GROOVE AXLE PULLEY FOR 4.5KW BRUSHLESS ALTERNATOR

R.D.S.O ELEC. DTE. | SKEL 3883

TL/13

A2

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