AIS-078

AUTOMOTIVE INDUSTRY STANDARDS

Specification for Automotive V-Belts

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ON BEHALF OF
AUTOMOTIVE INDUSTRY STANDARDS COMMITTEE

UNDER
CENTRAL MOTOR VEHICLE RULES – TECHNICAL STANDING COMMITTEE

SET-UP BY
MINISTRY OF SHIPPING, ROAD TRANSPORT & HIGHWAYS
(DEPARTMENT OF ROAD TRANSPORT & HIGHWAYS)
GOVERNMENT OF INDIA

December 2005

Status chart of the standard to be used by the purchaser for updating the record

Sr. No.	Corr-igenda.	Amend-ment	Revision	Date	Remark	Misc.

General Remarks :

INTRODUCTION

The Government of India felt the need for a permanent agency to expedite the publication of standards and development of test facilities in parallel when the work on the preparation of the standards is going on, as the development of improved safety critical parts can be undertaken only after the publication of the standard and commissioning of test facilities. To this end, the erstwhile Ministry of Surface Transport (MoST) has constituted a permanent Automotive Industry Standard Committee (AISC) vide order No. RT-11028/11/97-MVL dated September 15, 1997. The standards prepared by AISC will be approved by the permanent CMVR Technical Standing Committee (CTSC). After approval, the Automotive Research Association of India, (ARAI), Pune, being the secretariat of the AIS Committee, has published this standard. For better dissemination of this information ARAI may publish this document on their Website.

The present automotive standard is prepared to provide specification for Automotive V-Belts for incorporating construction, quality control and performance requirements of V-belts.. It is recommended for safety related components.

While preparing this standard considerable assistance is taken from following International Standards:

1.	JASO E 107 - 1998	Automotive V-belts
2.	SAE J 636 DEC.2001	V-Belts and Pulleys
3.	ISO 2790 - 1989	Belt Drives - Narrow V-belts for Automotive Industry and Corresponding Pulley Dimensions
4.	DIN 7753 Part 3 July 1976	Endless Narrow V-Belt for the Automotive Industry – Dimensions

The Automotive Industry Standards Committee (AISC) responsible for preparation of this standard is given in Annex : I

Specification for Automotive V- Belts

1. SCOPE

This standard is applicable to the V- belts used to drive the automotive front engine accessories such as radiator cooling fan, alternator, water pump, air conditioning compressor, and power steering pump.

2. PURPOSE

This standard aims to provide specification for cross sectional dimensions, belt length, and durability testing of V-belts used for driving automotive front engine accessories.

3. TYPES OF BELTS

The automotive V-belts are classified by their structure as either wrapped belt (WB) or raw edge belt .

a) **Wrapped belt** – All the four sides of trapezoidal cross section are wrapped with jacketing fabric and hence, it is called wrapped V-belt (Ref. Figure 1)

b) **Raw edge belt** – Unlike wrapped V-belt, the flanks are not covered with jacketing fabric and hence, it is called raw edge belts (Ref. Figure 1). Raw edge belts are further divided into three types.

(i) **Raw edge plain (REP)** – Raw edge plain belt has one or more top fabric layers and may or may not have fabric at the bottom.

(ii) **Raw edge laminated (REL)** – This is similar to REP but has more than one fabric layer at the bottom.

(iii) **Raw edge cogged belt (REC)** – As the name implies, this belt has notch or cog or teeth underneath. Otherwise, it is similar to REP or REL belts.

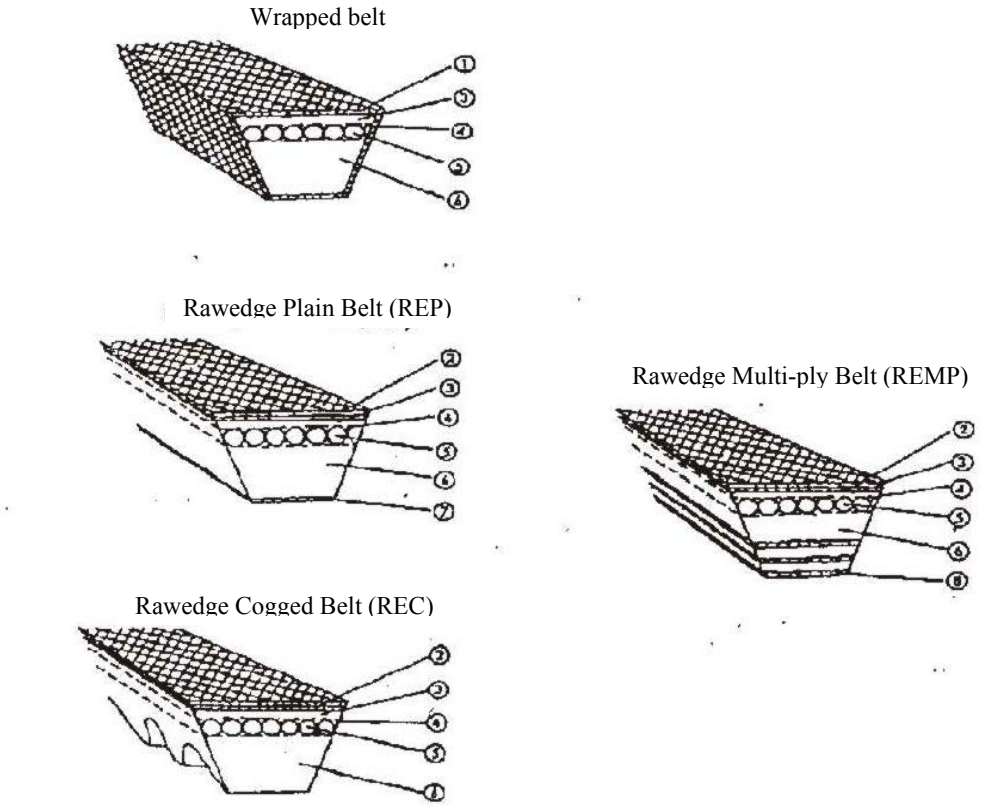

Figure 1

Types of Belts

Table 1

Belt Material

No.	Construction
1	Cover Fabric
2	Top Fabric
3	Tension Rubber
4	Cushion Rubber
5	Tension Member
6	Compression Rubber
7	Bottom Fabric
8	Laminate Fabric

4. MATERIAL USED

The generally used main components of V-belts material are given in Table 1.

4.1 **Rubber** - The rubber compound shall have uniform composition or mixed with short fibers to enhance performance of the belts as designed by

4.2 **Fabric** – The fabric shall be a plain square woven or wide angle fabric of natural or synthetic or blended fibre. The fabric shall be free from flaws, distortions or any other foreign matter. The fabric shall be rubberised on both sides with synthetic rubber.

4.3 **Tension Member** – The tension member shall be high modulus polyester cord having specified range of heat shrinkage, uniform twist and treated with bonding agent for better compatibility with rubber compound.

5. STRUCTURE

The V-belt shall have a trapezoidal cross section with an endless loop and made out of material specified as above.

6. DIMENSIONS

6.1 **Cross section** V-belt shall have cross sectional dimensions as shown in Table 2.

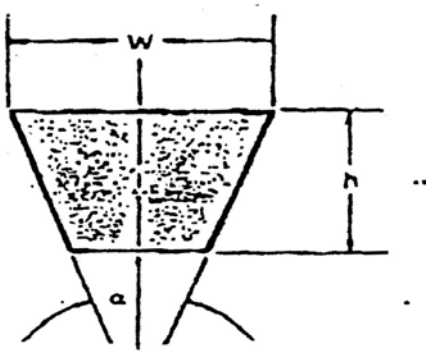

Figure 2

Cross Section of V-Belt

Table 2

Cross Sectional Dimensions (Nominal)

Cross Sectional Dimensions and Tolerances	**V 10**	**V 13**	**V 15**	**V 17**	**V 20**
W ± 0.5 (mm)	10	13	15	17	20
H ± 0.8 (mm)	8	9	10	11	13
α ± 2 (°)	38	38	38	38	38

7. LENGTH MEASUREMENT

To measure a belt length, the belt shall be mounted on a measuring fixture comprised of two-sheave of equal diameter as shown in Figure 3 and specified load is applied to the belt. Next, the Belt shall be allowed to rotate at least two rounds to seat the belt properly in the pulleys grooves. Then, the belt length shall be calculated by the following formula:

$$L = 2C + K$$

$$C = \frac{C_{max.} + C_{min.}}{2}$$

where, L : V-Belt Length (mm)

C : Centers Distance (mm)

K : Value in Table 3 (mm)

$C_{max.}$: Maximum Center Distance (mm)

$C_{min.}$: Minimum Center Distance (mm)

The measuring pulley dimensions and weight to be applied on the belt are specified in the Table 3.

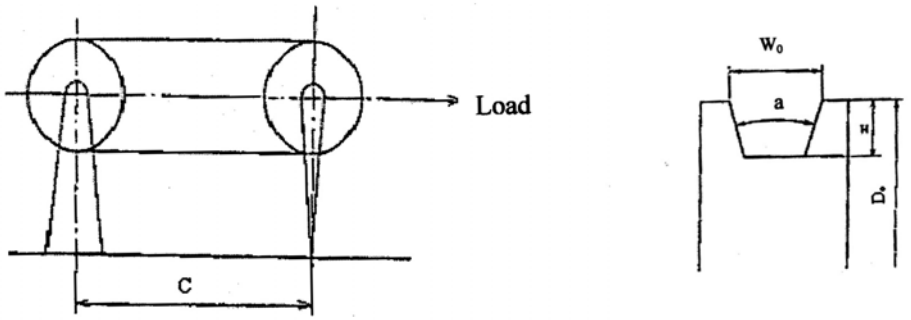

Figure 3
Length Measuring Fixture and Pulley Groove

Table 3
Dimensions of Length Measuring Pulleys

Shape	Dimensions of pulley for measurement				Load (N) {Kgf}	K
	$W_0 \pm 0.03$	$D_0 \pm 0.01$	H min.	α (^{0}) ± 10'		
V10	9.5	95.5	10	38	245 {25}	300
V13	11.7		12	38		
V15	14.4		15	38		
V17	16.8		16	38	343 {35}	
V20	19.8	121.0	19	38	441 {45}	380

8. TOLERANCE FOR BELT LENGTH

The belt length shall be maintained within the tolerance given in Table 4. In a multiple belt drive, the length variation with in a set shall not be more than the matching limit.

Table 4

Tolerance for Belt Length

Belt Length, mm	Tolerance	Matching Limit
Up Thru 1000	± 6.0	1.6
Over 1000 to 1200 incl.	± 8.0	1.6
Over 1200 to 1400 incl.s	± 9.0	1.6
Over 1400 to 1600 incl.	± 10.0	2.0
Over 1600 to 2000 incl.	± 11.0	2.0
Over 2000	± 12.0	2.0

9. RIDE OUT

This is an important parameter which reflects the over all variation of width and angle of belt as well as those of pulley V grooves. It is always preferable to have ride out so that the belt does not touch the bottom of the pulley grooves. Once the V-belt touches the bottom of pulley groove, the belt looses the wedging action and hence, the power transmission efficiency.

The projection of belt over the pulley rim shall be defined as ride out (ref. Figure. 4). This shall be measured over the length measuring pulley and maintained with in the specification given in Table 5.

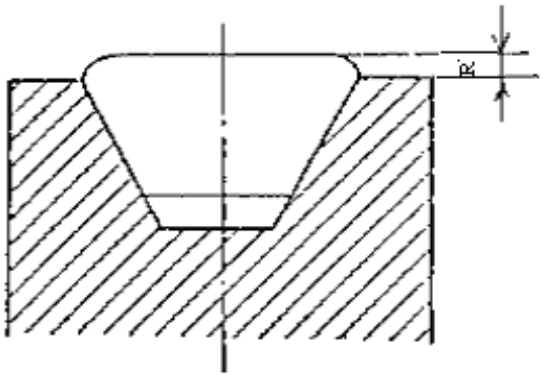

Figure 4
Ride Out

Table 5

Belt Ride Out

Belt type	V10	V13	V15	V17	V20
Ride out, (mm)	2.0 ± 0.8	2.2 ± 0.8	2.5 ± 1.0	2.5 ± 1.0	2.5 ± 1.0

10. BREAKING LOAD TEST

The belt elongation at the specified load, which has been decided based on the power to be transmitted by the belt, is an important parameter to control the elongation of the belt during the course of service.

A test piece, about 250 mm long, shall be prepared from the belt and breaking load and elongation at specified load and at break shall be tested at a cross head traveling speed of 50 mm/min. with gauge length of 100 mm at room temperature (25 ± 5 ^{0}C). The average of three test results shall be with in the specification given in Table 6. The reading of any test piece that breaks at clamping portion shall be excluded.

Table 6

Breaking Load and Elongation Haracteristics

Belt type	Min. Breaking Load,(kg).	Specified load(kg),	Max. elongation at specified load,(%)
V10	230	80	3
V113	300	140	3
V15	450	240	4
V17	600	300	4
V20	850	400	4

11. DURABILITY TESTS

11.1 DURABILITY TEST AT ELEVATED TEMPERATURE

In general, the under hood temperature reaches around 80 to 90° C and hence the durability of belt has to be tested at elevated temperature. The 4 % belt slippage and 80 hours minimum life have been specified in line with other international standards like JASO, etc.

The durability test shall be conducted by mounting the test sample on the tester shown in Figure 5. The test pulley dimensions should be as given in Table 7. The test shall be carried at 85 ± 2 ^{0}C. Apply tension through tension pulley and allow the belt to run without load for two minutes. Stop the belt, re-adjust the belt tension and then allow the belt to run as per test condition given in Table 8. After reaching specified belt speed, apply load on the driven pulley, measure the rpm of drive and driven pulley and from the difference, calculate the belt slippage. Stop the testing when the slippage exceeds 4%, allow to stand for 20 min. or longer, and re-adjust the belt tension to the specified level. Rotate the belt two or three times, and continue the testing according to the conditions given in Table 8. By measuring the drive and driven pulley rpm, slippage percentage shall be calculated as per the following formula :

$$\text{Slippage , \%} = \frac{N_r - N_n}{N_r} \times 100$$

Where

N_r : rpm of drive pulley .

N_n : rpm of driven pulley.

11.2 DURABILITY TEST AT LOW TEMPERATURE

Since the vehicles or the belts are likely to be exported to cold countries, low temperature test at – 30 °C has been specified in this standard. This low temperature flexibility at the time of cold starting of engine is very important and hence the test has to be done at 1800 rpm. And just for 5 minutes. This test can be done in a test fixture similar to one given in Figure 5.

Set the test sample on the tester shown in Figure 5, at - 30 ^{0}C, apply belt tension as given in Table 8 and keep it for 24 hours. Then drive the tester for 5 minutes at 1800 rpm. and then stop it for 25 minutes. Inspect the belt for crack. There shall not be any crack on the belt.

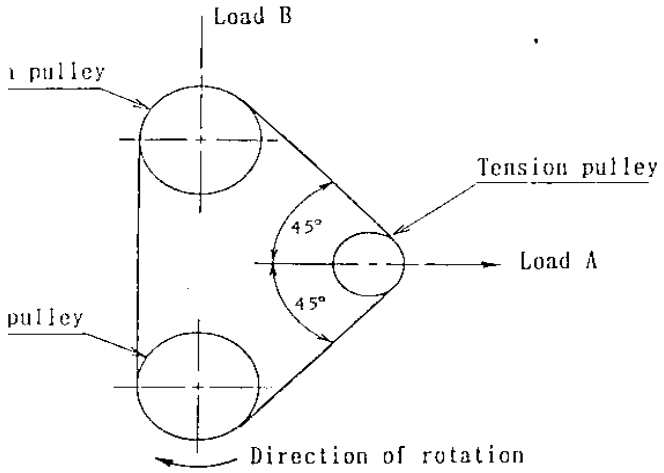

Figure 5

Durability Test Fixture

Table 7

Durability Test Pulley Dimensions

Unit: mm

Shape	Drive and driven pulleys					Tension pulley				
	D_0 ±0.25	α (°) ±10′	W_0 ±0.03	H min.	r $^{+0.5}_{0}$	D_0 ±0.25	α (°) ±10′	W_0 ±0.03	H min.	r $^{+0.5}_{0}$
V10	120	36	9.5	10	1.0	65	34	9.5	10	1.0
V13	125		11.7	12		70		11.7	12	
V15			15.4	15	1.5	85		15.4	15	1.5
V17			16.8	16				16.8	16	
V20	150		20.8	19		100		20.8	19	

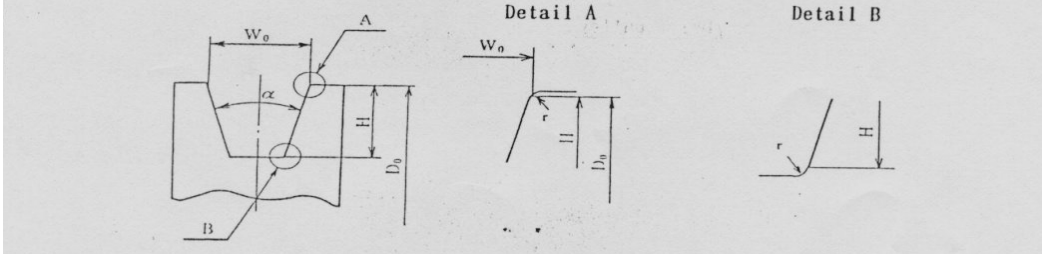

Table 8

Belt Durability Testing Conditions

Type	Rotation of driver pulley (rpm)	Load on driven pulley, kW	Load on Tension pulley, kg
V10	4900 ± 100	6.0	55
V13	4900 ± 100	7.5	65
V15	4900 ± 100	9.0	85
V17	4900 ± 100	19.5	90
V20	3900 ± 100	10.0	95

Note: The initial setting belt tension and applied load on driven pulley shall not vary more than 10% of values specified in Table 8.

The belt shall run 80 hours minimum and belt tension during the course of testing shall not be readjusted more than twice. At least two belts are to be tested and each belt must meet the above specification.

12. MARKING ON THE BELT

All the belts shall have indelible marking on the top surface and the matter shall be as follows:

a) Brand or trade mark of the manufacture.

b) Belt type and belt length

c) Date of manufacturing or its code.

13. RECOMMENED PRACTICES FOR STORAGE

V-belts should always be stored in dry and cool conditions. Contact with hot pipes and direct sunlight should be avoided. They should be hung loosely or laid flat, and never be reverse bent, squeezed into restrictive storage space. Avoid, wherever possible, tying V-belts tightly with strings.

ANNEX : I

(See Introduction)

COMMITTEE COMPOSITION *

Automotive Industry Standards Committee

Chairman	
Shri B. Bhanot	Director The Automotive Research Association of India, Pune
Members	**Representing**
Shri Alok Rawat	Ministry of Shipping, Road Transport & Highways, New Delhi
Shri Sushil Kumar	Department of Heavy Industry, Ministry of Heavy Industries & Public Enterprises, New Delhi
Shri. Chandan Saha	Office of the Development Commissioner Small Scale Industries, Ministry of Small Scale Industries, New Delhi
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Shri T.C. Gopalan Shri Ramakant Garg (Alternate)	Tractor Manufacturers Association, New Delhi
Shri K.N.D. Nambudiripad	Automotive Components Manufacturers Association
Shri G. P. Banerji	Automotive Components Manufacturers Association

Member Secretary
Mrs. Rashmi Urdhwareshe
Deputy Director
The Automotive Research Association of India, Pune

* At the time of approval of this Automotive Industry Standard (AIS)