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Belt drives — V-ribbed belts, joined V-belts and V-belts including wide section belts and hexagonal belts — Electrical conductivity of antistatic belts: Characteristics and methods of test

Transmission par courroies — Courroies striées, courroies trapézoïdales simples et jumelées y compris celles à section large et hexagonales — Conductibilité électrique des courroies anti-électrostatiques: Spécifications et méthodes d'essai

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 1813 was prepared by Technical Committee ISO/TC 41, *Pulleys and belts (including veebelts)*, Subcommittee SC 1, *Veebelts and grooved pulleys*.

This third edition cancels and replaces the second edition (ISO 1813:1979), which bas been technically revised. In particular a production control test method (factory method) and the limit values of electrical resistance for each type and profile of belts have been added.

Annex A of this International Standard is for information only.

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Belt drives — V-ribbed belts, joined V-belts and V-belts including wide section belts and hexagonal belts — Electrical conductivity of antistatic belts: Characteristics and methods of test

1 Scope

This International Standard specifies the maximum electrical resistance of antistatic endless V-ribbed belts, joined V-belts, and single V-belts including wide section belts and hexagonal belts, as well as corresponding production control and individual proof methods of measurements.

The application of this International Standard is limited to new belts intended to be used in an explosive atmosphere or in situations where there is a fire risk. The test is intended to ensure that the belt is sufficiently conductive to dissipate charges of electricity which may form on it in service.

In the case of a production control test, the decision is left to national standards or agreement between interested parties as to whether the test shall be carried out on each belt in a batch or on only a percentage of belts in a batch.

NOTE — For each proof test, the belt manufacturer should determine which type of electrode and conductive coating material must be used.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of the publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 471:1995, *Rubber — Temperatures, humidities and times for conditioning and testing*.

ISO 1604:1989, *Belt drives — Endless wide V-belts for industrial speed-changers and groove profiles for corresponding pulleys*.

ISO 2790:1989, *Belt drives — Narrow V-belts for the automotive industry and corresponding pulleys — Dimensions*.

ISO 3410:1989, *Agricultural machinery — Endless variable-speed V-belts and groove sections of corresponding pulleys*.

ISO 4183:1995, *Belt drives — Classical and narrow V-belts — Grooved pulleys (system based on datum width).*

ISO 4184:1992, *Belt drives — Classical and narrow V-belts — Lengths in datum system*.

ISO 5289:1992, *Agricultural machinery — Endless hexagonal belts and groove sections of corresponding pulleys*.

ISO 5290:1993, *Belts drives — Groove pulleys for joined narrow V-belts — Groove sections 9J, 15J, 20J and 25J (effective system).*

ISO 5291:1993, *Belts drives — Groove pulleys for joined classical V-belts — Groove sections AJ, BJ, CJ and DJ (effective system).*

ISO 9981:1998, *Belts drive — Pulleys and V-ribbed belts for the automotive industry — PK profile: Dimensions*.

ISO 9982:1998, *Belts drive — Pulleys and V-ribbed belts for industrial applications — PH, PJ, PK, PL and PM profiles: Dimensions*.

3 Electrical conductivity characteristics

The electrical conductivity of an individual belt when tested by the production control test method (factory test) in accordance with clause 7 shall have an electrical resistance not greater than that given by the appropriate tables referred to in 7.4.

The electrical conductivity of an individual belt when proof-tested in accordance with clause 8 shall have an electrical resistance not greater than that given by the appropriate formula in 8.6.

4 Principle

The electrical resistance along a fixed length of belt is measured by an insulation tester under specified conditions. The belt(s) is (are) accepted as suitable for antistatic duties if the electrical conductivity is sufficiently high that a specified level of electrical resistance is not exceeded.

5 Test apparatus and material

5.1 Insulation tester

Electrical insulation test meter with a nominal open circuit voltage of 500 V d.c. capable of applying a voltage of not less than 40 V with a power of not more than 3 W in the belt section under test and capable of measuring the electrical resistance with an accuracy of ± 5 %.

The voltage shall be applied no longer than is necessary to carry out the test, in order to reduce the risk of overheating the test piece.

NOTE — For values of resistance above 10^6 Ω, an instrument with a nominal open circuit voltage of 1 000 V may be used.

5.2 Metal electrodes

Metal electrodes (two) of low electrical resistance, preferably brass, having contact surfaces of minimum width 25 mm, arranged a nominal distance of 100 mm apart on an electrically insulated base (see figure 1).

5.2.1 Electrodes for testing single V-belts (driving surfaces)

The dimensions of the V-groove of the fixed electrodes shall be as specified for the pulley groove profile associated with the belt. The groove angle shall be specified by the manufacturer according to the design and type of belt being tested (see figure 3).

In order to maintain continuity with previous editions of this International Standard, the movable electrodes applicable to classical and narrow V-belts are retained as alternatives to the fixed electrodes. These electrodes have contact surfaces which are free to rotate around an axis parallel to the drive side surfaces of the belt (see figures 5 and 6 and table A.1).

These types of electrodes are not applicable to V-ribbed belts or joined V-belts.

5.2.2 Electrodes for testing V-ribbed belts (driving surfaces)

The dimensions of the grooved electrode shall be as specified for the pulley groove profile associated with the belt (see figure 4).

For V-ribbed belts with more than four ribs, it is necessary to move the belt so that entire number of ribs are tested.

5.2.3 Electrodes for testing joined V-belts (driving surfaces)

When testing the joined V-belt as a whole the dimensions of the grooved electrodes shall be as specified for the pulley groove profile associated with the belt. The groove angle shall be specified by the manufacturer according to the design and type of belt being tested (see figure 4).

When testing the individual belts comprising the joined V-belt, the electrodes shall consist of two V-grooves. The groove angle shall be specified by the manufacturer according to the design and type of belt being tested.

For joined V-belts with more than two strands, it is necessary to move the belt so that entire belt is tested.

5.3 Belt loading

A means of applying a force of 1 N per millimetre of nominal width of belt to ensure adequate contact between electrode and the belt shall be provided (see figure 1). The force may be applied indirectly by a lever arm (see figure 2 for typical apparatus).

For joined V-belts inserted in an electrode arrangement as shown in figure 4, the specified test force shall be applied on each single belt. Here the groove spacing is considered to be the belt top width.

6 Test piece

The test piece is a complete endless V-ribbed belt, joined V-belt or single V-belt.

7 Production control test method (factory method)

7.1 Conditioning and test conditions

The test shall be made not less than 24 h after vulcanization. The test shall be made at a temperature between 15 °C and 30 °C.

7.2 Test procedure

Straighten the belt between the electrodes and to ensure adequate electrical contact between the belt and the electrode apply the force as given in 5.3.

Take care not to breathe on the test surfaces as any condensation of moisture can falsify the result.

Measure the resistance in ohms, 5 s ± 1 s after applying the voltage.

7.3 Number of tests

For belts up to an including 2000 mm in length test as follows:

— test single V-belts at two points along the length of the belt;

— test hexagonal belts on both sets of driving surfaces at two points each along the length of the belt;

— for joined V-belts, when testing the belt as a whole, test at two points along the length of the belt; when testing each strand of belt within the joined V-belt, test each belt at two points along the length of the belt [see also footnote 1) in table 3];

— for V-ribbed belts, for standard widths up to and including 20 ribs, test each belt at two points along the length of the belt [see also footnote 1) in table 2].

For longer belts increase the number of test points by 1 for each increase in length of 1000 mm or part thereof.

7.4 Belt electrical resistance criteria

None of the individual values obtained in 7.3 shall be more the values specified in tables 1, 2 and 3.

For marking belts, the electrical conductivity of belts shall fulfil the values given in tables 1, 2 and 3.

8 Proof test method for individual belts (laboratory method)

8.1 Conditioning and test conditions

The following treatments and the test shall be made in a standard atmosphere 23/50 in accordance with ISO 471 at a temperature of (23 ± 2) °C and (50 ± 5) % relative humidity.

8.2 Electrical conductive coating

To ensure minimum electrical resistance between the test metal electrodes and the test belt surfaces, a conductive coating shall be provided comprising either

a) a conductive silver lacquer or colloidal graphite, which shall be of the type that dries at room temperature and the surface resistivity of the dried film shall be below 10 Ω·m, or

b) a conductive liquid consisting of:

  — 800 parts of anhydrous polyethylene glycol of molecular mass 600,

  — 200 parts of water,

  — 1 part of wetting agent,

  — 10 parts of potassium chloride.

In the latter case, the electrode contact areas shall be completely wetted and remain so until the end of the test.

8.3 Preparation

The belt shall be maintained in an unstrained state, for a period not less than 2 h in a standard atmosphere 23/50, in accordance with ISO 471.

Immediately following this conditioning, clean the belt surfaces that are to be placed against the test electrodes by rubbing with dry Fuller's earth using a clean cloth.

After cleaning away all traces of the powder, wipe the surface with a cloth moistened with distilled water and rub dry with a clean dry cloth, taking care to avoid straining the test piece. Then immediately apply the conductive coating material (see 8.2) on each of the belt/electrode contact areas for a length of 25 mm along the belt; these two zones shall be separated by a dry distance of 100 mm ± 6 mm.

8.4 Test procedure

The test shall be made in a place having a standard atmosphere 23/50, in accordance with ISO 471.

Clean the electrodes. With the belt being in an unstrained state, apply the electrodes on the coated contact areas so only these surfaces of the belt are in contact.

Take care not to deform the surfaces of the belt during the application of the electrodes and during the test. To ensure adequate electrical contact between the belt and electrode, apply the force as detailed in 5.3.

Take care not to breathe on the test surface as any condensation of moisture can falsify the result.

Measure the resistance, in ohms, 5 s ± 1 s after applying the voltage. The voltage applied shall not be less than 40 V.

Measure the distance L between the contact areas of the belt and the sum l of the contact lengths of the face or faces of the belt.

8.5 Number of tests

Make at least five tests, spaced at regular intervals along the complete length of the belt.

NOTE — If the belt is too short to carry out this minimum of five tests then the number of tests may be reduced accordingly.

8.6 Belt electrical resistance criteria

The specified maximum value belt electrical resistance, R, expressed in ohms, in tables 1, 2 and 3, is derived from the following formula:

$$R \leqslant 6 \times 10^5 \frac{L}{l}$$

where

L is the dry distance between the electrodes;

l is the total length of contact across the width of the belt with the electrode.

For example,

— narrow V-belt: sum of two equal flank lengths of the belt section;

— V-ribbed belts: sum of measured flank contact lengths per rib multiplied the number of ribs;

— back of a joined V-belt: width of electrode or width of belt, whichever is the lesser;

— joined V-belts: sum of two equal flank lengths of the belt section multiplied by the number of belts.

None of the individual values obtained in 8.5 shall be more than the specified value.

Table 1 — Limit values of electrical resistance when testing the driving surfaces of single V-belts including hexagonal belts

Maximum resistance MΩ	Industrial V-belts			Automotive V-belts	Agricultural belts	
	Classical ISO 4183 ISO 4184	Narrow ISO 4183 ISO 4184	Wide ISO 1604	Narrow ISO 2790	Wide ISO 3410	Hexagonal ISO 5289
8						
7,1	Y					
6,3						
5,6						HAA
5			W 16			
4,48	Z					HBB
4			W 20			
3,6	A	SPZ	W 25	AV 10	HG	
3,2						HCC
2,8		SPA	W 31,5	AV 13	HH	
2,5	B					
2,24			W 40		HI	HDD
2	C	SPB				
1,8			W 50		HJ	
1,6		SPC			HK	
1,42	D		W 63		HL	
1,26					HM	
1,2					HN	
1,12	E		W 80		HO	
1						
0,9			W 100			

NOTES

1 Distance between the contact areas: L = 100 mm.

2 Electrode configuration: see figures 3, 4, 5 and 6.

Table 2 — Limit values of electrical resistance when testing the driving surfaces of V-ribbed belts

Number of ribs [1)]	Maximum resistance MΩ				
	ISO 9981 and ISO 9982 V-ribbed belts profiles				
	PH	PJ	PK	PL	PM
3	9	5,6	3,2	—	—
4	6,7	4,14	2,5	1,6	0,8

NOTES

1 Distance between the contact areas: L = 100 mm.

2 Electrode configuration: see figure 4.

1) For V-ribbed belts with greater than four ribs, it is necessary to move the belt so that all ribs are tested.

Table 3 — Limit values of electrical resistance when testing the driving surfaces of joined V-belts

Number of strands in band [1)]	**Maximum resistance** MΩ							
	ISO 5290 narrow				ISO 5291 classical			
	9J	15J	20J	25J	AJ	BJ	CJ	DJ
2	1,8	1,26	1	0,8	1,8	1,26	1	0,71

NOTES

1 Distance between the contact areas: L = 100 mm.

2 Electrode configuration: see figure 4.

1) For joined V-belts with greater than two strands, it is necessary to move the belt so that the entire belt is tested.