



JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS C 9108 : 2017

(JEMA)

Electric vacuum cleaners

ICS 97.080

Reference number : JIS C 9108 : 2017 (E)

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Date of Establishment: 1955-03-05

Date of Revision: 2017-08-21

Date of Public Notice in Official Gazette: 2017-08-21

Investigated by: Japanese Industrial Standards Committee
Standards Board for IEC area
Technical Committee on Electricity

JIS C 9108:2017, First English edition published in 2018-11

Translated and published by: Japanese Standards Association
Mita MT Building, 3-13-12, Mita, Minato-ku, Tokyo, 108-0073 JAPAN

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Printed in Japan

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Foreword

This Japanese Industrial Standard has been revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by The Japan Electrical Manufacturers' Association (JEMA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently, **JIS C 9108**:2009 is replaced with this Standard.

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Attention is drawn to the possibility that some parts of this Standard may conflict with patent rights, applications for a patent after opening to the public or utility model rights.

The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying any of such patent rights, applications for a patent after opening to the public or utility model rights.

Electric vacuum cleaners

1 Scope

This Japanese Industrial Standard specifies electric vacuum cleaners for household use which utilizes the back pressure of a blower driven by a motor and which has a rated power consumption of 100 W to 1 500 W (hereafter referred to as vacuum cleaners). However, this Standard is not applicable to the following.

- Vacuum cleaners having a rotary brush mechanically connected with a blower motor
- Rechargeable vacuum cleaners and industrial-use vacuum cleaners
- Vacuum cleaners with a floor cleaning head being directly attached to the cleaner body and with a floor cleaning head or its path that is inseparable
- Vacuum cleaners that require piping work

NOTE The term “body” used in this Standard refers to vacuum cleaner body.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS A 5705 *Polyvinyl chloride floorcoverings*

JIS C 3301 *Rubber insulated flexible cords*

JIS C 3306 *Polyvinyl chloride insulated flexible cords*

JIS C 8303 *Plugs and receptacles for domestic and similar general use*

JIS C 60695-11-10 *Fire hazard testing—Part 11-10: Test flames—50 W horizontal and vertical flame test methods*

JIS C 61000-3-2 *Electromagnetic compatibility (EMC)—Part 3-2: Limits—Limits for harmonic current emissions (equipment input current ≤ 20 A per phase)*

JIS K 2240 *Liquefied petroleum gases*

JIS K 5600-5-4 *Testing methods for paints—Part 5: Mechanical property of film—Section 4: Scratch hardness (Pencil method)*

JIS K 7202-2 *Plastics—Determination of hardness—Part 2: Rockwell hardness*

JIS S 6006 *Pencil, coloured pencils and leads for them*

JIS Z 8731 *Acoustics—Description and measurement of environmental noise*

3 Terms and definitions

For the purpose of this Standard, the following terms and definitions apply.

3.1

standard condition for measurement

condition in which the vacuum cleaner is fitted with a new dust collecting bag and/or new dust receptacle and new filter, the auxiliary hose to be connected to the suction port of the body is straightened naturally, and an extension tube is connected to the end of the hose under the standard condition with its opening end fully opened and at least 100 mm apart from any obstacles

For a vacuum cleaner having either a hose or an extension tube, the term refers to the condition in which the cleaner is fitted with either of these accessories. For a vacuum cleaner with no accessories, the term refers to the condition in which the floor cleaning head or its path is separated from the body with the opening end fully opened and at least 100 mm apart from any obstacles.

NOTE When the cleaner is equipped with multiple extension tubes, the standard condition of the extension tube refers to the condition in which all extension tubes are connected to the body. For a telescopic extension tube, the standard condition of the extension tube refers to the condition in which the tube is extended to the maximum.

3.2

standard load condition

condition of the vacuum cleaner which is operated under the standard condition for measurement

For a vacuum cleaner equipped with a mechanical, electrical or other types of air volume controller, the term indicates the condition in which the cleaner is operated with the maximum air volume. For a vacuum cleaner of which the floor cleaning head is electrically loaded, the term indicates the condition in which the floor cleaning head is connected to the body, and the vacuum cleaner is operated with the opening end of the floor cleaning head at least 100 mm apart from any obstacle.

3.3

aerodynamic power

motion of air or power generated by the influence on the object which moves in air

Aerodynamic power can be calculated from the air flow and vacuum degree by the following formula.

$$P = 0.01666 \times Q h_s$$

where, P : aerodynamic power (W)

Q : air flow (m³/min)

h_s : vacuum degree (Pa)

3.4

suction power

index for the air suction ability of a vacuum cleaner and the maximum value of aerodynamic power curve

The aerodynamic power curve shall be in accordance with **A.2 f**).

3.5

rated power consumption

power consumption of a vacuum cleaner operated under the standard load condition by applying the rated voltage at the rated frequency, which is indicated on the appliance by the manufacturer

3.6

maximum load current

maximum current which flows steadily when a vacuum cleaner is operated under the standard load condition by applying the rated voltage at the rated frequency

3.7

floor transfer type

form of a vacuum cleaner used by pulling the body with a hose to move on a floor

3.8

broom type

form of a vacuum cleaner of which the grip and floor cleaning head are integrated with the body

3.9

portable type

form of a vacuum cleaner held with a body sling around the shoulder, or held by hand

4 Classification

The vacuum cleaners are classified as follows.

- a) Floor transfer type
- b) Broom type
- c) Portable type

5 Rated voltage and rated frequency

The rated voltage shall be a single phase 300 V a.c. or under, and the rated frequency shall be 50 Hz and/or 60 Hz.

6 Performance

6.1 Voltage fluctuation

When the voltage fluctuation is tested in accordance with **9.3**, the vacuum cleaner shall continue operating without showing any defects.

6.2 Starting

When tested in accordance with **9.4**, the vacuum cleaner shall start.

6.3 Power consumption

When the test is performed in accordance with **9.5**, the power consumption of the vacuum cleaner shall be within $\pm 15\%$ of the rated power consumption for vacuum cleaners with a rated power consumption of 100 W to 1 000 W. For vacuum cleaners with a rated power consumption of over 1 000 W to and including 1 500 W, the power consumption shall be within $\pm 10\%$ of the rated power consumption and shall not exceed 1 500 W. In the entire range of power consumption with the suction port fully opened to fully closed, including the maximum value of the power consumption among three measurements adopted in the test of **9.8**, the power consumption shall be $+15\%$ or under of the rated power consumption for vacuum cleaners with a rated power consumption of 100 W to 1 000 W. For vacuum cleaners with a rated power consumption of over 1 000 W to and including 1 500 W, the power consumption shall be $+10\%$ or under of the rated power consumption and shall not exceed 1 500 W.

6.4 Temperature

When the test is performed in accordance with **9.6**, the temperature of each part shall not exceed the value given in Table 1.

Table 1 Temperature upper limit

Unit: °C

Measured part		Temperature upper limit ^{a)}
Winding	Class A insulation	100
	Class E insulation	115
	Class B insulation	125 (120) ^{b)}
	Class F insulation	150 (140) ^{b)}
	Class H insulation	170 (165) ^{b)}
Rectifier (limited to those used in a.c. power supply side circuit)	Selenium	75
	Germanium	60
	Silicone	135
Contact part of fuse clip		90
Carrying handle (excluding those operated by user during service)	Metal, ceramic and glass	65
	Others	80
Handle (grip) operated by user during service	Metal, ceramic and glass	55
	Others	70
Knob and push button of switch, etc.	Metal, ceramic and glass	60
	Others	75
Easily accessible enclosure		65

Table 1 (concluded)

Unit: °C

Measured part		Temperature upper limit ^{a)}
Surface of each layer of power supply cord in cord reel mechanism	Natural rubber compound, polyurethane rubber compound, p.v.c. compound	60
	Chloroprene rubber compound, styrene butadiene rubber compound, heat resistant p.v.c. compound, polyethylene compound	75
	Butyl rubber compound, ethylene propylene rubber compound	80
	Chlorosulfonic polyethylene rubber compound, cross linked polyethylene compound, silicone rubber compound, ethylene tetrafluoride resin compound	90
Notes ^{a)} The reference ambient temperature is 30 °C.		
^{a)} The values in parentheses apply to the winding of motors.		

6.5 Insulation

The requirements for the insulation shall be as follows.

- When the test is performed in accordance with **9.7.1**, the insulation resistance shall be 1 MΩ or over.
- When the dielectric strength is tested in accordance with **9.7.2**, the vacuum cleaner shall withstand the test voltage.

6.6 Suction power

When the test is performed in accordance with **9.8**, the measured value of suction power shall be at least 90 % of the marked value, except for the vacuum cleaner which exerts control only for reducing the power consumption in the low air flow area as shown in Figure 1. For the vacuum cleaner which controls the power consumption by automatically detecting the power consumption, current, air flow, vacuum degree, number of revolutions and the like, the measured value shall be at least 97 % of the marked value.

The marked value of suction power in accordance with **12.1 e)** shall not be less than the value given in Table 2. When the rated power consumption falls between adjacent values given in Table 2, the suction power corresponding to the rated power consumption shall be not less than the value obtained by the linear interpolation method.

Table 2 Suction power

Unit: W

Rated power consumption	Suction power
100	10
200	25
300	45
400	70
500	100
600	115
700	125
800	135
900	145
1 000	155
1 500	205

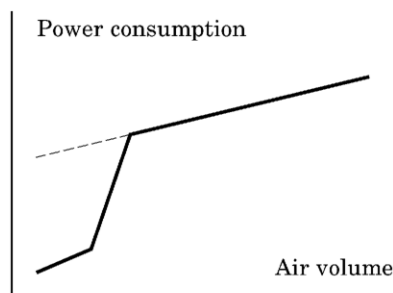


Figure 1 Control only for reducing power consumption in low air flow area (example)

6.7 Withstand overspeed

When the overspeed test is performed in accordance with **9.9**, each part of the body shall be free from any abnormalities.

6.8 Switch

The switch shall comply with the following requirements.

- When the make and break test is performed in accordance with **9.10 a)**, each part of the body shall be free from any defects.
- When the temperature test is performed in accordance with **9.10 b)**, the temperature of the contact shall not be greater than the value given in Table 3.

Table 3 Temperature of contact

Unit: °C

Material of contact	Temperature ^{a)}
Copper or copper alloys	70
Silver or silver alloys	95
Note ^{a)} The reference ambient temperature is 30 °C.	

6.9 Flexure of cord

When the flexure of cord is tested in accordance with **9.11 a)** and **9.11 b)** for cords to be directly fixed to the cleaner body and in accordance with **9.11 b)** for other types of cord, the cord shall comply with the following requirements.

- a) The cord shall be free from short circuit or other hazards.
- b) The rate of broken wires of cords shall be 20 % or under.

The vacuum cleaners equipped with two or more storage hooks in the cleaner body shall comply with the following requirements when tested in accordance with **9.11 c)**.

- c) The cord shall be free from short circuit or other hazards.
- d) The rate of broken wires of cords shall be 10 % or under.

6.10 Reeling of cord

The vacuum cleaners equipped with the cord reel mechanism shall comply with the following requirements when tested in accordance with **9.12**.

- a) The cord shall be free from short circuit or other hazards.
- b) The rate of broken wires of cords shall be 20 % or under.
- c) The cord reel mechanism shall be free from any defects detrimental to practical use.

NOTE The defects detrimental to practical use generally refer to splits, cracks, looseness, detachment of parts, pullout, etc.

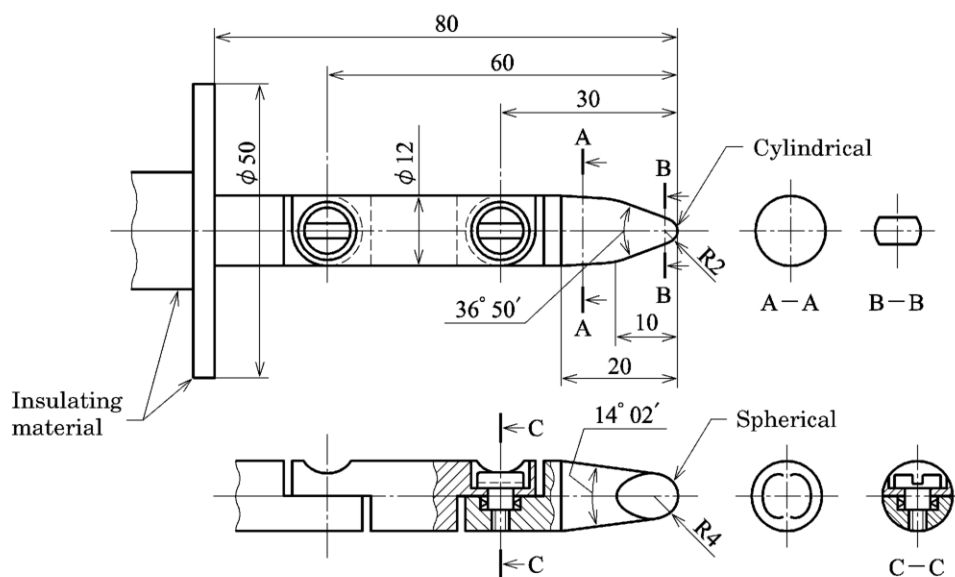
- d) The contact resistance of the contact part measured by the voltage drop method after the test shall be 50 mΩ or under.

6.11 Mechanical strength

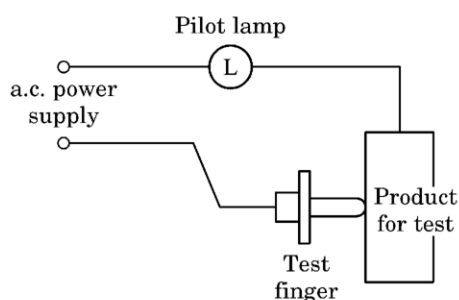
The vacuum cleaner shall comply with the following requirements for mechanical strength.

- a) When the test is performed in accordance with **9.13 a)** for floor transfer type vacuum cleaners and in accordance with **9.13 b)** for portable type and the broom type vacuum cleaners, the vacuum cleaners shall comply with the following **1) to 4)**. Further, each part of the body shall be free from cracks, splits and other abnormalities which may cause hazards.
 - 1) The live part shall not be exposed, except for the case: when, after the test, the test finger shown in Figure 2 is pushed into the opening with a force of 10 N, and the test finger does not touch the live part.
 - 2) The vacuum cleaner shall be free from hazards of fire and electric shock when connected to the power supply.
 - 3) The insulation resistance between the live part and the surface of the vacuum cleaner body shall comply with **6.5 a)**.
 - 4) The vacuum cleaner shall be free from any defects detrimental to practical use.

Unit: mm



a) Test finger



b) Schematic (example)

NOTE 1 The tolerance on angle is $\pm 5'$.

NOTE 2 The dimensional tolerance is $0_{-0.05}$ mm for parts under 25 mm and ± 0.2 mm for parts 25 mm or over.

NOTE 3 The material to be used is brass.

NOTE 4 Conductive parts of the product for testing are all connected.

NOTE 5 The voltage of a.c. power supply may be any voltage not exceeding the rated voltage (40 V or over).

Figure 2 Test finger and the schematic (example)

- b) The floor cleaning head shall be free from cracks, splits and other abnormalities detrimental to practical use when tested in accordance with 9.13 c).
- c) The carrying handle on the body shall be free from any defects detrimental to practical use when tested in accordance with 9.20.

6.12 Durability

When tested for the durability in accordance with 9.14, the vacuum cleaner shall be free from any defects such as the loosening of any part which could be detrimental to practical use.

6.13 Noise

When the noise test is performed in accordance with **9.15**, the measured value of noise of the vacuum cleaner shall not exceed the value given in Table 4. When a noise value has been provided by the manufacturer, the value shall not exceed those given in Table 4 and shall be +3 dB or under of the noise value provided.

Table 4 Noise value

Classification	Noise value dB
Floor transfer type and broom type	75 max.
Portable type	85 max.

6.14 Flexure of hose

When the test is performed in accordance with **9.16**, the flexure of hoses shall comply with the following requirements.

- a) The hose tube shall be free from breaks which cause air leakage.
- b) When a metal film is wound around the surface of a hose tube, dielectric breakdown shall not occur between the live part and metal film and between live parts of different polarities during the test in accordance with **c)**. However, this requirement does not apply to any of the following cases.
 - 1) The live part is the circuit connected to the secondary side of an insulating transformer, and the voltages to the earth and between lines are 30 V a.c. or under or 45 V d.c. or under.
 - 2) When a resistance of 1 k Ω is connected to the earth or between lines, the current flowing through the resistance is 1 mA or under.
 - 3) Even if the current in the above **2)** exceeds 1 mA, the hose tube is free from the risk of electric shock at the commercial frequency or over.
- c) A sinusoidal a.c. voltage of 1 000 V shall be applied for 1 min at a frequency of 50 Hz or 60 Hz for the vacuum cleaner with a rated voltage of 100 V, of 1 500 V for that with a rated voltage of 200 V, and of twice the rated voltage plus 1 000 V for that with other voltages.

6.15 Resistance to compression of hose

After the test is performed in accordance with **9.17**, the resistance to compression of hose shall comply with the requirements in **6.14 b)**.

6.16 Mass

When the test is performed in accordance with **9.18**, the measured value of mass shall be +3 % or under of the marked value provided by the manufacturer.

The mass shall be expressed to the first decimal place in kilograms (kg).

6.17 Maximum dust collecting volume

When the test is performed in accordance with **9.19**, the measured value of maximum dust collecting volume shall be within $\pm 10\%$ of the marked value provided by the manufacturer.

The volume shall be expressed in litres (L).

6.18 Harmonic current

The harmonic current shall comply with **JIS C 61000-3-2**.

7 Construction

7.1 Construction in general

The construction of the vacuum cleaner shall comply with the following requirements.

- a) Each part shall be finished well and shall not easily cause mechanical or electrical failure.
- b) The vacuum cleaner shall be free from noticeable vibration or noise during service.
- c) The blower motor shall not emit noticeable sparks between the commutator and brush under the normal operating condition.
- d) The vacuum cleaners which may be exposed to hazards caused by temperature rise shall be equipped with a temperature limiter. Those with possible hazards caused by overcurrent, overload, etc. shall be equipped with an overload protecting device. These devices shall not operate under normal service conditions.
- e) Movable parts accessible by an user under normal service conditions shall be fitted with an appropriate protective frame or net to prevent easy access. However, this requirement does not apply to movable parts which are exposed during use due to unavoidable functional reasons and movable parts which are free from risks of electric shocks, injuries, etc. when the movable parts are touched.
- f) The vacuum cleaner which controls temperature, revolution speed, etc. using semiconductor elements, excluding the simple rectifier, shall comply with the following requirements when these semiconductor elements have lost their control capability.
 - 1) The components connected to the control circuit shall not burn, except the case where the burning of a component connected to the circuit does not pose any risk of burning other components.
 - 2) Non-live metallic parts liable to be earthed or exposed live parts shall comply with either of the following requirements.
 - 2.1) The voltages to the earth and between lines are 30 V a.c. or under or 45 V d.c. or under.
 - 2.2) When a resistance of 1 k Ω is connected between the live part and the earth, between lines, and between the non-live metallic part and the live part, the current flowing through the resistance concerned is 1 mA or under.

- 2.3) Even if the current flow in the above **2.2)** exceeds 1 mA, the parts are free from the risk of electric shock at the commercial frequency or over.
 - 3) After the current test in the above **2.2)**, the insulation resistance between the live part and the surface of the vacuum cleaner body measured with a 500 V d.c. insulation resistance tester shall be 0.1 MΩ or over.
- g) When the tests given below are performed, the components connected to the following circuits shall not burn: a circuit on the secondary side of an insulating transformer, a circuit on the d.c. side of a rectifier or other circuits to which electronic tubes, capacitors, semiconductor elements, resistors, etc. are connected, except circuits complying with the requirements in **7.2 c)**. Further, the circuit shall comply with **f) 2)** and **f) 3)**, except the case where the burning of a component connected to the circuit does not pose the risk of burning other components.
- 1) Short-circuit test between terminals for electronic tubes, pilot lamps, etc. and open test of terminals of heaters or filaments
 - 2) Short-circuit test between terminals or open test of terminals for capacitors, semiconductor elements, resistors, transformers, coils and the like
 - 3) Short-circuit test between the terminal and the metallic case for items indicated in **1)** and **2)** and housed in a metallic case, except for the case where there is no risk that the part connected to the terminal makes contact with the metallic case inside the component
- h) The rated voltage, rated current and permissible current of a component or accessory shall not be less than the maximum voltage applied to the component or accessory or shall not be less than the maximum current flowing through the component or accessory.
- i) The hose, extension tube, floor cleaning head, etc. shall be securely and easily attached or detached.
- j) The hose shall be flexible and easily handled.
- k) The dust collecting bag and/or dust receptacle and filter shall be capable of collecting small dust so that the amount of dust contained in exhaust is small.
- l) The dust collecting bag and/or dust receptacle and filter shall be robust and shall have a construction which allows a user to easily remove collected dust.
- m) The operation and transfer shall be easy.
- n) The noise intensity shall comply with the following requirements.
- 1) The noise power shall be 55 dB or under in the frequency range from 30 MHz to 300 MHz when measured with an absorbing clamp. In this case, the value in decibel (dB) shall be calculated on the assumption of 1 pW=0 dB.
 - 2) The noise terminal voltage measured between a line and the earth shall comply with the following requirements.
 - The continuous noise terminal voltage shall not exceed the value given in Table 5. The value in decibel (dB) shall be calculated on the assumption of 1 μV=0 dB.

Table 5 Continuous noise terminal voltage

Range of frequency	Continuous noise terminal voltage dB
526.5 kHz or over up to and incl. 5 MHz	56 max.
Over 5 MHz up to and incl. 30 MHz	60 max.

- For an apparatus switching the contact mechanically, not with a manual switch, the intermittent noise terminal voltage shall not exceed the value obtained by adding the correction value according to the click rate shown in Table 6 to the value given in Table 5.

Table 6 Correction value

Click rate Times/min	Correction value dB
Under 0.2	44
0.2 or over up to and incl. 30	$20 \log_{10} (30/N)$
Over 30	0
NOTE N indicates the click rate expressed in times/min.	

- o) If a switch is provided, the operation or state of switching shall be marked in a conspicuous place using letters, symbols or colours. When the marking is impracticable, the state of the vacuum cleaner shall be noticeable from the light, sound, current of air, whirl, etc.
- p) Place the vacuum cleaner with an enclosure made of synthetic resin in the state where the square plane part of 9 cm² or more on the outside surface of the enclosure is inclined approximately 45° to a horizontal surface. Burn the gas of Class 1 No. 1 specified in **JIS K 2240** using a gas burner which has 0.5 mm nozzle bore with its air vent closed. Apply the tip of the flame approximately 20 mm in length to the centre of the plane part from directly underneath for 5 s. When the flame is removed, the enclosure shall not burn.

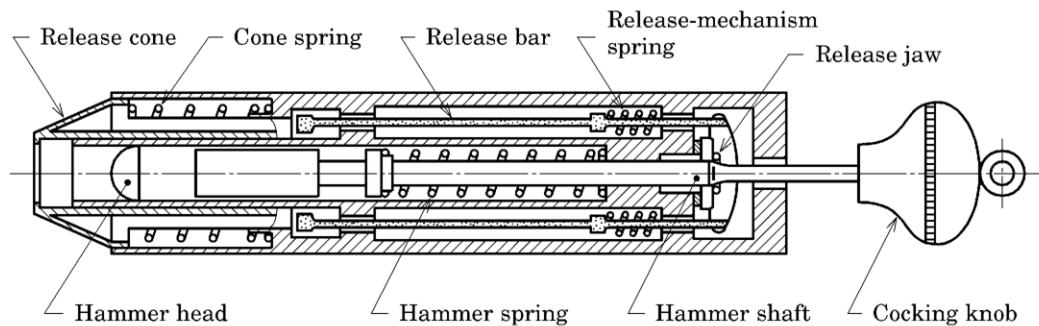
The vacuum cleaner which passes the horizontal burning test of synthetic resin material for enclosures specified in **JIS C 60695-11-10** and at least equivalent to this shall be regarded as a vacuum cleaner conforming to the requirements above.

The vacuum cleaner not having a square plane part of 9 cm² or more on the enclosure shall be tested using a test piece of original thickness cut into a square of 3 cm × 3 cm.

NOTE This requirement does not apply to those with synthetic resin enclosure which needs translucency or transparency, or those which needs flexibility, mechanical strength, etc. due to functional reasons.

- q) When a steel weight which has a mass of 250 g, which has a spherical surface of 10 mm radius and which is treated by polyamide to have a Rockwell hardness of HR-R100 specified in **JIS K 7202-2** is allowed to fall vertically once on the enclosure

from the height of 200 mm, or when an impact force of $0.5 \text{ Nm} \pm 0.05 \text{ Nm}$ is applied once with the spring hammer test apparatus shown in Figure 3, the enclosure shall be free from flaw, crack or the like which may result in risks of electric shock, fire, etc. However, this requirement does not apply to pilot lamps, fuse holders and the like that are exposed outside the body, and to their protective covers each having a surface area of 4 cm^2 or under and not projecting 10 mm or more from the surface of body enclosure.



NOTE The hammer head has a spherical face of 10 mm radius and is treated by polyamide to have a Rockwell hardness of HR-R100 specified in **JIS K 7202-2**.

Figure 3 Spring hammer test apparatus

7.2 Live part

The live part shall comply with the following requirements.

- a) When easily detachable parts are removed, the test finger shown in Figure 2 shall not touch the live part. In this case, the force to be applied to the test finger shall be 30 N. However, this requirement does not apply to the live parts which is exposed due to unavoidable constructional reasons and does not apply to any of the following cases.
 - 1) In the case where the voltages to the earth and between lines of the circuits connected to the secondary side of an insulation transformer are 30 V a.c. or under or 45 V d.c. or under
 - 2) In the case where the current flowing through a resistance of $1 \text{ k}\Omega$ connected to the earth or between lines is 1 mA or under
 - 3) In the case where there is no risk of electric shock at the commercial frequency or over even if the current in the above 2) exceeds 1 mA
- b) The clearance and creepage distance between the live parts of different polarities, between the live part and the non-live metallic part liable to be earthed, and between the live part and the surface of accessible non-metallic part shall be at least the values given in Table 7. In this case, the clearance and creepage distance shall be measured by applying a force of 30 N on the outside of the cleaner body and a force of 2 N inside the cleaner body so that the distance is minimum.

Table 7 Clearance and creepage distance

Unit: mm

Division	Parts concerned		Clearance and creepage distance				
			Line voltage or voltage to earth				
			15 V or under		Over 15 V up to and incl. 50 V	Over 50 V up to and incl. 150 V	Over 150 V up to and incl. 300 V
			With moisture resistant insulating film	Others			
Mount of power supply wire	Between terminals connected by manufacturer		—	—	—	3.0	4.0
	Between terminal connected by manufacturer and non-live metallic part liable to be earthed or accessible non-metallic surface		—	—	—	2.5	3.0
Other parts	Between live parts of different polarities	Fixed part where no ingress of dust is expected and deposit of metallic powder is difficult	0.5	1.0	1.2	1.5	2.0
		Other places	0.5	1.0	1.5	2.5	3.0
	Between live part and non-live metallic part liable to be earthed or accessible non-metallic surface	Fixed part where no ingress of dust is expected and deposit of metallic powder is difficult	0.5	1.0	1.2	1.5	2.0
		Other places	0.5	1.0	1.2	2.0	2.5
	Commutator of motor (between live part and non-live metallic part)		1.6				1.6 (6.4) ^{a)}
	Note ^{a)} The value in parentheses is applicable to a voltage over 250 V up to and including 300 V.						

c) The requirement of **b)** does not apply to the parts such as the circuit on the secondary side of an insulating transformer or the circuit on d.c. side of a rectifier which does not satisfy the requirement due to unavoidable constructional reasons and does not apply to the parts passing the following tests.

- 1) When the live parts of different polarities are short-circuited, the components connected to the short circuit shall not burn, except the case where the burning of a component connected to the circuit does not pose the risk of burning other components.
- 2) When a connection is established between the live parts of different polarities, between the live part and non-live metallic part liable to be earthed, or between the live part and the surface of accessible non-metallic part, the following requirements shall be satisfied.
 - 2.1) The voltages to the earth and between lines of the non-live metallic part or the exposed live part shall be 30 V a.c. or under or 45 V d.c. or under.

- 2.2) When a resistance of 1 k Ω is connected to the earth, between lines, or between the non-live metallic part and the live part, the current flowing through the resistance shall be 1 mA or under.
- 2.3) Even if the current in the above 2.2) exceeds 1 mA, there shall be no risk of electric shock at the commercial frequency or over.
- 3) After the test of 1) above, the insulation resistance between the live part and the surface of the vacuum cleaner body measured with a 500 V d.c. insulation resistance tester shall be 0.1 M Ω or over.
- d) The joint between the live parts or between the live part and the non-live part shall not work loose and shall withstand the temperature under normal service conditions.

7.3 Electrical insulating material

The thickness of insulating material shall comply with the following requirements.

- a) When the material of the body enclosure also serves as the insulation, the insulating material, except the part integrated into the apparatus, shall have a thickness of 0.8 mm or over in general or 0.5 mm or over for non-accessible insulation, and shall be free from pinholes. However, this requirement does not apply to the following case: when a steel weight which has a mass of 250 g, which has a spherical surface of 10 mm radius and which is treated by polyamide to have a Rockwell hardness of HR-R100 specified in **JIS K 7202-2** is allowed to fall vertically three times on the insulating material from the height of 200 mm, or when an impact force of 0.5 Nm $\pm$ 0.05 Nm is applied three times with the spring hammer test apparatus shown in Figure 3, the insulating material is free from flaw, crack or other abnormalities which may result in risks of electric shock, fire, etc. and is free from pinholes.
- b) The insulating material other than that specified in a) which is employed for the parts where external damage is anticipated and which complies with the requirements in 7.2 shall have a thickness not less than 0.3 mm and shall be free from pinholes. However, this requirement does not apply to the material which passes tests in the following 1) and 2) and which is free from pinholes.
- 1) The insulating material shall withstand the a.c. voltage applied for a duration of 1 min according to the division of the voltage of the parts where insulating materials are used as shown in Table 8.

Table 8 Dielectric strength of insulating material

Unit: V

Division of voltage of parts where insulating materials are used	a.c. voltage
30 or under	500
Over 30 up to and incl. 150	1 000
Over 150 up to and incl. 300	1 500

- 2) The insulating material shall be tested in accordance with Clause **9** of **JIS K 5600-5-4**. After the test procedure is completed, the pencil shall not contact the testing plate through the break of the insulating material. In this case, the insulating material shall have a pencil scratch hardness of 8 H specified in **JIS S 6006**.
- c) The insulating material used for the parts where no external damage is anticipated, excluding the parts between the motor windings and the lead from the winding, shall pass the test of **b) 1)** and shall be free from pinholes. However, this requirement does not apply to the insulating materials which have a thickness of 0.3 mm or over and which are free from pinholes.

7.4 Wiring

The wiring shall comply with the following requirements.

- a) The entry hole of a cord shall be given a suitable protective treatment such as chamfering so that the cord is not damaged, except when protective springs, protective bushings or other suitable protective devices are employed.
- b) When the following tensions are applied toward outside of the cleaner body for a duration of 15 s, and when the cord is pushed into the cleaner body, being gripped at a position 50 mm from the cleaner body, no tension shall be exerted on the joint of the cord and inner terminal, and the bushing shall be free from the risk of coming off.
 - 1) 30 N if the value 3 times the mass of the cleaner body is less than 3 kg
 - 2) The value 3 times the mass if the value 3 times the mass of the cleaner body is 3 kg to 10 kg
 - 3) 100 N if the value 3 times the mass of the cleaner body exceeds 10 kg
- c) The wiring inside the cleaner body shall comply with the following requirements.
 - 1) The wiring shall be free from the risk of contacting the high temperature part when a force of 2 N is applied, unless the contact does not cause any abnormalities.
 - 2) The wiring shall be free from the risk of contacting the movable part when a force of 2 N is applied, unless the contact does not cause any hazards.
 - 3) The covering of the wire shall not be damaged when the covered wire is fixed, passes through the entry hole or comes in contact with other parts with a force of 2 N being applied, unless the damage of covering does not cause any hazards.
 - 4) The wires connected by a connector shall not be separated when a force of 5 N is applied to the joint, except when the separation created by applying a force of 2 N or over to and excluding 5 N does not cause any hazards.
 - 5) For the wire connected to the movable part and used as given in Table 9, the wiring shall not be short-circuited when the wire is bent for the number of times (count the movement of bending and restoring as once) given in Table 9 at a rate of once per 5 s within the movable range, and the rate of broken wires shall be not more than 30 %. Furthermore, the wiring shall pass the dielectric strength