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**Electric resistance welding—
Transformers—
General specifications
applicable to all transformers**

ICS 25.160.30; 29.180

Descriptors : resistance-welding equipment, welding equipment, transformers,
specifications

Reference number : JIS C 9323 : 1999 (E)

Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of International Trade and Industry through deliberations at the Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law.

At the establishment “**ISO/FDIS 5826** *Electric resistance welding—Transformers—General specifications applicable to all transformers*” was used to prepare a Japanese Industrial Standard conforming with the International Standard.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

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Electric resistance welding— Transformers—General specifications applicable to all transformers

Introduction This Japanese Industrial Standard has been prepared based on **ISO/FDIS 5826** *Electric resistance welding—Transformers—General specifications applicable to all transformers* published in 1998, without modification of technical contents for the corresponding portions (definitions, standard service conditions and tests), however specifications not stated in the corresponding International Standard are added in this Standard.

The portions underlined with dots mean the matter not stated in the corresponding International Standard.

1 Scope This Japanese Industrial Standard specifies all welding transformers without connected rectifier (hereafter referred to as “transformers”).

NOTE: The International Standard corresponding to this Standard is given below.

ISO/FDIS 5826 : 1998 *Electric resistance welding—Transformers—General specifications applicable to all transformers*

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

JIS C 0365 *Protection against electric shock—Common aspects for installation and equipment*

JIS C 0704 *Insulation test for control gear*

JIS C 0920 *Tests to prove protection against ingress of water and degrees of protection against ingress of solid objects for electrical equipment*

JIS C 1102 *Electrical indicating instruments*

JIS C 4003 *Thermal evaluation and classification of electrical insulation*

JIS C 9305 *General rule for resistance welding machines*

IEC 60204-1 *Electrical equipment of industrial machines ; Part 1 : General requirements*

IEC 60905 *Loading guide for dry-type power transformers*

ISO 10656 *Electric resistance welding—Integrated transformers for welding guns*

3 Definitions For the purposes of this Standard the definitions of principal terms stated in **JIS C 9305** apply.

4 Standard service conditions Transformers shall be suitable for use in the physical environment and operating conditions as specified below.

When the physical environment and/or operating conditions are outside those specified below, an agreement may be needed between the supplier and the user, (see e.g. Annex B of **IEC 60204-1**).

- a) **Ambient air temperature** Transformers shall be capable of operating correctly in an ambient air temperature between +5 °C and +40 °C.

In case of other maximum temperatures of the cooling medium, see Annex 3.

- b) **Humidity** Transformers shall be capable of operating correctly within a relative humidity range of 30 % to 95 %.

Harmful effects of occasional condensation shall be avoided by proper design of the equipment or, where necessary, by proper additional measures (e.g. air conditioners, drain holes).

- c) **Altitude** Transformers shall be capable of operating correctly at altitudes up to 1 000 m above mean sea level.

In case of other altitudes, see Annex 3.

- d) **Transportation and storage** Transformers shall be designed to withstand, or suitable precautions shall be taken to protect against, transportation and storage temperatures between -25 °C and +55 °C and for short periods not exceeding 24 h up to +70 °C. Suitable means shall be provided to prevent damage from humidity, vibration and shock.

- e) **Provisions for handling** Transformers shall be provided with suitable means for handling by cranes or similar equipment.

- f) **Temperature of the cooling liquid** The temperature of the cooling liquid may be up to +30 °C at the inlet of the transformer.

In case of other maximum temperature of the cooling liquid, see Annex 3.

NOTE : Condensation caused by high cooling liquid flow or low cooling liquid temperature in relation to the relative humidity should be prevented.

5 Cooling liquid circuit

- a) The flow rate at permanent power shall not exceed the values given in Table 1.

Table 1 Limits for cooling liquid flow

Permanent power S_p kVA	Flow rate Q l/min
100 max.	$4 \geq Q$
101 to 350	$8 \geq Q$

- b) The cooling liquid circuit shall be tight at a pressure of 10 bar for 10 min.
- c) The cooling liquid circuit shall not have a maximum pressure drop ΔP higher than 0.60 bar at the flow rates Q according to Table 1.

NOTE : 1 bar = 10^5 Pa = 10^{-1} MPa

6 Electrical characteristics

6.1 Rated no-load output voltage (U_{20}) When the test of 8.2 is carried out, the no-load output voltage shall fall within ± 2.0 % from the value stated in the rating plate.

6.2 No-load input If necessity is agreed between the supplier and the user, the test of 8.3 is carried out and the no-load input shall not exceed the value obtained from the S_0 -rated maximum welding input curve (solid line) in Fig. 1. However, for a transformer whose maximum welding input is not clear, the value said above is obtained from S_0 -rated capacity curve (dotted line).

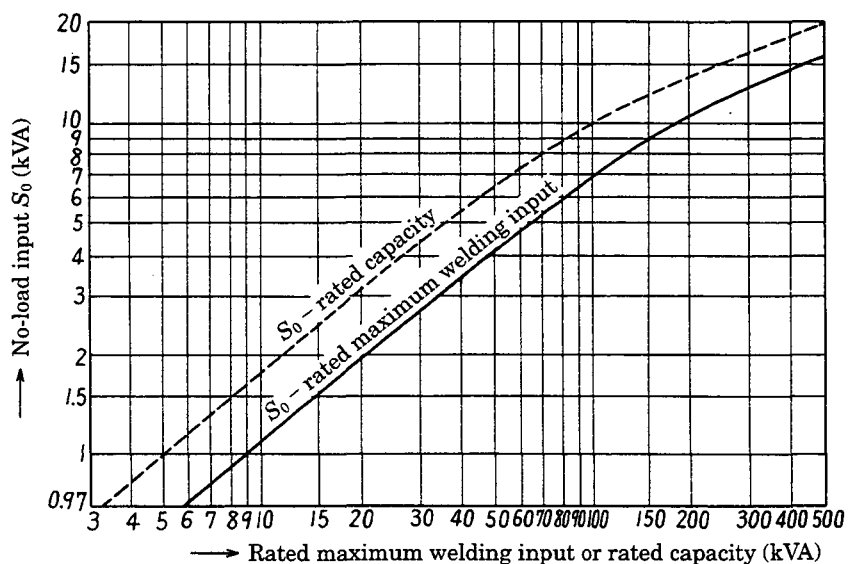


Fig. 1 No-load input

6.3 Temperature rise The limits of temperature rise of transformers shall be as given below.

- a) for windings: in accordance with 6.3.1;
- b) for accessible surfaces: in accordance with 6.3.2.

6.3.1 Windings The temperature rise of windings shall not exceed the values given in Table 2.

No part shall be allowed to reach any temperature that will damage another part even though that part might be in compliance with Table 2.

Table 2 Temperature limits for windings

Unit : K

Class of insulation °C	Peak temperature °C	Limits of temperature rise			
		Air cooled windings		Liquid cooled windings	
		Embedded temperature sensor	Resistance	Embedded temperature sensor	Resistance
105 (A)	140	60	60	70	70
120 (E)	155	75	75	85	85
130 (B)	165	85	85	95	95
155 (F)	190	110	105	120	115
180 (H)	220	135	130	145	140
200	235	155	145	165	155
220	250	175	160	185	170

NOTE 1 The highest temperature occurring in a winding (hot spot) can be measured by embedded temperature sensors. The temperature measured by the resistance method gives the average between all temperatures occurring in the windings.

NOTE 2 Other classes of insulation having higher temperature limits than those given in **JIS C 4003** are available. The peak temperature shall be as stated in **IEC 60905**.

6.3.2 Accessible surfaces The temperature rise with reference to the ambient air temperature [see 4 a)] and the cooling liquid [see 4 f)] for accessible surfaces shall not exceed the limits given in Table 3, when checked by the test of 8.4.

Table 3 Limits of temperature rise for accessible surfaces

Unit : K

Accessible surface	Limits of temperature rise	
	Air cooled transformers	Liquid cooled transformers
Bare metal enclosures	25	35
Painted metal enclosures	35	45
Non-metallic enclosures	45	55
Metal handles	10	20
Non-metallic handles	30	40

6.4 Rated short-circuit voltage (U_{cc}) The short-circuit voltage U_{cc} shall be obtained by the manufacturer in accordance with 8.5 and reported. For transformers with two separate output windings, the values measured for each winding may differ up to $\pm 5\%$ from the maximum value.

6.5 Dynamic characteristics Transformers shall withstand the test of 8.6 without any abnormality.

7 Protection against electric shock

7.1 Insulation resistance The insulation resistance shall be measured on the parts stated below using an insulation resistance tester of d.c. 500 V and the measured value shall be not less than 50 MΩ.

- a) the input and output windings and
- b) the windings and the frame.

7.2 Dielectric strength The insulation shall withstand the following test voltages without any flashover or breakdown and no damage shall occur which might impair the function of the insulation.

Compliance is checked according to **JIS C 0704** and the following test.

An a.c. voltage, having the frequency of the mains supply, of:

- a) 4 000 V r.m.s. for integrated gun transformers and
- b) 2 500 V r.m.s. for all other transformers

is applied between the inlet and one winding of the outlet circuit, of class I or class II transformers. However, if the design of class I is so that one point of the secondary is connected to earth, the test voltage can be decreased to 2 500 V r.m.s.

An a.c. voltage of 1 000 V r.m.s. having the same shape is applied between one winding of the outlet circuit and earth.

The 1 000 V test voltage shall be applied instantaneously.

The 2 500 V and 4 000 V test voltages shall be applied progressively so that the prescribed value is reached in about 20 s.

NOTE: Dielectric tests shall not normally be repeated on a same transformer. If, for any reason, they should be, they should be tested again with a test voltage of only 75 % of the above-mentioned values.

7.3 Protection against electric shock in normal service (direct contact) The minimum degree of protection for transformers provided by the enclosure shall be IP54 as specified in **JIS C 0920**.

If the transformer is intended to be in-built, the degree of protection may be IP00.

Compliance is checked according to **JIS C 0920**.

7.4 Protection against electric shock in case of a fault condition (indirect contact) Transformers shall be built to protection class I or II according to **JIS C 0365**.

Compliance is checked by visual inspection.

7.5 Isolation of input and output circuits The welding circuit shall be electrically isolated from the input circuit and from all other circuits having a voltage higher than the no-load voltage by reinforced or double insulation. If another circuit is

connected to the secondary circuit, the power of the other circuit shall be supplied by an isolating transformer or equivalent means.

Compliance is checked by visual inspection of the design.

8 Tests

8.1 Test conditions

8.1.1 Test environment The test environment shall be as follows:

- a) The tests shall be carried out on new, dry and completely assembled transformers.
- b) The ambient temperature shall be +10 °C to +40 °C.
- c) The ventilation shall be identical with that prevailing under normal service conditions.
- d) When placing the measuring instruments, the only access permitted shall be through openings with cover plates, checking doors or easily removable panels.
- e) The measuring instruments shall not interfere with the normal ventilation of the transformer or causes transfer of heat to or from it.
- f) Liquid cooled transformers shall be tested with liquid conditions as specified by the manufacturer.

8.1.2 Accuracy of measuring instruments The accuracy of measuring instruments shall be as follows:

- 1) Electrical measuring instruments: class 0.5 (0.5 % at full scale as shown in **JIS C 1102**)
- 2) Thermometer: ± 2 K

8.2 No-load output voltage test In the no-load output voltage test, the no-load output voltage shall be measured when the rated supply voltage at the rated frequency is applied to each tap on supply side of the transformer.

8.3 No-load input test The rated supply voltage at the rated frequency is applied to the transformer tap which is capable of passing the maximum current and the no-load input shall be measured.

8.4 Heating test

8.4.1 Heating test conditions

- a) The test shall be carried out for all settings.
- b) For liquid cooled transformers the flow rate shall be specified for a 100 % duty factor.
- c) The actual values during the heating test shall meet the rated values within the following tolerances: