

JIS

JAPANESE INDUSTRIAL STANDARD

Warm air furnaces

JIS A 4003—1995

Translated and Published

by

Japanese Standards Association

Printed in Japan

**In the event of any doubt arising,
the original Standard in Japanese is to be final authority**

Errata for JIS (English edition) are printed in *Standardization Journal*, published monthly by the Japanese Standards Association.

Errata will be provided upon request, please contact:
Business Department,
Japanese Standards Association
4-1-24, Akasaka, Minato-ku,
Tokyo, JAPAN 107
TEL. 03-3583-8002
FAX. 03-3583-0462

Errata are also provided to subscribers of JIS (English edition) in *Monthly Information*.

JAPANESE INDUSTRIAL STANDARD

J I S

Warm air furnaces

A 4003-1995

1. Scope This Japanese Industrial Standard specifies warm air furnaces with a rated heating capacity not less than 18.6 kW {16000 kcal/h} employing kerosine, fuel oil, town gas or liquefied petroleum gas as the fuel and mainly used for heating. However, space heaters specified in JIS S 2039 and JIS S 2122 are excluded.

Remarks 1. The standards cited in this Standard are shown in Attached Table 1.

2. The units and numerical values in { } in this Standard are based on the traditional units and are appended for informative reference.

2. Definitions For the purpose of this Standard, in addition to the definitions specified in JIS B 0113, and JIS S 2091, the following principal definitions apply.

- (1) gas duct A path which leads the flue gas from the heat exchanger to the exhaust pipe or chimney in a warm air furnace.
- (2) chimney A path through which flue gas is exhausted outdoors which has a rising part and on which draft effect can be expected.
- (3) non-ignition Such a phenomenon that the fuel is not ignited in the igniting operation.
- (4) dew formation Such an atmospheric phenomenon that the temperature of air or flue gas which comes in contact with the surface of a cool substance decreases and water drops are formed due to condensation of water vapor when the humidity at that part becomes 100 %.

3. Classification and symbolization Warm air furnaces are classified in accordance with the type and the fuel to be used, and symbolized as stated below.

3.1 Classification by type The classification by type shall be as stated in Table 1.

Table 1. Classification by type

Type		Symbol	Informative reference
Direct blow-out type	A furnace which is installed in a room to be heated, directly blows out warm air in the room, and in which the warm air blower is built-in the appliance body.	P	Attached Fig. 1
Duct connection type with built-in blower	A furnace which sends warm air to the room to be heated through a duct and in which the warm air blower is built-in the appliance body.	D	Attached Fig. 2
Duct connection type with separate blower	A furnace which sends warm air to the room to be heated through a duct and in which the warm air blower is separately installed without built-in the appliance body.	S	Attached Fig. 3

3.2 Classification by fuel The classification by fuel shall be as stated in Table 2.

Table 2. Classification by fuel

Fuel to be used		Symbol
Kerosine	No.1 specified in JIS K 2203	K
Fuel oil	Class 1 specified in JIS K 2205	A
	Class 2 specified in JIS K 2205	B
	Class 3 specified in JIS K 2205	C
Gas	Town gas	TG
Liquefied petroleum gas	Class 1 No.1 specified in JIS K 2240	LPG1
	Class 1 No.2 specified in JIS K 2240	LPG2
	Class 1 No.3 specified in JIS K 2240	LPG3

4. Performances

4.1 Service performances Service performances of warm air furnaces shall be as follows :

- (1) Automatic ignition system shall be employed.
- (2) The operation of each part shall be smooth, sure and no abnormalities detrimental to service shall be found.
- (3) The furnace shall automatically shut off combustion when the warm air temperature rises abnormally.
- (4) The knobs, handles, etc. shall not cause deformation during operation, nor any abnormal operation.
- (5) The operation, check and cleaning shall be made simply and there will be no risk of danger at the said procedure.
- (6) The fire extinguish operation can be made quickly and firmly.
- (7) When interruption of electric supply occurs during service, the fuel supply can be cut off, and there will be no risks of hazards when the power is supplied again inspite of the length of duration of interruption.

4.2 Quality performances When the tests are carried out in accordance with 8., the quality performances shall comply with the references stated in Table 3.

Table 3. Quality performances

Item		Quality performance	Sub-clause of applicable test
Air blow operation		No abnormal sound, abnormal vibration, loosening of joint and abnormal run out of belt.	8.2
Heating		No unstable operation or mal-operation, abnormal sound, abnormal vibration and imperfect connection.	8.3
Combustion performances	(1) Surface temperature of part touched with hand such as knob and handle ⁽¹⁾	The difference between measured temperature and room temperature shall not exceed 25 °C for metals and ceramics, or 35 °C for plastics.	8.4 (1)
	(2) Surface temperature of part accessible by hand ⁽²⁾	140 °C max.	8.4 (2)
	(3) Temperature of floor on which appliance body is installed	80 °C max.	8.4 (3)
	(4) Oil temperature in accommodated fuel tank	The difference between measured temperature and room temperature shall not exceed 25 °C.	8.4 (4)
	(5) Temperature of winding in motor, solenoid valve and solenoid pump	Class A insulation 100 °C max. Class E insulation 115 °C max. Class B insulation 120 °C max. Class F insulation 140 °C max. Class H insulation 165 °C max.	8.4 (5)
	(6) Combustion state	(1) Furnace shall be ignited firmly and show no instability of flame nor remarkable change of flame shape. (2) The flame shall be uniform and shall not incline. (3) No abnormalities such as oscillated combustion and adhesion of unburned oil to combustion chamber.	8.5
	(7) Overload performance	No abnormal combustion shall appear when the fuel is burnt at a rate 10 % more than the rated fuel consumption rate.	8.6
	(8) Heating capacity	Not less than 90 % of rated heating capacity	8.7
	(9) Thermal efficiency	Not less than 75 % with respect to thermal input of rated fuel consumption rate.	8.7.2
	(10) Fuel consumption rate	The difference shall be ± 10 % with respect to rated fuel consumption rate.	8.7.4
	(11) Temperature of exhaust gas	450 °C max.	8.7.5
	(12) Carbon monoxide in flue gas	300ppm max.	8.7.6
	(13) Smoke density	Smoke density shall not exceed No.4. Provided that smoke density shall not exceed No.6 for fuel oil B and C.	8.7.7
Fuel leakage		No leakage	8.8
Operation of warm air overheat shut off devices		The device shall operate surely, cut off fuel supply and also stop combustion or transfer it to pilot combustion. At least one shall operate at 95 °C or below, and the other at 140 °C or below. However the device mounted to warm air furnace specially designed for higher warm air temperature is an exception.	8.9

Table 3. (continued)

Item	Quality performance		Sub-clause of applicable test
Operation of combustion safety and control device	The device shall operate surely, cut off fuel supply and stop combustion when non-ignition or flame failure occurs. The device shall be manually reset when safety switch operates.		8.10
Electric power consumption	Within ± 10 % from rated power consumption		8.11
Noise ⁽³⁾	Rated heating capacity (H_c) kW (kcal/h)	Direct blow out type	8.12
	$H_c < 29.1$ {25000}	65 dB max.	
	29.1 {25000} $\leq H_c < 58.1$ {50000}	70 dB max.	
	58.1 {50000} $\leq H_c < 116$ {100000}	75 dB max.	
	116 {100000} $\leq H_c < 233$ {200000}	80 dB max.	
	233 {200000} $\leq H_c$	90 dB max.	
Insulation resistance	1 M Ω min.		8.13
Dielectric withstand voltage	The specimen shall withstand for 1 min or more.		8.14
Operation of earthquake extinguish/tip-over switch	For each of periods 0.3 s, 0.5 s and 0.7 s, (1) When vibrated at 100 cm/s ² {100 Gal}, the extinguish device shall not operate within 10 s. (2) When vibrated at 170 cm/s ² {170 Gal}, the flame shall go off within 10 s or the fuel supply be shut off within 5 s. No abnormal combustion shall appear until the flame goes off. Further no abnormalities such as damage and deformation shall appear on each part of warm air furnace.		8.15

Notes ⁽¹⁾ The part touched with hand such as knob and handle means the part touched with hand for control of combustion conditions during service. If jigs or tools are used, such a case is an exception.

⁽²⁾ The part accessible by hand means the casing of warm air furnace main body excluding the external plate 30 cm from periphery of exhaust pipe or chimney mounting hole and the burner mounting hole.

⁽³⁾ The noise is indicated in noise level [dB (A)]. The noise of duct type one is not specified, however it is desirable to measure the noise generated from the main body, the noise transmitted into the duct, the noise transmitted into exhaust pipe or chimney, etc. as the data for noise preventive means.

5. Construction

5.1 Construction in general The construction of warm air furnace shall be as stated below.

- (1) The furnace shall be so constructed that the flue gas and combustion products do not mix into the circulating air.
- (2) The warm air furnace of forced exhaust type shall be so constructed that the action of negative pressure produced by the forced ventilation will not cause trouble to combustion.
- (3) Each part of a warm air furnace shall be so constructed that the part has

sufficient strength and stability for transportation, carrying, installation, running, etc.

- (4) The warm air furnace shall be free from fuel leakage at every part.

The furnace employing liquid fuel shall not be so constructed that the oil spilt out at the time of fuel supply, maintenance, etc. drops on, travels to, or stays at the portion where the temperature during service may rise 25 °C or more above the room temperature.

- (5) The warm air furnace shall be so constructed that the water drops produced by dew formation in the furnace do not drop on the burner, electrical equipment or other corrosive parts.
- (6) The heat exchanger shall be so constructed that the water drops produced by dew formation will not stay therein.
- (7) The door or lid attached to combustion chamber and heat exchanger shall be so constructed that the airtightness is maintained under normal service conditions.
- (8) The baffle plate, if provided in the path of flue gas, shall be so constructed that it will not remarkably deformed or deteriorated by the flue gas.
- (9) The gas duct mounting opening shall be so constructed that the gas duct can be mounted firmly and the flue gas do not leak.
- (10) The combustion chamber shall be so constructed that cleaning of its inside is possible.
- (11) The burner shall be so constructed that it can be mounted to the correct position, and check and cleaning of the inside of burner can be done easily.
- (12) The furnace shall be so constructed that combustion can be verified by means of an observation window or a durable pilot lamp (e.g. a neon lamp).
- (13) The body shall be so constructed that it can be firmly mounted to a floor, wall, etc.
- (14) The air filter built in the body shall be so constructed that it can be easily taken out.

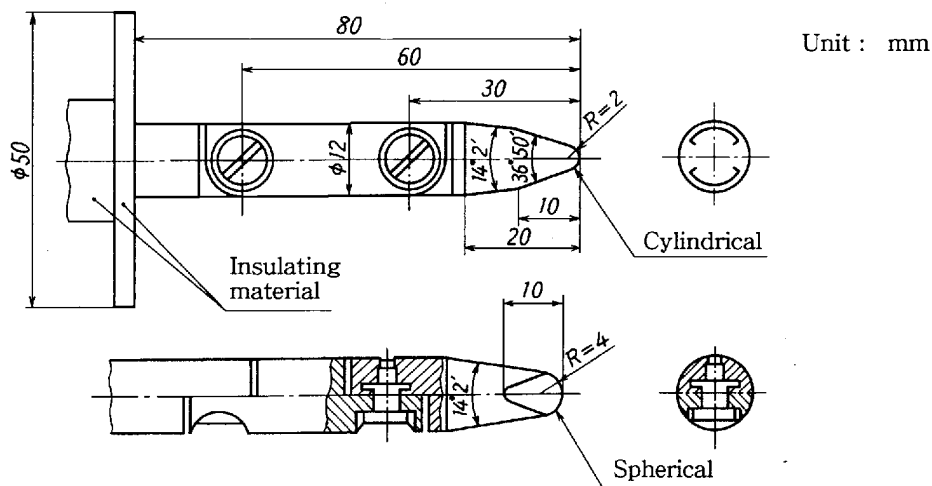
Informative reference : For duct connection type, use of non-combustible material is desirable.

- (15) The air fuel tank built in the body shall be constructed as stated below.
- (a) The fuel tank shall be made of metals, and rust preventive treatment shall be applied to the inside. If corrosion resistant material or material treated deterrent to corrosion is used and the corrosion resistant effect of treated film at joints and bends is not decreased by the processing, such a case is an exception.
- (b) The upper face and side faces of fuel tank shall be free from dents in which water, fuel, etc. may stay.
- (c) The fuel tank which can be removed from the warm air furnace body shall be so constructed that the fuel tank can be firmly attached and easily detached.
- (d) The fuel tank shall have a capacity less than 200 l, be equipped with a level gauge at an easily visible position and be easily filled with fuel.
- (e) The fuel tank shall be mounted to a position where the fuel temperature will not rise 25 °C or more above the room temperature.

5.2 Construction of live part The construction of live part shall be as follows:

- (1) The live parts, except those prescribed below, shall not be touched by the test finger shown in Fig.1, with easily detachable parts removed. In this procedure, the force to be applied to the test finger shall be 30N {3 kgf}.
 - (a) The live part on mounting face which is not easily accessible under mounted state.
 - (b) The live part of an appliance exposure of which is unavoidable due to construction, that is connected to an insulating transformer secondary circuit where the voltage to earth and voltage between lines do not exceed 30 V for a.c. or 45 V for d.c., or where the current flowing through a 1 k Ω resistor connected between the live part and the earth and that between the lines do not exceed 1 mA unless there is no risk of electric shock at a frequency not less than power frequency.

Fig. 1. Test finger



- Remarks
1. The tolerances on angle shall be $\pm 5'$.
 2. The tolerances on dimensions shall be $\pm_{0.05}^0$ mm for less than 25 mm, and ± 0.2 mm for 25 mm or more.

- (2) Between live parts of different polarity The clearance (including creepage distances) between live part and dead metallic part liable to be earthed, and between live part and surface of non-metallic part accessible by a man shall have at least the appropriate values prescribed in Table 4.

Table 4. Clearance

Line voltage or voltage to earth (E)			Unit : mm		
			$E \leq 50 \text{ V}$	$50 \text{ V} < E \leq 150 \text{ V}$	$150 \text{ V} < E \leq 300 \text{ V}$
Power supply cable mount	Between terminals connected by user		—	6.0	6.0
	Between terminal connected by user and dead metal part liable to be earthed or accessible surface of non-metallic part		—	6.0	6.0
	Between terminals connected by manufacturer		—	3.0	4.0
	Between terminal connected by manufacturer and dead metal part liable to be earthed or accessible surface of non-metallic part		—	2.5	3.0
Other parts	Between live parts of different polarity	Fixed part where ingress of dust and adhesion of metal powder are difficult	1.2	1.5	2.0
		Other parts	1.5	2.5	3.0
	Between live parts and dead metal part liable to be earthed or accessible surface of non-metallic part	Fixed part where ingress of dust and adhesion of metal powder are difficult	1.2	1.5	2.0
		Other parts	1.2	2.0	2.5

Remarks : The clearance means the distance measured when a force of 30 N {3 kgf} is applied to relevant parts on outside surface of appliance body and of 2 N {200 gf} to those on inside of body to minimize the distance.

- (3) However, in the secondary circuit of an insulating transformer or in the circuit behind a rectifier, the parts where decrease of insulation distance is unavoidable owing to structural considerations, are not necessarily conform to (2), provided that they satisfy the following requirements as the test results :
- (a) When live parts of different polarity are short-circuited, components connected to the shorted circuit shall not burn. And there is no danger of burning other components even if one of the components in the circuit burns.
 - (b) When the live parts of different polarity, the live part and dead metal part liable to be earthed, and the live part and accessible surface of non-metallic part are connected, the dead metal parts or exposed live parts shall comply with either of the following requirements :

- ① The voltage to earth and line voltage shall not exceed 30 V for a.c. or