

JIS

JAPANESE INDUSTRIAL STANDARD

Microwave ovens

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In the event of any doubt arising,
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1. Scope

This Japanese Industrial Standard specifies microwave ovens of rated high-frequency output not exceeding 2 kW and those incorporating additional devices (hereafter referred to as "ovens") for heating food stuffs by electromagnetic energy of a frequency band 2450 MHz (hereafter referred to as "microwave").

This Standard is not applicable to combination ovens which also use gas or other heat sources.

Remarks 1. The following Standards are cited in this Standard:

- JIS C 0602 General rules of color identification for protective conductor and neutral conductor and terminal marking for apparatus
- JIS C 1102 Electrical indicating instruments
- JIS C 1302 Insulation resistance testers (Battery operated)
- JIS C 2520 Wires and rolled wires for electrical heating
- JIS C 3301 Rubber insulated flexible cords
- JIS C 3306 Polyvinyl chloride insulated flexible cords
- JIS C 3327 600 V rubber insulated flexible cables
- JIS C 4505 Sensitive switches
- JIS C 8303 Plugs and receptacles for domestic and similar general use
- JIS C 8304 Small switches for indoor use
- JIS H 4461 Tungsten wires for lighting and electronic equipments
- JIS K 5400 Testing methods for paints
- JIS K 7202 Method of Rockwell hardness test for plastics
- JIS R 3503 Glass apparatus for chemical analysis
- JIS S 6006 Pencils and coloured pencils

2. The Corresponding International Standards to this Standard are shown below.

IEC 335-1: 1991 Safety of household and similar electrical appliances. Part 1: General requirements

IEC 335-2-6: 1986 Safety of household and similar electrical appliances. Part 2: Particular requirements for cooking ranges, cooking tables, ovens and similar appliances for household use

IEC 335-2-25: 1988 Safety of household and similar electrical appliances. Part 2: Particular requirements for microwave ovens

IEC 705: 1988 Methods for measuring the performance of microwave cooking appliances for household and similar purposes

3. The units and numerical values given in { } in this Standard are based on the traditional unit system and are appended for Informative reference.

2. Definitions

For the purposes of this Standard, the following definitions shall apply:

- (1) body Whole apparatus including a heating chamber, a microwave generating device and a control device as well as additional devices but not including the power supply cord or cable.
- (2) heating chamber Chamber for heating the food stuffs laid in it by a microwave generating device, and other additional devices.
- (3) tray Flatware or stand for holding food stuffs to be heated by microwave generating device, and other additional devices.
- (4) additional device A device added to an oven for the purpose of expansion of cooking category or of effective cooking by combination with the microwave generating device. It means an electric heating device and a steam generating device.
- (5) electric heating device Device equipped with heating element used to heat food stuffs directly or indirectly.

Remarks: The electric heating device includes, besides an independent heater and cooker, the one which performs grill function supplementing microwave heating, such as making scorched pattern, etc.

- (6) steam generating device Device for heating the food stuffs by steam.
- (7) short-time high-output function A function by which a microwave output larger than the output when the temperature at each part stabilizes, can be exerted for a short period of time immediately after start of operation or the like. This function shall be maintained at least one minute.

3. Classification

Ovens shall be classified into the following two kinds:

- (1) Oven only for microwave heating
- (2) Oven incorporating an additional device to (1)

Remarks: Oven incorporating an electric heating device in the above (2) is classified functionally as follows:

- (a) Oven whose electric heating device performs the oven function.
- (b) Oven whose electric heating device performs the grill function as a support to microwave heating.
- (c) Oven whose electric heating device performs both the oven function and the grill function.

4. Rating

4.1 Rated voltage Rated voltage of oven shall be single phase or three phase a.c. 300 V or less.

4.2 Rated frequency The rated frequency shall be 50 Hz, 60 Hz and 50/60 Hz in common.

4.3 Rated power consumption

4.3.1 Rated power consumption at microwave heating Rated power consumption at microwave heating shall be the power consumption under the working condition at microwave heating applying the rated voltage and rated frequency. In the case of the oven equipped with output changeover, rated power consumption at microwave heating shall be power consumption at the time when changeover is so made that high-frequency output becomes maximum.

It means the power consumption when the short-time high-power function, if provided, is in operation.

4.3.2 Rated power consumption at electric heating Rated power consumption at electric heating shall be the power consumption under the working condition of electric heating while the rated voltage and rated frequency are applied. However, in the case of the oven integral with the steam generating device, when its power consumption at steam heating turns out greater than the rated power consumption at electric heating, the power consumption at steam heating shall be deemed as the rated power consumption at electric heating.

In the case of the oven equipped with heating changeover, rated power consumption at electric heating shall be the power consumption at the time when changeover is so made as to maximize power consumption.

4.3.3 Rated power consumption of electric heating device Rated power consumption of electric heating device shall be the power consumption of heating element under the working condition while the rated voltage and rated frequency are applied. However, as for the oven incorporating a steam generating device, when the power consumption of heating element of steam generating device at steam heating is larger than the rated power consumption of electric heating device, the power consumption of heating element of steam generating device shall be deemed as the rated power consumption of electric heating device.

4.4 Rated microwave output Rated microwave output shall be microwave output under the working condition at microwave heating while the rated voltage and rated frequency are applied. In the case of oven equipped with output changeover, the rated microwave output shall be the microwave output when changeover is so made as to maximize microwave output.

As to ovens equipped with short-time high-output functions, the maximum output when oscillator continues the operation without a break shall be the rated continuous microwave output.

5. Performances

5.1 Voltage fluctuation characteristic When the voltage fluctuation characteristic test is carried out according to the method of 8.2.2, the specimen shall operate without any trouble.

5.2 Power consumption When the power consumption test is carried out according to the method of 8.2.3, the power consumption shall fall within the tolerance given in Table 1 correlating with the rated power consumption.

Table 1. Tolerance

Classification	Rated power consumption W	Tolerance %
Rated power consumption of electric heating device, if incorporated	$P \leq 20$	+ 20
	$20 < P \leq 100$	$\pm 15^{(+15)}_{(-20)}$
	$100 < P \leq 1000$	$\pm 10^{(+10)}_{(-15)}$
	$1000 < P$	$+ 5^{(+5)}_{- 10^{(-12)}}$
Rated power consumption at microwave heating and at electric heating	$P \leq 1000$	± 15
	$1000 < P$	± 10

Remarks: The values in parentheses are applicable in such a case that a thyristor or the like is connected in series to the heating element.

5.3 Microwave output The microwave output under the test specified in 8.2.4 shall be 90 to 115 % of rated microwave output.

5.4 Insulation

5.4.1 Insulation resistance The insulation resistance shall be $1\text{ M}\Omega$ or over under the test specified in 8.2.5. However, the value shall be at least $3\text{ M}\Omega$ for double insulation construction.

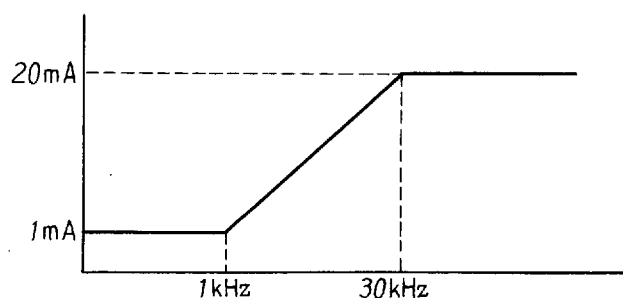
5.4.2 Dielectric withstand voltage The oven shall withstand the test specified in 8.2.6.

5.4.3 Insulation resistance under damp heat When the test of 8.2.7 (1) is carried out, the insulation resistance shall be not less than $1\text{ M}\Omega$ for ovens of double insulation, and not less than $0.3\text{ M}\Omega$ for other ovens; and when the test of 8.2.7 (2) is carried out the results shall comply with the provisions of 5.4.1 and 5.4.2.

5.5 Leakage current When the test of 8.2.8 is carried out, the leakage current shall not exceed 1 mA at power frequency, and shall not exceed the appropriate values shown in Fig. 1 at frequencies exceeding the power frequency.

If plural frequencies are superposed on the leakage current, the voltage across the output side terminals of filter produced by the leakage current shall be measured, and the value shall not exceed 1 V .

Fig. 1. Leakage current at frequencies exceeding power frequency



5.6 Temperature

5.6.1 Normal temperature When the normal temperature test is carried out according to the method of 8.2.9, the temperature at each part shall not exceed the appropriate value of Table 2, and the test results shall comply with the provisions of 5.4.1 and 5.4.2.

Table 2. Temperature rise

Unit: °C

Point of measurement			Temperature limit
Winding		Class A insulation	100
		Class E insulation	115
		Class B insulation	125 (120) (¹)
		Class F insulation	150 (140) (¹)
		Class H insulation	170 (165) (¹)
Rectifier (Only that used in power supply circuit of a.c. side)		Made of selenium	75
		Made of germanium	60
		Made of silicon	135
Contact part of fuse clip			90
Handle to be manipulated during operation		Made of metal, porcelain and glass	55
		Others	70
Knob and push button of switch, etc.		Made of metal, porcelain and glass	60
		Others	75
Enclosure	Portion easily accessed by man during use (²)	Made of metal, porcelain and glass	85
		Others	100
	Portion not easily accessed by man during use (³)	At microwave heating	100
		At electric heating and steam heating	135
Surface of wooden board for test specimen			95

Notes (1) The values in parentheses shall be applied to the winding of rotary machine.

- (²) The portion easily accessed by man during use, means all the surfaces confronting to the user when the oven is installed as in normal service.

This is not applicable to the front surface of door in heating chamber of an oven having electric heating device or steam generating device and bearing the caution marking for high temperature part specified in 12, during the test associated with operation of such devices.

- (³) Exhaust opening and its periphery are excluded.

Remarks: The limit of reference ambient temperature is 30°C.

5.6.2 Abnormal temperature As for abnormal temperature, the appliance or wooden board on which the appliance is placed shall not be liable to take fire, and the insulation resistance shall be 0.1 MΩ or over in the test specified in 8.2.10, and the specimen shall conform to the requirement of 5.8. However, power density of leakage microwave radiation of 5.8 (1) shall be 5 mW/cm² or under and, in this test, 5.8 (3) shall not be applied.

5.7 Oscillation frequency The oscillation frequency shall be within 2450 ± 50 MHz in the test specified in 8.2.11.

5.8 Power density of leakage microwave radiation The power density of leakage microwave radiation shall comply with the following requirements in the test specified in 8.2.12.

- (1) The density shall be 1 mW/cm² or under when door is closed.
- (2) The density shall be 5 mW/cm² or under when the door is fixed at maximum opening position just before the oscillation stopping device of the oscillating tube starts operation.
- (3) The density shall be 5 mW/cm² or under in the state that a oscillation stopping device other the principal one is restricted.

If pural principal oscillation stopping devices are provided, the test shall be carried out on each principal oscillation stopping device while one of them is free. If the pural principal oscillation stopping devices are linked with the same mechanism, the test may be carried out while any one of them is free. If the one among the pural principal oscillation stopping devices that causes the maximum leakage microwave is clear, the test may be carried out while the said oscillation stopping device is free.

5.9 Strength of noise

5.9.1 Noise field strength The noise field strength shall not exceed the appropriate value of Table 3, in the test of 8.2.13 (1).

Table 3. Noise field strength

Frequency range (f)(⁴)	Noise field strength dB
526.5 kHz $\leq$ f $\leq$ 1606.5 kHz 90 MHz $\leq$ f $\leq$ 108 MHz 170 MHz $\leq$ f $\leq$ 222 MHz	30
470 MHz $\leq$ f $\leq$ 770 MHz	40
1606.5 kHz < f < 90 MHz 108 MHz < f < 170 MHz 222 MHz < f < 470 MHz 770 MHz < f < 11.7 GHz 12.7 GHz < f $\leq$ 18 GHz	$20 \log_{10} \sqrt{20P}$ (40)
11.7 GHz $\leq$ f $\leq$ 12.7 GHz	57(⁵)

Notes (⁴) The frequency ranges of 13.56 MHz $\pm$ 6.78 kHz, 27.12 MHz $\pm$ 162.72 kHz, 40.68 MHz $\pm$ 20.34 kHz, 2450 MHz $\pm$ 50 MHz and 5.8 GHz $\pm$ 75 MHz are excluded.

(⁵) This is the effective radiation power of half wavelength dipole antenna.

- Remarks 1. The numerical value in parentheses is applicable to ovens of rated microwave output less than 500 W.
2. P means the rated microwave output and the unit is watt (W). It shall be 1000, if the rated microwave output exceeds 1000 W.
3. The decibel (dB) means the value calculated based on 1 μ V/m = 0 dB. However, it means the value calculated based on 1 pW = 0 dB for the frequency range from 11.7 GHz (incl.) to 12.7 GHz (incl.).

5.9.2 Noise terminal voltage The noise terminal voltage shall not exceed the appropriate value of Table 4 in the test of 8.2.13 (2).

Table 4. Noise terminal voltage

Frequency range (f)(⁶)	Noise terminal voltage dB
526.5 kHz $\leq f \leq$ 5 MHz	56
5 MHz $< f \leq$ 30 MHz	60

Note (⁶) The frequencies in the ranges of 13.56 MHz $\pm$ 6.78 MHz and 27.12 MHz $\pm$ 162.72 kHz are excluded.

Remarks: The decibel (dB) means the value calculated based on 1 μ V = 0 dB.

5.10 Opening and closing of door As for opening and closing of door, the opening and closing mechanism of door and the oscillation stopping device of oscillating tube shall be normal and the other mechanism and devices shall be free from dangerous abnormalities in the test specified in 8.2.14.

The specimen also shall comply with the requirements of 5.8. However, power density of leakage microwave radiation of 5.8 (1) shall be 5 mW/cm² or under, and 5.8 (3) shall not be applied.

5.11 Heating characteristics Heating characteristics shall conform to the following requirements. However, in the case of the oven incorporating heating device intended only for grill function, (2) shall not be applied.

- (1) As for heating unevenness at microwave heating, the temperature rise of water in each of 2 (or 4) beakers shall be within $\pm 3^\circ\text{C}$ from the mean value of temperature rises, in the test specified in 8.2.15 (1).
- (2) As for temperature rise period of heating chamber at electric heating, the time required shall be within 20 min and the highest temperature shall be 220°C or over in the test specified in 8.2.15 (2.1).

As for temperature distribution, the temperature difference between the measuring point in the center and those on other six points (two measuring points for the oven using a revolving tray) shall be in any case 20°C or under, in the test specified in 8.2.15 (2.2).

- (3) As for time of temperature rise of the heating chamber at steam heating, the time required shall be within 20 min in the test specified in 8.2.15 (3).

5.12 Short circuit and open circuit of electronic component Secondary circuit of transformer (exclusive of autotransformer), circuit beyond a rectifier and similar circuits accommodating oscillating tube, capacitor, semiconductor element, resistor, etc. shall be subjected to the test specified in 8.2.16. In the test, insulation resistance shall be $0.1\text{ M}\Omega$ or more at each time of short circuit or open circuit, and the oscillation stopping device shall operate normally.

The parts connected to the circuit shall not burn. When other components do not burn even if a component burns, such a case is an exception.

5.13 Mechanical times switch As for the mechanical time switch, the deviation of operating time shall be within 10 %, when tested in accordance with 8.2.17, and it shall have no trouble, such as melting of contact points, detrimental to practical use.

5.14 Dielectric withstand voltage of capacitor for high voltage power source A capacitor for high voltage power source shall withstand the voltage in the test specified in 8.2.18.

5.15 Thermostat Thermostat shall present no abnormality in any part and shall comply with the following requirements when put to the test specified in 8.2.19.

- (1) The mean value of the measured values before the test shall be $\pm 5^\circ\text{C}$ for the setting temperature less than 100°C , $\pm 5\%$ for the setting temperature from 100°C up to 200°C , and $\pm 10^\circ\text{C}$ for the setting temperature over 200°C .
- (2) The mean value of measuring values after the test shall be $\pm 5^\circ\text{C}$ from the mean value before the test under 100°C and $\pm 5\%$ for 100°C or over.

5.16 Temperature limiter As for the temperature limiter, the mean value of temperature at open circuit shall fall within $\pm 15^\circ\text{C}$ from the set temperature in the test specified in 8.2.20 (1). The temperature limiter shall show no abnormalities in any part and the deviation of the mean value of temperatures at open circuit shall be within $\pm 5^\circ\text{C}$ for an oven with a temperature setting of less than 100°C and within $\pm 5\%$ for the temperature setting of 100°C or more. However, for a limiter of bimetal type with a rated temperature of reset -20°C or below, the open circuit operation shall be once, and the temperature at open circuit by the method of 8.2.20 (1) shall fall within $\pm 15^\circ\text{C}$ from the set temperature.

When a test is carried out according to the method of 8.2.20 (3), no abnormalities shall be found out in any parts.

5.17 Resistance to thermal shock of inspection hole As for the resistance to thermal shock of inspection hole, the glass shall be free from any abnormalities such as cracks, breakage, and deficiency in the test specified in 8.2.21 carried out on the oven incorporating an electric heating device and using inspection hole of glass in the outer surface of enclosure.

5.18 Overload of heating element As for overload of heating element, heating wire, heating ribbon or filament shall not be broken in the test specified in 8.2.22 (1) for heating element used for grill function and in the test specified in 8.2.22 (2) for other heating elements.

5.19 Water overflow in heating chamber When the test for water overflow in heating chamber is carried out according to 8.2.23, the specimen shall comply with the provisions of 5.4.1 and 5.4.2, and the live parts shall not be splashed with water.

5.20 Starting characteristic of motor When an oven equipped with a motor is tested according to 8.2.25, the motor shall start irrespective of the position of the rotor.

6. Construction

6.1 Construction in general Construction of ovens shall comply with the following requirements:

- (1) For the portions of a metal cover or box likely to be exposed to the arc when the switch is operated, arc resistant insulating materials shall be used.
- (2) For the parts liable to cause such danger as burning of component and exposure of live part due to moisture absorption, moisture proof treatment shall be applied.
- (3) The movable parts liable to be touched by man under normal working condition shall be provided with suitable protective frame or guard net to avoid easy access. The movable part which is unavoidably used in exposed position due to its function is exempted from the above requirement if there is no risk of electric shock or injury when the part is touched by a man.
- (4) An oven which may cause danger by temperature rise shall be equipped with a temperature limiter which does not operate under normal service conditions.
- (5) The insulating materials used as the enclosure, and the indicator lamp, fuse holder or the similar components which are exposed on the outside of the body, and their protective covers shall not cause fissures, cracks, or other abnormalities which result in such danger as electrical shock and fire when a weight 250 g in mass, having a spherical surface of 10 mm radius finished with polyamide to have Rockwell hardness HRR 100 specified in JIS K 7202 is dropped vertically from the height of 20 cm once or when an impact force of $0.5 \pm 0.05 \text{ N}\cdot\text{m}$ {50 g·m} is applied with the impact testing apparatus given in Attached Fig. 1, once. However, the indicator lamp, fuse holder or the like exposed on the outside of the body and their protective covers, each of which has a surface area not exceeding 4 cm^2 , and does not project by 10 mm or more from the outer surface of the body, are excluded.
- (6) The rotation of the motor shall not be disturbed under normal service. If the disturbance of rotation does not result in a trouble or hazard, such a case is an exception.

- (7) The oven shall have double oscillation stopping devices (inclusive of such a construction that its door can not be opened without stopping the oscillation of oscillating tube) for the oscillating tube, which will operate by the mere manipulation of door opening. Moreover, either of the oscillation stopping devices shall be so constructed that the oscillating tube can not be oscillated by manipulation of testing stick of 3 mm in diameter and 100 mm in length from outside of the body with door opened.
- (8) The oven shall be so constructed that a straight wire 0.8 mm in diameter can not be inserted from the inspection hole of oven door into the oven chamber under its oscillating condition.
- (9) The body shall not tumble when placed in any direction on the slope of 10° against horizontal level whether the door is opened or closed.
- (10) The oven shall have a device to stop oscillation or a warning device, in case of abnormalities, such as melting of contacts in the main oscillation stopping device.
- (11) The oven which incorporates electric heating device, etc. and whose function can be selectively used by changeover operation, shall clearly indicate the state and shall be firmly switched over.
- (12) The oven which controls the temperature by means of semiconductor elements shall be such that the components connected to the control circuit shall not burn when the semiconductor elements lose the control ability.
- (13) If the total capacitance of the circuit viewed from the plug-in blade side exceeds 0.1 F, the voltage across the plug-in blades shall fall to 45 V or below after one second from withdrawal of the blades from the blade receptacle.

6.2 Live part The live part of oven shall comply with the following requirements:

- (1) If the peak voltage between live parts of different polarity and between live parts and dead metal part liable to be touched by a man (accessible part) exceeds 600 V, high voltage warning shall be indelibly marked in the vicinity of the live part or on an easily visible position of the outer surface.
- (2) The live parts shall not be touched by the test finger shown in Attached Fig. 2, with easily detachable parts removed.

In an oven of double insulation system, the test finger of Attached Fig. 2 shall not touch to the live parts and the basic insulation, and the test pin of Attached Fig. 3 shall not touch with the live parts. In this procedure, the force to be applied to the test finger shall be 10 N { 1 kgf } on the bottom surface and 30 N { 3 kgf } on the outer surface and opening part.

- (3) Double insulation or reinforced insulation shall be applied between the live parts and the surface of an oven of double insulation system.

6.3 Insulation distance The insulation distance shall comply with the following requirements:

- (1) The clearance (including the creepage distance) between live parts of different polarity, between live parts and dead metal parts liable to be earthed and between live parts and accessible surface of non-metallic part shall be as given in Table 5 and Table 6.

The clearance (including the creepage distance) for the basic insulation or supplementary insulation of an oven of double insulation system shall comply with Table 7. For the reinforced insulation, the distance shall be twice the appropriate value shown in Table 7.

The measurement of clearance shall be carried out with a force of 30 N {3 kgf} applied to the relevant parts on outer surface of appliance and a force of 2 N {200 gf} to such parts inside the appliance, moving the direction to minimize the clearance. However, the part in the secondary circuit of an insulating transformer (except for autotransformer), in the circuit behind a rectifier or other similar parts where decrease of clearance is unavoidable due to construction is exempted from the above requirement if the part complies with the requirements given below.

Table 5. Clearances and creepage distances relative to line voltage or voltage to earth

Unit: mm

Line voltage or voltage to earth (E) V		Mount of power supply wire		Other parts			
		Between terminals	Between terminal parts and dead metal parts liable to be earthed or surface of appliance body	Between live parts of different polarity (including wire mounting terminals of component with switching mechanism)		Between live parts and dead metal parts liable to be earthed or surface of body	
				Fixed part where dusts and metal powders are unlikely to accumulate	Other positions	Fixed part where dusts and metal powders are unlikely to accumulate	Other positions
$E \leq 15$	With moisture resistant insulating film	-	-	0.5	0.5	0.5	0.5
	Others	-	-	1.0	1.0	1.0	1.0
$15 < E \leq 50$		-	-	1.2	1.5	1.2	1.2
$50 < E \leq 150$		3	2.5	1.5	2.5	1.5	2.0
$150 < E \leq 300$		4	3	2	3	2	2.5
$300 < E \leq 600$		-	-	4	5	4	5
$600 < E \leq 1000$		-	-	6	7	6	7
$1000 < E \leq 3000$		-	-	20	20	20	20
$3000 < E \leq 7000$		-	-	30	30	30	30
$7000 < E \leq 12000$		-	-	40	40	40	40
$12000 < E$		-	-	50	50	50	50

Remarks: The clearance (excluding creepage distance) of appliance with a line voltage or voltage to earth exceeding 1000 V, may be reduced to the value in table minus 10 mm. However, the clearance between external terminals of capacitors of Table 6 is excluded.

Table 6. Clearances between external terminals of capacitor

Line voltage or voltage to earth (E) V	Clearance (including creepage distance) mm			
	Between live parts of different polarity		Between live parts and dead metal part liable to be earthed	
	Fixed part where dusts and metal powders are unlikely to accumulate	Other posi- tions	Fixed part where dusts and metal powders are unlikely to accumulate	Other posi- tions
$E \leq 50$	1	1.2	1	1
$50 < E \leq 150$	1.5	2	1.5	1.5
$150 < E \leq 300$	2	2.5	2	2
$300 < E \leq 600$	3	4	3	4
$600 < E \leq 1000$	4	5	4	5
$1000 < E \leq 1500$	6	6	6	6
$1500 < E \leq 2000$	7	7	7	7
$2000 < E \leq 3000$	10	10	10	10
$3000 < E \leq 4000$	13	13	13	13
$4000 < E \leq 5000$	20	20	20	20
$5000 < E \leq 6000$	25	25	25	25
$6000 < E \leq 7000$	30	30	30	30
$7000 < E \leq 12000$	40	40	40	40
$12000 < E$	50	50	50	50