

4.1.1.4 Limits for electric fence energizers apply to

- a) the fence terminals on all energizers (columns 4 and 5 of table 1);
- b) the mains terminals on energizers designed for connection to the mains (columns 2 and 3 of table 1);
- c) the battery terminals on energizers designed for operation from a battery (columns 4 and 5 of table 1).

However, no limits apply to the battery terminals of energizers with built-in batteries which cannot be connected to the mains supply, or energizers with external batteries if the connecting lead between the energizer and the battery is shorter than 2 m and is not applicable of being easily extended by the user without special tools.

Type D energizers, according to IEC 60335-2-76, are measured as battery operated energizers with connecting leads between the energizer and the battery greater than 2 m in length.

NOTE In practice, the fence wire can also act as an active source of disturbances, due to the high-voltage discharges, in particular to radio and telecommunication networks. Manufacturers of electric fence energizers should instruct the users to eliminate discharge points such as touching vegetation or a broken fence wire.

4.1.1.5 For battery operated appliances (with built-in batteries, as well as with external batteries) which can be connected to the mains the limits of columns 2 and 3 of table 1 apply to the mains terminals.

No radio disturbance limits apply to appliances with built-in batteries, which cannot be connected to the mains supply.

No radio disturbance limits apply to appliances with external batteries, if the connecting lead between appliance and battery is shorter than 2 m. If the connecting lead is longer than 2 m or easily extendable by the user without special tools, then the limits of columns 4 and 5 of table 1 apply to these leads.

4.1.2 Frequency range 30 MHz to 300 MHz (disturbance power)

The limits of the disturbance power are given in table 2.

Disturbance power is measured in accordance with clause 6, at all terminals.

Table 2 – Disturbance power limits for the frequency range 30 MHz to 300 MHz

1	Household and similar appliances		Tools					
	2	3	4	5	6	7	8	9
Frequency range			Rated motor power not exceeding 700 W		Rated motor power above 700 W and not exceeding 1 000 W		Rated motor power above 1 000 W	
(MHz)	dB (pW) Quasi-peak	dB (pW) Average*	dB (pW) Quasi-peak	dB (pW) Average*	dB (pW) Quasi-peak	dB (pW) Average*	dB (pW) Quasi-peak	dB (pW) Average*
30 to 300	Increasing linearly with the frequency from:							
	45 to 55	35 to 45	45 to 55	35 to 45	49 to 59	39 to 49	55 to 65	45 to 55
* If the limit for the measurement with the average detector is met when using a receiver with a quasi-peak detector, the equipment under test shall be deemed to meet both limits and the measurement using the receiver with an average detector need not be carried out.								

NOTE The limits for the measurement with the average detector are tentative and may be modified after a period of experience.

4.1.2.1 The limits in columns 2 and 3 of table 2 shall be met by all appliances except those mentioned in 4.1.2.2, second paragraph, to 4.1.2.4.

4.1.2.2 For battery operated appliances (with built-in batteries as well as with external batteries) which can be connected to the mains the limits of columns 2 and 3 of table 2 apply, together with 4.1.2.3 and 4.1.2.4.

For battery operated appliances (with built-in batteries) which cannot be connected to the mains, no disturbance power limits apply.

4.1.2.3 For electric tools the particular limits given in columns 4 to 9 of table 2 apply according to the rated power of the motor, the power of any heating device is to be excluded (for instance heating power in a blower for plastic welding).

4.1.2.4 Regulating controls which incorporate semiconductor devices, electric fence energizers, rectifiers, battery chargers and convertors which do not contain any internal frequency or lock generator operating at frequency higher than 9 kHz are not subject to the disturbance power requirements in the frequency range 30 MHz to 300 MHz.

4.2 Discontinuous disturbance

Switching operations in thermostatically controlled appliances, automatic programme controlled machines and other electrically controlled or operated appliances generate discontinuous disturbance. The subjective effect of discontinuous disturbance varies with repetition rate and amplitude in audio and video presentation. Therefore distinction is made between various kinds of discontinuous disturbance.

The discontinuous disturbance is only measured with a measuring receiver including a quasi-peak detector as mentioned in 5.1.1 and specified in clause 2 of CISPR 16-1.

See annex C for guidance.

4.2.1 The limits for discontinuous disturbance depend mainly on the character of the disturbance and on the click rate N as given in detail in 4.2.2 and 4.2.3.

No discontinuous disturbance limits apply in the frequency range 30 MHz to 300 MHz.

NOTE The level of disturbances below 30 MHz is interpreted as an indication for the level above 30 MHz.

4.2.2 Frequency range 148,5 kHz to 30 MHz (terminal voltages)

4.2.2.1 The limits of table 1 apply also to discontinuous disturbances from all equipment which produce:

- a) disturbances other than clicks, or
- b) clicks with a click rate N equal to or greater than 30.

Appliances as described in 4.2.3 are exempted.

NOTE Examples of discontinuous disturbances for which the limits for continuous disturbance apply are shown in figures 4a and 4b.

4.2.2.2 For discontinuous disturbance, the click limit L_q is attained by increasing the relevant limit L (as given in 4.1.1) with:

$$44 \text{ dB} \quad \text{for } N < 0,2, \text{ or}$$

$$20 \lg (30/N) \text{ dB} \quad \text{for } 0,2 \leq N < 30$$

NOTE Examples of discontinuous disturbances which are classified as clicks are shown in figures 3a, 3b and 3c.

See also annex A, table A.1 and table A.2.

4.2.2.3 The click limit L_q applies for click rates N determined under operating conditions and interpretation of results as specified in clause 7.

4.2.3 Exceptions from the click definition

Under certain conditions some kinds of discontinuous disturbances are exempted from the definition of a click (see 3.2).

This subclause contains these exceptions which are applicable in combination with subclauses 4.2.1 and 4.2.2 to all kinds of appliances. In figure 9, a flow diagram shows how to take these conditions into account in the verification procedure.

Product specific relaxations are contained in annex A, which contains also table A.2, a list of appliances for which the switching operations are counted, to derive the click rate N .

4.2.3.1 Individual switching operations

The disturbance from individual switching operations, caused directly or indirectly, manually or by similar activities on a switch or a control which is included in an appliance or otherwise to be used for:

- a) the purpose of mains connection or disconnection only;
- b) the purpose of programme selection only;
- c) the control of energy or speed by switching between a limited number of fixed positions;
- d) the changing of the manual setting of a continuously adjustable control such as a variable speed device for water extraction or electronic thermostats, is to be disregarded for the purpose of testing the appliance for compliance with the limits of radio disturbance set out in this standard.

Examples of switches included in this subclause are the on/off switches for apparatus (including foot activated), for instance the switch for an electric typewriter, manual switches for heat and air flow control in fan heaters and hair dryers, as well as the indirectly operated switch in a cupboard, wardrobe or refrigerator, and sensor-operated switches, etc. Switches which usually will be repeatedly operated are not included in this subclause, e.g. for sewing machines, calculating machines, soldering equipment, etc. (see 7.2.3. and 7.3.2.4.c).

Also the disturbance caused by the operation of any switching device or control which is included in an appliance for the purpose of mains disconnection for safety only, is to be disregarded for the purpose of testing the appliance for compliance with the limits of radio disturbance as described in this standard.

4.2.3.2 Combination of clicks in a time frame less than 600 ms

In programme controlled appliances a combination of clicks in a time frame less than 600 ms is allowed once per selected programme cycle.

For other appliances such a combination of clicks is allowed once during the minimum observation time. This is also valid for thermostatically controlled three-phase switches, causing three disturbances sequentially in each of the three phases and the neutral. The combination of clicks is considered as one click.

4.2.3.3 Instantaneous switching

Appliances which fulfil the following conditions:

- the click rate is not more than 5,
- none of the caused clicks has a duration longer than 20 ms,
- 90 % of the caused clicks have a duration less than 10 ms,

shall be deemed to comply with the limits, independent of the amplitude of the clicks (see tables A.1 and A.2). If one of these conditions is not satisfied then the limits in accordance with 4.2.2 apply.

4.2.3.4 Separation of clicks less than 200 ms

For appliances which have a click rate less than 5, any two disturbances each having a maximum duration of 200 ms, shall be evaluated as two clicks even when the separation between the disturbances is less than 200 ms.

In this case, for instance observed with refrigerators, the example shown in figure 4b, would be evaluated as two clicks and not as continuous disturbance.

5 Methods of measurement of terminal disturbance voltages (148,5 kHz to 30 MHz)

This clause lays down the general requirements for the measurement of disturbance voltage produced at the terminals of apparatus.

The operating conditions are given in clause 7 of this standard.

5.1 Measuring devices

The measuring devices given below are to be used:

5.1.1 Measuring receivers

Receivers with quasi-peak detectors shall be in accordance with clause 2 of CISPR 16-1; receivers with average detectors shall be in accordance with clause 4 of CISPR 16-1.

NOTE Both detectors may be incorporated in a single receiver and measurements carried out either using the quasi-peak detector or the average detector.

5.1.2 Artificial mains network

The artificial mains V-network is required to provide a defined impedance at high frequencies between the terminals of the equipment under test and reference ground, and also to isolate the test circuit from unwanted radio-frequency signals on the supply mains.

The artificial mains V-network $50 \Omega/50 \mu\text{H}$ (or $50 \Omega/50 \mu\text{H} + 5 \Omega$) as defined in clause 11 of CISPR 16-1 shall be used.

To ensure that, at the frequency of measurement, the impedance of the mains does not materially affect the impedance of the artificial mains V-network, a suitable radio-frequency impedance shall be inserted between the artificial mains V-network and the supply mains. This impedance will also reduce the effect of unwanted signals which occur on the supply mains (see also 5.3).

The connection between the artificial mains V-network and the measuring receiver shall be made by means of a coaxial cable with a characteristic impedance of 50Ω .

5.1.3 Voltage probe

The voltage probe shall be used when measuring on terminals other than mains terminals (see 5.2.3.2) e.g. load and control terminals (5.2.4.4). The voltage probe shall also be used on mains terminals when the artificial mains V-network cannot be used without unduly influencing the equipment under test or the test equipment, e.g. while measuring motors and heating devices operating at more than 25 A per phase.

The voltage probe contains a resistor having a resistance value of at least 1 500 Ω in series with a capacitor with a reactive value negligible to the resistance (in the range 150 kHz to 30 MHz) (see clause 12 of CISPR 16-1).

The measuring results shall be corrected according to the voltage division between the probe and the measuring set. For this correction only the resistive parts of the impedances shall be taken into account.

If the function of the equipment under test is affected by the impedance of the probe being too low, its impedance (at 50/60 Hz and at radio frequencies) shall be increased as needed (for example 15 k Ω in series with 500 pF).

5.1.4 Artificial hand

In order to simulate the influence of the user's hand, application of the artificial hand is required for hand held equipment during the disturbance voltage measurement.

The artificial hand consists of metal foil which is connected to one terminal (terminal M) of an RC element consisting of a capacitor of 220 pF \pm 20 % in series with a resistor of 510 Ω \pm 10 % (see figure 8a); the other terminal of the RC element shall be connected to the reference ground of the measuring system (see CISPR 16-1). The RC element of the artificial hand may be incorporated in the housing of the artificial mains network.

5.1.5 Disturbance analyzer for discontinuous disturbance

The measuring equipment for discontinuous disturbance shall comply with clause 14 of CISPR 16-1. An alternative method using an oscilloscope may be applied provided that the degree of accuracy is sufficient.

For the measurement of the duration of the disturbance see CISPR 16-1.

5.2 Measuring procedures and arrangements

5.2.1 Arrangement of the leads of the equipment under test

NOTE Clause 3 and annex A of CISPR 16-2 give more information about the connection of the electrical appliances to the measuring equipment.

5.2.1.1 Mains lead

During all measurements of disturbance terminal voltages (on the mains terminals or on other terminals) the artificial mains V-network is connected to the mains terminals in order to provide a defined termination. As described in detail in 5.2.2 the V-network is situated at a distance of 0,8 m from the appliance.

The disturbance voltage measurements are normally to be made at the plug end of the lead.

If the mains lead of the appliance under test is longer than necessary to be connected to the V-network the length of this lead in excess of 0,8 m shall be folded back and forth parallel to the lead so as to form a horizontal bundle with a length between 0,3 m and 0,4 m. In the case of controversy with regard to the banning of sales or withdrawal of a type approval it may be replaced by a lead of similar quality with a length of 1 m.

If the lead on which the measurements are to be made is shorter than the required distance between the appliance and the mains V-network, it shall be extended to the necessary length.

If the mains lead of the appliance under test includes the earthing conductor, the plug end of the earthing conductor shall be connected to the reference ground of the measuring equipment.

Where an earthing conductor is required, but is not included in the lead, the connection of the earth terminal of the appliance to the reference ground of the measuring equipment shall be made by a lead not longer than necessary to be connected to the V-network running parallel to the mains lead at a distance of not more than 0,1 m from it.

If the appliance is not supplied with a lead it is to be connected to the artificial mains V-network by a lead not longer than 1 m (also in case of plug or socket-outlet).

5.2.1.2 Other leads

The lead connecting the appliance with an auxiliary apparatus and the leads to regulating controls or to batteries of battery-powered appliances shall be treated in accordance with 5.2.1.1 except where otherwise stated in this standard.

5.2.2 Disposition of appliances under test and their connection to the artificial mains V-network

5.2.2.1 Appliances normally operated without an earth connection and not held in the hand

The appliance shall be placed 0,4 m above an earthed conducting surface of at least 2 m × 2 m in size and at a distance of 0,8 m from the artificial mains V-network and shall be kept at least 0,8 m from any other earthed conducting surface. If the measurements are made in a screened enclosure, the distance of 0,4 m may be referred to one of the walls of the enclosure.

Equipment that, according to its design and/or weight, usually stands on the floor while in use (so-called floor standing equipment) is subject to the same provisions as above.

However,

- the equipment shall be placed on a horizontal metal ground plane (the reference ground plane), but isolated from it by a non-metallic support (such as a pallet) of 0,1 m ± 25 % in height;
- the lead shall be led downward along the EUT to the level of the non-metallic support and be led horizontally to the artificial V-network;
- the artificial V-network shall be bonded to the reference ground plane (see CISPR 16-2);
- the reference ground plane shall extend at least 0,5 m beyond the boundaries of the EUT and have minimum dimensions of 2 m by 2 m.

5.2.2.2 Handheld appliances which are normally operated without an earth connection

Measurements shall first be made in accordance with 5.2.2.1.

Additional measurements shall then be made using the artificial hand described in 5.1.4.

The general principle to be followed in the application of the artificial hand is that the metal foil shall be wrapped around all handles, both fixed and detachable, supplied with the appliance and the terminal M shall additionally be connected to any exposed non-rotating metalwork as specified in 5.2.2.2.2 to 5.2.2.2.4.

Metalwork which is covered with paint or lacquer is considered as exposed metalwork and shall be directly connected to the terminal M of the RC element.

The artificial hand is to be applied the following way:

5.2.2.2.1 When the casing of the appliance is entirely of metal, no metal foil is needed, but the terminal M of the RC element shall be connected directly to the body of the appliance.

5.2.2.2.2 When the casing of the appliance is of insulating material, metal foil shall be wrapped round the handles, e.g. in figure 8b, around handle B, and also round the second handle D, if present. Also metal foil 60 mm wide shall be wrapped round the body C at that point where the iron core of the motor stator is located, or around the gearbox if this gives a higher disturbance level. All these pieces of metal foil, and the ring or bushing A, if present, shall be connected together and to the terminal M of the RC element.

5.2.2.2.3 When the casing of the appliance is partly metal and partly insulating material, and has insulating handles, metal foil shall be wrapped round the handles, as handles B and D in figure 8b. If the case is non-metallic at the location of the motor, a metal foil 60 mm wide shall be wrapped round the body C at that point where the iron core of the motor stator is located, or alternatively around the gearbox, if this is of insulating material and a higher disturbance level is obtained. The metal part of the body, the point A, the metal foil round the handles B and D and the metal foil on the body C shall be connected together and to the terminal M of the RC element.

5.2.2.2.4 When a class II appliance has two handles of insulating material A and B and a case of metal C, for example an electric saw (figure 8c), metal foil shall be wrapped round the handles A and B. The metal foil at A and B and the metal body C shall be connected together and to the terminal M of the RC element.

NOTE Classes 0, 0I, II and III according to IEC 60536: Classification of electrical and electronic equipment with regard to protection against electric shock.

5.2.2.3 Appliances normally required to be operated with an earth connection

The appliance shall be placed at a distance of 0,8 m from the artificial mains V-network, the disturbance voltages to be measured in accordance with 5.2.1.

The measurements shall be made with the earth terminal of the appliance connected to the reference ground of the measuring equipment.

If the appliance is not supplied with a lead the connection of the earth terminal of the appliance to the reference ground of the measuring equipment shall be made by a lead running parallel to the mains lead and of the same length and at a distance of not more than 0,1 m from it.

If the enclosure of the appliance is of non-conducting material, the appliance shall be tested as described in 5.2.2.1.

Appliance that, according to its design and/or weight, usually is standing on the floor while being in use (so-called floor standing equipment) is subject to the same provision as above.

However,

- it shall be placed on a horizontal metal ground plane (the reference ground plane), but insulated from it by a non-metallic support (e.g. a pallet) of $0,1 \text{ m} \pm 25 \%$ in height. If the measurements are made in a screened enclosure, the distance of $0,1 \text{ m} \pm 25 \%$ shall be referred to the metal ground of the screened enclosure;
- the boundaries of the appliance shall have a distance of at least 0,4 m to a grounded vertical conducting surface of at least $2 \text{ m} \times 2 \text{ m}$ in size. If the measurements are made in a screened enclosure, the distance of 0,4 m shall be referred to the nearest wall of the enclosure;
- the reference ground plane shall extend at least 0,5 m beyond the boundaries of EUT.
- the V-network shall be bonded with metal straps to the reference ground plane (see CISPR 16-2);
- the reference ground plane shall be bonded with the vertical surface by a low impedance connection.

5.2.3 Appliances having auxiliary apparatus connected at the end of a lead other than the mains lead

NOTE 1 Regulating controls incorporating semiconductor devices are excluded from this subclause, as these are covered in 5.2.4.

NOTE 2 When the auxiliary apparatus is not essential to the operation of the appliance and has a separate test procedure specified elsewhere in this standard (e.g. power nozzle of a vacuum cleaner) this subclause does not apply. The main appliance is tested as an individual appliance.

Connecting leads exceeding 1 m in length are arranged in accordance with 5.2.1.1.

Measurements need not to be made when the connecting lead between the appliance and the auxiliary apparatus is permanently fixed at both ends, and is either shorter than 2 m, or if it has a shielding whose ends are connected to the metal housing of the appliance and that of the auxiliary apparatus.

5.2.3.1 Measuring arrangement

The equipment under test shall be arranged in accordance with 5.2.2 with the following additional requirements:

- a) The auxiliary apparatus shall be placed at the same height and distance from the earthed conducting surface as the main appliance, and if the auxiliary lead is long enough, at a distance of 0,8 m from the main appliance, 5.2.1.1 shall be observed.

If the auxiliary lead is shorter than 0,8 m, the auxiliary apparatus shall be placed at the longest possible distance from the main apparatus.

If the auxiliary lead is longer than 0,8 m, the length of the auxiliary lead in excess of 0,8 m shall be folded parallel to itself so as to form a horizontal bundle with a length between 0,3 m and 0,4 m.

The auxiliary lead is stretched in the opposite direction to the mains lead.

When the auxiliary apparatus contains controls, the arrangements for its operation must not unduly affect the level of disturbance;

- b) If an appliance having an auxiliary apparatus is earthed, no artificial hand shall be connected. If the appliance itself is made to be held in the hand, the artificial hand shall be connected to the appliance and not to any auxiliary apparatus;
- c) If the appliance is not made to be held in the hand, the auxiliary apparatus which is not earthed and is made to be held in the hand shall be connected to the artificial hand; if the auxiliary apparatus is not made to be held in the hand either, it shall be placed above an earthed conducting surface as described in 5.2.2.1.

5.2.3.2 Measuring procedure

In addition to the measurement on the terminals for the mains connection, measurements are conducted on all other terminals for incoming and outgoing leads (e.g. control and load lines) using a probe as described in 5.1.3 in series with the input of the measuring receiver.

The auxiliary apparatus, control or load is connected to allow measurements to be made under all provided operating conditions and during interactions between the appliance and the auxiliary apparatus.

Measurements are performed both on the terminals of the appliance and on those of the auxiliary apparatus.

5.2.4 Regulating controls incorporating semiconductor devices

5.2.4.1 The regulating control shall be arranged as shown in figure 5. The output terminal of the control shall be connected to a load of the correct rated value by leads of 0,5 m to 1 m length.

Unless otherwise specified by the manufacturer, the load shall consist of incandescent lamps.

5.2.4.2 When a regulating control or its load is to be operated with an earth connection (i.e. Class I equipment) then the earth terminal of the regulating control shall be connected to the earth terminal of the artificial mains V-network. The earth terminal of the load, if any, is connected to the earth terminal of the regulating control, or, if not available, directly to the earth terminal of the artificial mains V-network.

5.2.4.3 The control shall first be measured in accordance with the provisions of 5.2.2.1 or 5.2.2.3.

5.2.4.4 Secondly, measurement of the disturbance voltage is made at the load terminals using a probe as described in 5.1.3 in series with the input of the measuring receiver.

5.2.4.5 For regulating controls having additional terminals for connection to a remote sensor or control unit, the following further provisions apply:

- a) The additional terminals shall be connected to the remote sensor or control unit by leads of 0,5 m to 1 m length. If a special lead is provided, the length of this lead in excess of 0,8 m shall be folded back and forth parallel to the lead so as to form a horizontal bundle with a length between 0,3 m and 0,4 m.
- b) Measurement of the disturbance voltage at the additional terminals of the regulating control shall be carried out in the same way as described in 5.2.4.4 for the load terminals.

5.3 Reduction of disturbance not produced by the equipment under test

Any measurable disturbance voltage not caused by the equipment under test (arising from the supply mains or produced by extraneous fields), shall give an indication on the measuring set at least 20 dB below the lowest voltage to which it is desired to measure.

Should the background noise not be at least 20 dB below the measurement level, it should be quoted in the results of measurement.

The disturbance voltages not caused by the equipment to be tested are measured when the equipment under test is connected but not operated.

NOTE Realization of this condition may require the addition of a supplementary filter in the supply mains and the measurements may have to be made in a screened enclosure.

6 Methods of measurement of disturbance power (30 MHz to 300 MHz)

This clause lays down the general requirements for the measurement of disturbance power produced at the terminals of apparatus.

The operating conditions are given in clause 7 of this standard.

It is generally considered that for frequencies above 30 MHz the disturbing energy is propagated by radiation to the disturbed apparatus.

Experience has shown that the disturbing energy is mostly radiated by the part of the mains leads and other leads near the appliance. It is therefore agreed to define the disturbing capability of an appliance as the power it could supply to its leads. This power is nearly equal to that supplied by the appliance to a suitable absorbing device placed around these leads at the position where the absorbed power is at its maximum.

Calibration is accomplished in accordance with annex I of CISPR 16-1.

6.1 Measuring devices

6.1.1 Measuring receivers

Receivers with quasi-peak detectors shall be in accordance with clause 2 of CISPR 16-1; receivers with average detectors shall be in accordance with clause 4 of CISPR 16-1.

NOTE Both detectors may be incorporated in a single receiver and measurements carried out either using the quasi-peak detector or the average detector.

6.1.2 Absorbing clamp

The absorbing clamp shall be in accordance with clause 13 of CISPR 16-1.

6.2 Measurement procedure on the mains lead

6.2.1 The appliance to be tested is placed on a non-metallic table at least 0,4 m from other metallic objects and the lead to be measured on is stretched in a straight line for a distance sufficient to accommodate the absorbing clamp, and to permit the necessary measuring adjustment of position for tuning. The clamp is placed around the lead so as to measure a quantity proportional to the disturbance power on the lead.

6.2.2 The absorbing clamp is positioned for maximum indication at each test frequency: the clamp shall be moved along the lead until the maximum value is found between a position adjacent to the appliance and a distance of about a half-wavelength from it.

NOTE The maximum may occur at a distance close to the appliance.

6.2.3 The straight portion of the lead to be measured on should therefore be about 6 m long, this being equal to $\lambda_{\max}/2 + 0,6$ m in order to allow at any time the positioning of the absorbing clamp and a possible second clamp for additional isolation.

If the original lead of the appliance is shorter than the necessary length it shall be extended or replaced by a similar lead.

Any plug or socket which will not pass through the absorbing clamp due to its size shall be removed or, especially in the case of controversy with regard to the banning of sales or withdrawal of a type approval the lead may be replaced by a lead of similar quality with the necessary length.

NOTE λ_{\max} is the wavelength corresponding to the lowest frequency at which measurements are to be made for instance 10 m at 30 MHz.

6.2.4 If the r.f. isolation between mains supply and the input of the absorbing clamp on the side of the appliance appears to be insufficient, a fixed ferrite absorber (see CISPR 16-1) should be placed along the lead at a distance of about 6 m from the appliance. This improves the stability of the loading impedance and reduces extraneous noise coming from the mains supply. For more information see clause 13 of CISPR 16-1.

6.3 Special requirements for appliances having auxiliary apparatus connected at the end of a lead other than the mains lead**6.3.1 Measuring arrangement**

6.3.1.1 Auxiliary leads normally extendable by the user, for instance with a loose end, or leads fitted with a plug or socket on one or both ends shall in accordance with 6.2.3 be extended to a length of about 6 m.

Any plug or socket which will not pass through the absorbing clamp due to its size shall be removed (see 6.2.3).

6.3.1.2 If the auxiliary lead is permanently fixed to the appliance and to the auxiliary apparatus and:

- is shorter than 0,25 m, measurement are not to be made on these leads;
- is longer than 0,25 m but shorter than twice the length of the absorbing clamp, it shall be extended to twice the length of the absorbing clamp;
- is longer than twice the length of the absorbing clamp, measurements shall be made using the original lead.

When the auxiliary apparatus is not necessary for the operation of the main appliance (e.g. a power nozzle to a vacuum cleaner) and a separate test procedure for the auxiliary apparatus is specified elsewhere in this standard, only the lead, but not the auxiliary apparatus, shall be connected. (However, all measurements on the main appliance in accordance with 6.3.2 are to be made.)

6.3.2 Measurement procedure

6.3.2.1 Measurement of the disturbance power is made firstly on the mains lead of the main appliance using the absorbing clamp in accordance with 6.2. Any lead connecting the main appliance to an auxiliary apparatus is disconnected if this does not affect the operation of the appliance, or is isolated by means of ferrite rings (or an absorbing clamp) close to the appliance.

6.3.2.2 Secondly, a similar measurement is made on each lead which is or may be connected to an auxiliary apparatus, whether or not it is necessary for the operation of the appliance; the current transformer of the clamp pointing towards the main appliance. Isolation, or disconnection of the mains lead and other leads is made in accordance with 6.3.2.1.

NOTE For short, permanently connected leads the movement of the clamp (as described in 6.2.3) is limited by the length of the lead.

6.3.2.3 In addition, measurement is made as above but with the current transformer of the clamp pointing towards any auxiliary apparatus, unless this auxiliary apparatus is not needed for the operation of the main appliance and a separate test procedure for it is specified elsewhere (no disconnection or r.f. isolation of other leads is of course necessary in this case).

6.4 Assessment of measuring results

The measured power is derived from the maximum indicated value found at each frequency of measurement and the calibration curve of the absorbing clamp (see also the example given in annex I of CISPR 16-1).

7 Operating conditions and interpretation of results

When measurements of disturbance are being made, the appliance shall be operated under the following conditions:

7.1 General

7.1.1 Normal load conditions shall be as defined in 7.2 and 7.3, unless these are in conflict with the manufacturer's instruction for use, which in such cases take precedence. Where appliances are not covered by these subclauses, the manufacturer's instruction for use shall be followed.

7.1.2 The duration of operation is not restricted unless the appliance is marked accordingly. In this case the limitations shall be complied with.

7.1.3 No running-in time to be specified but, prior to testing, the appliance shall be operated for a sufficient period to ensure that the conditions of operation will be typical of those during normal life of the equipment. Running-in of motors shall be carried out by the manufacturer.

7.1.4 The appliances shall be operated from a supply which provides the rated voltage and the rated frequency of the appliance.

A test at about 160 kHz and at about 50 MHz shall be made over a range of 0,9 to 1,1 times the rated voltage in order to check whether the level of disturbance varies considerably with the supply voltage; in which case, the measurements are to be made at the voltage which causes maximum disturbance.

Appliances with more than one rated voltage shall be tested at the rated voltage which causes maximum disturbance.

7.1.5 Speed controls with a limited number of fixed positions are to be adjusted to approximately average and to maximum speed, the higher reading to be registered if there is no instruction to the contrary in this standard.

Apparatus which incorporate electronic regulating controls shall have the controls adjusted for maximum disturbance in accordance with the procedure outlined in 7.2.6.1, in both frequency ranges 148,5 kHz to 30 MHz and 30 MHz to 300 MHz.

If the setting of continuously adjustable controls, which are not designed for frequent adjustment in normal use, has been pre-set, it shall not be adjusted during the test.

7.1.6 The ambient temperature shall lie within the range 15 °C to 35 °C.

7.2 Operating conditions for particular equipment and integrated parts

7.2.1 Multifunction equipment

Multifunction equipment which is subjected simultaneously to different clauses of this standard and/or other standards shall be tested with each function operated in isolation, if this can be achieved without modifying the equipment internally. The equipment thus tested shall be deemed to have complied with the requirements of all clauses/standards when each function has satisfied the requirements of the relevant clause/standard.

For equipment for which it is not practical to test with each function operated in isolation, or where the isolation of a particular function would result in the equipment being unable to fulfil its primary function, the equipment shall be deemed to have complied only if it meets the provisions of each clause/standard with the necessary functions operative.

7.2.2 Battery operated equipment

If the appliance can be connected to the mains it shall be tested operating in each permitted mode and in accordance with the operating conditions given in 7.3 while connected to the mains.

In the frequency range 148,5 kHz to 30 MHz measurements on equipment with external batteries are made at the terminals of the connecting lead using a probe as described in 5.1.3 in series with the input of the measuring receiver. Equipment which is made to be held in the hand shall be connected to the artificial hand.

In the frequency range 30 MHz to 300 MHz measurement on equipment with external batteries are made as described in 6.3.2.2 with the current transformer of the clamp pointing toward the appliance.

7.2.3 Integrated starting switches, speed controls, etc.

For starters, speed controls etc. incorporated in appliances like sewing machines and similar apparatus given in table A.2 the second paragraph of 7.4.2.3 applies.

7.2.3.1 Starters and speed control of sewing machines and dental drills. To determine the disturbance generated during starting and stopping the speed of the motor shall be increased to maximum speed over a 5 s period. For stopping, the control shall be reset quickly to its off position. To determine the click rate N , the period between two starts shall be 15 s.

7.2.3.2 Starting switches in adding machines, calculating machines and cash registers shall be operated intermittently with at least 30 starts per minute. If 30 starts per minute cannot be attained, then intermittent operation with as many starts per minute as possible in practice shall be used.

7.2.3.3 Picture change devices of slide-projectors. To determine the click rate N , the device shall be operated with the lamp switched on and with four picture-changes per minute without slides.

7.2.4 Thermostats

Separate as well as incorporated thermostats for the control of electric room or water heaters, oil and gas burners and the like.

Thermostats for, or integrated in permanently installed room heating equipment intended for stationary use shall be allocated with a click rate N which is five times the click rate determined for a single, portable or removable room heater.

The click rate N shall be determined for the maximum operating rate stated by the manufacturer or – if sold for or together with a heater or burner – for a duty-cycle of $(50 \pm 10) \%$ of this heater or burner.

The amplitude and duration of the disturbance shall be measured for the lowest rated current of the thermostat. For thermostats which have an acceleration resistor incorporated, the same measurements shall be performed in addition, without any separate heater connected.

When, in practice, the thermostat may be used together with inductive loads (e.g. relay, contactor) all measurements shall be performed using such a device, having the highest coil inductance used in practice.

In order to obtain a satisfactory measurement, it is essential that the contacts shall be operated for a sufficient number of times with a suitable load to ensure that the levels of disturbance are representative of those encountered in normal operation.

NOTE 1 For appliances containing thermostatically operated switches 7.3.4 is to be observed.

NOTE 2 If a thermostat is integrated in an appliance which it does not control, it is to be treated according to 7.2.4 or 7.3.4.14.

7.2.5 Thermostats – Alternative procedure to that specified in 7.2.4

For thermostats following this alternative procedure the subclauses 4.2.3.2, 4.2.3.4 and the flow diagram of figure 9 are not applicable.

7.2.5.1 For thermostats, separate or incorporated in a control box, e.g. with timer, intended to be integrated in a fixed room heating installation, the manufacturer shall specify the maximum operating switching rate. The click rate N shall be derived from this specification. Failing that, a click rate $N = 10$ shall be used, and L_q shall be determined, see 4.2.2.2.

The thermostat shall be caused to operate for 40 contact operations (20 opening and 20 closing), either manually by actuating of the temperature setting means, or automatically by e.g. a hot/cold blower.

The amplitude and duration of the disturbance shall be measured for the lowest rated current of the thermostat. In the absence of a marked or a declared minimum rated current, a current equal to 10 % of the maximum rated current is used. The amplitude of no more than 25 % of the disturbances shall exceed the L_q level. For thermostats which have an acceleration resistor incorporated, the same measurements shall be performed in addition without any separate load connected.

When, in practice, the thermostat may be used together with inductive loads (e.g. relay, contactor) all measurements shall be performed using such a device, having the highest coil inductance allowed for by the manufacturer's specification.

Prior to test, it is essential that the contacts shall be operated for a hundred times with the rated load.

NOTE This is to ensure that the levels of disturbance are representative of those encountered in normal operations.

7.2.5.2 Thermostatically controlled three-phase switches

Thermostatically controlled three-phase switches shall be treated as thermostats (see 7.2.5.1). Where no manufacturer's specification is given, a clickrate $N = 10$ shall be used.

7.2.5.3 Thermostatically controlled portable and removable room heating appliances

For portable and removable room heating appliances the manufacturer shall specify the maximum operating switching rate. The click rate N shall be derived from this specification, and the procedure in 7.2.5.1 shall be followed.

Where no manufacturer's specification is given, a clickrate $N = 10$ shall be used, following the procedure in 7.2.5.1,

or

the clickrate N shall be determined for a duty-cycle of (50 ± 10) % of the control device, attained under adequate heat transfer. The procedure of figure 9 shall be followed.

The power range switch, if any, shall be in the lowest position.

Prior to test, it is essential that the contacts shall be operated for a hundred times with the rated load.

NOTE This is to ensure that the levels of disturbance are representative of those encountered in normal operations.

7.2.6 Regulating controls incorporating semiconductor devices

NOTE According to 4.1.2.4 these controls as such are not subject to the disturbance power limits in the frequency range 30 MHz to 300 MHz, see also 7.1.5.

7.2.6.1 Adjustments for maximum disturbance level

The regulating control shall be adjusted to give a maximum indication on the meter at each frequency of measurement. After the value of the disturbance is registered at each preferred frequency (see 7.4.1.3) the frequency band adjacent to the preferred frequency is scanned without adjustment to the regulating control and the highest disturbance values are noted (for instance scan between 150 kHz and 240 kHz with the regulating control set at the value that gave the maximum on the meter at 160 kHz).

7.2.6.2 Equipment with several regulating controls

The following measurement procedure shall be applied to appliances containing several individually adjustable regulating controls each one having a maximum rated load current of not more than 25 A.

It shall be applied both on appliances where several regulating controls are connected to the same phase of the mains and to appliances where the regulating controls are connected to separate phases of the mains.

7.2.6.2.1 Each regulating control is tested separately. Measurements are made in accordance with 7.2.6.1 on all terminals of the appliance.

If separate switches are provided for the individual regulating controls, the units not being used should be switched off during these tests.

7.2.6.2.2 As many individual regulating controls as possible are connected to their loads without the maximum current per phase to the appliance exceeding 25 A when each of the controls is carrying its maximum rated current.

When not all individual controls can be connected to their maximum load, those controls are given priority which gave the highest disturbance values when tested in accordance with 7.2.6.2.1.

NOTE The controls may be different for different frequencies or for different terminals.

The setting of the individual controls shall be the same as those giving maximum disturbance during the measurement in accordance with 7.2.6.2.1. In addition a simple check shall be made that no other setting will give greater disturbance. Measurements are made on the mains terminals, all phases and neutral, on the terminals to the loads and on additional terminals of the appliance.

This test is not made when each individual regulating control consists of an entirely self-contained regulating circuit including all suppression components and operates independently of the others and does not control, either by design or fortuitously, any load that another individual regulator is controlling.

7.3 Standard operating conditions and normal loads

7.3.1 Motor-operated appliances for household and similar purposes

7.3.1.1 Vacuum cleaners

7.3.1.1.1 Vacuum cleaners without auxiliary apparatus, and not falling under 7.3.1.1.2 or 7.3.1.1.3 shall be measured while operating continuously without accessories and with an empty dust bag in place. Vacuum cleaners with a mains lead retracted by an automatic cord reel are to be measured with the mains lead pulled out completely, in accordance with 5.2.1.1.

7.3.1.1.2 Vacuum cleaners with control leads for power control of the vacuum cleaner integrated in the suction hose shall be operated in accordance with 7.3.1.1.1.

For the frequency range 30 MHz to 300 MHz the measurement of disturbance power shall be performed with the absorbing clamp (in addition to the measurement at the mains terminals) by replacing the suction hose and its integrated lead with a flexible cord connected to the terminals on the main unit and of necessary length having the same number of wires as provided in the originally submitted suction hose; 6.3 shall be taken into account, the lead is supposed to be permanently connected.

If the length of the hose is more than 2 m, additional measurement of disturbance voltage (for the frequency range 148,5 kHz to 30 MHz) shall be performed (in addition to the measurement at the mains terminals) on each lead in the hose using the voltage probe as described in 5.1.3. The limits given in table 1, columns 4 and 5 apply.

7.3.1.1.3 Vacuum cleaners with control leads and power supply leads for a power nozzle integrated in the suction hose, the conditions are as in 7.3.1.1.1 and 7.3.1.1.2 but without the power nozzle connected. The limits given in table 1, columns 4 and 5 apply to both the control and power lead terminals.

7.3.1.1.4 Auxiliary power nozzles of vacuum cleaners shall be operated continuously without mechanical load on the brushes. The cooling, if necessary, shall be provided by a non-metallic hose.

If the power nozzle is connected by a non-detachable supply lead having a total length shorter than 0,4 m or if connected directly by plug and socket to the vacuum cleaner they shall be measured together. In all other cases, the appliances shall be measured separately.

7.3.1.2 Floor polishers shall be operated continuously without any mechanical load on the polishing brushes.

7.3.1.3 Coffee grinders shall be operated continuously without load.

7.3.1.4 Food mixers (kitchen machines), liquid-mixers, blenders, liquidizers shall be operated continuously without load. For speed controls, see 7.1.5.

7.3.1.5 Clocks shall be operated continuously.

7.3.1.6 Massage apparatus shall be operated continuously without load.

7.3.1.7 Fans, cooker extractor hoods shall be operated continuously with maximum air flow; the fans shall be operated with and without heating, if this facility is provided. For thermostatically controlled switches, see 7.3.4.14. For fans and extractor hoods with electronic regulating controls 7.1.5 applies in addition.

7.3.1.8 Hair-dryers shall be operated as in 7.3.1.7. For thermostatically controlled switches see 7.3.4.14.

7.3.1.9 Refrigerators and freezers shall be operated continuously with the door closed. The thermostat shall be adjusted to the middle of the adjustment range. The cabinet shall be empty and not heated. The measurement shall be made after the steady state has been reached.

The click rate N is determined from half the number of switching operations.

NOTE Due to ice deposition on the cooling element, the number of switching operations in normal use is about half that compared with the refrigerator being empty.

7.3.1.10 Washing machines shall be operated with water but without textiles, the temperature of the incoming water shall be in accordance with the manufacturer's instruction for use. The thermostat, if any, must be adjusted to the maximum setting for the programme chosen or to 90 °C, whichever is lower. The most unfavourable control programme of an appliance shall be taken for the determination of click rate N .

NOTE For machines where the drying function forms a part of the programme, see 7.3.1.12.

7.3.1.11 Dish-washing machines as in 7.3.1.10.

7.3.1.12 Tumble-dryers shall be operated with textile material in form of pre-washed, double-hemmed cotton sheets having dimensions of approximately 0,7 m × 0,7 m and a mass between 140 g/m² and 175 g/m² in dry condition.

Control devices are set to either the lowest or highest position. The position that gives the highest click rate N shall be taken.

Separate tumble dryers are operated with half the maximum dry weight of cotton textile material recommended in the manufacturer's instruction for use. The specified dry weight of material shall be saturated with an equal weight of water at (25 ± 5) °C.

Tumble dryers combined with washing machines where the washing, spinning and drying operations are performed sequentially in a single container, are operated with half the maximum dry weight of cotton textile material recommended for the tumble dryer sequence operation in the manufacturer's instruction for use, the water content at the start of the dryer operation being that obtained at the end of the spinning operation after the previous washing operation.

7.3.1.13 Centrifugal dryers shall be operated continuously without load.

7.3.1.14 Razors and hair clippers shall be operated continuously without load, according to 7.1.2.

7.3.1.15 Sewing machines

For testing continuous disturbance of the motor, the motor shall be operated continuously at its maximum speed with the sewing gear, but not sewing a material.

For testing switch disturbance or semiconductor control disturbances, see 7.2.3.1 or 7.2.6.1.

7.3.1.16 Electro-mechanical office machines

7.3.1.16.1 Electric typewriters shall be operated continuously.

7.3.1.16.2 Paper shredders

The device shall be tested for continuous disturbances while the device is fed continuously with paper, resulting in continuous operation of the drive (if possible)

The device shall be tested for continuous disturbances while the device is fed with one single sheet at the time, allowing the motor to switch off between each sheet.

This process shall be repeated as quickly as possible.

The paper shall be suitable for typewriter or copying machine, and shall have a length between 278 mm and 310 mm independent of the dimensions for which the shredder is designed. The weight category shall be 80 g/m².

7.3.1.16.3 Copying machines are under consideration.

7.3.1.17 Projectors

7.3.1.17.1 Cine projectors shall be operated continuously with a film, the lamp being switched on.

7.3.1.17.2 Slide projectors shall be operated continuously without slides, the lamp being switched on. To determine the click rate *N*, see 7.2.3.3.

7.3.1.18 Milking machines shall be operated continuously without vacuum.

7.3.1.19 Lawn mowers shall be operated continuously without load.

7.3.1.20 Air conditioning equipment

7.3.1.20.1 If the air temperature is controlled by changing the time interval of operation of the compressor motor used in the appliance, or the appliance has heating device(s) controlled by thermostat(s), measurements shall be made according to the same operating condition as in 7.3.4.14.

7.3.1.20.2 If the appliance is a variable capacity type which has inverter circuit(s) that control(s) the revolution of the fan or compressor motor, measurements shall be made with the temperature controller setting at the lowest position when in cooling mode, and at the highest position when in heating mode.

7.3.1.20.3 The ambient temperature for testing the equipment by 7.3.1.20.1 and 7.3.1.20.2 shall be (15 ± 5) °C when the appliance is operating in heating mode, and (30 ± 5) °C when it is operating in cooling mode. If it is impractical to keep the ambient temperature within this range, another temperature is also permissible, provided that the equipment operates in a stable manner.

The ambient temperature is defined at the temperature of the air flow to the indoor unit.

7.3.1.20.4 If the appliance consists of indoor and outdoor units (split type), the length of connecting refrigerant pipe shall be $5 \text{ m} \pm 0,3 \text{ m}$ and the pipe shall be shaped like a coil with a diameter of approximately 1 m. If the pipe length cannot be adjusted, it shall be longer than 4 m, but not longer than 8 m. The connecting leads between the two units shall be routed along the refrigerant pipe. Where an earthing conductor is required, but not included in the mains lead, the earthing terminal of the outdoor unit shall be connected to the reference ground (see 5.2.1, 5.2.2 and 5.2.3). The artificial V-network shall be situated at a distance of 0,8 m from the unit (either the indoor or outdoor unit) which is connected to the mains network.

7.3.2 Electric tools

7.3.2.1 General

7.3.2.1.1 For motor-operated tools with two rotating directions, measurements shall be made for each direction after operating periods of 15 min for each direction, the highest of the two disturbance levels shall comply with the limit.

7.3.2.1.2 Electric power-operated tools which incorporate vibrating or swinging masses shall, where possible, be measured with these masses removed or disconnected. Such tools, which have an inadmissible increase of their revolutions per minute (rev/min) when operating without their vibrating or swinging masses, can be operated at lower voltages so that their nominal operating rev/min is reached.

7.3.2.1.3 For tools designed to operate via a transformer intended to be connected to the mains supply, the following measuring procedure shall be applied:

a) Terminal voltage: 148,5 kHz to 30 MHz

If the tool is sold together with a step-up transformer the disturbance shall be assessed by measurements made on the power supply side of the transformer. The power supply lead from the tool to the transformer shall have a length of 0,4 m or, if longer, folded to form a horizontal bundle with a length between 0,3 m and 0,4 m.

If the tool is intended to be used with a transformer, the disturbance shall be assessed by measurements made on the power supply side of the transformer recommended by the manufacturer for use with the tool.

Where a tool is not supplied with a "sample" transformer at the time of the test, it shall be operated at its rated voltage, and the disturbance shall be assessed by measurements made at the tool's power input connections.

b) Disturbance power: 30 MHz to 300 MHz

The disturbance shall be assessed by measurements made on the tool's power input connection whilst being supplied at its rated voltage. The tool shall, during measurement, be equipped with a power supply lead with a length suitable for measurements with the absorbing clamp as described in 6.2.4.

7.3.2.2 Handheld (portable) motor-operated tools, as:

Drills, impact drills
Screwdrivers and impact wrenches
Thread-cutting machines
Grinders, disc-type and other sanders and polishers
Saws, knives and shears
Planing machines and hammers

shall be operated continuously without load.

7.3.2.3 Transportable (semi-stationary) motor-operated tools shall be operated similar to the handheld (portable) tools contained in 7.3.2.2.

7.3.2.4 Soldering equipment, soldering guns, soldering irons

- a) For equipment with neither a thermostatically or electronically controlled switch, nor a motor, nor a regulating control (i.e. equipment which does not generate disturbances) measurements need not be performed;
- b) Equipment with thermostatically or electronically controlled switch shall be operated with the highest possible duty-cycle. If there is a control device for the temperature the click rate N shall be determined for a duty cycle of $(50 \pm 10) \%$ of this control device;
- c) For equipment repeatedly operated with a push button switch (e.g. soldering guns) where only disturbance from this mains switch can be observed, the manufacturer's instruction for use (on the rating label) are to be taken in account: duty factor and cycle-duration ascertain the highest possible number of switching operation per time unit.

7.3.2.5 Glue guns shall be operated continuously with a glue stick in working position; if clicks occur, the click rate N shall be assessed under steady-state conditions, without adequate heat transfer, e.g. the gun in stand-by position on the table.

7.3.2.6 Heat gun (blower for removal of paint, blower for plastic welding etc.) shall be operated as described in 7.3.1.7.

7.3.2.7 Power staplers shall be measured with the longest nails or cramps in accordance with the manufacturer's instruction for use, while working on soft wood (e.g. pinewood).

For all power staplers the click rate N shall be determined while operating at 6 strokes per minute (independent of product information or manufacturer's instruction for use).

The limits for portable tools smaller than 700 W are valid for power staplers, independent of their rated power consumption.

7.3.2.8 Spray guns shall be operated continuously with the container empty and without accessories.

7.3.2.9 Internal vibrators shall be operated continuously in the centre of a round steel-plate container filled with water, the volume of the water being 50 times the volume of the vibrator.

7.3.2.10 Arc welding equipment is under consideration.

7.3.3 Motor-operated electromedical apparatus

7.3.3.1 Dental drills

For testing continuous disturbance of the motor, the motor shall be operated continuously at its maximum speed with the drilling apparatus, but not drilling a material.

For testing switch disturbance or semiconductor control disturbance see 7.2.3.1 or 7.2.6.1.

7.3.3.2 Saws and knives shall be operated continuously without load.

7.3.3.3 Electrocardiograms and similar recorders shall be operated continuously with a tape or paper.

7.3.3.4 Pumps shall be operated continuously with a liquid.

7.3.4 Electrical heating appliances

Before making measurements the appliances shall reach steady-state conditions. The click rate N shall be determined for a duty-cycle of (50 ± 10) % of the control device, unless otherwise specified. If the duty-cycle of (50 ± 10) % cannot be reached, the highest possible duty-cycle shall be applied instead.

7.3.4.1 Cooking ranges, i.e. appliances having one or more hotplates controlled by thermostats or by energy regulators, shall be operated under conditions of adequate heat discharge: an aluminium pan filled with water is heated on the appliance until the water boils. The click rate N is half of the number (or of the highest number for several boiling plates measured in succession) of switching operations per minute for a duty-cycle (50 ± 10) % of the control device(s).

7.3.4.2 Cooking pans, table-type roasters, deep-fat fryers shall be operated under conditions of adequate heat discharge. Unless a minimum oil level is specified the quantity of oil above the highest point of the heating surface shall be:

- about 30 mm for cooking pans,
- about 10 mm table-type roasters,
- about 10 mm for deep-fat fryers.

7.3.4.3 Feed boilers, water boilers, kettles, coffee makers, milk boilers, feeding-bottle heaters, glue pots, sterilizers, wash boilers, shall be operated under conditions of adequate heat discharge half-filled with water and without lid. Immersion heaters shall be operated fully submerged. The click rate N shall be determined with a medium setting (60 °C) of a variable control device having a range between 20 °C and 100 °C or with the fixed setting of a fixed control device.

7.3.4.4 Instantaneous water heaters shall be operated in usual position of use with the water flow set at half of the maximum flow rate. The click rate N shall be determined with the highest setting of any control device fitted.

7.3.4.5 Thermal and non-thermal storage water heaters shall be operated in usual position of use, filled with typical quantity of water; no water to be drawn off during test. The click rate N shall be determined with the highest setting of any control device fitted.

7.3.4.6 Steam generators for indirect heating of appliances e.g. used in hotels and open waterbaths, shall be operated under adequate heat transfer and using the typical quantity of water.

7.3.4.7 Warming plates, boiling tables, heating drawers, heating cabinets shall be operated without adequate heat transfer.

7.3.4.8 Cooking ovens, grills, waffle irons, waffle grills shall be operated without adequate heat transfer, the oven door being closed.

NOTE The microwave function, if any, is covered by CISPR 11.

7.3.4.9 Toasters: if the conditions in 4.2.3.3 "instantaneous switching" are satisfied, no click limit applies.

All other toasters are to be tested according to 7.3.4.9.1 or 7.3.4.9.2 using as normal load slices of white bread about 24 h old (dimensions approximately 10 cm × 9 cm × 1 cm) to produce golden-brown toast.

7.3.4.9.1 Simple toasters are toasters which:

- incorporate a manually operated switch for switching on the heating element at the start of the toasting cycle and which will switch off the heating element automatically at the end of a predetermined period, and
- incorporate *no* automatic control device to regulate the heating element during the toasting operation.

For simple toasters the click rate N shall be determined and the level of disturbance generated assessed as follows:

a) *Determination of click rate N*

Using the normal load the manual control shall be set to give the required result. With the appliance in a warm condition the average "on" time (t_1 seconds) of the heating element shall be determined from three toasting operations. A rest period of 30 s shall be allowed after each "on" time. The time for a complete toasting cycle is ($t_1 + 30$) s. Thus the click rate N is:

$$N = 120/(t_1 + 30) \text{ s}$$

b) *Assessment of disturbance level*

The click rate N , established as described above shall be used to calculate the click limit L_q using the formula given in 4.2.2.2.