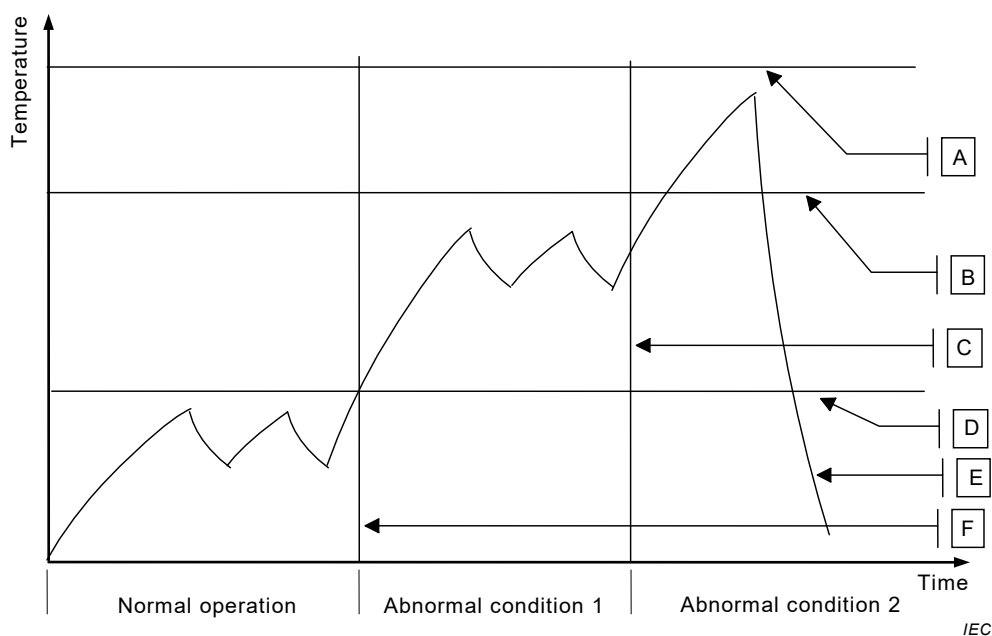




Key

- A final hazard temperature (abnormal condition 2)
- B interim hazard temperature (abnormal condition 1)
- C **failure of thermal cut-out**, or abnormal condition to which the **thermal cut-out** is not responsive
- D **maximum temperature** during **normal use**
- E requires replacement of **control** or part
- F **fault** condition

Figure EE.7 – Three-stage control system

EE.4.4.3 Examples of application

Refer to Table EE.1.

Table EE.1 – Typical examples of the classification of temperature sensing controls in accordance with IEC 60730-2-9

Classification	Declaration/Action															
	Type 1	Type 2	A	B	C	D	E	F	G	H	J	K	L	M	N	P
Control application																
Thermostat in room heaters		X ^a		X									X			
Manual reset thermal cut-out in room heaters (small)	X				X											
Thermal cut-out for electric kettles		X		X		X		X		X		X	X	X	X	
Temperature limiter in electric kettles	X		X	X												
Auto reset thermal cut-out in space heaters (dwelling)		X		X												
Manual reset thermal cut-out in space heaters		X		X		X			X							
Thermal cut-out for refrigerator compressor control (for thermal motor protector, refer to IEC 60730-2-4)		X			X											
Thermal cut-out for room heaters		X			X											
Thermal cut-out for hair dryers		X			X											
Thermal cut-out for transformers		X			X											
Thermal cut-out for fans		X			X											

^a In general, thermostats provide type 1 action but depending on the application, it is possible for a thermostat to provide type 2 action where the efficacy of the output is desired.

Declaration/ Actions	Control applications												
	TRH	MTC RH	TC EK	TL EK	ART CSH	MTC SH	TC RC	TC RH	TC HD	TCT	TCF	TC WH	TC SP
Type 1	X			X									
Type 2		X	X		X	X	X	X	X	X	X	X	X
A				X									
B		X	X		X	X	X	X	X	X	X	X	X
C	X			X									
Y												X	X
D		X				X							
E													
F		X	X										
G						X							
H		X											
J													
K		X											
L	X	X											
M		X											
N													
P		X											
X													
Z													
AK													
AM													
Class A control function ^c	x			X									
Class B control function ^c		X	X		X	X	X	X	X	X	X	X ^a	X
Class C control function ^c												X ^b	
Electronic circuit faults with regard to functional safety		FF	FF		FF	FF	FF	FF	FF	FF	FF	SF ^b FF ^a	FF

Control application codes:	
Control application	Code
Thermostat in room heaters	TRH
Manual reset thermal cut-out in room heaters (small)	MTCRH
Thermal cut-out for electric kettles	TCEK
Temperature limiter in electric kettles	TLEK
Auto reset thermal cut-out in space heaters (dwelling)	ARTCSH
Manual reset thermal cut-out in space heaters	MTCSH
Thermal cut-out for refrigerator compressor control (for thermal motor protector, refer to IEC 60730-2-22)	TCRC
Thermal cut-out for room heaters	TCRH
Thermal cut-out for hair dryers	TCHD
Thermal cut-out for transformers	TCT
Thermal cut-out for fans	TCF
Thermal cut-out for water heaters	TCWH
Thermal cut-out for spa applications	TCSP
^a First fault applies to non-closed water heater applications ^b First and second fault applies to closed water heater applications. ^c Control functions generally apply to electronic controls.	
Component fault code:	
Component fault	Code
First fault	FF
First and second fault	SF

EE.5 Examples of controls used with domestic appliances

EE.5.1 General usage of controls in appliances

See Figure EE.8 for a typical representation of controls evaluated to IEC 60730-2-9 used in appliances.

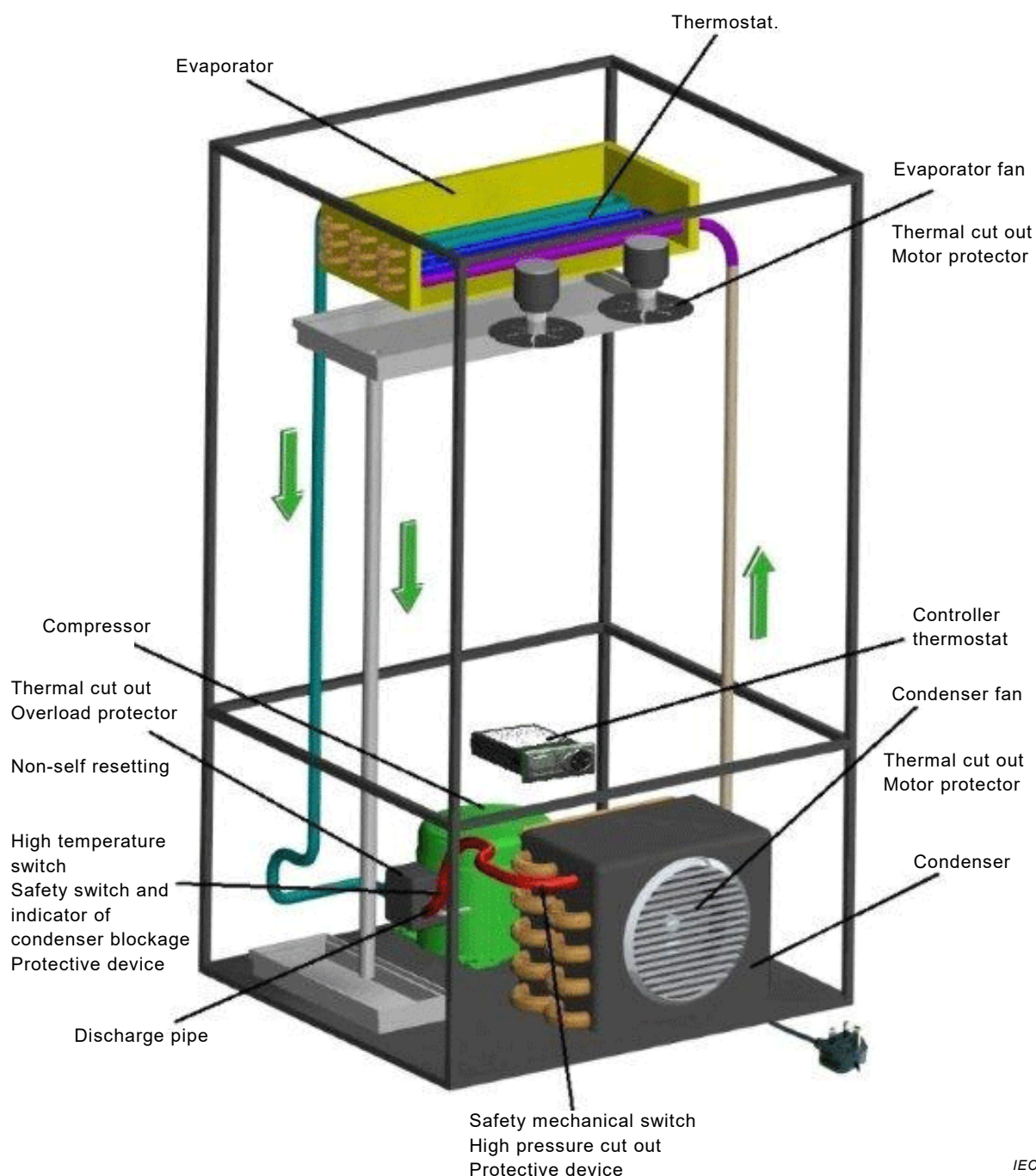


Figure EE.8 – Schematic diagram showing usage of various controls approved to IEC 60730-2-9

EE.5.2 Examples of which device is expected to operate during the tests of Clauses 11 and 19 of IEC 60335 (all parts)

Table EE.2 provides examples of applications where the controls are expected to operate during the tests of Clauses 11 and 19 of IEC 60335 (all parts)

Table EE.2 – Examples of controls expected to operate during Clauses 11 and 19 of IEC 60335 (all parts)

Iron IEC 60335-2-3	Thermostat operates (cycles) during the test of normal operation tests of Clause 11. SOD / thermal fuse / current fuse operate during the abnormal operation tests of Clause 19
Washing machine IEC 60335-2-7	Thermostat operates / cycles during the test of normal operation tests of Clause 11. SOD / thermal fuse / current fuse operate during the abnormal operation tests of Clause 19
Toaster IEC 60335-2-9	Temperature limiter / thermostat operate during the test of normal operation tests of Clause 11. Thermal cut-out / SOD / thermal fuse / current fuse operate during the abnormal operation tests of Clause 19
Kettle IEC 60335-2-15	Temperature limiter / thermostat operate during the test of normal operation tests of Clause 11. Thermal cut-out / SOD / thermal fuse / current fuse operate during the abnormal operation tests of Clause 19
Electric blanket IEC 60335-2-17	Temperature limiter / thermostat operate during the test of normal operation tests of Clause 11. Thermal cut-out / SOD / thermal fuse / current fuse operate during the abnormal operation tests of Clause 19
Skin or hair care IEC 60335-2-23	Temperature limiter / thermostat operate during the test of normal operation tests of Clause 11. SOD / thermal fuse / current fuse operate during the abnormal operation tests of Clause 19
Battery chargers IEC 60335-2-29	Temperature limiter / thermostat operate during the test of normal operation tests of Clause 11. Thermal cut-out / SOD / thermal fuse / current fuse operate during the abnormal operation tests of Clause 19
Panel heater IEC 60335-2-30	Thermostat operates during the test of normal operation tests of Clause 11. Thermal cut-out / SOD / thermal fuse / current fuse operate during the abnormal operation tests of Clause 19

Table EE.3 provides a correlation between the various part 2 standards of IEC 60335 to the type of action and functionality of various controls used in the particular products.

Table EE.3 – Guidance on the common usage of types of control

Product	Standard	Temperature limiter	Thermostat	Thermal cut-out (auto reset)	Voltage maintained Thermal cut-out	Thermal cut-out (manual reset)	SOD	Further classification of type of action
Minimum type of control action specified	-	Type 1	Type 1	Type 2	Type 2	Type 2	Type 2	-
Minimum class of control function required for equivalent electronic control		Class A	Class A	Class B	Class B	Class B	Class B	
Appliances	IEC 60335-1	Operating	Operating	Clause 19 (See Note)	Clause 19 (See Note)	Clause 19 (See Note)	Clause 19 (See Note)	
Vacuum cleaners	IEC 60335-2-2			Clause 19 (See Note)	Clause 19 (See Note)	Clause 19 (See Note)	Clause 19 (See Note)	-
Electric irons	IEC 60335-2-3		Operating		Clause 19 (See Note)	Clause 19 (See Note)	Clause 19 (See Note)	-
Spin extractors	IEC 60335-2-4			Clause 19 (See Note)	Clause 19 (See Note)	Clause 19 (See Note)	Clause 19 (See Note)	
Dishwashers	IEC 60335-2-5		Operating	Clause 19			Clause 19	
Stationary cooking ranges	IEC 60335-2-6	Operating	Operating	Clause 19		Clause 19	Clause 19	
Washing machines	IEC 60335-2-7		Operating	Clause 19		Clause 19	Clause 19	
Shavers	IEC 60335-2-8						Clause 19	
Grills and toasters	IEC 60335-2-9	Operating	Operating	Clause 19		Clause 19	Clause 19	
Tumble dryers	IEC 60335-2-11		Operating	Clause 19		Clause 19	Clause 19	
Deep fat fryers	IEC 60335-2-13		Operating	Clause 19		X	X	
Kitchen machines	IEC 60335-2-14		Operating	Clause 19		X	X	

Product	Standard	Temperature limiter	Thermostat	Thermal cut-out (auto reset)	Voltage maintained Thermal cut-out	Thermal cut-out (manual reset)	SOD	Further classification of type of action
Minimum type of control action specified	-	Type 1	Type 1	Type 2	Type 2	Type 2	Type 2	-
Minimum class of control function required for equivalent electronic control		Class A	Class A	Class B	Class B	Class B	Class B	
Appliances for heating liquids TCEK TLEK	IEC 60335-2-15	Operating	Operating	Subclause 19.4			Clause 19	
Food waste disposers	IEC 60335-2-16					Clause 19	Clause 19	
Electric blankets	IEC 60335-2-17	Operating	Operating			Clause 19	Clause 19	
Storage water heaters	IEC 60335-2-21		Operating			Clause 19 Class C	Clause 19	
Appliances for skin or hair care	IEC 60335-2-23	Operating	Operating				Clause 19	
Refrigerating appliances	IEC 60335-2-24		Operating	Clause 19		Clause 19	Clause 19	
Microwave ovens	IEC 60335-2-25			Clause 19			Clause 19	
Battery chargers	IEC 60335-2-29	Operating	Operating	Clause 19		Clause 19	Clause 19	
Room heaters TRH MTCRH	IEC 60335-2-30		Operating	Clause 19	Clause 19	Clause 19	Clause 19	
Motor compressors	IEC 60335-2-34			Clause 19			X	
Instantaneous water heaters	IEC 60335-2-35		Clause 19	Clause 19		Clause 19	Clause 19	

Product	Standard	Temperature limiter	Thermostat	Thermal cut-out (auto reset)	Voltage maintained Thermal cut-out	Thermal cut-out (manual reset)	SOD	Further classification of type of action
Minimum type of control action specified	-	Type 1	Type 1	Type 2	Type 2	Type 2	Type 2	-
Minimum class of control function required for equivalent electronic control		Class A	Class A	Class B	Class B	Class B	Class B	
Pumps	IEC 60335-2-41			Clause 19		Clause 19	Clause 19	
Thermal storage heaters	IEC 60335-2-61		Clause 19	Clause 19		Clause 19	Clause 19	
Fixed immersion heaters	IEC 60335-2-73		Clause 19			Clause 19	Clause 19	
Vending machines	IEC 60335-2-75		Operating	Clause 19		Clause 19	Clause 19	
Ventilating fans	IEC 60335-2-80			Clause 19			Clause 19	
Commercial refrigerating appliance	IEC 60335-2-89		Operating	Clause 19		Clause 19	Clause 19	

NOTE Clause numbers refer to when the control is required to operate during the tests of IEC 60335 (all parts). In some applications, a thermal fuse, current fuse or intentionally weak part is also used as an equivalent method of protection.

Bibliography

The Bibliography of Part 1 is applicable except as follows:

Addition:

IEC 60079 (all parts), *Explosive atmospheres*

IEC 60335-2-2, *Household and similar electrical appliances – Safety – Part 2-2: Particular requirements for vacuum cleaners and water-suction cleaning appliances*

IEC 60335-2-3, *Household and similar electrical appliances – Safety – Part 2-3: Particular requirements for electric irons*

IEC 60335-2-4, *Household and similar electrical appliances – Safety – Part 2-4: Particular requirements for spin extractors*

IEC 60335-2-5, *Household and similar electrical appliances – Safety – Part 2-5: Particular requirements for dishwashers*

IEC 60335-2-6, *Household and similar electrical appliances – Safety – Part 2-6: Particular requirements for stationary cooking ranges, hobs, ovens and similar appliances*

IEC 60335-2-7, *Household and similar electrical appliances – Safety – Part 2-7: Particular requirements for washing machines*

IEC 60335-2-8, *Household and similar electrical appliances – Safety – Part 2-8: Particular requirements for shavers, hair clippers and similar appliances*

IEC 60335-2-9, *Household and similar electrical appliances – Safety – Part 2-9: Particular requirements for grills, toasters and similar portable cooking appliances*

IEC 60335-2-11, *Household and similar electrical appliances – Safety – Part 2-11: Particular requirements for tumble dryers*

IEC 60335-2-13, *Household and similar electrical appliances – Safety – Part 2-13: Particular requirements for deep fat fryers, frying pans and similar appliances*

IEC 60335-2-14, *Household and similar electrical appliances – Safety – Part 2-14: Particular requirements for kitchen machines*

IEC 60335-2-15, *Household and similar electrical appliances – Safety – Part 2-15: Particular requirements for appliances for heating liquids*

IEC 60335-2-16, *Household and similar electrical appliances – Safety – Part 2-16: Particular requirements for food waste disposers*

IEC 60335-2-17, *Household and similar electrical appliances – Safety – Part 2-17: Particular requirements for blankets, pads, clothing and similar flexible heating appliances*

IEC 60335-2-21, *Household and similar electrical appliances – Safety – Part 2-21: Particular requirements for storage water heaters*

IEC 60335-2-23, *Household and similar electrical appliances – Safety – Part 2-23: Particular requirements for appliances for skin or hair care*