A technical choice: the gasket raw materials

The material was not chosen in regards of its price or ease of molding like gaskets made of PU foam injected through the process "Formed in place foam gasket or FIPFG ", or even of the possibility of die-cutting, but to meet the technical requirements of electrical heating applications: heat resistance, fire resistance, mechanical resistance to successive openings and closings, UV resistance.

Comparison chart of the common materials used for housing gaskets (Compared with equivalent density of 2.4 g/cm3 and equivalent hardness of 12 to 18 Shore A)

Material	Minimum using temperature (weakening) (ASTM D 746)	Maximum permanent using temperature (SAE J-2236)	Residual distortion after compression (ASTM D1056)	Breakage mechanical resistance	Fire resistance (UL94)	UV resistance (SAE J1960= Automotive Industry) UL508 : boxes	Required force for a 25% compression (ASTM D1056)
Polyurethan foam	-20°C	+90°C	< 5%	455KPa (ASTM D3574, test E)	HBF (the lowest class)	Medium deterioration	76 kPa
Silicone foam	-55°C	+200°C	< 5%	246Kpa (ASTM) D412)	V0 and HF1 (the highest class)	No deterioration	27 kPa: the smallest constraint to close a lid or a window

Average values for general comparison only as characteristics may vary from a supplier to another.

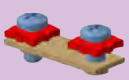
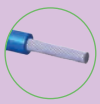
A technical choice: the main connection block

Main terminal block features (6mm²+2.5mm² version)
The plastic material of this terminal block is different from that of the box base and has been selected to meet its use specific constraints.
The most important constraint submitted to a terminal block is an overheating due to a lead bad tightening. The class of plastic having a GWFI (glow wire flammability index) above 850 ° C provides the highest resistance to overheating. This class is mandatory for applications involving unsupervised applications, as specified in the EN60335-1 § 30-2-3-1Standard. The material used for connectors has a GWFI of 960 °, which is much higher.
The other constraints of the application are:
Resistance to current tracking: CTI> 600 (Class 1, the highest).
Clearances and creepage distances: > 9 mm. 30% and 40% higher than the 6.3 and 5 mm @ 500V values requested under the highest pollution 3 environmental conditions. Distances measured in the worst case, with the largest possible cable gauge.
Protection against accidental electrical contacts : a screwed protection plate, exceeding the related specifications of the Standard 60-335-1

A technical choice: main connection block screws

Use of screws with captive notched square washers, allows to connect two slightly different size conductors on each terminal without compromising the clamping quality. This solution provides a universal wiring capability, independent of the wire end termination: bare conductors, tinned conductors, spade or eyelet terminals and conductors with cable shoes can be used.
As the conductor end is not hidden by the connection block, the user can clearly see if the wire is correctly inserted in the terminal, which is a common problem of the cage type terminal blocks in which the wire is often wrongly inserted under the cage and not tightened.

Comparative table of connection types accepted by the different terminal styles

Terminal type	Column header			
	Direct screw	Screw with plate	Cage terminal	Screw with notched square washer
				
Bare wire (solid or finely stranded)				
Bare tinned wire				
Cable shoe				
Spade terminal				
Eyelet terminal				

E-Mail: info@ultimheat.com Web: www.ultimheat.com

Technical information related to the temperature control in electro-thermal applications

Technical information N°1 : Terminology and vocabulary

Standards EN60730 and EN 60335 define, sometimes with differences, the vocabulary to use. However, it is often different from what is used in practice.

Usual vocabulary:
Set point: The value set on the temperature control device, corresponding to the temperature to reach
Differential: the temperature difference between the opening and closing of the contact
Snap action: contacts open and close instantly
Manual reset: action to turn on by manual intervention, to heating position contacts opened by a temperature rise that does not automatically return to closed position when the temperature drops
Automatic reset: Contact that automatically closes when the temperature drops
Sensing control: automatic control in which initiation is done by an element sensitive to the activating temperature

Definitions of the different thermostatic systems according to EN60335-1
§3.7.1 Thermostat: temperature sensing system of which the operating temperature may be fixed or adjustable and which, during normal operation, maintains the temperature of the controlled part within certain limits by automatic opening and closing of a circuit
§3.7.2 temperature limiter: temperature-sensing device, the operating temperature of which may be either fixed or adjustable and which during normal operation operates by opening or closing a circuit when the temperature of the controlled part reaches a predetermined value
NOTE A temperature limiter does not make the reverse operation during the normal duty cycle of the appliance. It may or may not require manual resetting.
temperature limiter: temperature sensing control which is intended to keep a temperature below or above one particular value during normal operating conditions and which may have provision for setting by the user
A temperature limiter may be of the automatic or of the manual reset type. It does not make the reverse operation during the normal duty cycle of the appliance.
§3.7.3 Thermal cut-out : device which during abnormal operation limits the temperature of the controlled part by automatically opening the circuit,... and is constructed so that its setting cannot be altered by the user.
thermal cut-out: temperature sensing control intended to keep a temperature below or above one particular value during abnormal operating conditions and which has no provision for setting by the user
A thermal cut-out may be of the automatic, manual reset or non-resettable type.
§3.7.4 self-resetting thermal cut-out: thermal cut-out that automatically restores the current after the relevant part of the appliance has cooled down sufficiently
§3.7.5 non-self-resetting thermal cut-out: thermal cut-out that requires a manual operation for resetting, or replacement of a part, in order to restore the current
NOTE Manual operation includes disconnection of the appliance from the supply mains.
§3.7.6 Protective device: device, the operation of which prevents a hazardous situation under abnormal operation conditions
§3.7.7 Thermal link: thermal cut-out which operates only once and requires partial or complete replacement

Fail safe temperature limiter: the fail safe in a thermostat is defined by the EN60730-2-9 Standard § 6.4.3.101, as a temperature control device wherein a leakage of the filling fluid does not increase the temperature set point. More generally a system is said to be failsafe, when a loss of fluid (including electricity) leads the equipment to a stable safety state. The safety state must be maintained over time.

Thermostats recommended applications:
IEC (EN) 60730-1 Standards « Automatic electrical controls
for household and similar use» and especially IEC (EN)
60730-2-9-(2008) : « Particular requirements for temperature sensing controls» are the standards that define the functional characteristics of thermostats. Appendix EE of the latest version of the standard describes all recommended applications for these devices.

Technical information N°2 : Important extracts of standards related to control or safety circuits

Electrical cut out: (IEC 60335-1)
§3.8.1 All-pole cut out: Cutting in two conductors in a single operation, or for three phase units, the cut of the three conductors in a single step ... Note: for three-phase, the neutral lead is not considered as a power conductor.
§22.2: Phase cut out: single pole protection systems cutting heating elements in single pole circuits of Class 01 devices and continuously connected Class 01 devices, must be connected to the phase conductor.
Electrical conductors colors: (IEC 60446)
§3.1 ... For the identification of leads the following colors are allowed: black, brown, red, orange, yellow, green, blue, purple, gray, white, pink, turquoise.
§3.2.2 Neutral conductor or center conductor : when a circuit includes a neutral conductor or neutral conductor identified by color, the color used for this purpose should be blue ...
Note 2 – In the United States of America, Canada and Japan, identifying with white or natural gray colors for the neutral conductor or center conductor is used as a replacement for the identification by the light blue color.
§3.2.3 AC phase conductors: black and brown colors are the favorite colors for the phase conductors of AC systems.
§3.3.2 Conductor protection: The two-tone green-and-yellow combination must be used for identification of the protective conductor to the exclusion of any other use. The green-and-yellow is the only recognized color scheme for the identification of the protective conductor
Note 2 – In the United States of America, Canada and Japan, identifying with green color for the protection conductor is used as a replacement for the identification by the two-tone green-and-yellow combination.

Fail safe, functional safety, safety levels:
It is required by the European Directive 97/23 dealing with heat generators, pressure equipment and boilers as follows : «the procedures for conformity assessment and the essential safety requirements of the Directive apply to the complete safety chain. The requirements for the sensor itself can be different according to the safety design principles, for instance: redundancy or fail-safe ». Many "product" standards of the IEC (EN) 60335-xxx series require this type of safety.
Definitions related to the functional safety: this concept was introduced by the CEI 61508:1998 Standard. « Functional Safety for electrical /electronic and programmable electronic (E/E/PES) systems.» This standard defines the requirements and provisions for the design of electronic and programmable complex systems and subsystems. This is a general standard that can be used in all industrial sectors. The categories of protection of industrial heating equipment have been classified into three levels by the old EN 954-1 Standard.
Level 1 includes mainly the process control instrumentation: temperature sensors, thermostats, controllers, programmers. This level provides a control either permanently or in a sequence by programmed commands initiated by the operator (for example: control disc, bimetal, bulb and capillary thermostats, electronic temperature controls).
Level 2 consists essentially of an instrumentation composition close to that of level one, but functionally completely independent of this level.
This level 2 protects the process by a discontinuous unsystematic function, that is to say not initialized by the operator, from threshold violation information on critical parameters of the process.
(For example, disc thermostat + disk limiter, bulb and capillary temperature limiters + bulb and capillary thermostat, double electronic controllers)
Level 3 is the ultimate protection of the process. It does not include identical instrumentation to those of Level 1 and 2, but devices working without auxiliary energy (for example: fixed temperature limiters with manual or automatic reset on circuits controlled by electronic controllers, thermal fuses for systems controlled by disc or bulb and capillary thermostats, or by electronic controllers).

The design of Y6, Y7 and Y8 enclosure series allows the making of products that comply with Level 1, Level 1+2 and Level 1 +2 +3, and optionally including failsafe systems.