ELTEK S.p.A. - Casale Monf. ITALY	TECHNICAL SPECIFICATION	CODE 82.0331.00

THERMOACTUATOR

code 10.0331.xx

First issue date:	01/06/90	Filled out by :	F.Segalini
Modification level :	12	Checked by :	R.Gaj.
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Description of the modifications:

11	21/01/10	Added UL-CSA mark on version at 12-24 Volt.
12	01/07/13	Revision of temperature data, consumption, removal of marking table
09	30/10/07	Added comment on storage, Tmax modification for very short on time
10	09/01/08	Added chart for versions of actuator with UL mark

▶ : The arrow indicates section of the text with latest modification level.

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1 GENERAL

1.1 Purpose of the specification

To define the characteristics and performance of the product subject of this specification. In case of contrast between the technical data reported in this specification and that which is indicated in ELTEK drawings, the latter will prevail.

1.2 Subject

Thermoelectric device called thermoactuator code 100331.xx.
The thermoactuator is a small device which, through a mobile plunger, performs a gradual stroke overcoming a determined reaction force. This operation is absolutely silent and practically with no electromagnetic emissions.
The thermoactuators available perform 6 or 8 mm strokes.
Among the different types it is possible to have:

- thermoactuators “long time ON”, when energized for more than 2 minutes;
- thermoactuators “short time ON”, when energized for max. 2 minutes;
- silicone injected thermoactuators, suitable for applications in high humidity ambients and/or in the presence of dust and pollution in the air.

Characteristics common to all versions:

- reaction force up to 100 N;
- voltage feed 12/24 V or 110/240 V.

1.3 Description

The thermoactuator consists of a thermoplastic housing encorporating mounting details, two spade type terminals 6.3 x 0.8. The housing also encloses the following elements:
A PTC (Positive Temperature Coefficient) thermistore ①, attached to one side of the wax motor. A square section metal body ②, called “wax motor” which contains a substance sensitive to heat ③ which, as it expands at a defined temperature, causes a pin ④ to move outwards and consequently originate a stroke.
A plunger in thermoplastic material ⑤ transfers the movement outwards; a helical spring ⑥ guarantees its retraction.
The version silicon injected is with extra protection from dust and moisture, an insulating substance ⑦ is injected inside the housing itself so as to increase insulation from the exterior

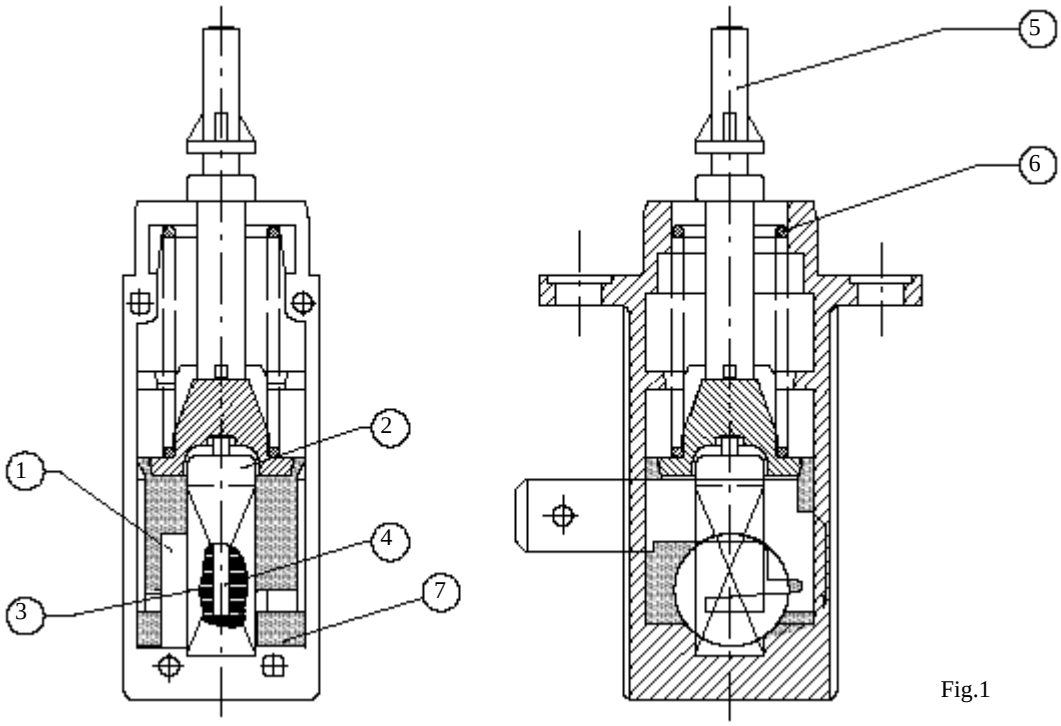


Fig.1

1.4 Principle of operation

There is a temperature rise of the PTC when it is energized electrically; the heat produced is transferred to the wax motor.
The substance, sensible to heat, expands and gradually pushes the plunger out of the housing.
When the PTC is de-energized the wax motor cools down and the plunger, assisted by a spring, retracts to the initial position.

1.5 General characteristics

- capable of developing a considerable force in respect to its small size; particularly if compared with the size of an electromagnet of equal performance;
- operates safely even if energized continuously;
- operates at different voltages;
- absolute silent when operating;
- no E.M.I. (Electromagnetic Interference);
- gradual movement;
- easy to mount/adaptability;
- operates in critical ambient conditions:

2 CONSTRUCTION FEATURES

2.1 Reference standards

EN 60730-1 ; EN 60730-2-14 ; EN 60335-1 ; EN 61210

2.2 Marks

The thermoactuator is certified by IMQ, European Institute of the Mark of Quality, (ENEC 03), in conformity with standards EN 60730-1 and EN 60730-2-14.

▶ Some versions of thermoactuators (indicated in the referred drawing) are certified by UL (USA) and CSA (Canada) Institutes.

Limit operating conditions of the thermoactuator:

- relative humidity : 30% ÷ 95% for standard versions
  : 30% ÷ 98% for silicone injected version
- ambient temperature : -10°C ÷ 90°C

▶ Methods of testing for verifying limit operating conditions:
Test in climatic room - 21 cycles (16h @ 40°C e 95%U.R. / 8h @ 13°C e 95%U.R. /16h @ 60°C <9% U.R.). During the climatic test, the thermoactuator is energized with 3 cycle ON / 12' OFF at 220Vac.

The thermoactuator is also certified, according to EN 60730-1 & EN 60730-2-14, for a safe limit operating temperature of 105°C.

▶ At the temperature > 95°C the termoactuator will start to push the plunger even without electrical supply and is not guaranteed to return to its original position.

▶ The running time performance is shown in the diagram running time cod. 12.0096.XX

2.3 Connection characteristics

The terminals dimensions are in conformity with the EN 61210 standard

2.4 Warehousing limit conditions/ not in operation

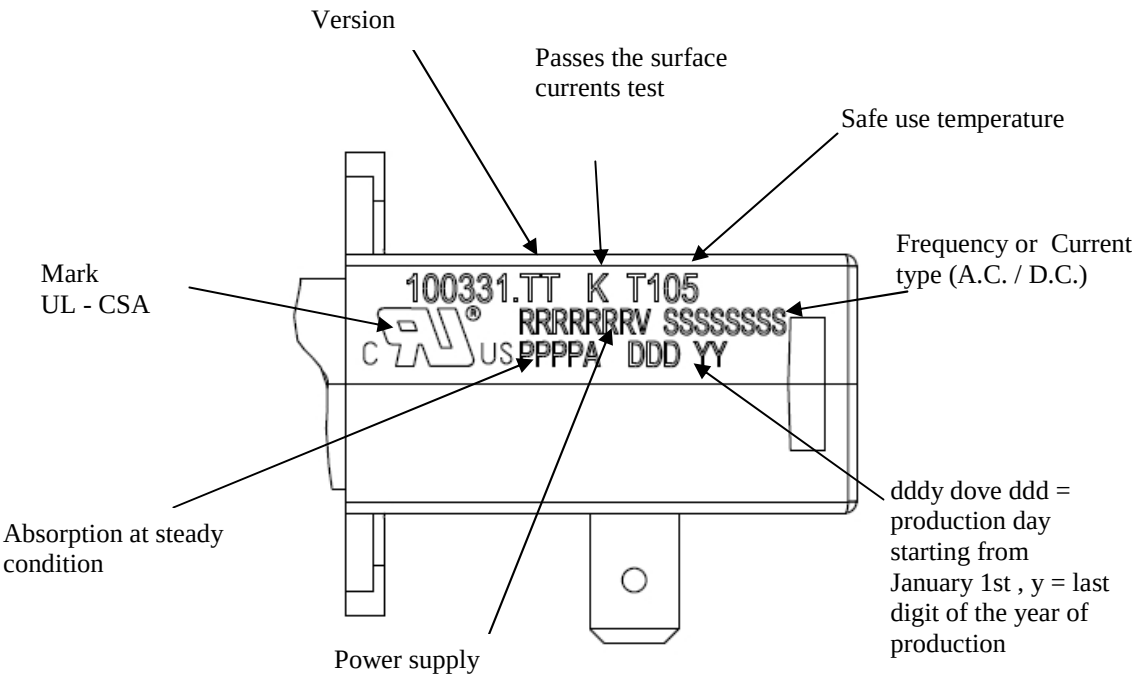
- ambient temperature : -30°C ÷ 80°C
- relative humidity : 30% ÷ 98%

NOTE.: before using the component, the stabilization of the piece at temperatures higher than -10°C is requested.

2.5 Markings

The thermoactuators are marked as follows :

- ELTEK logo;
- ELTEK code;
- nominal tension and frequency;
- approvals .



2.6 Noise

Noiseless.

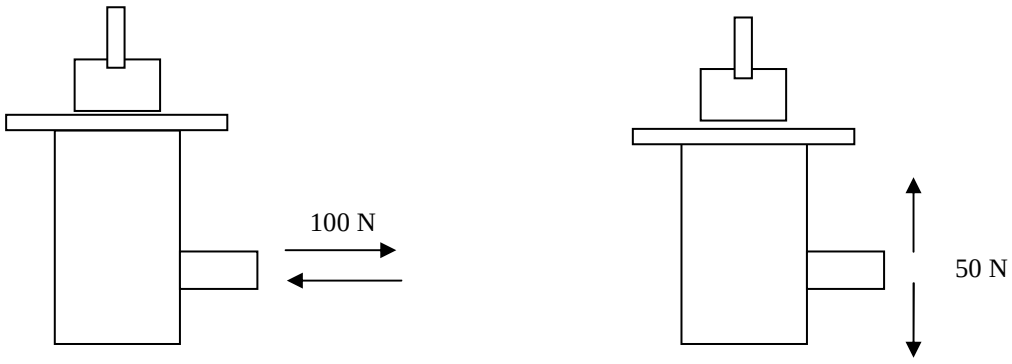
3 MECHANICAL FEATURES

Unless otherwise specified, the following characteristics are verified under the following conditions:

- Ambient temperature = 25 ± 5°C
- Relative humidity = 45 ÷ 75%

3.1 Tab terminals resistance to traction / compression

Resistance of the tab terminals to a force of 100 N along their axis, both in traction and in compression; resistance to stress equal to 50 N in all other directions, without deformations such as to impair its operation or safety.



3.2 Resistance to fall

No damage will occur to the actuator such as to impair its operation or safety if dropped on a cement surface from a height of 100 cm.

4 PHYSICAL-CHEMICAL CHARACTERISTICS

Unless otherwise specified, the following characteristics must be verified at ambient temperature = 25 ± 5°C and relative humidity = 45 ÷ 75%

4.1 Resistance to corrosion of the metal parts

According to EN 60335–1 par. 31.

4.2 Resistance to humidity

Grade of protection against ingress of water: IP 00 (not protected, ref. IEC 60529).
Resistance to humidity conditions: according to EN 60730–2–14 par. 12.2.
Even if the “silicone injected” actuator doesn’t obtain a higher degree of IP protection, it can work under severe environmental and relative humidity conditions (see 2.2 operating conditions).

4.3 Resistance to heat and fire

According to EN 60730–2–14 par. 21 .
The thermoactuator plastic materials in contact with the live parts are classified as self-extinguishing V0 (0.8 mm) according to UL94.
The thermoactuator also successfully passes the sphere test at 140°C ref. EN 60335-1 par. 30.1

4.4 Resistance to surface currents

According to EN 60730–2–14 par. 21 .
A resistance to the PTI 250 surface currentsof is guaranteed for the plastic materials of the thermoactuator in contact with the live parts , according to IEC 60112.

5 ELECTRICAL CHARACTERISTICS

5.1 Voltage feed

Voltage feed range available:

- 110 ÷240 V_{AC} at 50 ÷ 60 Hz.
- 12 ÷ 24 V_{AC} at 50 ÷ 60 Hz
- 12 ÷ 24 V_{DC}

5.2 Power absorbed

Power absorbed at steady condition after a time ON of 300 seconds.

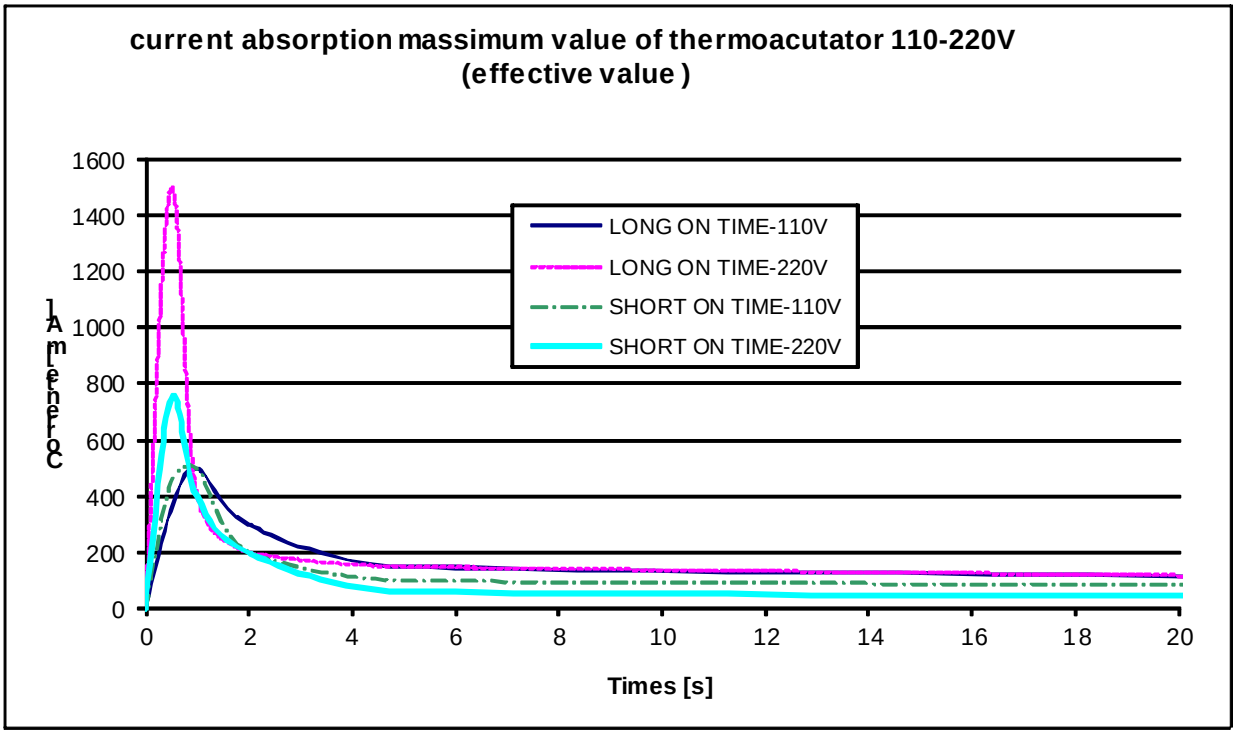
12/24 V	110 V	220 V
2.8 ±1 W	5.8 ±1 W	5.5 ±1 W

5.3 Characteristic curve Power/time

A representative diagram variation of current absorption vs time. The curves are diversified by the type of thermoactuator and voltage.

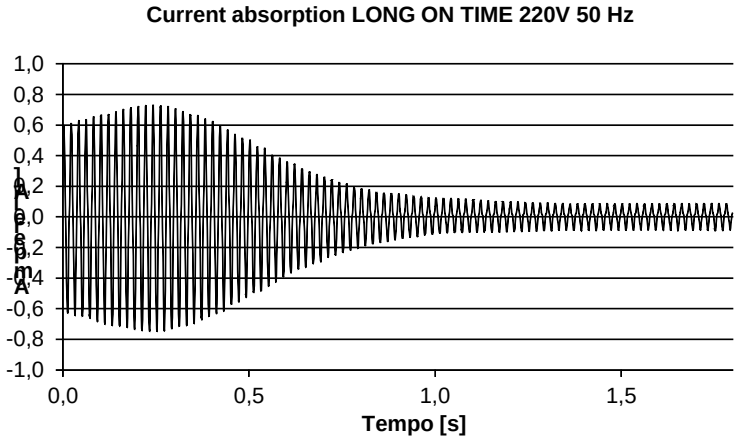
The diagram has been obtained with:

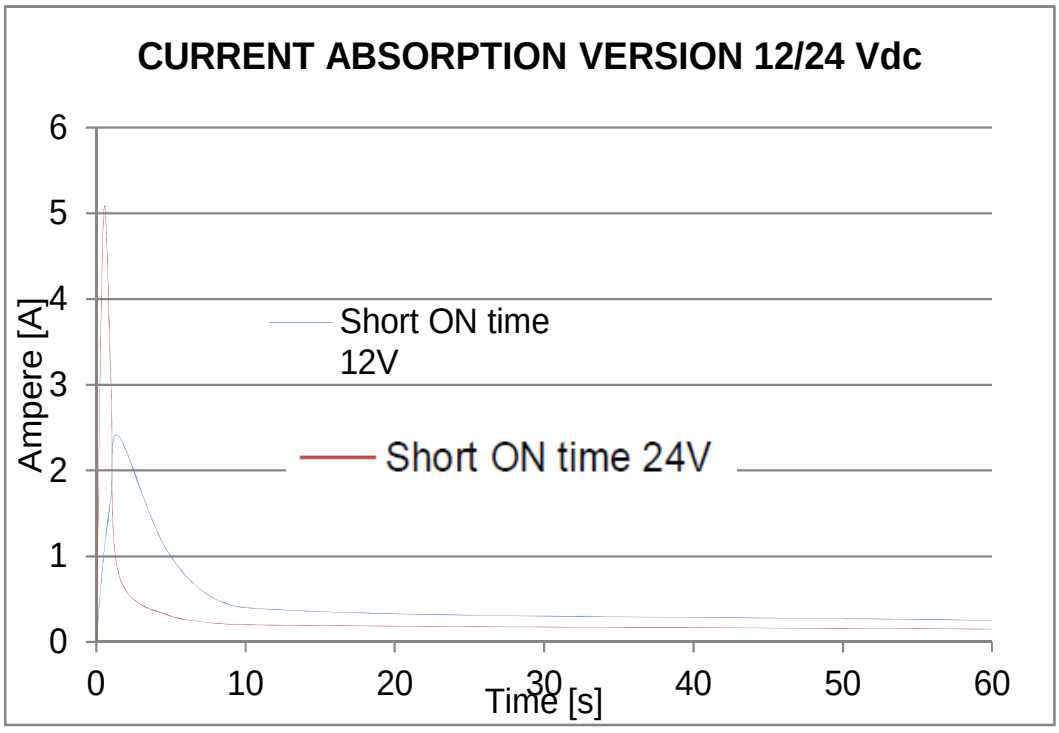
- thermoactuators with a 6 mm nominal stroke;
- thermoactuators energized for more than 5 minutes;
- without counteracting load;
- ambient temperature 25°C.



Description	Peak current at 110 V [A]	Stabilized current at 110V (120s) [A]	Peak current at 220 V [A]	Stabilized current at 220V (120s) [A]
Long ON time 110 –240V	0,5	0,05	1,5	0,03
Short ON time 110 –240V	0,5	0,05	0,75	0,03

EXAMPLE: effective value measured on a thermoactuator





Description	Current peak at 12 V_{DC} [A]	Stabilized current at 12 V_{DC} (120s) [A]	Current peak at 24 V_{DC} [A]	Stabilized current at 24 V_{DC} (120s) [A]
Short ON time 12 –24V	2,4	0,25	5	0,15

5.4 Distance through insulation

In conformity with EN 60730-1 par.20.
Insulation class II.

5.5 Resistance through insulation and dielectric strength

According to EN 60730–2–14 par. 13 .

6 PERFORMANCE

The thermoactuator's performance is correlated with the following applicable variations:

- counteracting load applied (up to 100 N);
- Feed time (ON / OFF);
- Voltage ;
- Ambient conditions (temperature / humidity).

On the basis of variables applied, it is possible to determine the more suitable type of thermoactuator among the following construction variables:

- "long time ON" if energized longer than 2 minutes;
- "short time ON" if energized less than or equal to 2 minutes;
- "silicone injected" version for ambient conditions with relative humidity up to 98% and/or presence of electrically conductive dust.

6.1 Useful life

The useful life of a thermoactuator is defined by the number of cycles; that is, the number of strokes performed within the tolerances established.
The useful life is influenced by certain parameters, mainly:
- applied load (see diagram 6.3.1);
- time ON (see diagram 6.3.2).

Other important parameters are:
- operating ambient temperature;
- operating ambient relative humidity;
- time OFF (time during which the thermoactuator is not energized.

For all the thermoactuators with "long time ON" and "short time ON, 12/14V, 110/220V, energized with standard cycle 2 min ON – 5 min OFF, at an ambient temperature of 20°C and with a counteracting load of 10 N; the minimum guaranteed life is 18,000 cycles.

An actuator is considered to have reached the end of its life when the stroke is no longer within the defined tolerances. The stroke becomes progressively shorter, this deterioration will be more or less rapid depending on the type of application

6.2 Stroke/time diagrams

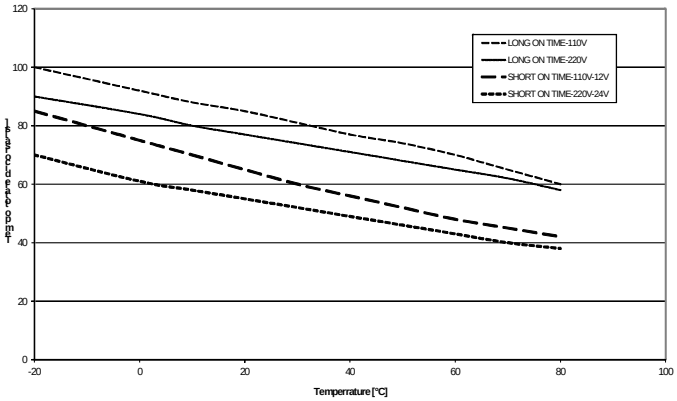
A stroke/time characteristic diagram is associated with each single actuator code.
The drawing shows, in scale, the stroke of the plunger vs time; it also identifies the time "range" within which the entire actuator population operates correctly (with a confidence ± 4 sigma – 99,993%). This means that:
- it performs a stroke equal to the nominal stroke, within a defined time;
- when de-energized it retracts to its initial position, within a defined time;

The diagram clearly shows:
- actuator's nominal stroke with relative tolerance range;
- time ON and time OFF;
- min and max time taken for the plunger to perform its complete stroke;
- min and max time taken for the plunger to retract to its rest position;
- electrical and mechanical characteristics (Enclosure A, table 1);
- validity code of the diagram (Enclosure A , table 2).

6.3 Characteristic curve “Duration as the counteracting load varies”

A representative diagram of the duration trend vs the counteracting load.
The diagram was obtained with :
- Thermoactuators “short time ON” having a nominal 6 mm stroke;
- voltage 220 V ;
- standard cycle (2 min ON – 5 min OFF);
- ambient temperature 25°C.

and it is applicable to all types of actuators as the voltage doesn’t have any effect on the useful life.



Note: reliability at 20.000 cycles (2min ON/5min OFF – no counteracting load): R=90% with CL=95%

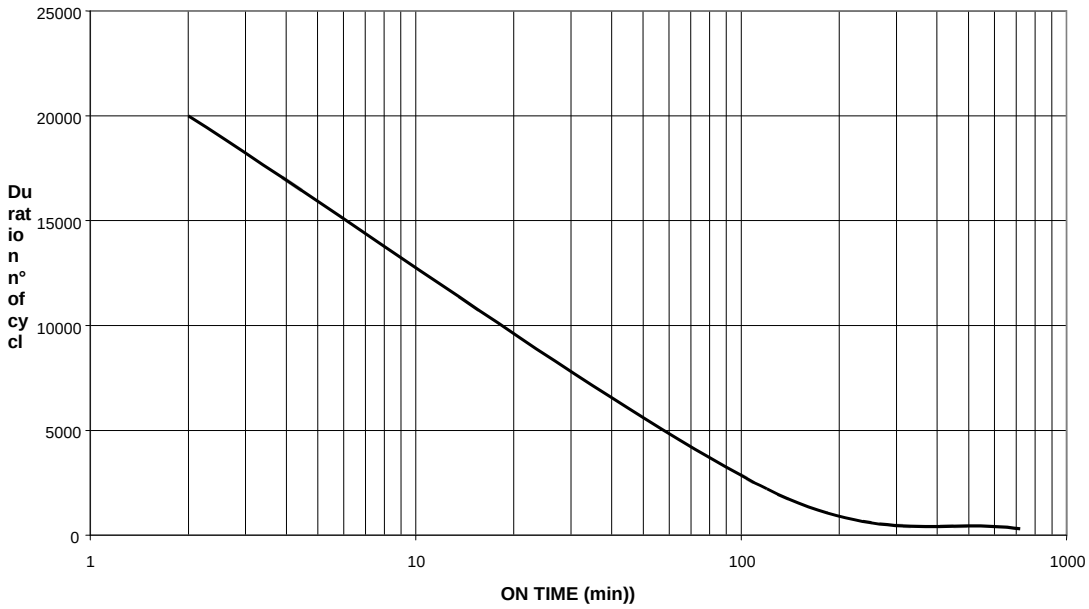
6.4 Characteristic curve “Duration as the time ON varies”

A representative diagram of the duration trend vs the time ON.
The diagram was obtained with :

- Thermoactuators “long time ON” having a nominal 6 mm stroke;
- voltage 220 V ;
- no counteracting load;
- ambient temperature 25°C.

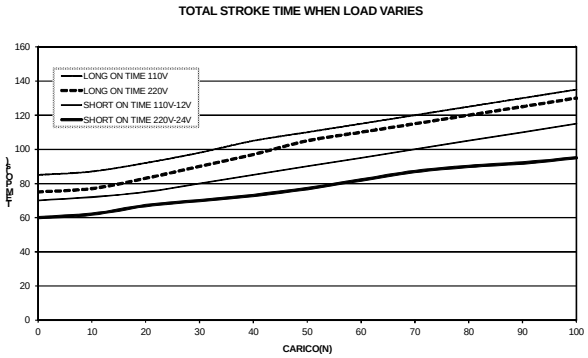
it is also valid for 110 V silicone injected actuators version and, unless otherwise specified, for 12/24 V actuators.

DURATION AS ON TIME VARIES



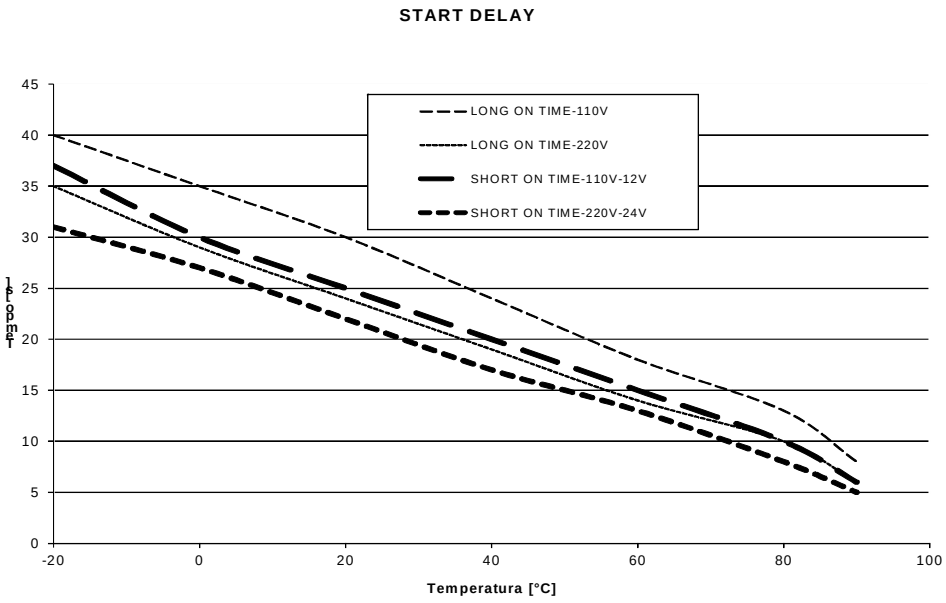
6.5 Characteristic curve “Total stroke time as the load varies”

A representative diagram of the trend of the total stroke time vs the counteracting load. The curves differ from one another for the type of actuator and voltage.
The diagram was obtained with:
- thermoactuators having a 6 mm nominal stroke;
- ambient temperature 25°C.



6.6 Characteristic curve “Start delay”

The “start delay” is the time interval before the plunger starts to move after it has been energized.
A representative diagram shown below shows the trend of the delay time vs ambient temperature. The curves differ from one another for the type of thermoactuator and tension.
The diagram was obtained with
- thermoactuator having a 6 mm nominal stroke;
- standard cycle (2 min. ON – 5 min. OFF);
- counteracting load 10 N.

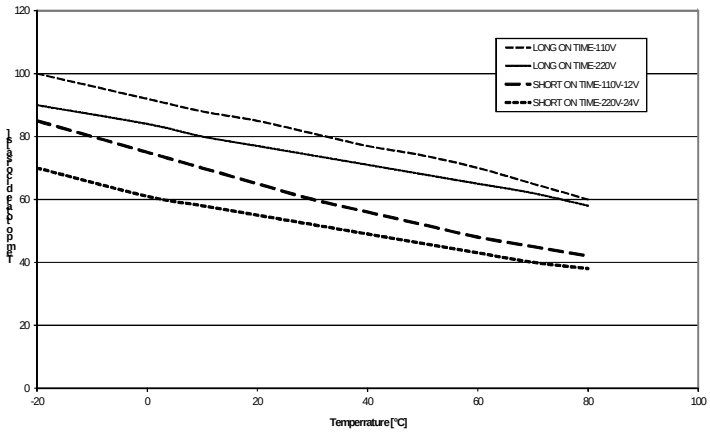


6.7 Characteristic curve “Total stroke time”

The “total stroke time” is the time taken by the device to reach the nominal stroke after it has been energized.

A representative diagram of the trend of total stroke time vs ambient temperature. The curves differ from one another for each type of actuator and voltage.
The diagram was obtained with:

- thermoactuators having a 6 mm nominal stroke;
- standard cycle (2 min. ON – 5 min. OFF);
- counteracting load 10N.

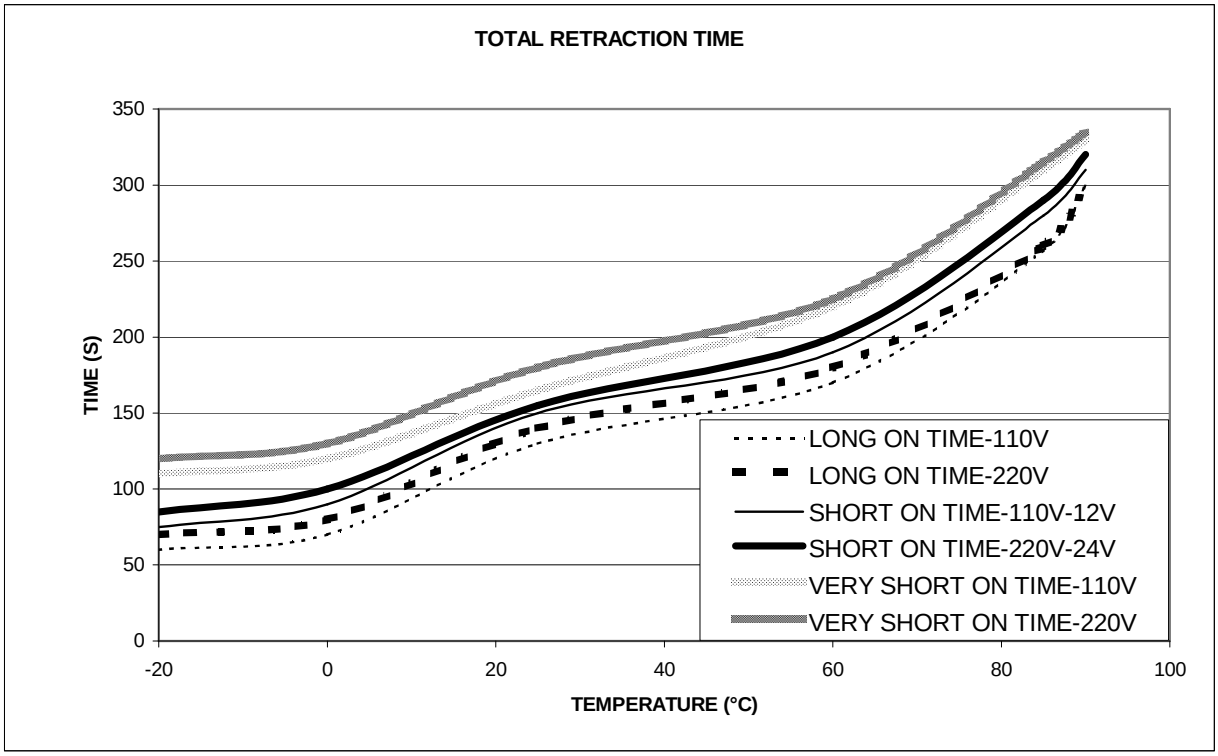


Total stroke time (s)

6.8 Characteristic curve “Total retraction time”

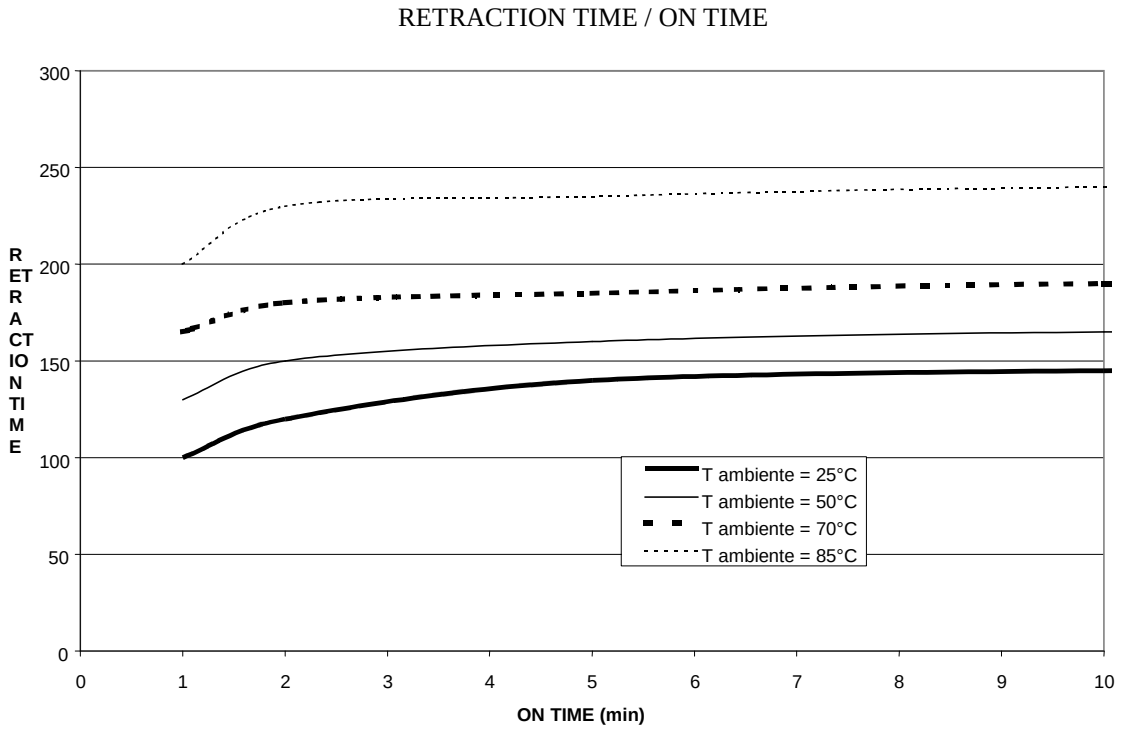
The “total retraction time” is the time taken by the plunger to retract to its initial position after the device has been de-energized.

A representative diagram of the trend of the total retraction time vs ambient temperature. The curves differ from one another for each type of actuators and voltage.
The diagram was obtained with:
- thermoactuators having a 6 mm nominal stroke;
- 2 min time;
- counteracting load 10 N.

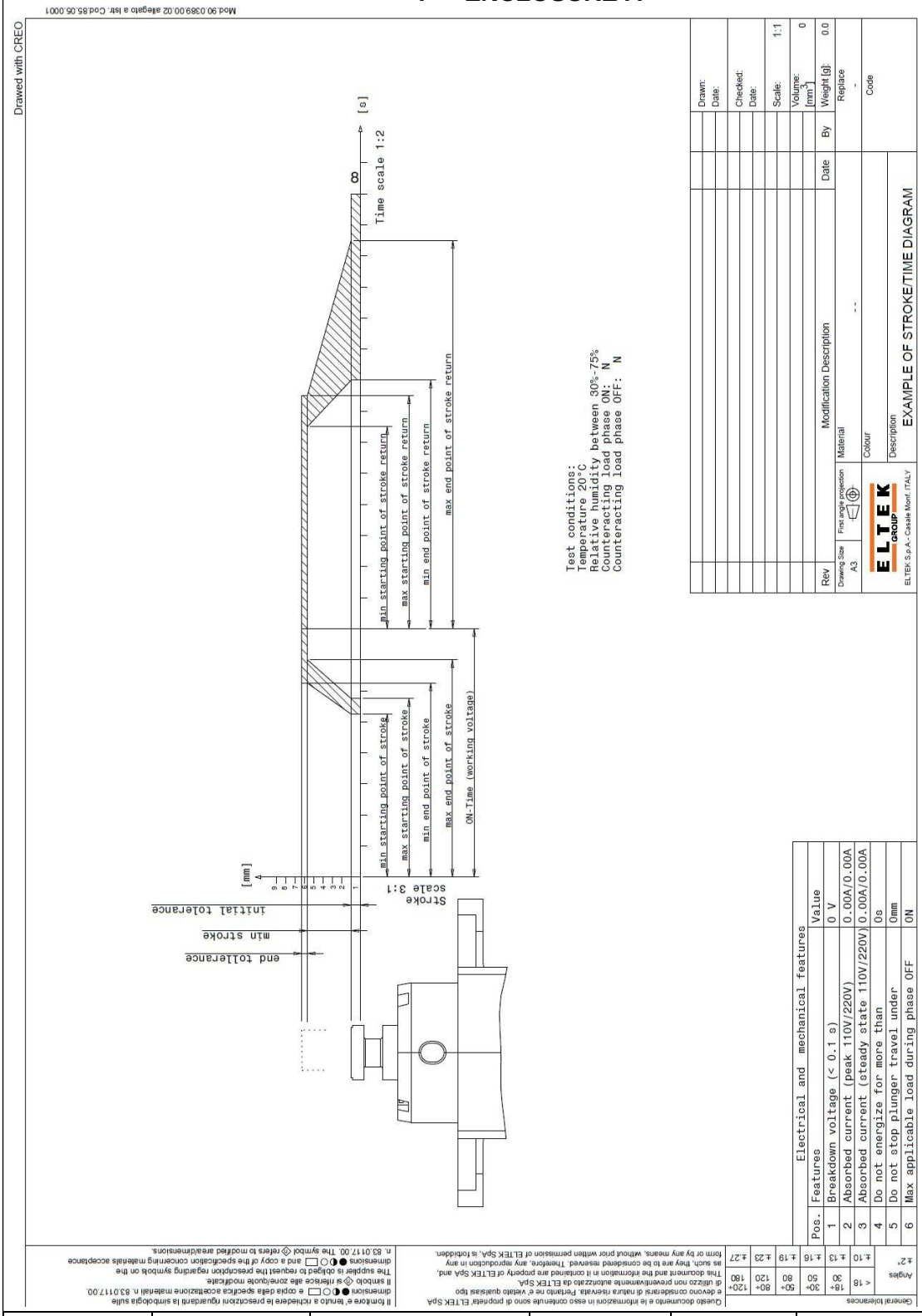


6.9 Characteristic curve “Retraction time as the time ON varies”

A representative diagram of the trend of the total retraction time vs the time ON. As the retraction time also depends on the ambient temperature, the curves were obtained at four different temperature values and with:
- thermoactuators having a 6 mm nominal stroke;
- no counteracting load.



7 ENCLOSURE A



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