ThermOmegaTech®

THERMAL ACTUATORS

PARAFFIN WAX PHASE CHANGE ACTUATORS

A thermal actuator, also known as a wax motor, is a linear actuator device that uses the phase change properties of paraffin wax to convert thermal energy into a mechanical force. ThermOmegaTech's thermal actuators utilize our proprietary Thermoloid® wax-blend material.

Since this material operates in the solid and liquid phase, both of which are nearly incompressible, load changes within the actuator's design parameters on the piston have little or no effect on actuating temperature.

In contrast, vapor-filled or liquid-to-vapor phase change devices are typically sensitive to load changes. Altering the load, such as adjusting spring tension, is a common method to modify the operating temperature range in these devices.



TOT-01 TOT-03 TOT-04 TOT-05 TOT-09

OPERATION

The thermal actuator contains our Thermoloid® wax-blend material, that undergoes a phase change within a specific temperature range. When the temperature rises past the melting point of the wax, it transitions from solid to liquid, significantly expanding in volume.

Encased within a rigid housing, this incompressible material ensures that only the piston can extend and move as its volume expands. The piston can then act upon a valve stem, lever or any other mechanical device.

When the Thermoloid® material cools, the wax changes back into its solid state enabling the piston to retract in response to a return force. The piston will not normally retract unless a return force is present.

The precision of this thermostatic material is such that is serves as primary reference standards by ASTM for instrument calibration.

BENEFITS

- No power source is required to produce motion
- Temperature change alone can be used to operate a device
- Reliable, reproducible, and accurate operating temperatures
- No periodic calibration or service requirements
- Low SWaP
- Fewer components = fewer failure points

APPLICATIONS

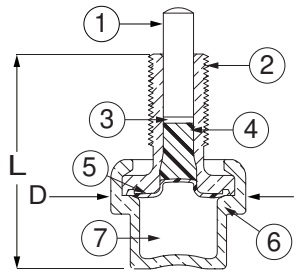
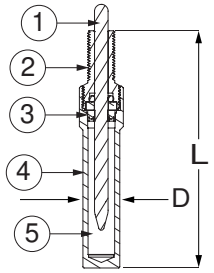
The precise motion of thermal actuators offers versatile functionality, capable of driving an extensive array of devices, limited only by the imagination of the designer. Typical applications include temperature-actuated valves, switches, latches, clamps, and control devices.

Our thermal actuators are used across diverse markets, including transportation, industrial, oil and gas, power generation, construction, aerospace, and defense. They are used to regulate the flow of fluids, gases, or mechanical components in response to temperature fluctuations.

DESIGN FEATURES

- Self-actuating, no power or signal required
- Long, powerful stroke
- Rugged and compact
- Wide choice of temperature ranges
- Can be made from most machinable materials
- Not affected by shock or vibration
- Operates in pressure or vacuum conditions and can monitor liquid or gas
- Custom mounting configurations available
- Typical temperature change for maximum stroke: 10°F to 20°F (5.5°C to 11.1°C)
- Start to stroke temperatures from about 15°F to 300°F (-9.4°C to 149°C)

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DIAPHRAGM TYPE ACTUATOR	SLIDING SEAL ACTUATOR
	
1 - Piston 2 - Guide 3 - Anti-Chafing Disc 4- Plug 5 - Diaphragm 6 - Actuator Cup 7 - Thermoloid® Material	1 - Piston 2 - Guide 3 - Seal 4 - Actuator Body 5 - Thermoloid® Material

DIMENSIONS & CAPACITIES

Actuators	D		L		Weight		Active Temperature Range
	in	mm	in	mm	Lb	Kg	
TOT-01 (SS)	0.7	17.7	1.10	27.9	0.04	0.018	15°F to 300°F (-9.4°C to 149°C)
TOT-01 (Brass)					0.041	0.018	
TOT-03 (SS)	0.83	21.0	1.85	47	0.11	0.049	
TOT-03 (Brass)					0.12	0.054	
TOT-04 (SS)	0.5	12.7	2.35	59.6	0.07	0.031	
TOT-04 LONG (SS)			3.35	85.1	0.09	0.040	
TOT-05 (SS)	0.83	21.0	1.75	44.4	0.08	0.036	
TOT-05 (Brass)					0.09	0.040	
TOT-09 (SS)	0.55	13.9	0.94	23.8	0.031	0.014	
TOT-09 (Brass)					0.035	0.015	

MINIMUM/MAXIMUM APPLIED FORCE CHART

Actuators	Retract Force (lbs)	Output Force (lbs)	Retract Force (kg)	Output Force (kg)
	Minimum	Maximum	Minimum	Maximum
TOT-01 (SS)	5	57	2.26	25.85
TOT-01 (Brass)		38		17.23
TOT-03 (SS)	10	147	4.53	66.67
TOT-03 (Brass)		98		44.45
TOT-04 (SS)	10	57	4.53	25.85
TOT-04 LONG (SS)				
TOT-05 (SS)	5	57	2.26	25.85
TOT-05 (Brass)		38		17.23
TOT-09 (SS)	3	37	1.36	16.78
TOT-09 (Brass)		25		11.33

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Actuator in “Cold” Position

In the diagram to the right, the Thermoloid® material is a solid at reduced volume. This allows the piston to be returned under spring force to open a direct-acting valve or device.

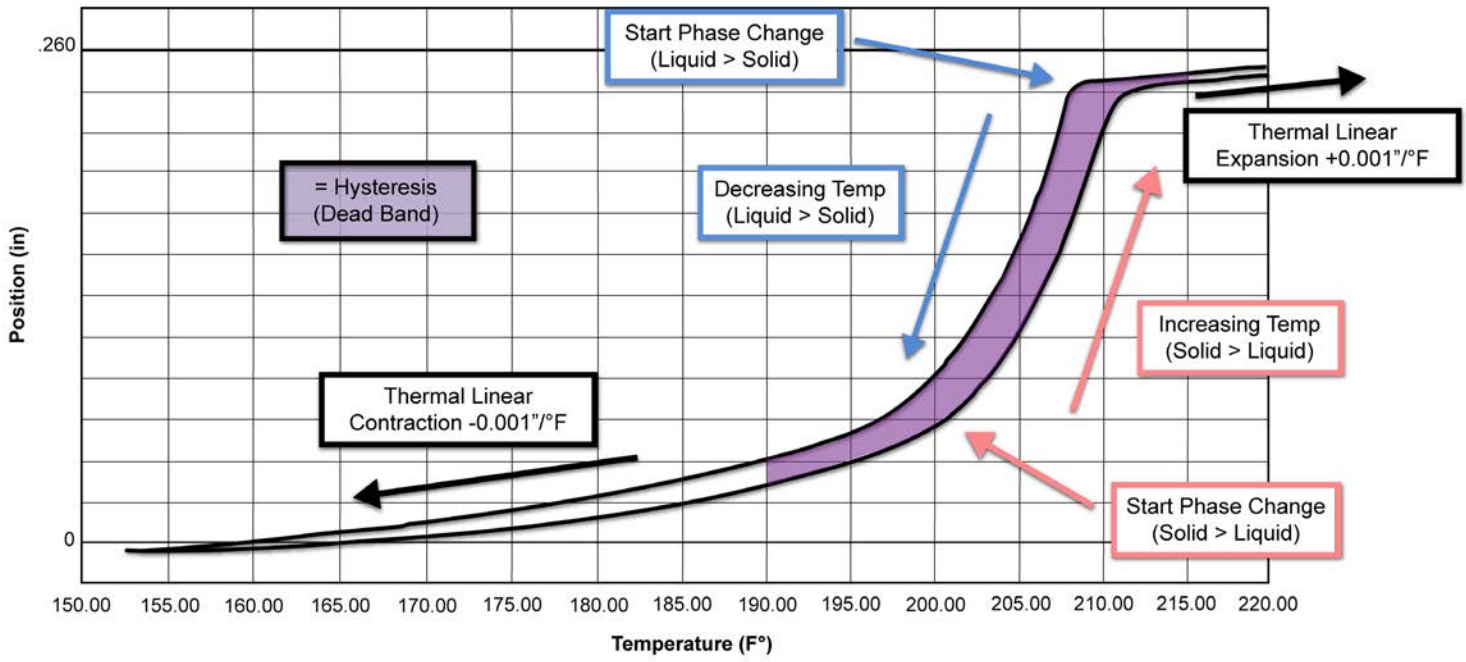


Actuator in “Hot” Position

In the diagram to the right, the Thermoloid® material is a liquid at increased volume. This forces the piston to extend and close a direct-acting valve or device.



ACTUATOR CURVE CHART



MATERIALS

Standard: Brass, 300 series SS
Alternatives: Duplex 2205 and 2507 SS. *Other materials can be used but would need to be discussed per application.*
Chemical treatment options: Passivation, Electropolishing, NACE Annealing, Chemfilm and Anodizing

CUSTOM CARTRIDGES

ThermOmegaTech® prides itself on its ability to provide custom solutions to meet the unique requirements of our customers. Our thermal actuators are available in a thermostatic valve cartridge to ease integration into pre-existing systems. We offer a comprehensive range of customization options, including adjustments to opening/closing temperatures, threads, and materials.

Contact us to schedule a meeting with our sales and engineering teams to discuss your needs.

Warranty information disclosed at www.thermomegatech.com/terms-conditions/

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Because of continuous improvements, ThermOmegaTech®, Inc. reserves the right to change the design and specifications without notice