



# BALANCED PRESSURE THERMOSTATIC STEAM TRAPS



# X-ELEMENT

Extremely strong

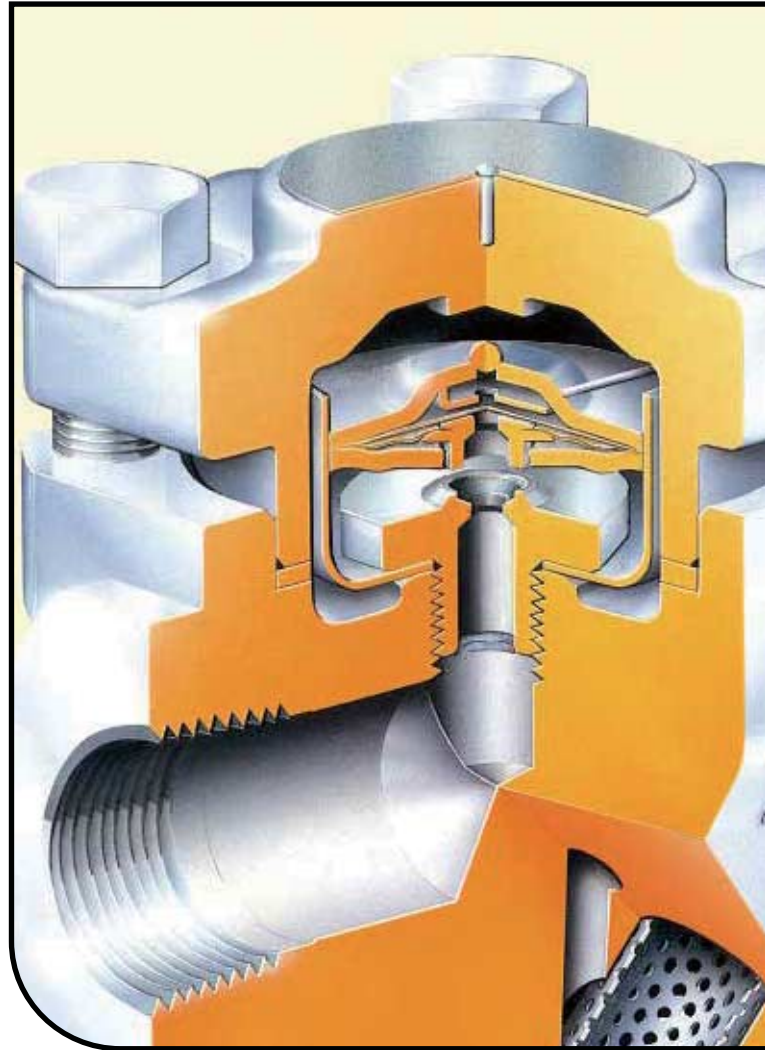
## Pressure resistant capsule

The X-Element responds alternately to internal pressure (pressure of evaporated fill) and external pressure (primary steam pressure). The internal pressure builds up according to the steam or condensate temperature. The temperature can be very high as a result of superheated steam (50 bar and higher) or the external pressure may decrease suddenly (e.g. when steam is blown off during batch operation) while the internal pressure remains high, resulting in sudden and high stress to the element. To withstand such harsh conditions the element is built of sufficiently thick, high-tensile stainless steel plate.

## Diaphragm support 1

### Shape of valve supports element

The design of the valve matches the shape of the diaphragm so that the latter is well supported and the danger of deformation or rupture of the element is eliminated.



## SAFETY - "FAIL OPEN" FEATURE

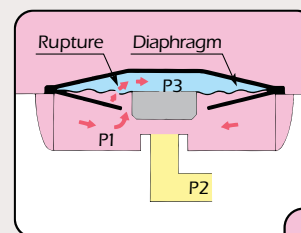
### What does "fail open" mean?...

The "fail open" feature means that the valve will open even if the diaphragm (the most delicate part of a thermostatic capsule element) should break. This is an advantage because a valve closed in case of failure allows condensate to accumulate and pose the following problems and hazards:

1. Temperature drop in process equipment.
2. Interruption of production or deterioration of product quality.
3. Water hammer.

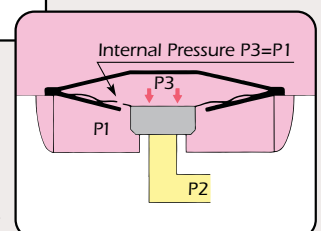
...the "fail open" feature minimizes the danger of production losses and safely avoids water hammer in the event of trap failure.

### Failure of capsule elements with only one diaphragm (including some bellows elements):



1. When the diaphragm breaks, its fill escapes and the primary pressure  $P_1$  builds up in the element above the diaphragm.

2. The internal pressure of the capsule  $P_3$  becomes equal to  $P_1$  so that the valve closes.  
 $P_1 = P_3 > P_2$



The closed valve causes condensate to accumulate.

# ong capsule element for reliability and safety.



## Diaphragm support 2

### Case supports diaphragm

The case is designed to completely match the shape of the diaphragm. Therefore, even with excessive internal pressure, the diaphragm is effectively protected from damage.



## Safety - "fail open" feature

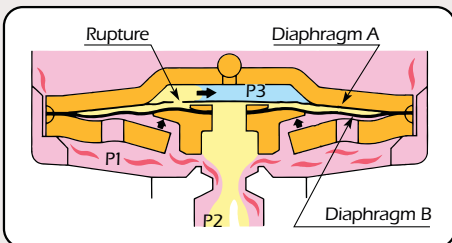
The unique configuration of multiple diaphragms and a valve with a hole through the center of its plug results in a "fail open" valve position should these parts fail. Condensate will be discharged even after damage to the X-element occurs. Consequently, the process will not be disturbed or interrupted, nor will there be a danger of water hammer due to condensate build-up.

## Inline repairable

Inline maintenance of valve and screen is easy with L-Series steam traps. After removing trap cover and spring clip the valve is accessible, while the screen can be reached by removing the screen holder plug.



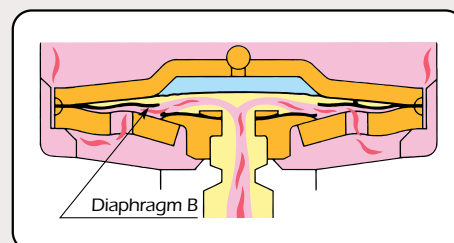
## Rupture of Diaphragm A in the X-Element



The pressure  $P_3$  approaches  $P_2$  and the valve plug is pushed up by the primary pressure  $P_1$  to open the valve.

As long as the primary pressure is maintained, the valve remains in the upper position and the "FAIL OPEN" feature works.

## Rupture of Diaphragm B in the X-Element



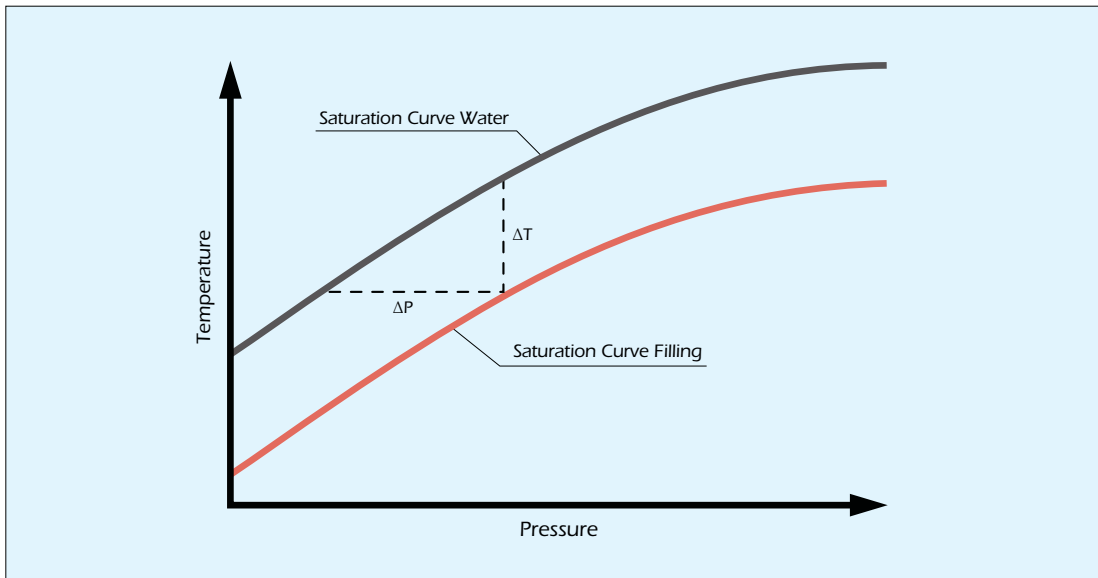
Even in an extreme case, where the valve plug is severed completely from the lower diaphragm, the condensate can drain through the hole in the valve plug center.

In this "OPEN" failure, the condensate discharge rate is approximately 60% of the maximum discharge rate of the steam trap. When the diaphragm B suffers only a slight rupture and the valve plug is not severed, the valve stays 100% open for maximum discharge.

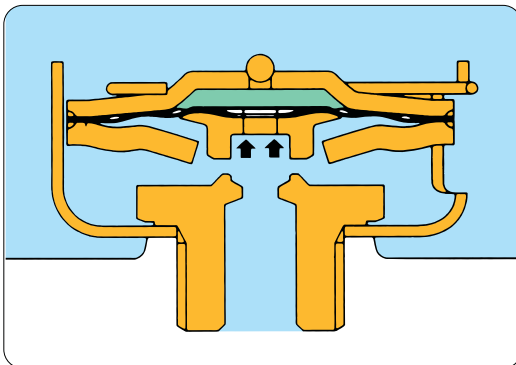
# capsule element for reliability and safety.



The capsule element contains a liquid whose saturation temperature is slightly lower than the saturation temperature of water. With rising temperature in the trap, the fill evaporates; the resulting internal pressure expands the diaphragm to close the valve. When the temperature decreases, the fill condenses and the resulting pressure reduction allows the diaphragm to contract and open the valve.

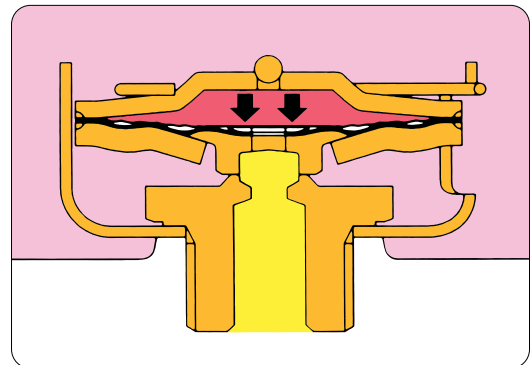


## VALVE OPEN



During start up of steam-using equipment while the capsule is still cold, the fill is in liquid state. The internal pressure is lower than the external pressure so that the diaphragm is pushed up to open the valve. Air, gases and condensate are discharged.

## VALVE CLOSED



As the condensate temperature approaches steam temperature, the capsule fill boils and evaporates, increasing the internal pressure which expands the diaphragm.

- The valve closes.

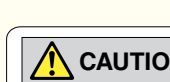
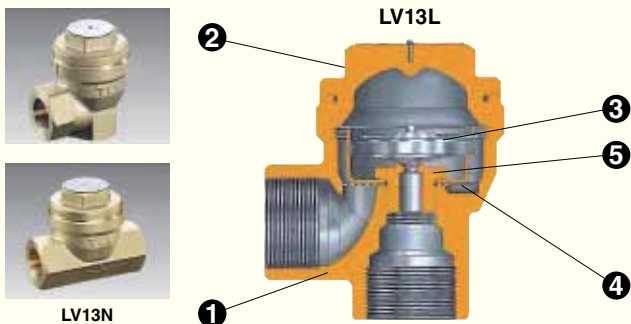
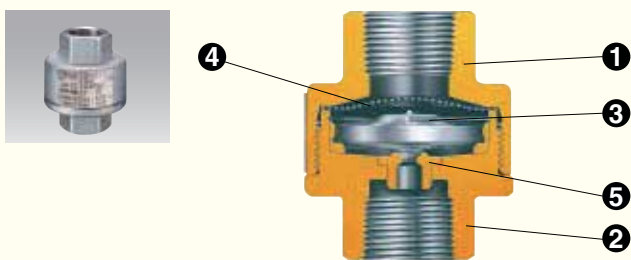
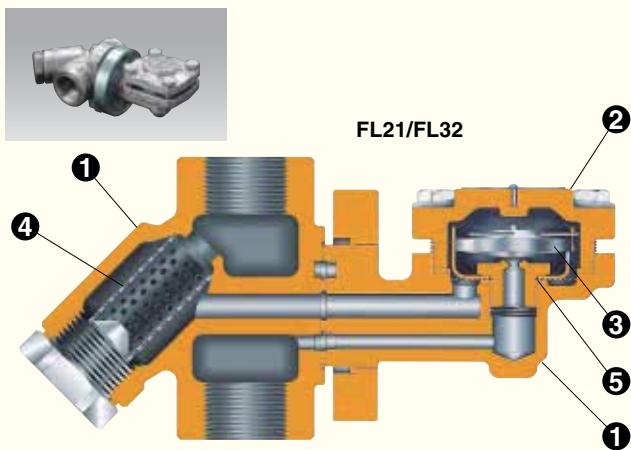
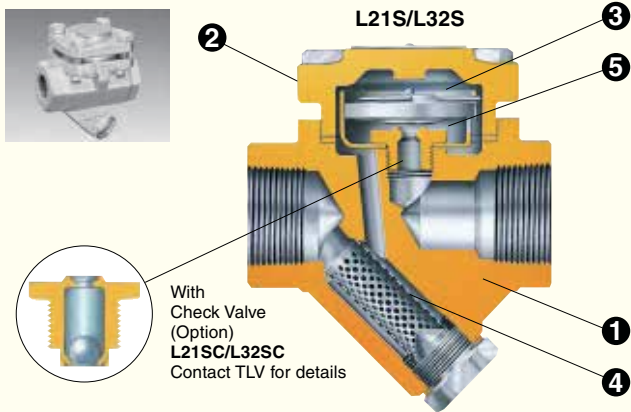
When the temperature of the condensate around the element drops due to heat loss to the environment, the fill will cool as well; it condenses and the internal vapour pressure decreases. The diaphragm is lifted up by the higher external pressure.

- The valve opens and discharges condensate again.

The cycle repeats itself frequently.

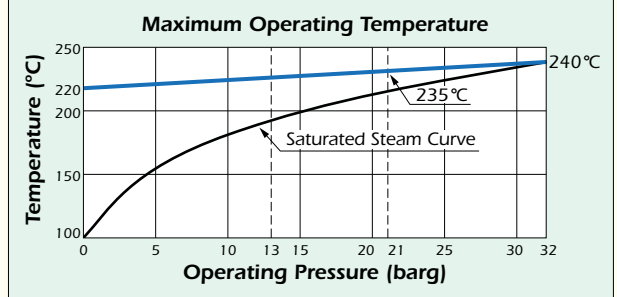


## Specifications



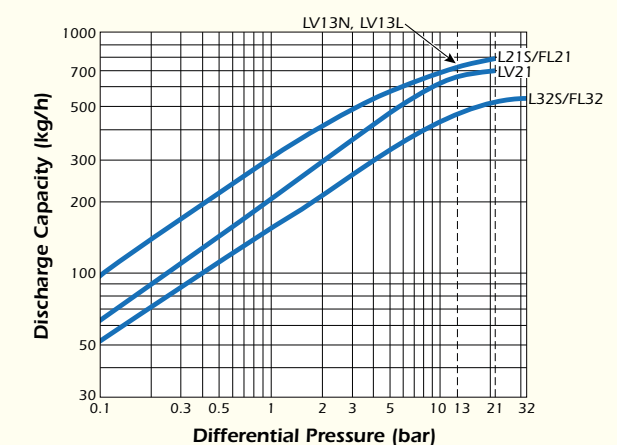
Model	Size	Maximum Operating Pressure (barg)	Maximum Operating Temperature (°C)	Connection
L21S	1/2", 3/4", 1" DN 15, 20, 25	21	See graph below	Screwed Socket Welded* Flanged
L32S		32		
FL21		21		
FL32		32		
LV21	1/4", 3/8", 1/2"	21	200	Screwed
LV13L	1/2", 3/4"	13		
LV13N				

\* L21S (Carbon Steel) and FL21/FL32 only



No.	Description	Material			
		L21S L32S	FL21 FL32	LV21	LV13L LV13N
1	Body	Carbon Steel Stainless Steel	Stainless Steel	Stainless Steel	Brass
2	Cover	Carbon Steel Stainless Steel	Carbon Steel	Stainless Steel	Brass
3	X-element	Stainless Steel			
4	Screen	Stainless Steel			
5	Valve Seat	Stainless Steel			

## Discharge Capacity



- Differential pressure is the difference between the inlet and outlet pressure of the trap.
  - Recommended safety factor: 2
- 1 bar = 0.1 MPa



To avoid abnormal operation, accidents or serious injury, DO NOT use this product outside of the specification range. Local regulations may restrict the use of this product to below the conditions quoted.



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## **TLV EURO ENGINEERING UK LTD.**

Units 7 & 8, Furlong Business Park, Bishops Cleeve, Gloucestershire GL52 8TW, UK

Tel: [44]-(0)1242-227223 Fax: [44]-(0)1242-223077

E-mail: [info@tlv.co.uk](mailto:info@tlv.co.uk) <https://www.tlv.com>

Manufacturer  
**TLV CO., LTD.**  
Kakogawa, Japan  
is approved by LRQA Ltd. to ISO 9001/14001

