

The Thermo-Differential Stratification Valve is a unique self-actuating 3-way switching valve for enhancing the stratification in thermal storage tanks, which have inlet flows with variable inlet temperatures, such as the inlet flow from a solar thermal heat source, or the return flow from a domestic hot water (DHW) station with circulation.



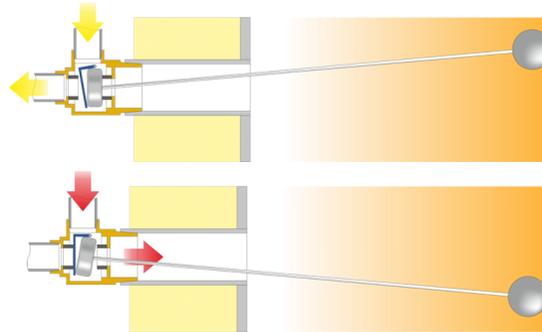
The valve enhances the stratification by directing the inlet flow into the upper region of the tank when it is sufficiently hot (at least as hot as the upper region of the tank), and directing it to the lower region of the tank when it is not, thereby boosting the storage tank's performance and thermal efficiency.

The Thermo-Differential Stratification Valve is installed directly on the storage tank inlet and doesn't require any sensors or controller to direct the flow to different levels in a storage tank. The self-actuating technology of the actuator is based on mass-transfer of the working fluid inside the actuator, which consists of a float sticking into the tank and a small container inside the valve, connected by a rigid, thin tube.



The mass transfer inside the actuator is driven by vapor pressure differences; the higher vapour pressure in the warmer part of the actuator pushes all the liquid towards the cooler part of the actuator. This transfer of liquid between the two parts of the actuator switches the flow direction of the valve; if the temperature in the tank is higher than in the valve,

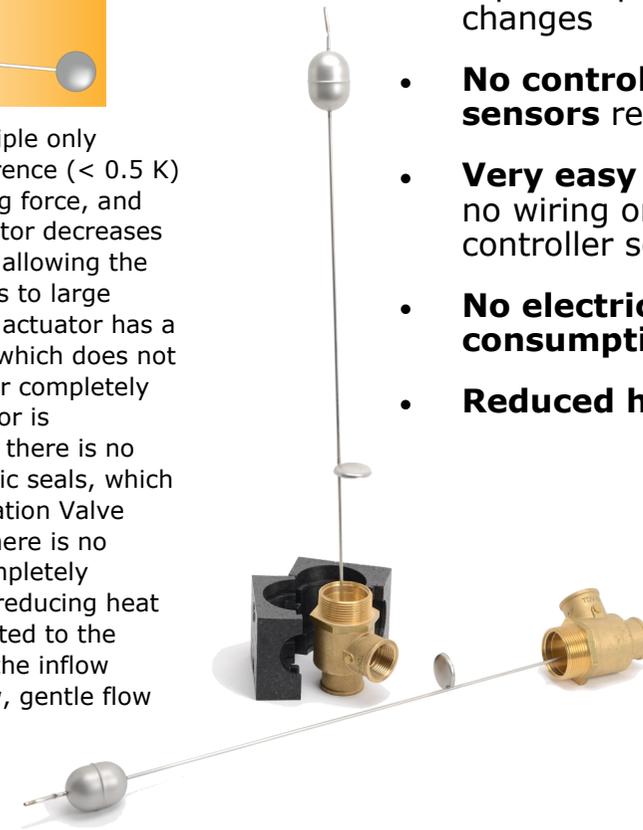
the float of the actuator is filled with vapour, and rises in the tank, switching the valve to the bypass position, but if the temperature in the tank is lower, the float is filled with liquid and sinks, switching the valve to the open position.

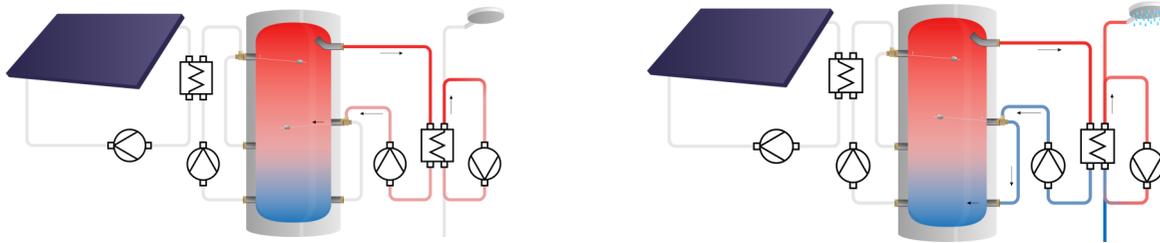


This novel and patented actuation principle only requires a very small temperature difference ($< 0.5 \text{ K}$) for the actuator to exert its full switching force, and the reaction/switching time of the actuator decreases with increasing temperature difference, allowing the valve to respond in less than 10 seconds to large changes in temperature difference. The actuator has a very straightforward working principle, which does not use any springs or membranes (actuator completely made of stainless steel), and the actuator is completely integrated into the valve, so there is no risk of the valve leaking through dynamic seals, which makes the Thermo-Differential Stratification Valve extremely reliable and durable. While there is no electrical actuator, the valve can be completely insulated using its EPP insulation shell, reducing heat losses, and it has a flow diverter disc fitted to the actuator as standard, which minimizes the inflow disturbance in the tank, ensuring a slow, gentle flow into the tank.

Benefits of using the TDSV:

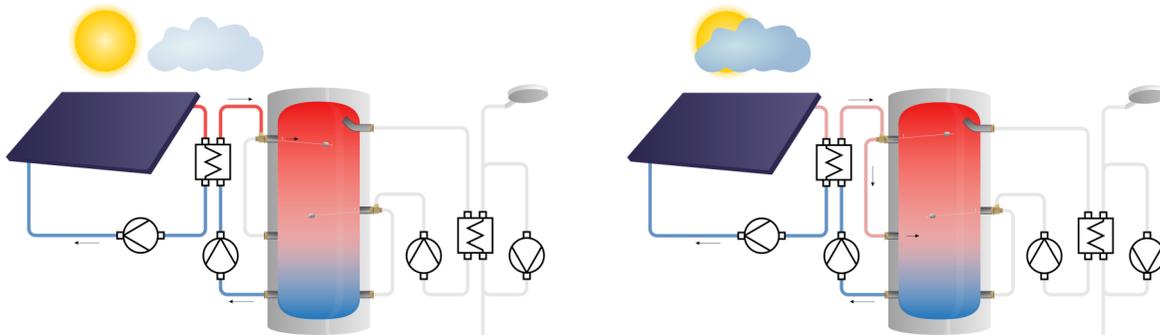
- **Increased reliability;** simple and robust design with no electrical parts
- **Faster reaction/switching** in response to rapid temperature changes
- **No controller and sensors** required
- **Very easy installation;** no wiring or sensors, no controller setup
- **No electricity consumption**
- **Reduced heat losses**





Application example 1; Stratification of the return flow from a DHW station with circulation:

The TDSV is installed just below the auxiliary zone, and as long as there is no DHW draw-off the TDSV directs the flow into the centre of the tank, but when DHW draw-off starts, the TDSV rapidly directs the flow to the bottom of the storage tank, to preserve the stratification



Application example 2; Stratification of return flow from the solar collector:

The TDSV is installed at the top of the tank (in the auxiliary zone), and directs the flow into the top of the tank as long as the solar collector can add heat to the auxiliary zone. If not, the TDSV directs the flow to a lower position in the storage tank, to preserve the stratification



| TDV-C-040-S | |
|-----------------------------------|----------------------|
| Storage Medium | Water |
| Tank connection | R 3/2" |
| Inlet/Bypass connection | G 1" |
| Max flow rate (l/min) | 30 |
| Max Δp bypass flow (mbar) | 40 |
| Hysteresis +/- (K) | 0.2 - 0.5 |
| Tank sleeve length | 100 mm |
| Max Temp flow/ambient | 140°C |
| Max pressure | 6 bar |
| Kvs | 7.5 |
| Typical response/switching time | <60s @ $\Delta T=2$ |
| | <20s @ $\Delta T=4$ |
| | <10s @ $\Delta T=20$ |
| Seal efficiency | 100% |
| Materials: | |
| Actuator | SS304/SS316L |
| Valve seats | Viton |
| O-rings | EPDM |
| Valve housing parts | Brass |