

## UNIT II THERMAL STORAGE SYSTEM

### Pressurized water storage system

Pressurized water storage system is used **to store heat in the form of sensible heat** within pressurized water, often for industrial or district heating applications. These systems are capable of storing large quantities of thermal energy and delivering it at relatively high temperatures.

In such systems, water is stored in a well-insulated pressurized tank, typically made of steel and designed to withstand high pressures. By maintaining the water under pressure, its boiling point is raised, allowing storage at temperatures above 100°C without boiling. This increases the energy density and makes it suitable for high temperature applications.

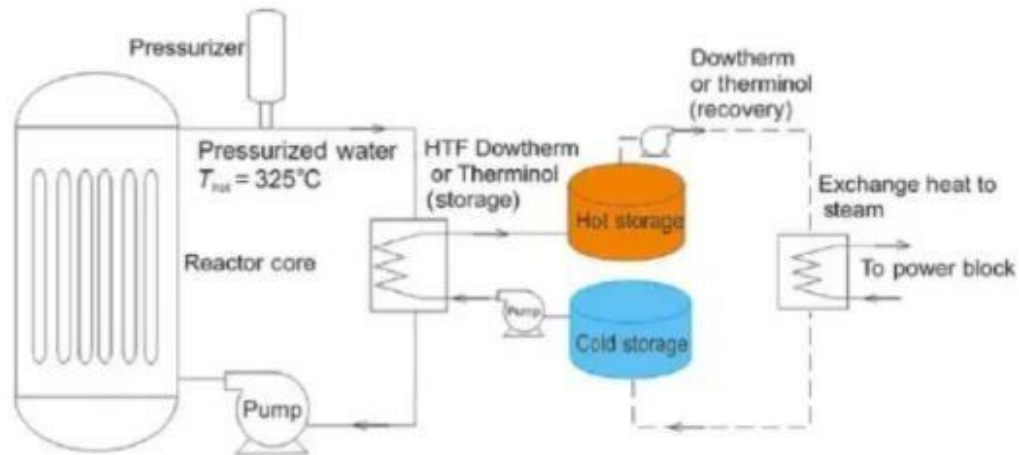
The system consists of

- **Charging System:** Where thermal energy is supplied via heat exchangers or directly from sources like solar collectors or boilers.
- **Storage tank:** Equipped with stratification mechanisms to keep hot water at the top and cooler water at the bottom, improving thermal efficiency.
- **Discharge system:** where hot water is extracted and cooler water returned for reheating.

Thermal stratification is a key design consideration. It ensures minimal mixing between hot and cold layers, which preserves temperature gradients and reduces energy losses. Stratification is maintained using flow diffusers or layered inlet or outlet structures.

### **Working Principle**

- The system consists of a pressure tank containing water and compressed air.
- When water is pumped into the tank, it compresses the inside.
- The compressed air stores energy in the form of pressure.
- When a tap or outlet is opened, the compressed air pushes water outlet, supplying water at uniform pressure.
- When pressure drops below a set level, the pump automatically turns ON to refill the tank.
- Once the desired pressure is reached, the pump turns OFF.



## Types of Pressurized water storage tanks

### 1. Bladder Pressure Tank

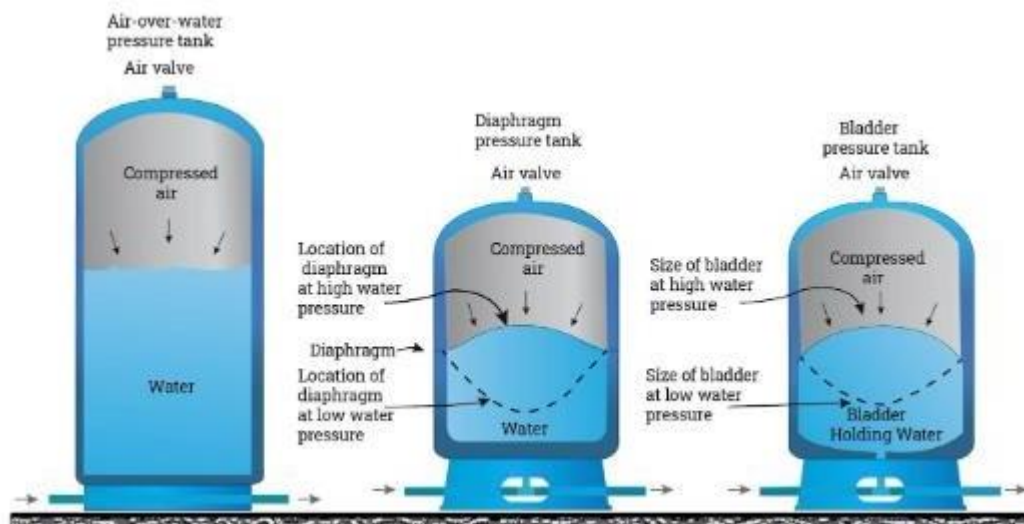
- Uses a flexible rubber bladder to separate air and water
- Prevents air loss into water

### 2. Diaphragm Pressure Tank

- Uses diaphragm membrane to separate air and water
- Maintains stable pressure

### 3. Single-Compartment Pressure Tank

- Air and water are in direct contact
- Simpler design but requires air replenishment



## Advantages

- Simple operation
- Low maintenance
- Reduced pump cycling
- Constant water pressure
- Compatibility with existing heating systems

**Disadvantages**

- High cost
- Require strong pressure- rated storage vessels

## **Applications**

- Domestic water supply systems
- Well water systems
- Industrial water supply
- Fire protection systems