

Unit - 7

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1. Explain the working principle of Reaction Turbine and its Application.
2. Explain the Importance of Draft tube, Penstock and Surge Tank.

A reaction turbine operates on the principle of Newton's third law of motion, which states that "for every action, there is an equal and opposite reaction". In this type of turbine, the pressure energy of the fluid is gradually converted into kinetic energy as it flows through the turbine.

It operates by converting both pressure energy and kinetic energy into mechanical energy.

its working principle :

- 1) Pressure Reduction : The fluid enters the turbine through a nozzle or inlet, where its pressure is reduced.
- 2) Expansion : The fluid then expands through a series of blades, which are attached to a motor.
- 3) velocity increase : As the fluid expands, its velocity increases, and it transfers its energy to the blades.

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4. **Torque Generation** : The energy transferred to the blades causes the rotor to rotate, generating torque.
5. **Mechanical Energy** : The rotational energy of the rotor is converted into mechanical energy, which can be used to drive a generator or other machinery.

Applications of Reaction Turbines :-

1. **Hydropower plants** : used in dams and reservoirs of generating electricity.
2. **Irrigation Systems** : used for energy generation in canal and dam-based irrigation systems.
3. **Industrial** : Drives pump, compressors, and generators in industries.
4. **Marine propulsion** : utilized in ship engines for propulsion systems where steam turbines are employed.

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Draft tube, penstock, and Surge tank are essential components of a hydropower plant. They play a crucial role in ensuring the plant operates efficiently, safely, and reliably.

* Draft Tube :

function : The draft tube is a conduit that discharges water from the turbine and recovers energy.

Importance :

- Converts kinetic energy of the discharged water into pressure energy, improving turbine efficiency.
- Helps maintain continuous water flow by lowering the discharge point below the turbine.
- Reduces K.E energy losses and improves overall energy output.

* Penstock :

function : A penstock is a large pipe that carries water from the reservoir to the turbine.

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Importance :

- Delivers water to the turbine under high pressure.
- Minimizes energy losses by ensuring a smooth flow.

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- Constructed to withstand high water pressure, typically using materials like steel or reinforced concrete.
- Regulates the flow of water to the turbine for efficient power generation.

* Surge Tank :

function: A Surge tank is a storage tank installed between the reservoir and the penstock to manage sudden changes in water pressure.

Importance :

- Mitigates water hammer effects, which occur due to rapid change in flow.
- protects the penstock and turbine from potential damage caused by pressure surges.
- stabilizes the water flow, ensuring consistent and safe operation.
- Improves the responsiveness of the system during load changes.