

4.0 Mechanical Equipment

The primary mechanical components of a small hydroelectric plant are the main valve, draft tube, turbine and runner. In some locations the energy from the water can support more than one generator. In this case the powerhouse may have more than one operating generator.

In addition to the primary mechanical components identified above, other mechanical equipment consists of valves, pneumatic and hydraulic power components, governors, lubrication and cooling water systems.

Valves

The penstock is attached to a main valve at the entrance to the powerhouse. This valve is necessary to stop the flow of water when the plant is shutdown or when maintenance of the turbine is being performed. Typically the main valve has a large diameter similar to the penstock. In a small hydroelectric plant the valve diameter is typically between one and two metres in diameter.

The main valve is normally accompanied by a bypass valve and occasionally a drain valve. The bypass valve's function is to divert water past the main valve prior to opening, thereby equalizing pressure on both sides of the main valve to reduce the strain associated with opening such a large valve. The drain valve is normally a manual valve that is used to drain the penstock for maintenance.

Governor

The governor can be a powerful piece of hydraulic or electric equipment controlled by a speed feedback from the generator. The governor's function is to keep the water flow to the turbine under control by adjusting the position of the wicket gates. Wicket gates regulate the water flow by adjusting the amount of force the water places on the turbine. If the generator starts to slow down, the governor opens the gates to create a greater force on the turbine. If the generator starts to speed up the governor closes the gates to reduce the force on the turbine. The regulation of the gates is intended to maintain an electrical frequency of 60.0 cycles per second.

Turbine

The turbine is a rotary engine that converts the energy from the water that is forced through the wicket gates to rotational motion. The turbine is then coupled to the generator through a series of shafts. The generator rotor converts the rotational motion into a rotating electric field. The generator stator windings convert the rotating electric field into electricity.

When the water leaves the turbine it passes through the draft tube on the way to the tailrace. The tailrace carries the water from the powerhouse back to the river system or ocean.