

Create a P&I diagram in textual notation for a steam water cycle in a power plant. Include equipment, instrumentation, piping, and control loops. Provide concrete tag names.



A Piping and Instrumentation Diagram (P&ID) is a schematic representation of the functional relationship between equipment, piping, instrumentation, and control loops in a process system. Here is a textual representation of a basic steam water cycle in a power plant:

- 1. Boiler (Equipment tag: B-101)
  - a. Feedwater Inlet (Piping tag: P-101)
  - b. Steam Outlet (Piping tag: P-102)
- 2. Steam Turbine (Equipment tag: ST-101)
  - a. Steam Inlet (Piping tag: P-102)
  - b. Exhaust Steam Outlet (Piping tag: P-103)
- 3. Condenser (Equipment tag: C-101)
  - a. Exhaust Steam Inlet (Piping tag: P-103)
- b. Condensate Outlet (Piping tag: P-104)
- 4. Feedwater Pump (Equipment tag: FP-101)
  - a. Condensate Inlet (Piping tag: P-104)
    b. Pumped Feedwater Outlet (Piping tag: P-105)
  - Feedwater Heater (Fauinment tag: H-101)
- 5. Feedwater Heater (Equipment tag: H-101)
  - a. Pumped Feedwater Inlet (Piping tag: P-105)
  - b. Preheated Feedwater Outlet (Piping tag: P-101)

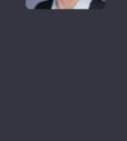
Instrumentation and Control Loops:

- 1. Boiler Drum Level Control (Instrument tag: LIC-101)
  - a. Level Transmitter (Instrument tag: LT-101)
  - b. Level Indicator (Instrument tag: LI-101)
  - c. Level Controller (Instrument tag: LC-101)
  - d. Control Valve (Instrument tag: LV-101)
- Steam Pressure Control (Instrument tag: PIC-101)
   a. Pressure Transmitter (Instrument tag: PT-101)
  - b. Pressure Indicator (Instrument tag: PI-101)
  - c. Pressure Controller (Instrument tag: PC-101)
  - d. Control Valve (Instrument tag: PV-101)
- 3. Steam Temperature Control (Instrument tag: TIC-101)
  - a. Temperature Transmitter (Instrument tag: TT-101)
  - b. Temperature Indicator (Instrument tag: TI-101)
  - c. Temperature Controller (Instrument tag: TC-101)
  - d. Control Valve (Instrument tag: TV-101)
- 4. Condensate Level Control (Instrument tag: LIC-102)
  - a. Level Transmitter (Instrument tag: LT-102)
  - b. Level Indicator (Instrument tag: LI-102)
  - c. Level Controller (Instrument tag: LC-102) d. Control Valve (Instrument tag: LV-102)
- 5. Feedwater Flow Control (Instrument tag: FIC-101)
  - a. Flow Transmitter (Instrument tag: FT-101) b. Flow Indicator (Instrument tag: FI-101)
  - c. Flow Controller (Instrument tag: FC-101)

d. Control Valve (Instrument tag: FV-101)

The steam water cycle starts with the boiler (B-101) generating steam, which flows through the piping (P-102) to the steam turbine (ST-101). The steam turbine converts the steam's energy into mechanical work, and the exhaust steam is sent through the piping (P-103) to the condenser (C-101). The condenser cools the steam into condensate, which is then pumped by the feedwater pump (FP-101) through the piping (P-104) and (P-105) to the feedwater heater (H-101). Finally, the preheated feedwater returns to the boiler (B-101) through the piping (P-101),

completing the cycle



continue



a. Level Transmitter (Instrument tag: LT-103)

6. Feedwater Heater Level Control (Instrument tag: LIC-103)

- b. Level Indicator (Instrument tag: LI-103)
- c. Level Controller (Instrument tag: LC-103)
- d. Control Valve (Instrument tag: LV-103)7. Condenser Pressure Control (Instrument tag: PIC-102)
  - a. Pressure Transmitter (Instrument tag: PT-102) b. Pressure Indicator (Instrument tag: PI-102)
  - c. Pressure Controller (Instrument tag: PC-102) d. Control Valve (Instrument tag: PV-102)
- 8. Turbine Speed Control (Instrument tag: SIC-101)

a. Speed Transmitter (Instrument tag: ST-102)

- b. Speed Indicator (Instrument tag: SI-101)
- c. Speed Controller (Instrument tag: SC-101) d. Turbine Governor Valve (Instrument tag: SV-101)

boiler (B-101), which produces steam to continue the cycle. The boiler drum level is maintained by LIC-101, which controls the feedwater inflow through the control valve LV-101. Steam pressure is managed by PIC-101, regulating the steam flow through control valve PV-101. Similarly, steam temperature is controlled by TIC-101 using control valve TV-101.

After the feedwater heater (H-101), the preheated feedwater flows back to the

101 using control valve TV-101.

In the condenser, LIC-102 ensures proper condensate levels by controlling the condensate outflow through the control valve LV-102. The condenser pressure is maintained by PIC-102, which manages the cooling water flow through control

valve PV-102.

The feedwater heater level is controlled by LIC-103, which manages the feedwater outflow through control valve LV-103. The steam turbine speed is regulated by

These control loops work together to ensure the optimal operation of the steam water cycle in the power plant, maximizing efficiency and maintaining safe operating conditions.

SIC-101, which controls the steam flow through the turbine governor valve SV-101.

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