

Brief Introduction on H₂ generating system

I. Description on H₂ generating unit

1. flows chart for H₂ generator by water electrolysis

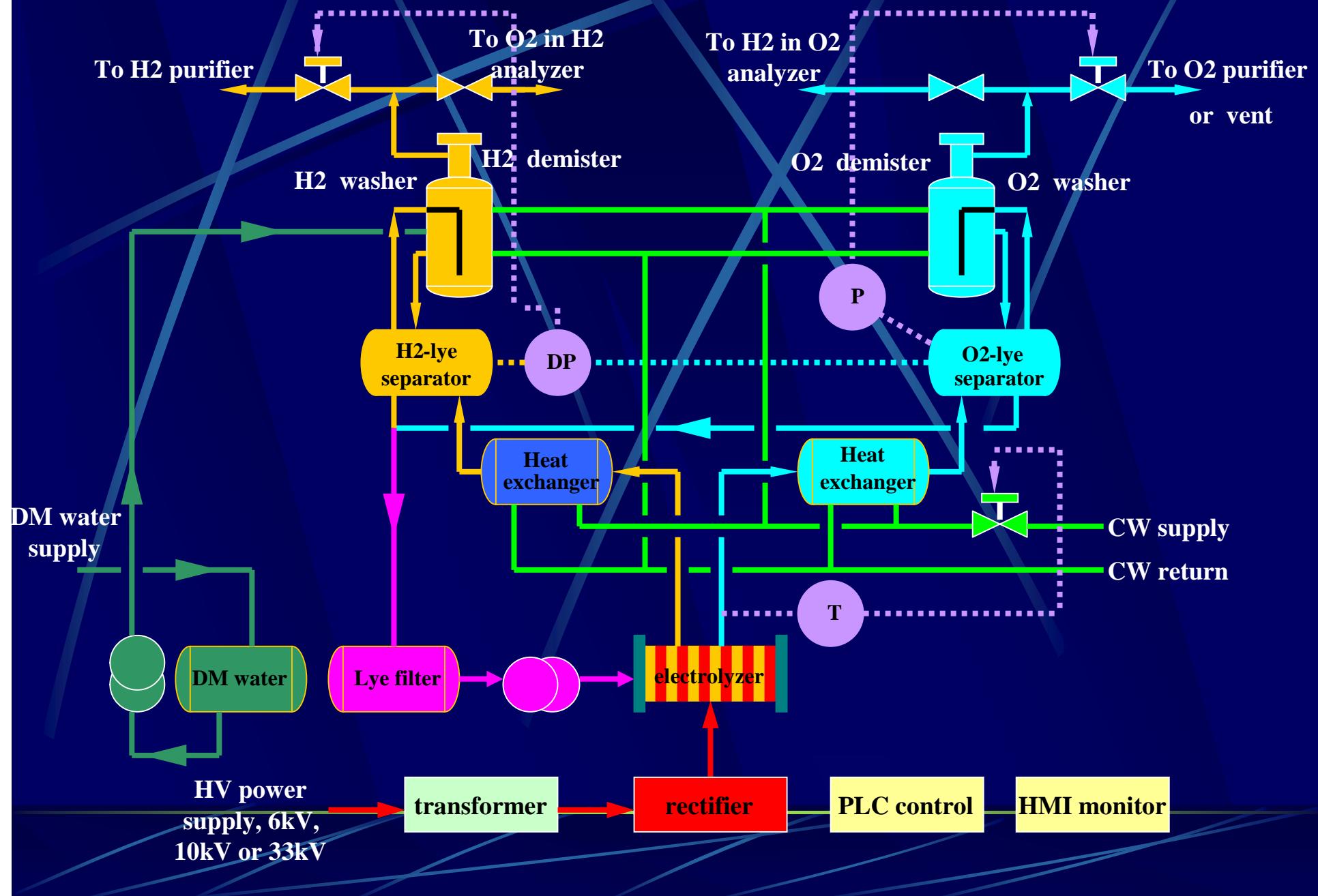
1.1 Description on the processing;

- 1) H₂ gas loop and O₂ gas loop ;
- 2) Lye cycling loop;
- 3) DM water supplementary loop;
- 4) Cooling water loop;

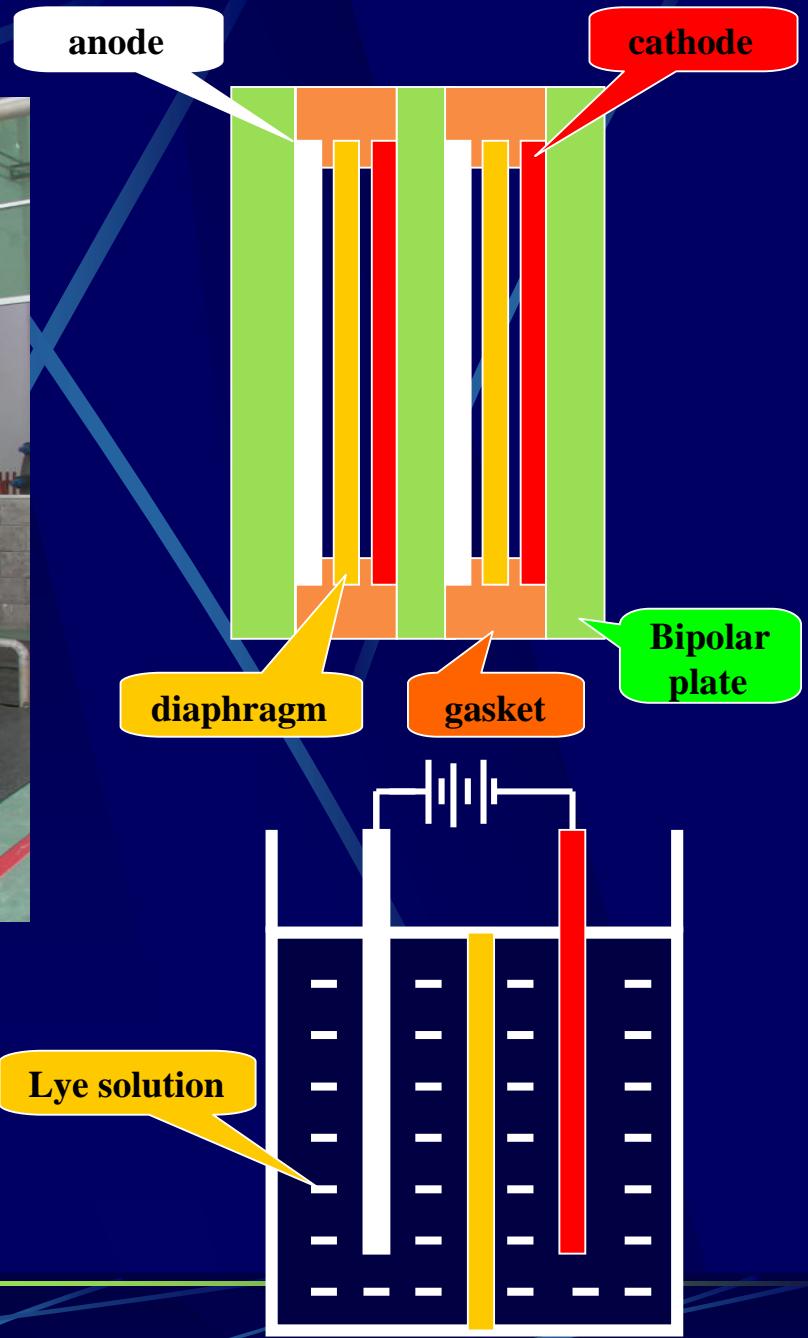
1.2 Description on the automatic control loops

- 1) control loop for operating pressure;
- 2) control loop for balance of H₂-lye level and O₂-lye level;
- 3) control loop for operating temperature;
- 4) Monitoring the H₂ purity, O₂ purity, lye flows and H₂ concentration.

1. typical flow chart for H₂ generating unit by water electrolysis



Electrolyser:



Electro-chemical reaction:



Skid of gas-lye treater



H2 washer

H2 demister

O2 demister

O2 washer

H2-lye
heat exchanger

H2 -lye
separator

Explosive-proof
junction box

Cables trench

Frame

H2-lye
heat exchanger

H2 -lye
separator

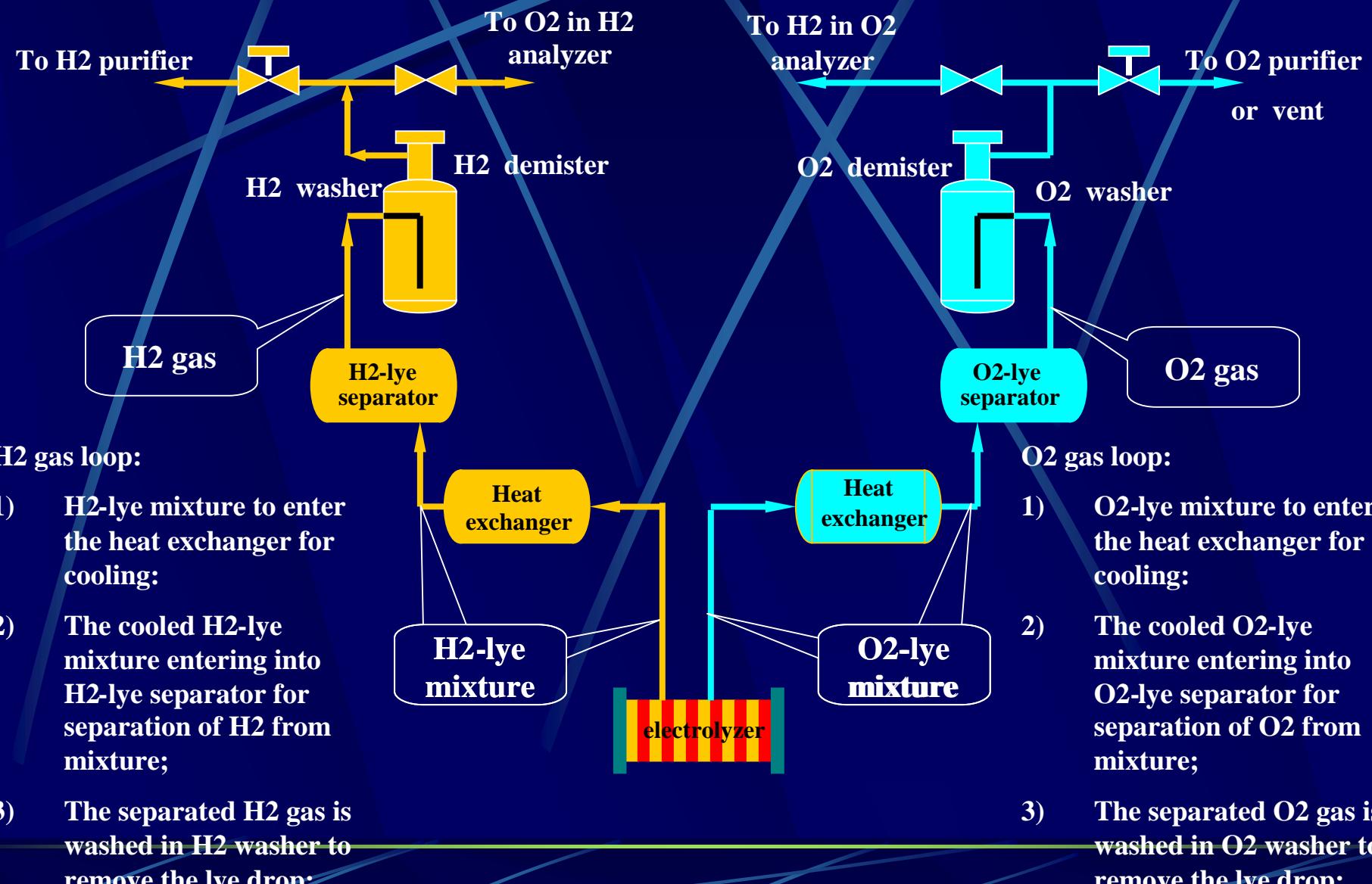
Lye
cycling pump

H2 in O2
analyser

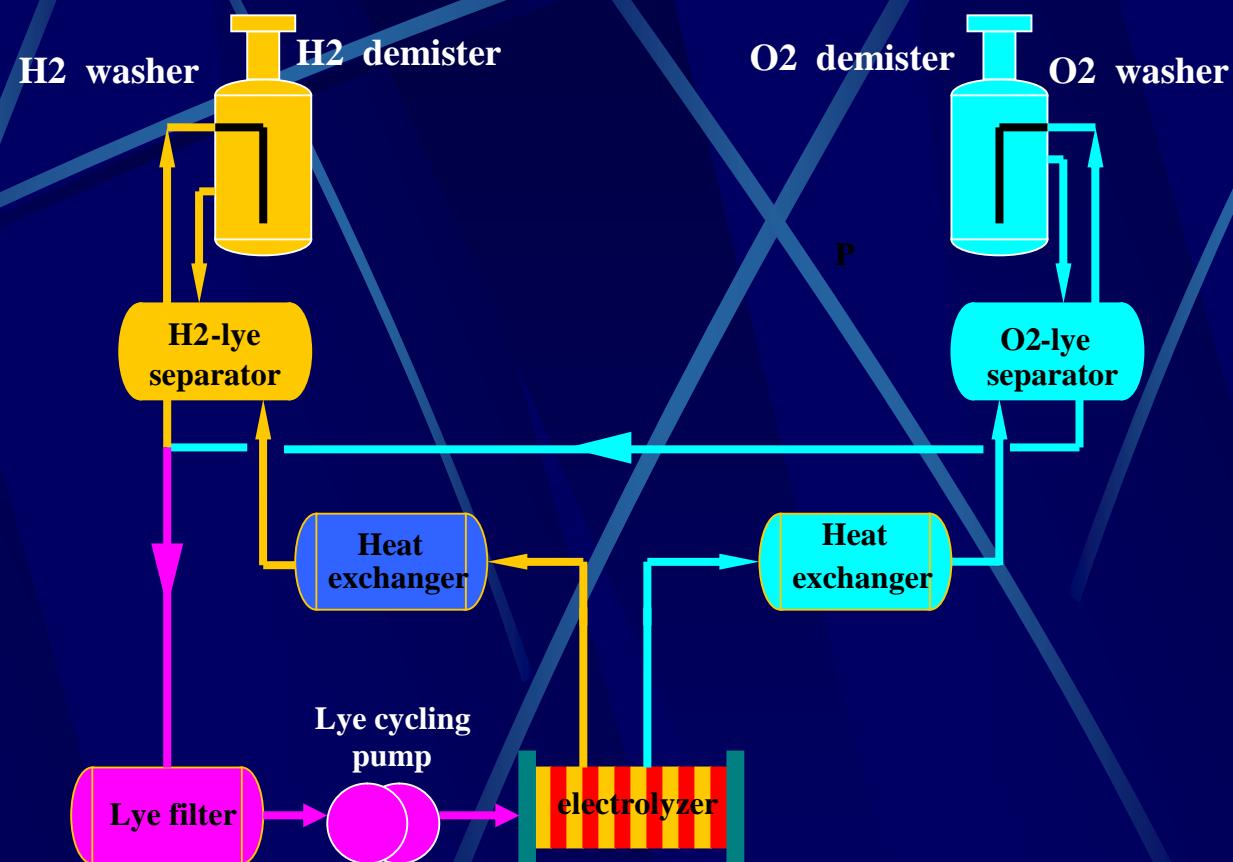
O2 in H2
analyser

Description on the process of H₂ generation unit

1. H₂ gas loop and O₂ gas loop:



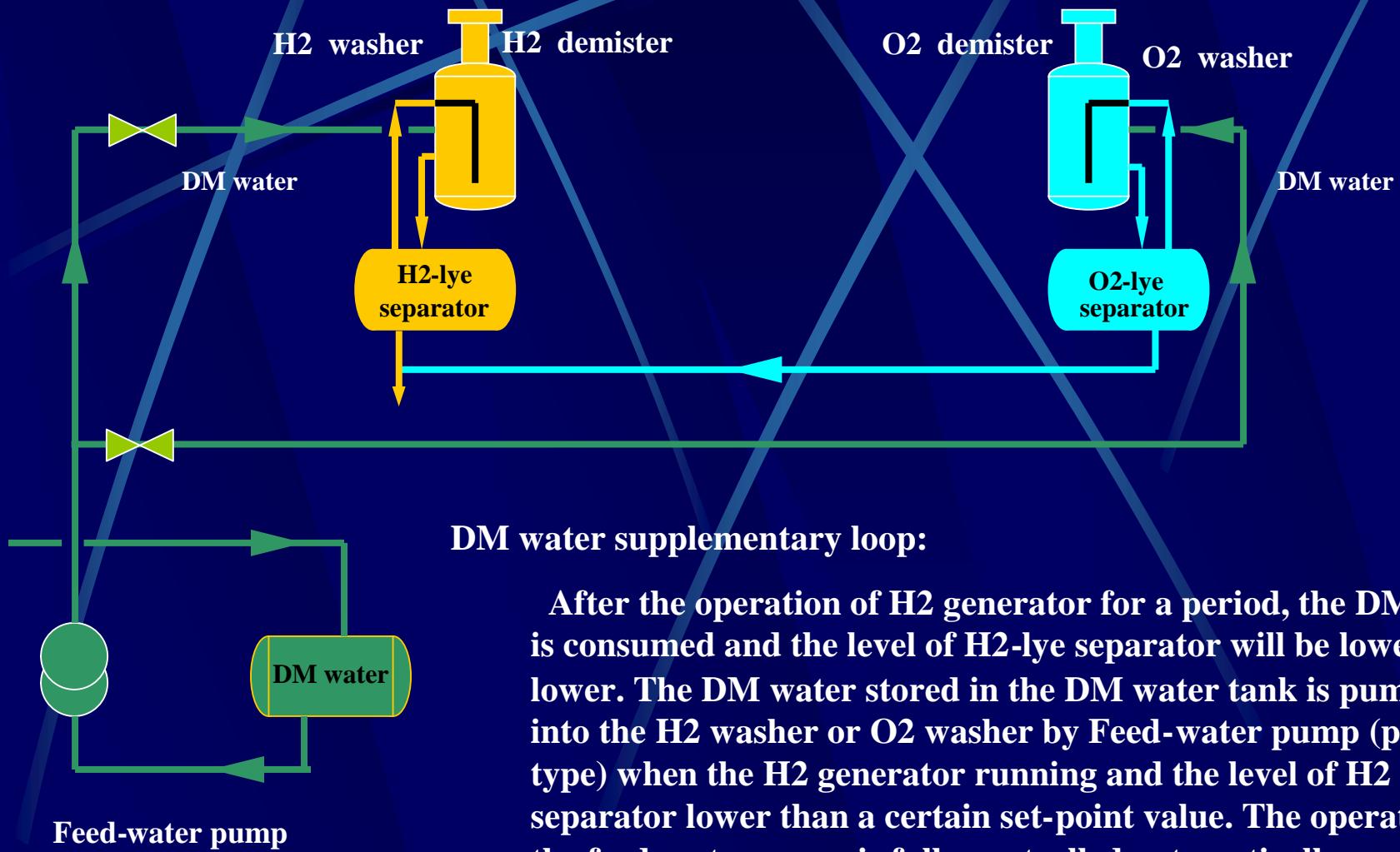
2. Lye cycling loop:



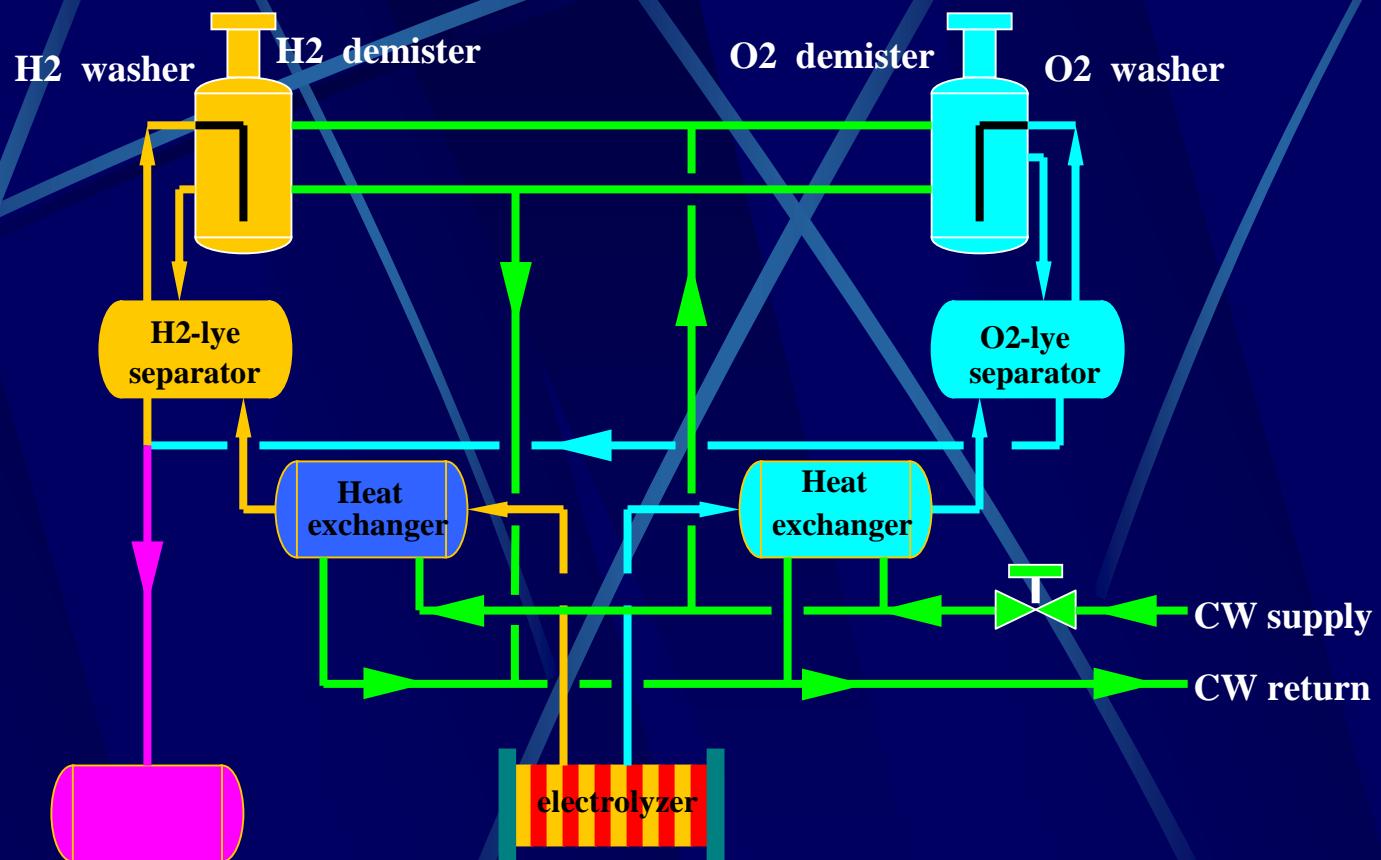
Lye cycling loop:

The separated lye in the **H2-lye separator** and **O2-lye separator** is combined together and flows into the lye filter, then is pumped into the electrolyser by lye cycling pump for further water electrolysis. The accumulated lye in the **H2 washer** and **O2 washer** is overflowed from the washer to the corresponding separator.

3. DM water supplementary loop



4. Cooling water loop:

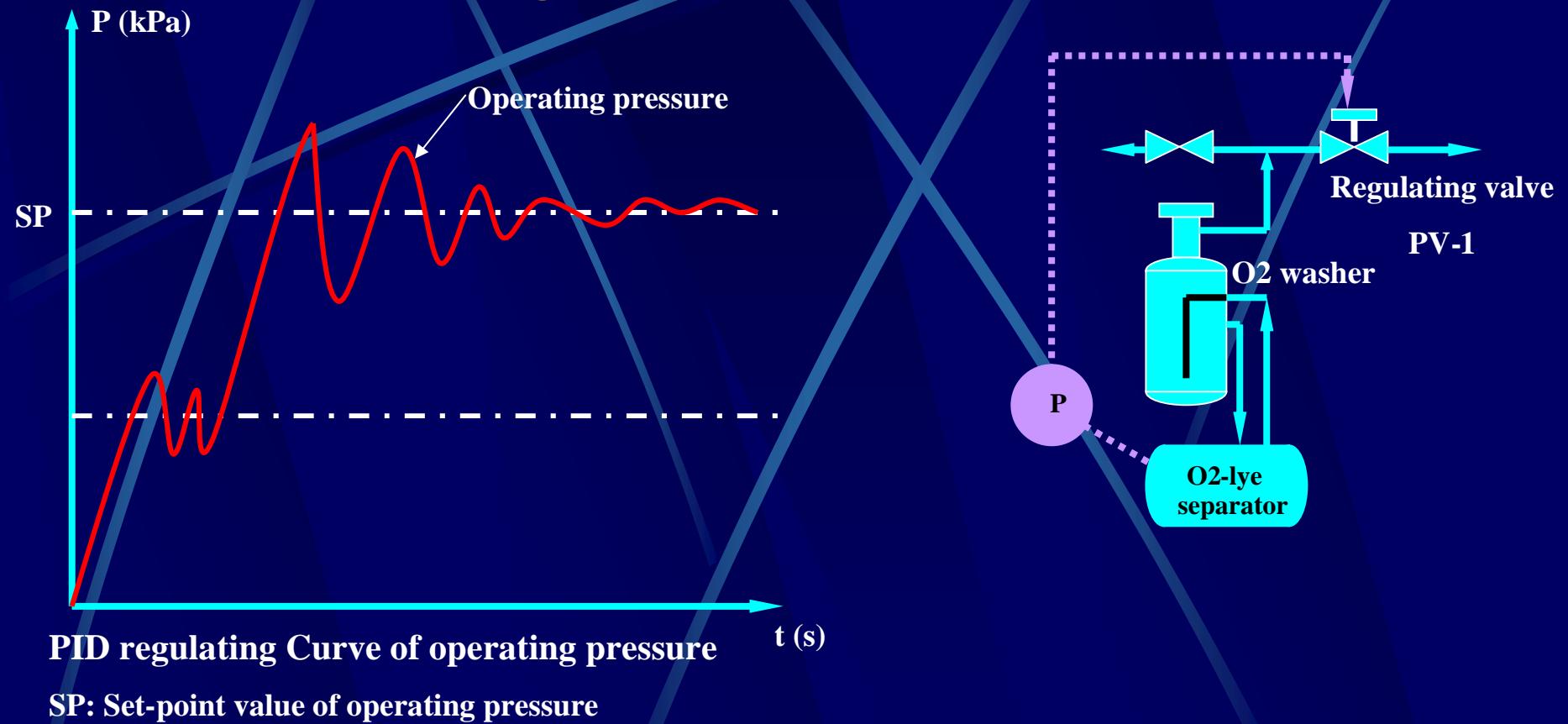


Cooling water loop:

With the operation of H₂ generator, the heat by water electrolysis shall be brought and the temperature shall be controlled. The heat is exchanged via lye cycling loop in the heat exchanger with the cooling water. The cooling water enters into the exchanger to cool the lye from electrolyser, the cooled lye flows back to electrolyser via lye cycling loop. The flows of cooling water is controlled to decide the heat exchanging.

Description on control loops of H₂ generation unit

1. Control loop for operating pressure



Pressure Transmitter

Safety Barrier

PID algorithim

E/P converter

Pneumatic Regulating valve

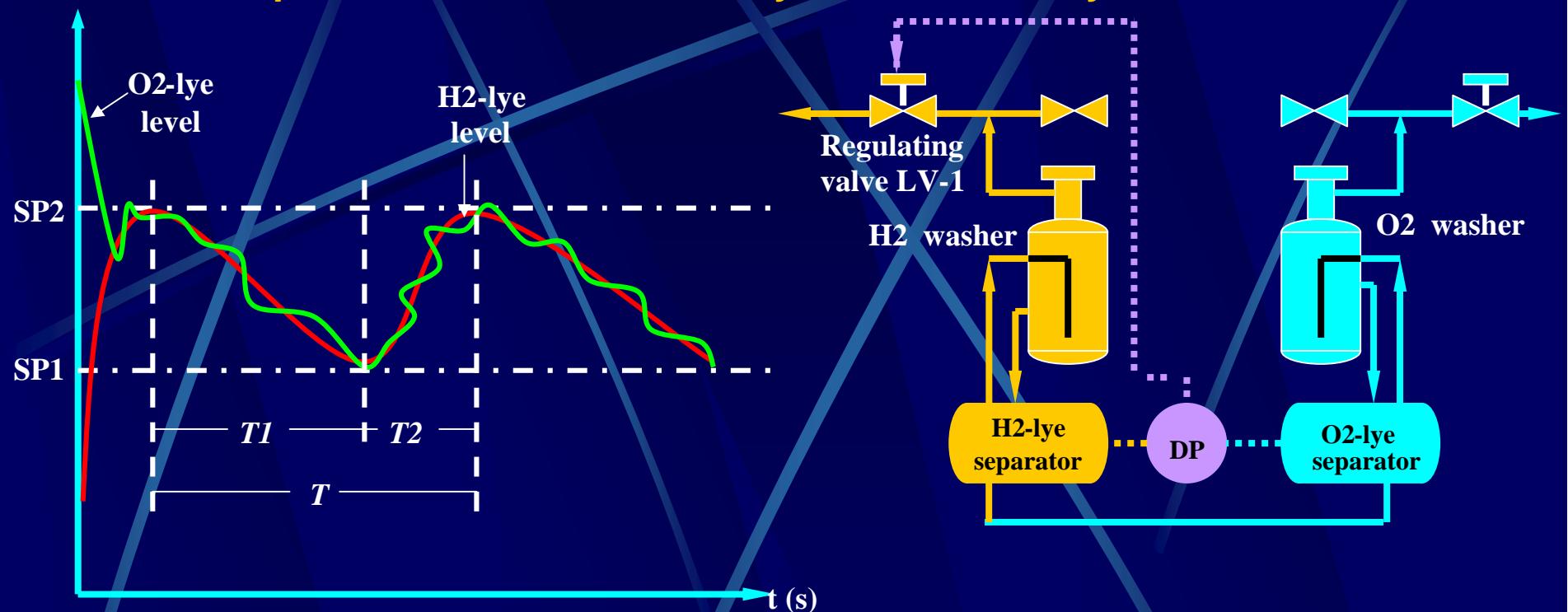
OP

SP

PLC

Control loop for operating pressure

2. Control loop for balance between H₂-lye level and O₂-lye level



PID regulating Curve of balance of levels

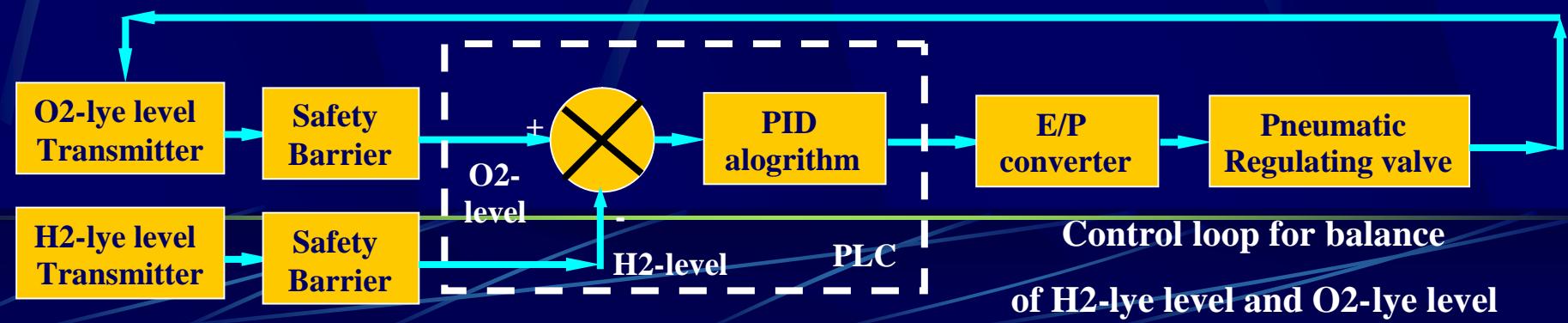
SP₁: low limit of DM water supplementary;

SP₂: high limit of DM water supplementary;

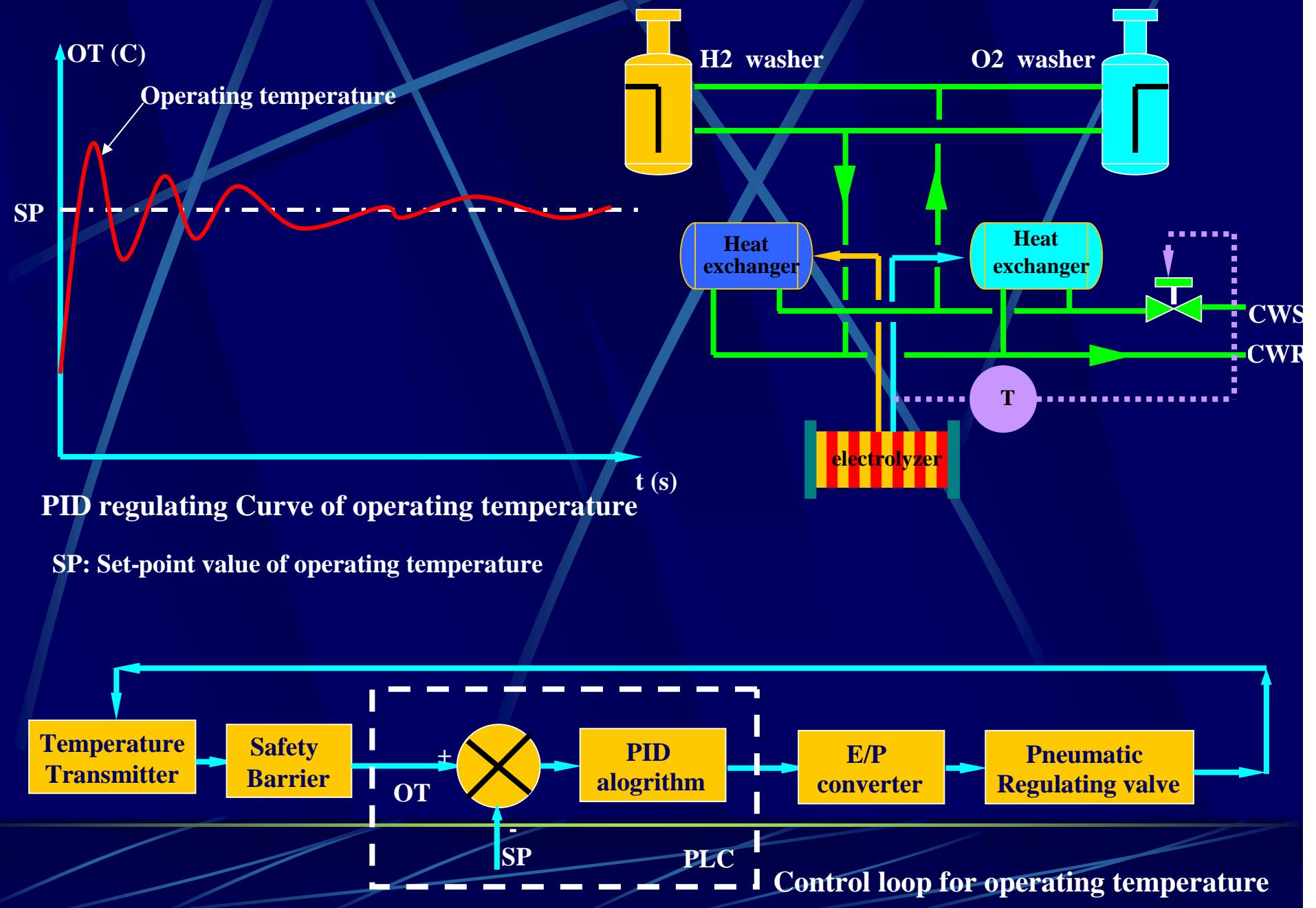
T_1 : period of H₂ generator operating;

T_2 : period of DM water supplementary;

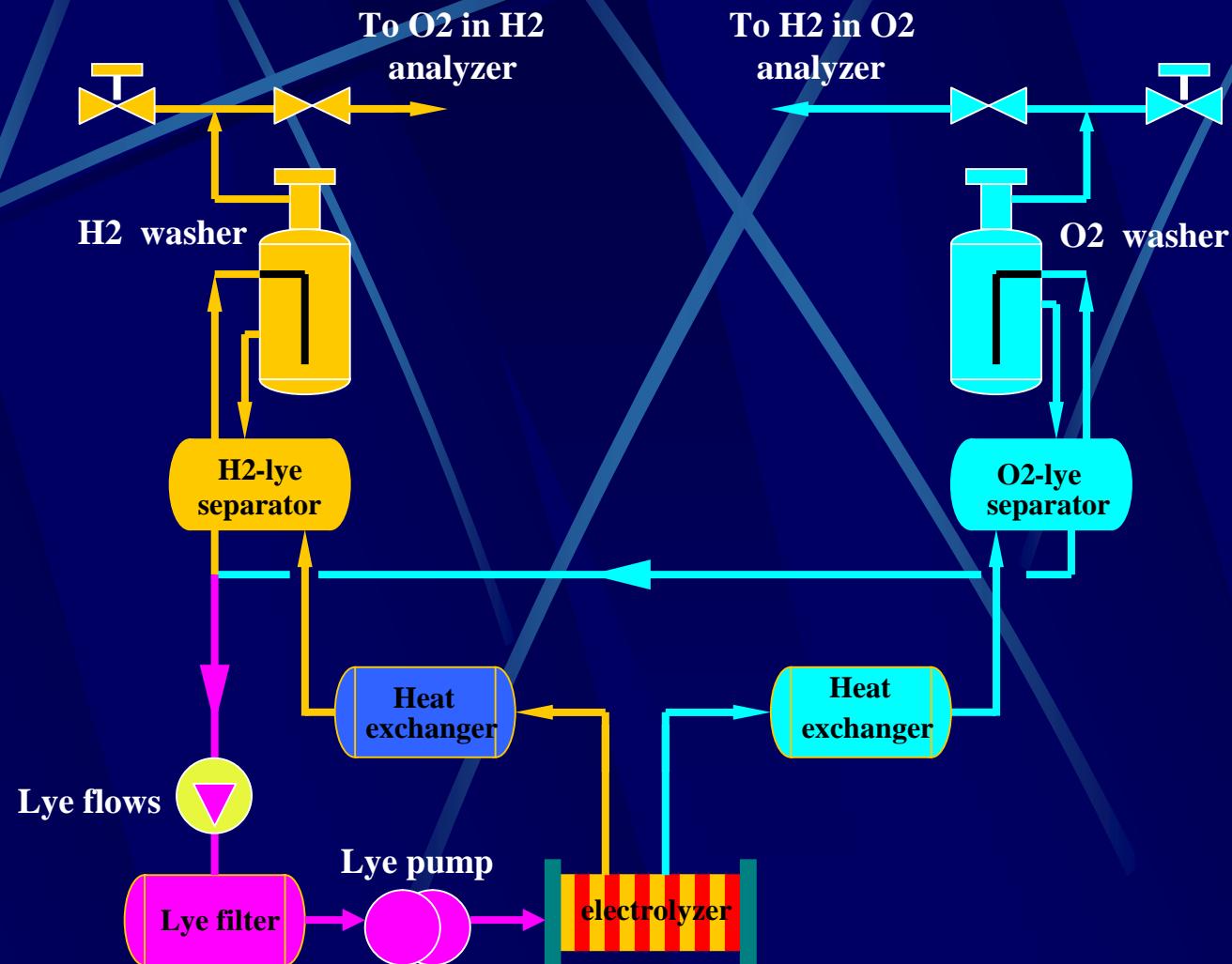
T : One period ; $T = T_1 + T_2$;



3. Control loop for operating temperature



4. Monitoring for H₂ purity, O₂ purity, lye flows and H₂ concentration



Note:

Action of alarm and / or interlock will be taken, in case the monitored parameters exceeds to their alarm / interlock set point values, to protect the operation of H₂ generator. One more, the secondary protection by pressure switch is designed in case the automatic control becomes out of order and the signal from the pressure switch is transmitted to rectifier to cut off the power to electrolyser directly.

II. Description on the process of H2 purification unit

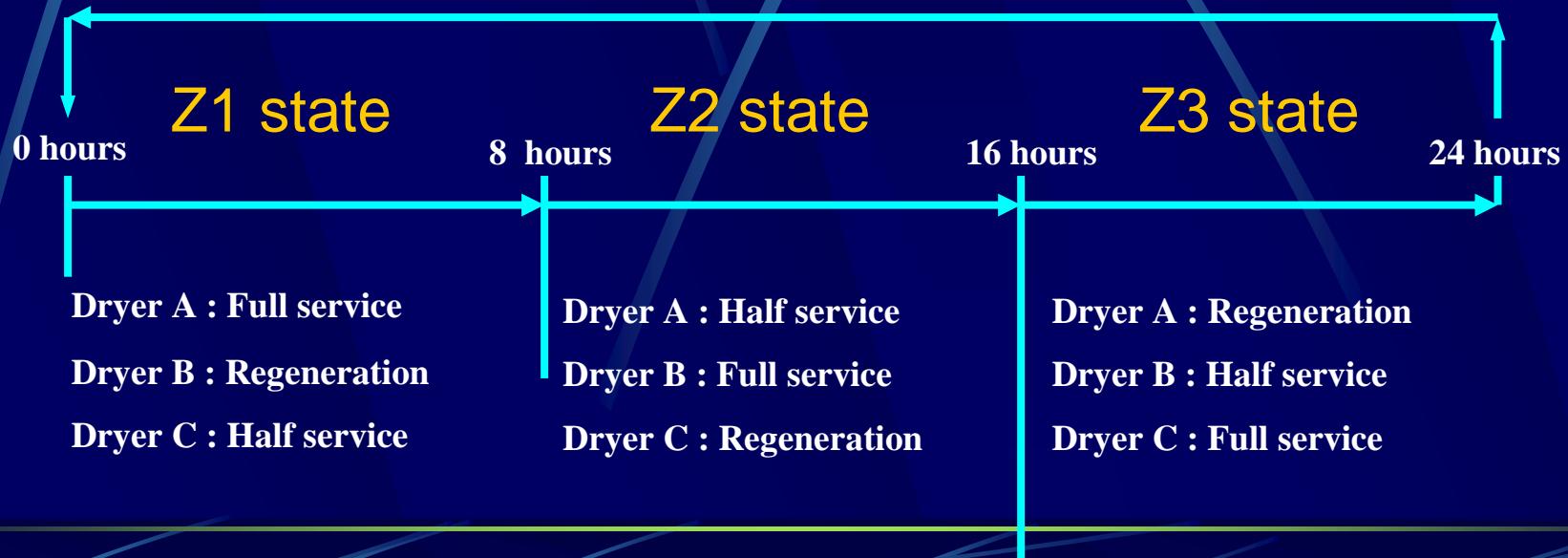
1. flows chart for H2 purification unit

1.1 Description on the processing:

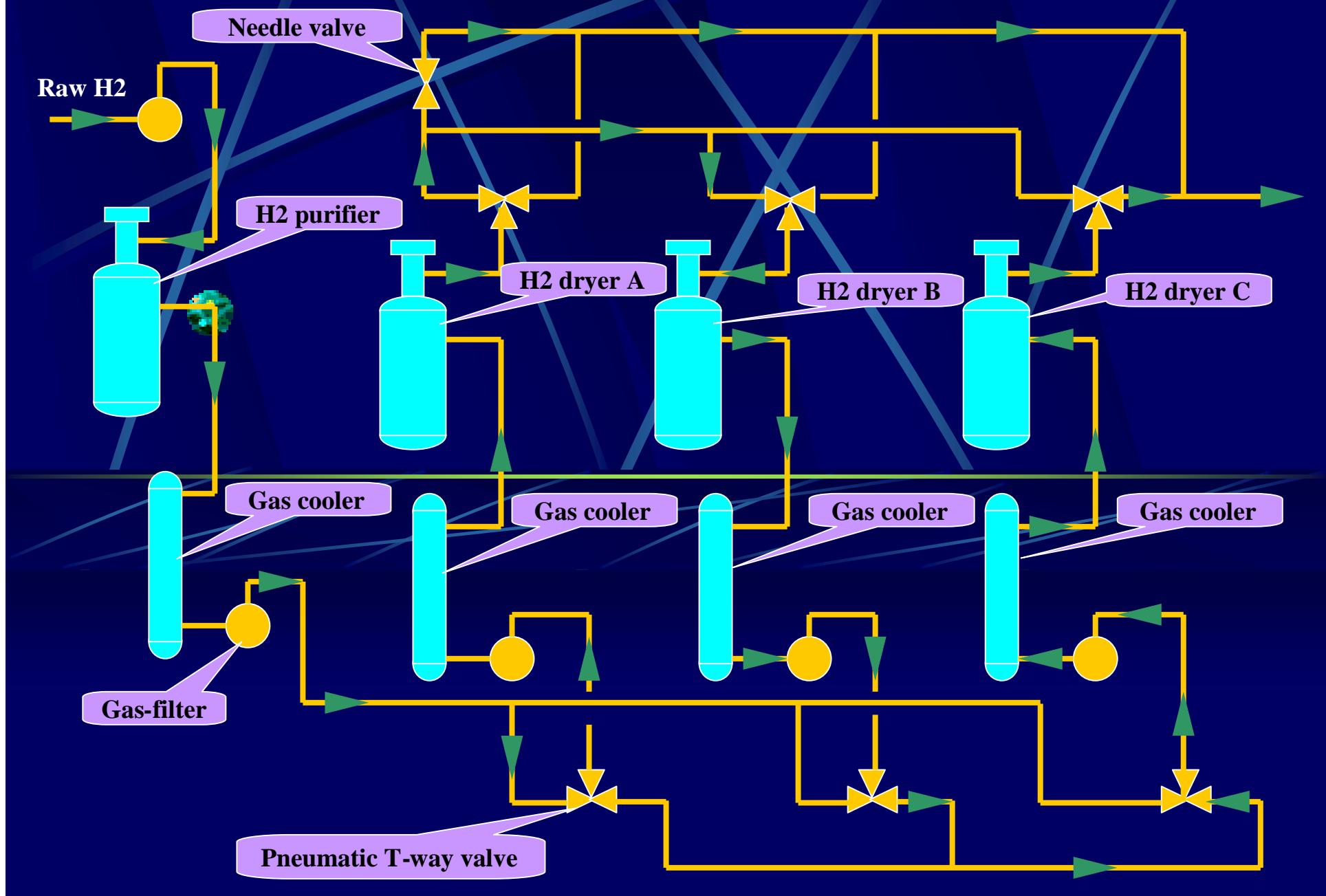
- 1) Structure of De-oxy tower;
- 2) Structure of H2 dryer;

1.2 Description on the automatic control loops

- 1) gas flows for the H2 purification units



1. typical flow chart for H₂ purifying system by catalyst



1.1 Description on the process

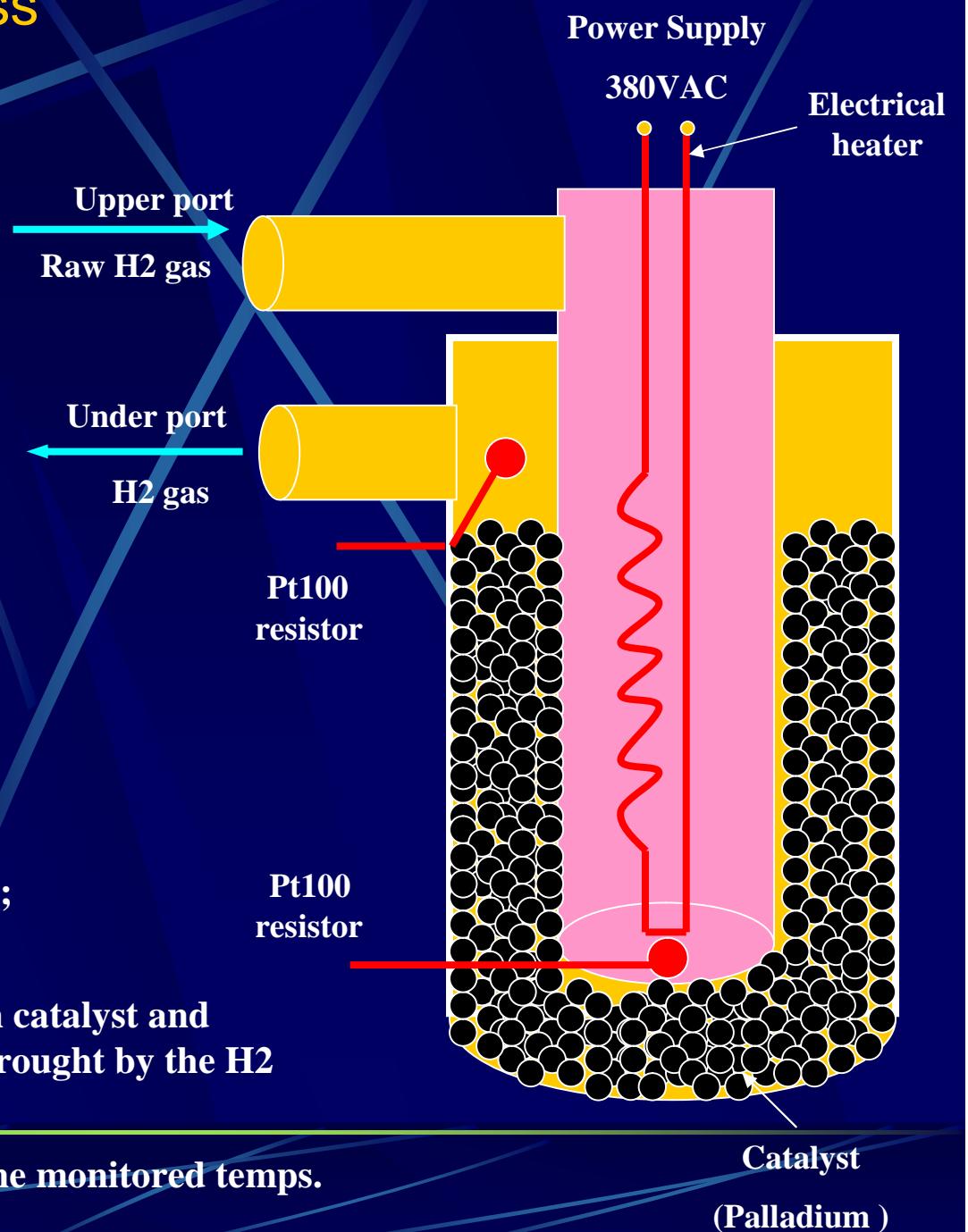
1) Structure of de-oxy tower

Explanation on the structure:

- (1) There are two cylinders combined together; the small cylinder is in the middle of big cylinder;
- (2) Inside of the small cylinder, electrical heater is installed and its power is depended on the gas capacity.
- (3) At the bottom of small cylinder, there is temperature sensor to detect the gas temperature;
- (4) At the outlet of big cylinder, there is another temperature sensor to detect the gas temperature;
- (5) The catalyst is filled fully in the space between small cylinder and big cylinder;

Principle :

- (6) Mini oxygen is reacted with H₂ gas with catalyst and moisture is generated; the moisture is brought by the H₂ gas flows;
- (7) The working of heater is depended on the monitored temps.



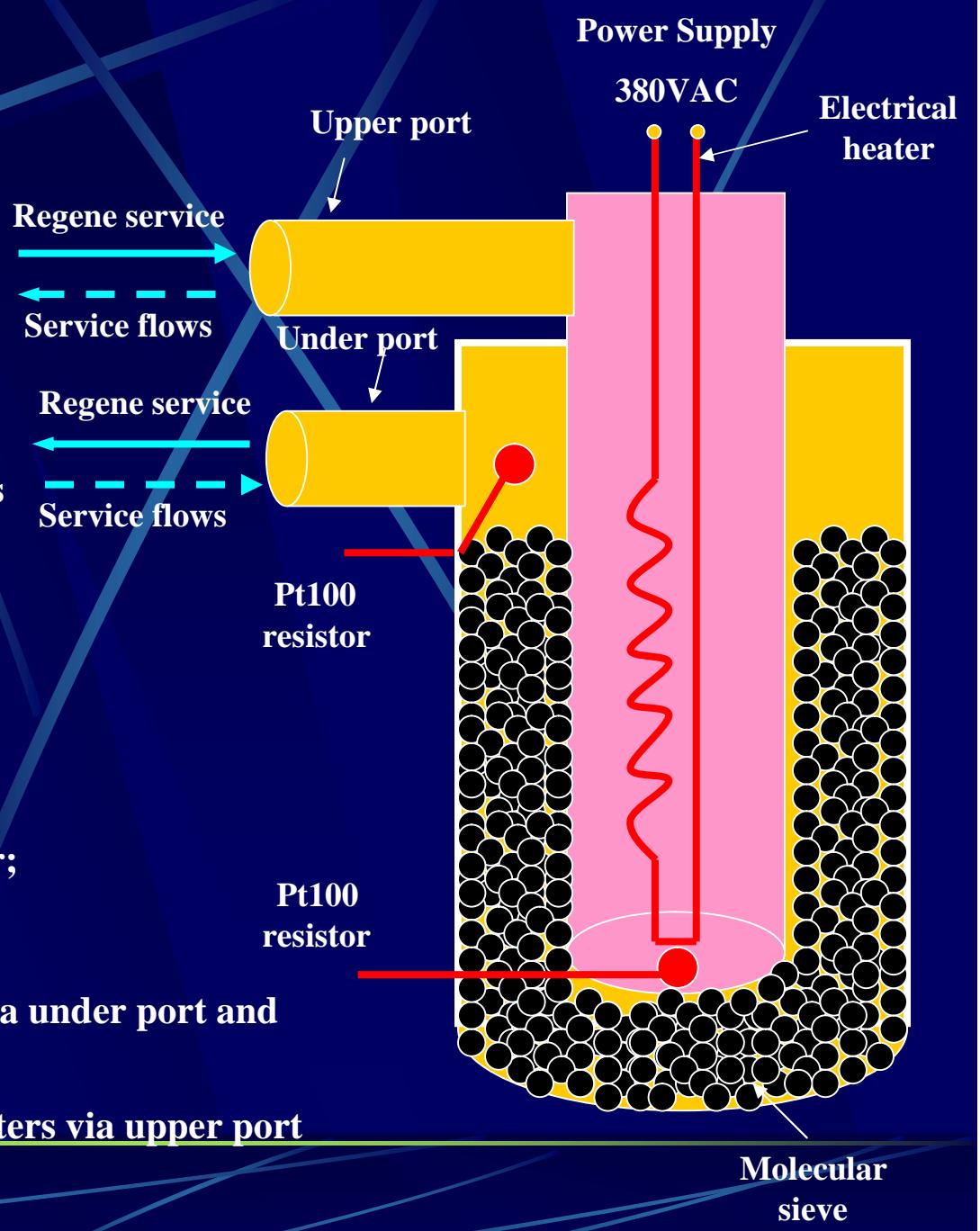
2) Structure of H2 dryer

Explanation on the structure:

- (1) There are two cylinders combined together; the small cylinder is in the middle of big cylinder;
- (2) Inside of the small cylinder, electrical heater is installed and its power is depended on the gas capacity.
- (3) At the bottom of small cylinder, there is temperature sensor to detect the gas temperature;
- (4) At the outlet of big cylinder, there is another temperature sensor to detect the gas temperature;
- (5) The desiccant is filled fully in the space between small cylinder and big cylinder;

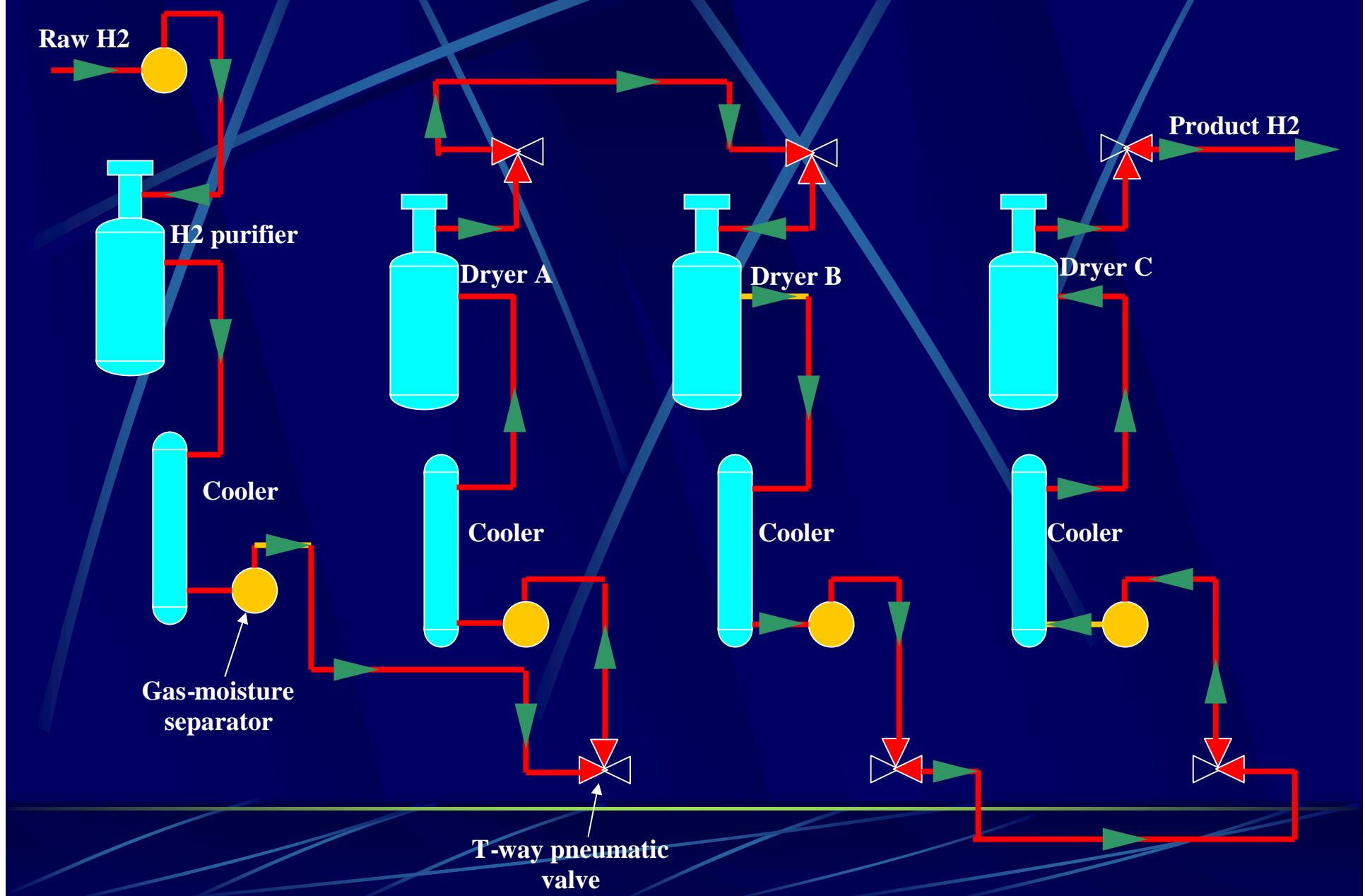
Principle :

- (6) When the dryer in service, gas enters via under port and flow out from upper port;
- (7) When the dryer in regeneration, gas enters via upper port and flows out from under port.

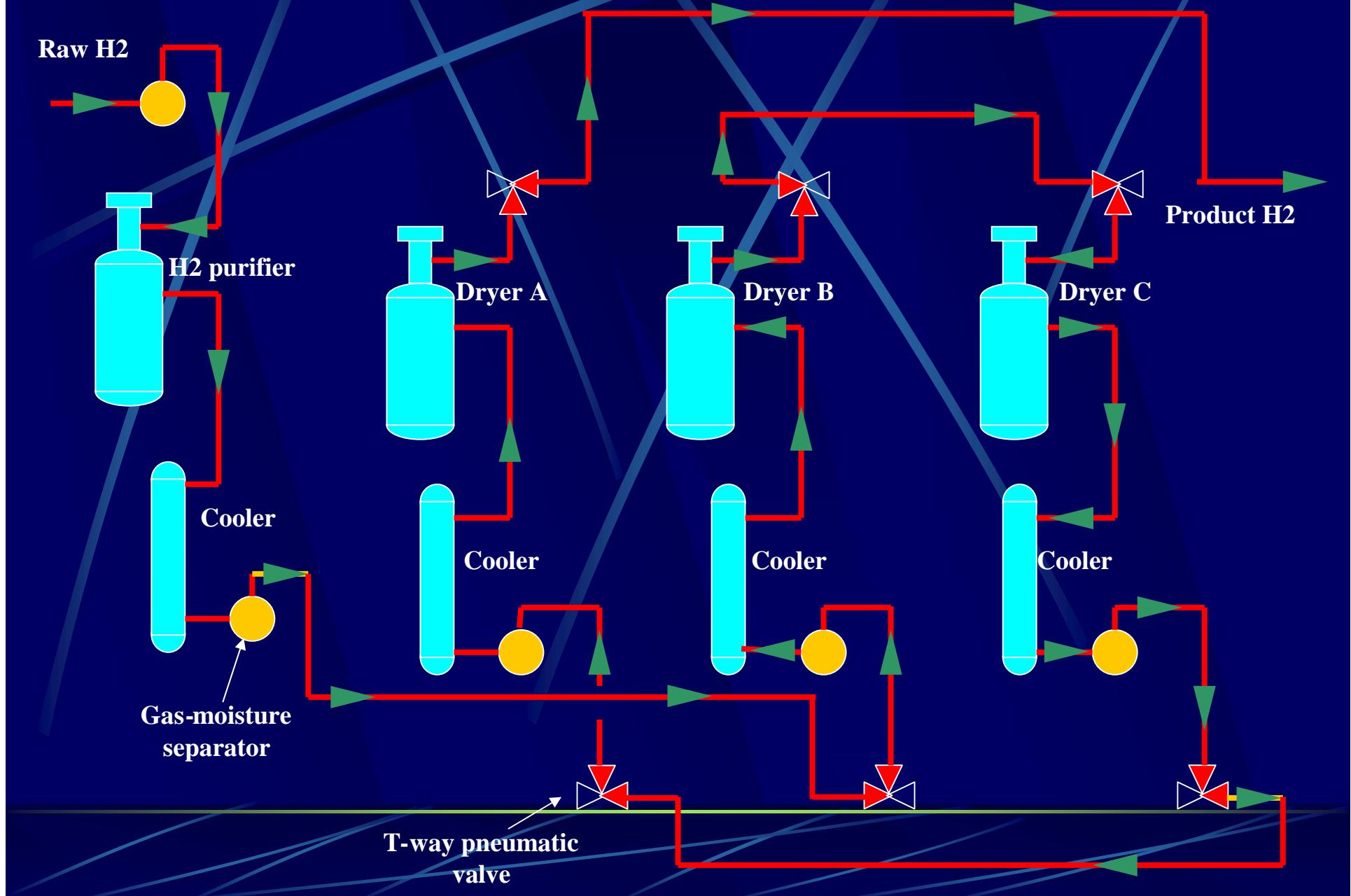


1.2 Gas flows in the hydrogen purification unit

1) When the purification unit is in Z1 state



2) When the purification unit is in Z2 state



3) When the purification unit is in Z3 state

