

Relationship between pump performance curve and its operating point

1. Arrangement

As shown in **Figure 1**, the liquid flows in the pump by passing the suction valve from the suction tank. And, the liquid is discharged by passing the check valve, discharge valve and the flow meter, and reaches the discharge tank.

Explanation of sign ;

H_a : Actual head (the difference of liquid height of the discharge tank and the suction tank)

Δh_s : Loss of head in suction pipings

Δh_d : Loss of head in discharge pipings

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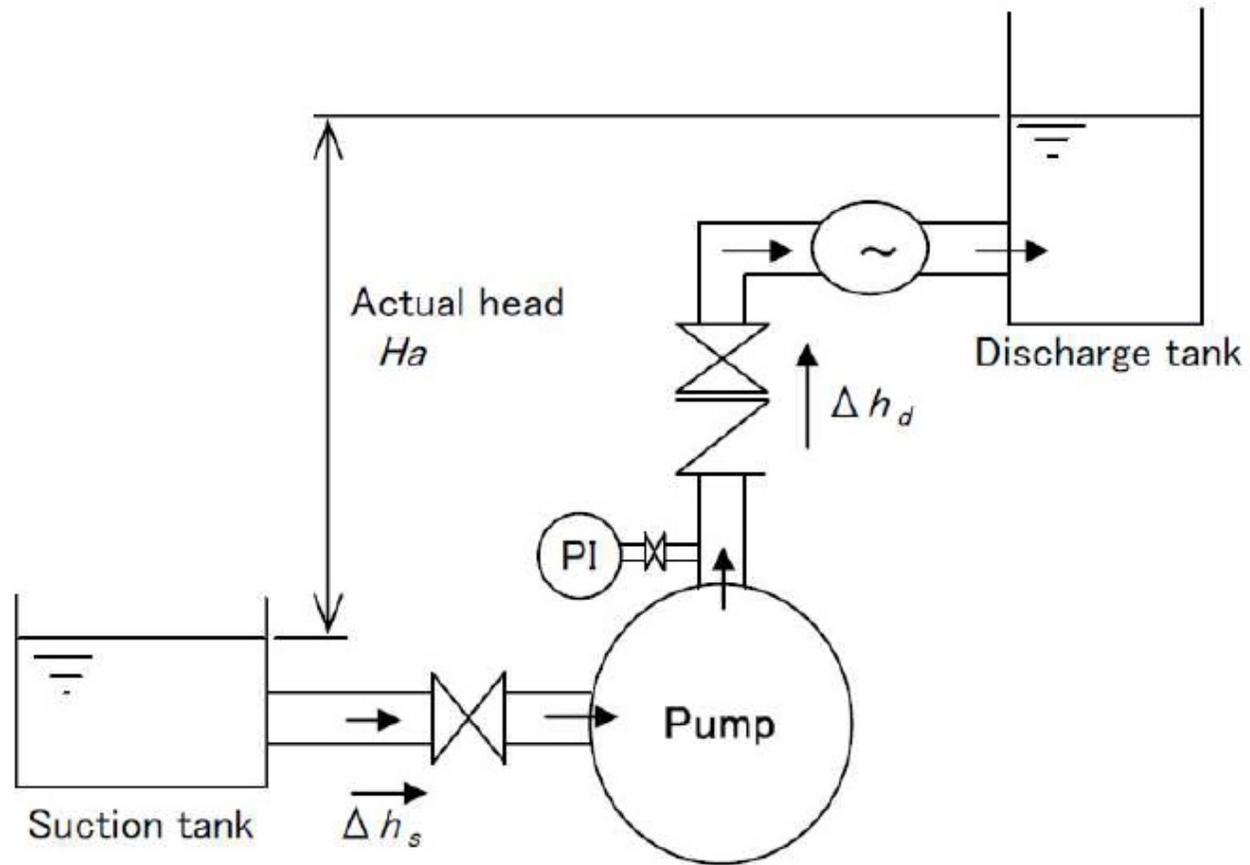


Figure 1 Arrangement

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2. Relationship between pump performance curve and its operating point

It explains the pump that the total head and efficiency show against the capacity of the pump in **Figure 2**.

Explanation of sign ;

O : When capacity 0 and total head 0, that is, pumps have stopped.

OA : Actual head H_a

B : Shutoff total head

ADC、AFE : System head curve (It is a sum total of Δh_s and Δh_d , and it is proportional to square of the capacity respectively.)

D、F : Pump operating point

Whether the discharge valve is open or shut, the route that reaches the operating point by starting the pump is different.

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(1) When the discharge valve fully opens

Route : O → A → D

- ① O → A : Starting the pump, and before the pump speed reaches the rated speed, when the total head covers the actual head H_a , the liquid flows from suction to discharge.
- ② A → D : The capacity and the total head increase gradually because the pump speed increases gradually. When the pump speed reaches the rated speed, operating point D is maintained.

(2) When the discharge valve partially opens

Route : O → A → F

- ① O → A : Starting the pump, and before the pump speed reaches the rated speed, when the total head covers the actual head H_a , the liquid flows from suction to discharge.
- ② A → F : The capacity and the total head increase gradually because the pump speed increases gradually. When the pump speed reaches the rated speed, operating point F is maintained.

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(3) When the discharge valve fully closes

Route : O \rightarrow A \rightarrow B

- ① O \rightarrow A : Starting the pump, and before the pump speed reaches the rated speed, even when the total head covers the actual head H_a , the liquid never flows because of the discharge valve closes.
- ② A \rightarrow B : The total head reaches the shutoff total head when the pump speed reaches the rated speed. Then the discharge valve gradually opens, the operating point goes to point F and when the discharge valve fully opens, the operating point reaches point D.

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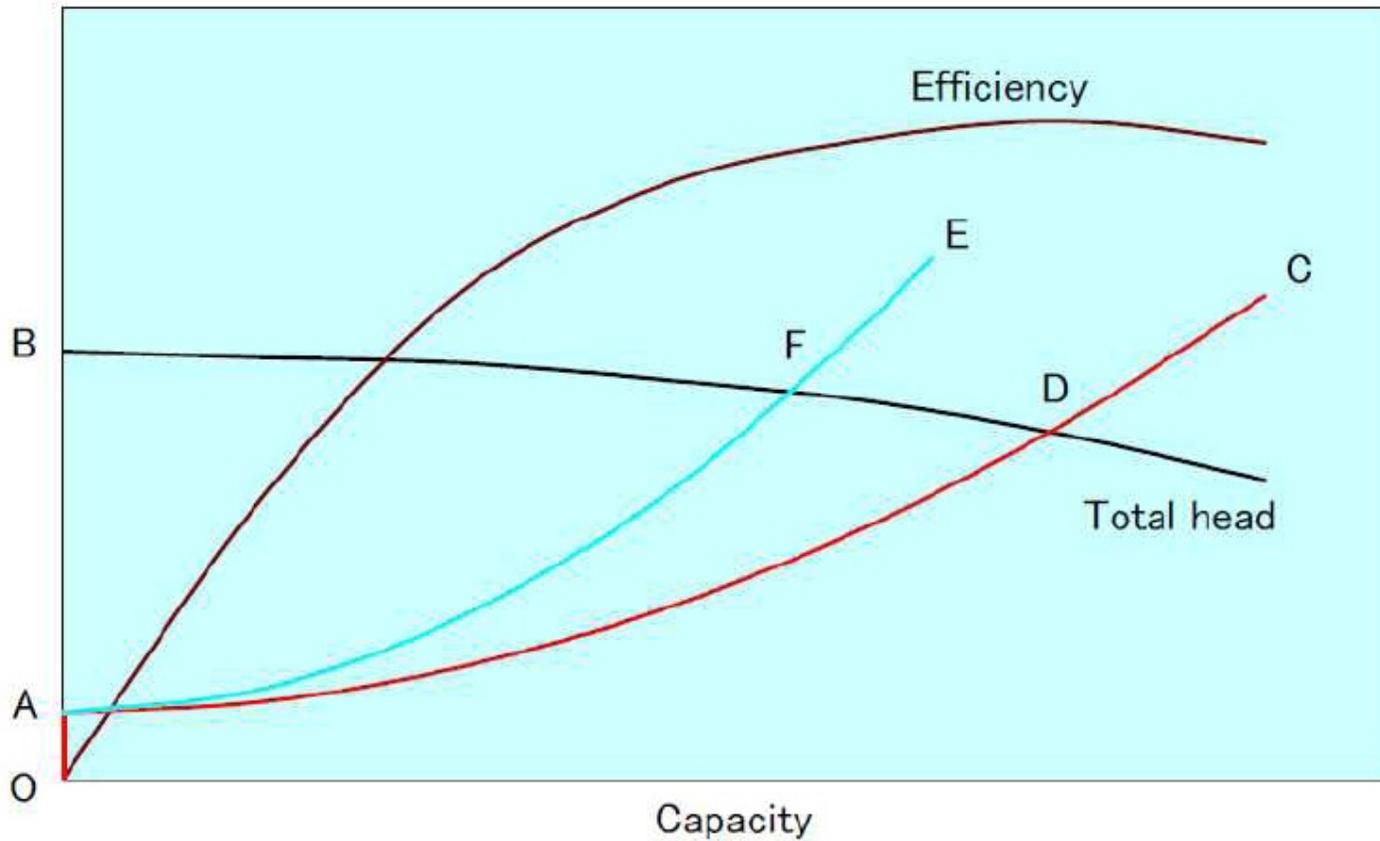


Figure 2 Pump performance curve and its operating point