1) Open or direct contact F.W.H.:

In this type extracted steam is mixed directly with incoming sub cooled feed water to produce saturated at extraction steam pressure. The sub cooled water (6) and wet steam (3) mix. in the low pressure feed water heater to produce saturated water at (7) .($\dot{m}_3$) is necessary to saturated the sub cooled water (6) , if less no feed water benefit .If more causes loss of turbine work and two phase mixture difficult to pump.

(6-7) constant pressure line approximately (p_3).If greater than (p_3) will cause reverse flow to the turbine at (3) . A second pump is used to pump the saturated water from (7) to (8).

Superheated steam at (2) mix with sub cooled water at (8) to produce saturated water at (9) which is then pumped (pressurized) to (10) to inter the boiler at its pressure.

ENERGY BALANCE:

H.P.F.W.H.

$$\dot{m}_2(h_2 - h_9) = (1 - \dot{m}_2)(h_9 - h_8)$$

L.P. F.W.H.

$$\dot{m}_3(h_3 - h_7) = (1 - \dot{m}_2 - \dot{m}_3)(h_7 - h_6)$$

$q_A=(h_1-h_{10})$

$$W_T=(h_1 - h_2) + (1 - \dot{m}_2)(h_2 - h_3) + (1 - \dot{m}_2 - \dot{m}_3)(h_3 - h_4)$$

$$W_{p1}=(1 - \dot{m}_2 - \dot{m}_3)(h_6 - h_5) = (1 - \dot{m}_2 - \dot{m}_3)\frac{\vartheta_5(p_6 - p_5)}{\eta_{p1}}$$

$$W_{p2}=(1 - \dot{m}_2)(h_8 - h_7) = (1 - \dot{m}_2)\frac{\vartheta_7(p_8 - p_7)}{\eta_{p2}}$$

$$W_{p3}=(h_{10} - h_9) = (1 - \dot{m}_2)\frac{\vartheta_9(p_{10} - p_9)}{\eta_{p3}}$$

$$\Delta \mathbf{W_{net}} = \mathbf{W_T} - \sum \mathbf{W_p}$$

EX: Steam power plant operates between boiler pressure of (42 bar) and condenser pressure (0.036 bar) calculate the η, S.S.C ,if the steam is dry saturated at entry to the turbine and include one direct contact feed water heater?

2)CLOSED TYPE WITH DRAINS CASADED BACKWARD:

A mount of steam bleed ($\dot{m}_2$) is passed to H.P.F.W.H and the L.P.F.W.H receives heat from it by the transfer of heat through the separating tubes (heat exchanger).The condensed steam is then throttled to the L.P.F.W.H which also supplied with a second quantity of bleed steam ($\dot{m}_3$) and lower temperature heating has been accomplished the condensed steam is hen fed to the condenser. The temperature differences between successive heaters are constant and the heating process at each is considered to be complete (i.e. the feed water leaves the feed water heater at temperature of bleed steam supplied to it)

EX: Steam power plant operates between boiler pressure of (42 bar) and condenser pressure (0.036 bar) calculate the η, S.S.C ,if the steam is dry saturated at entry to the turbine and include one direct contact feed water heater?(Neglect pumps work)