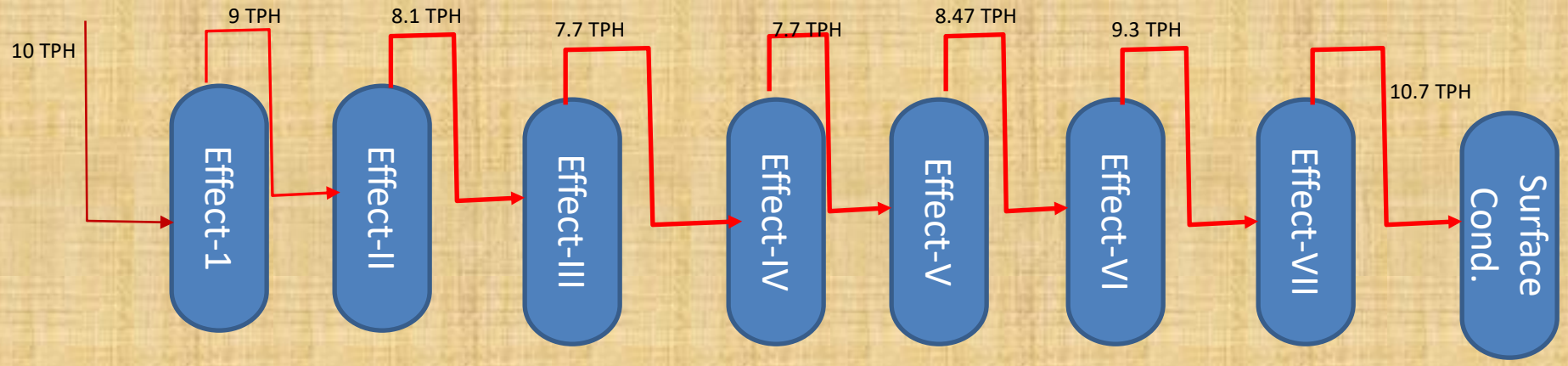
Patent process Two way feeding and Condensate sealing to increase individual effect overall heat transfer coefficient in Multiple Effect Evaporation plant

(WS2022-807)

General working of MEEs



Steam Economy factor for various effect

S.I	Particular	factors
1	Effect no.1	.9
2	Effect no.2	.9
3	Effect no.3	.95
4	Effect no.4	1
5	Effect no.5	1.1
6	Effect no.6	1.1
7	Effect no.7	1.15

S.I	Particular	Steam Economy	Specific steam consumption T/T
1	1 Effect plant	.9	1.1
2	2 Effect plant	1.8	.55
3	3 Effect Plant	2.7	.37
4	4 Effect plant	3.5	.285
5	5 Effect Plant	4.5	.22
6	6 Effect Plant	5.3	.19
7	7 Effect plant	6.3	.16
8	8 Effect plant	7.3	0.14

1. **How to Know Actual Capacity of Multiple Effect Evaporation?**

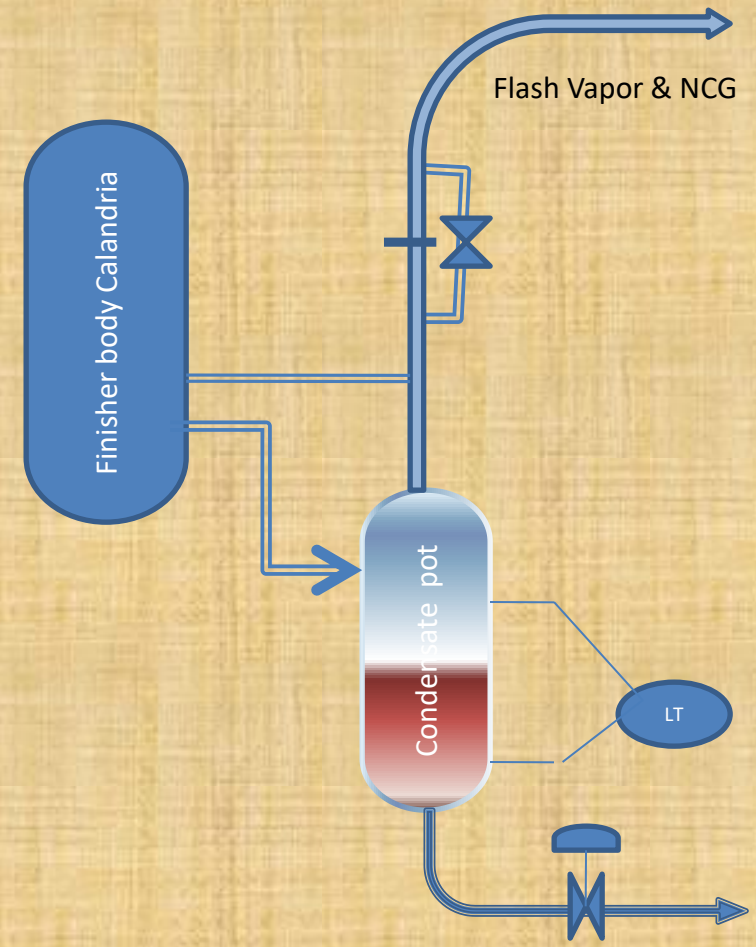
   If the steaming Effect's Overall heat transfer coefficient is 2000 W/M2.C , then take is as 100% . So if combined effect (Including all finishers) has overall heat transfer Coefficient is 1000 W/M2.C then Plant is running at just 50%.

2. **How Much steam we can charge in the evaporator's Steam Effect efficiently?**

   20 Kg/M2/hr Steam charging is accepted good for viscosity up to 4Poise but liquor Viscosity is up to 50cP then steam can be charged up 30kg/m2/Hr (Albeit Steam charge can be increased, Decreased as per desired evaporation required. But what we can not be reduced is Liquor recirculation inside the tubes (Reynolds no. always must be more than 2100 at every point of wetted surface).

3. To have good heat transfer condensate sealing is a must -2 requirement, One can easily relates with and heat exchanger with steam trap and without Steam trap.

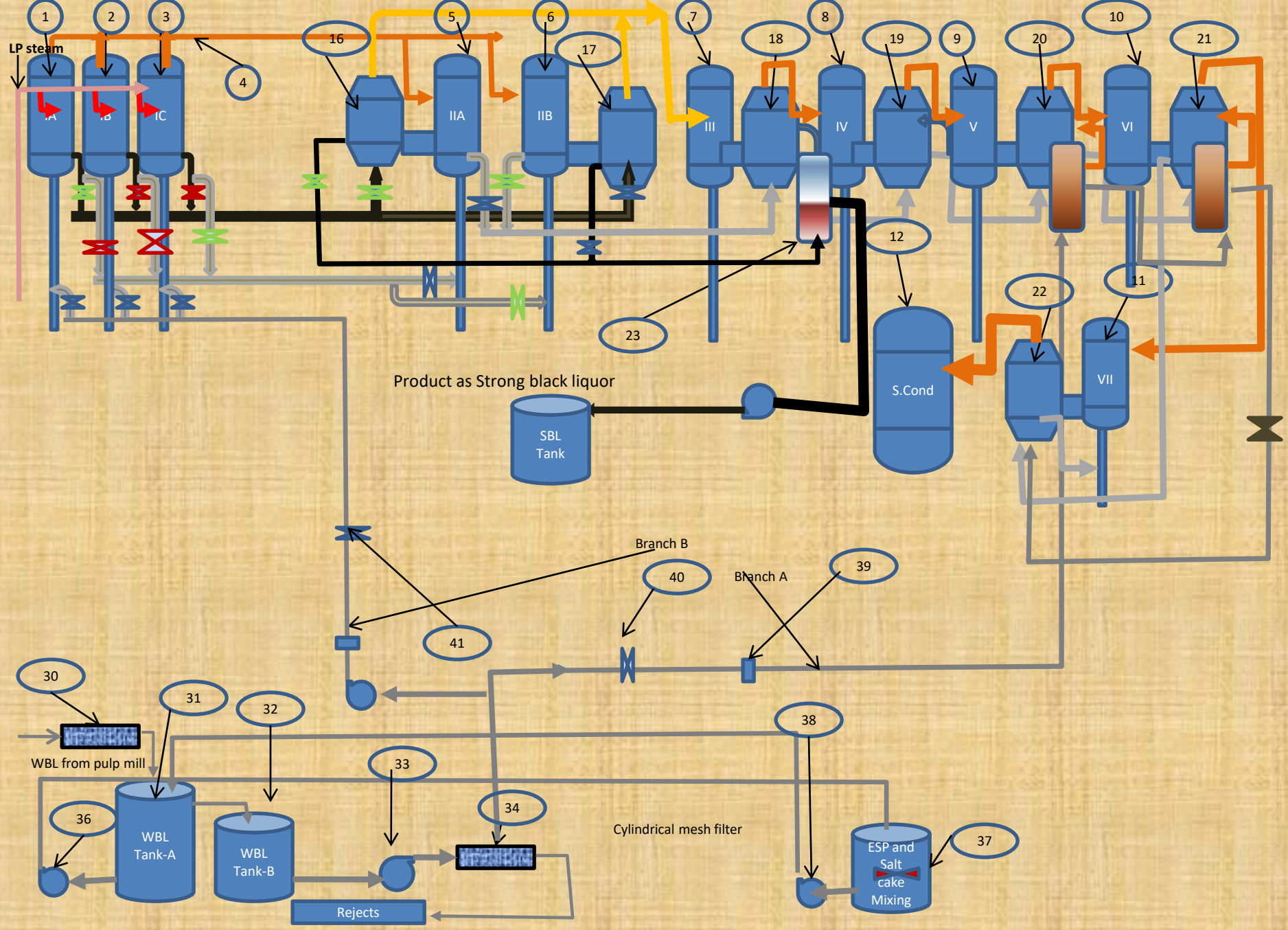
Conventional Condensate & NCG handling



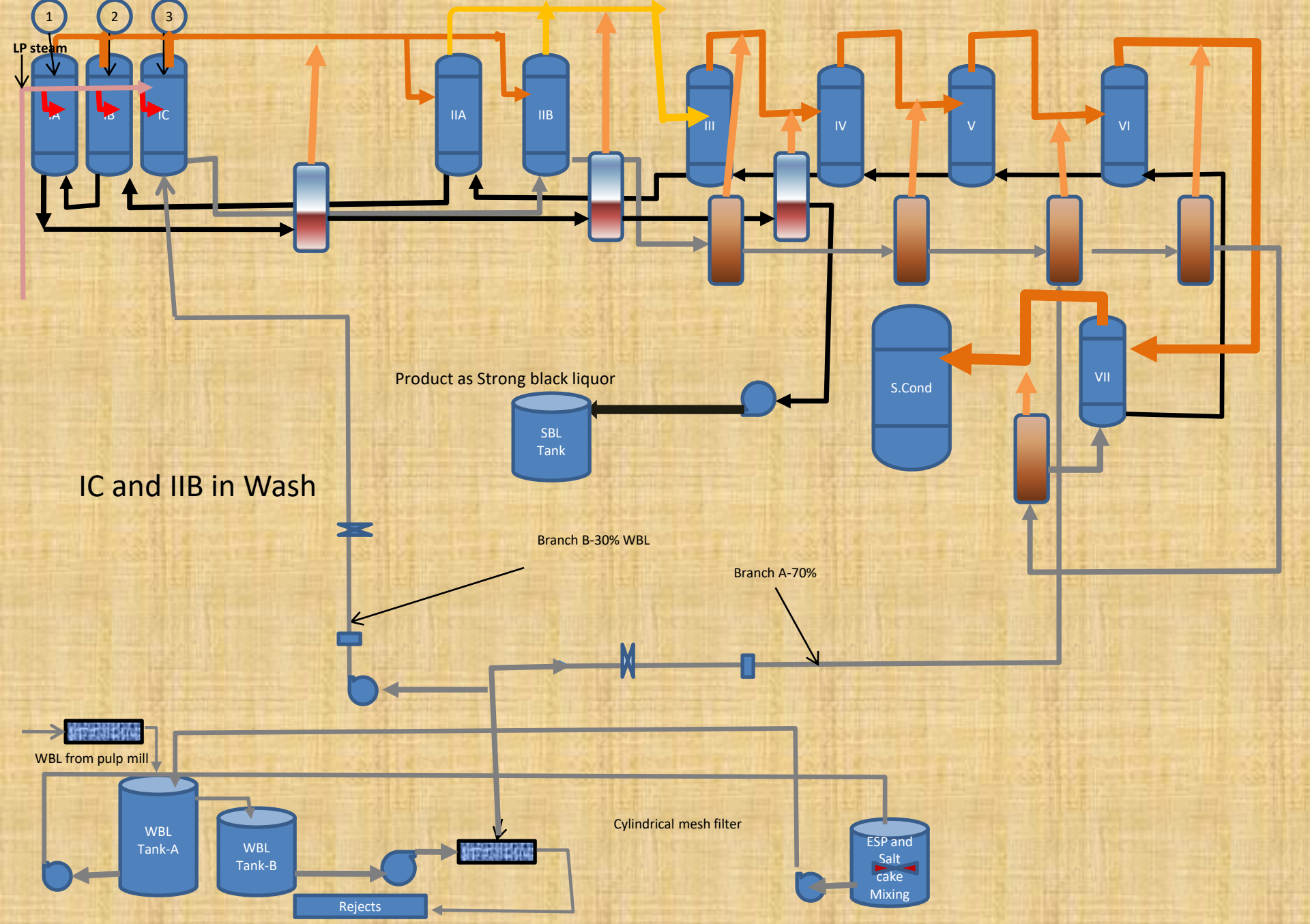
Proposed modification as per patent No. 202011006826 (Two way feeding and condensate sealing to increase overall heat transfer coefficient) by HECPL

- As per this patent process, Salt cake (Na2SO4) and ESP ash will be dissolved in WBL instead of SBL (tank-A) .
- This filtered WBL (Tank-B) will be fed to MEEs in two separate lines i.e. one for washing finisher 1A/IB/IC and IIA / IIB say 30% WBL in forward feed, and another to WBL feed flash tanks to VII effect in usual backward feed .
- For Flash evaporation a retention of 15-20 min is required .
- All finisher & other bodies condensate line will be sealed as per our process so that there will no vapor short circuiting.
- Wetting rate in finisher body has to be maintained …. m3/hr.M, …m3/hr.M in IInd and IIIrd effect, … m3/hr.M in IV to VII effects. if its not there then need to be modified to get the desired value. By using stand by pumps recirculation will be increased by individual recirculation lines. That will increase the wetting degree.
- Finisher product outlet control valves will be installed from body instead of recirculation lines.
- One body out of finisher(IA/IB/IC) and one body out of IInd effect (IIA/IIB) will always be in wash mode with WBL in series followed by flashing till WBL flash tank (Line A), Vapor and steam lines will be remain as such. Black liquor side will separated.
- All primary condensate line from flash tank will be modified as per our patent as required.
- All secondary condensate line from flash tank will be modified as per our patent as required.
- Final product SBL will be flashed in series from IIIrd effect calendria to VI effect calendria .
- Soft water line in vapor to Surface Condenser will be provided to maintain vapor temperature 50-55 deg with control loop.
- Product from finisher will extracted in the range of 74-76% and will flashed in II ndA / II ndB Vapor Separator cum flash tank and move on in series of Product liquor flash tank till temperature of product is 100 Deg C is achieved. And Solids concentration will be 80% and above at this and eventually will be fed to

  SBL storage tank.



Schematic diagram of patent process for HECPL-Patent no.202011006826



Schematic diagram of patent process for HECPL-Patent no.006826

Process Parameters

Present

S.I	Particulars	Running	Designed	Units
1.	Feed rate	78	88	M3/hr
2.	Mass flow	84	95	T/hr
3.	Steam flow	13	13.0	T/hr
	Steam loading	10.5	10.50	Kg/m2/hr
4.	Water Evap.	60.2	70	T/hr
5.	Steam Econ.	4.8	5.0	T/T
6.	Inlet Solids	17	17	%
7.	Outlet solids	60	65	%
8.	SBL mass flow	24.0	25	T/hr
9.	Condensate Rec.	60	60	%
10.	Feed temp to VI	80	62	DEG C
11	S.Cond water flow	850	850	T/Hr
12	S.Cond In temp	34	34	Deg

After

S.I	Particulars	T. Value	Units
1.	Feed rate	110	M3/hr
2.	Mass flow	104	T/hr
3.	Steam flow	13.1	T/hr
	Steam loading	10.5	Kg/m2/hr
4.	Water Evap.	79	T/hr
5.	Steam Econ.	6.0	T/T
6.	Inlet Solids	17	%
7.	Outlet solids	70	%
8.	SBL mass flow	25	T/hr
9.	Condensate Rec.	80	%
10.	Feed temp to VI	55-65	DEG C
11	S.Cond water flow	> 850+	T/Hr
12	S.Cond In temp	34	Deg

Wetting Degree

Present

S.I	Particular	Value	Units
1.	Effect I	4.9	M3/M.hr
2	Effect-II	4.9	M3/M.hr
3	Effect III	3.27	M3/M.hr
4	Effect IV	3.27	M3/M.hr
5	Effect V	3.27	M3/M.hr
6	Effect VI	3.27	M3/M.hr

After

S.I	Particular	Value	Units
1	Effect I		M3/M.hr
2	Effect-II		M3/M.hr
3	Effect III		M3/M.hr
4	Effect IV		M3/M.hr
5	Effect V		M3/M.hr
6	Effect VI		M3/M.hr

Specific Water Evaporation

Present

	Particular	Running	Designed	Units
1.	Effect I	10.5	12.0	T/hr
2	Effect-II	8.6	9.8	T/hr
3	Effect III	9.7	11.0	T/hr
4	Effect IV	9.5	10.8	T/hr
5	Effect V	9.0	10.2	T/hr
6	Effect VI	7.9	8.9	T/hr
8	FFTS	3.78	4.29	T/H
9	Prod.Flash	.5	.5	T/H

After

S.I	Particular	Value	Units
1.	Effect I	12.8	T/hr
2	Effect-II	10.1	T/hr
3	Effect III	9.1	T/hr
4	Effect IV	14.7	T/hr
5	Effect V	14.9	T/hr
6	Effect VI	18.7	T/hr
8	FFTS	5.34	T/H
9	Prod.Flash	.6	T/hr

Overall Heat Transfer Coefficient (W/M2.C)

Present

	Particular	Running	Designed	Units
1	Effect I	627	712	W/M2.C
2	Effect II	723	821	W/M2.C
3	Effect III	953	1083	W/M2.C
4	Effect IV	591	672	W/M2.C
5	Effect V	728	828	W/M2.C
6	Effect VI	404	460	W/M2.C

After

S.I	Particular	Value	Units
1.	Effect I	375	W/M2.C
2	Effect II	848	W/M2.C
3	Effect III	918	W/M2.C
4	Effect IV	897	W/M2.C
5	Effect V	1165	W/M2.C
6	Effect VI	1033	W/M2.C

Impression of modifications

- There will be increase in steam economy of evaporator.
- Solid concentration will increase.
- Higher SBL solid will facilitate HP steam generation.
- Evaporation capacity will increase.
- Thermal efficiency of recovery boiler will increase.

For your support

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