CAPACITY ENHANCEMENT OF SRI CLARIFIER, AN EXPERIENCE AT RANIPUR SUGAR MILLS.

By

Mian Abdul Shakoor
Production Manager
Ranipur Sugar Mills Private Limited Ranipur

ABSTRACT

- The major aim of this study was to utilize the available ample capacity of clarifier to reduce industrial sucrose losses. Brief descriptions of these modifications are given. In under given paper benefits from improved performance of clarifier with respect to reduction in inversion in clarification due to shorter retention time, levels of reducing sugar in clear juice, syrup and final molasses are discussed. The performance of the clarifier after modification revealed that shorter retention time has reduced final molasses production by 0.23%- 0.26% cane. Moreover lesser viscosity especially in low grade massecuite and better exhaustion of molasses were observed. These resulted in lesser purity of final molasses. All these factors reduced sugar loss in final molasses by 0.10% cane – 0.12% cane during season 2010-2011 and 2011-2012 as compare to season 2009-2010 and 2008-2009 (before modification) .

INTRODUCTION

- Ranipur sugar mills was installed in 1976 with crushing capacity 2000TCD.
- Old Name was Consolidated Sugar Mills.
- Plant was supplied and erected by FCB (France).
- FCB designed (multi tray, 8 M Dia.) juice clarifier having holding capacity of 140 cubic meter.

Modifications at juice clarifier.

Three modifications were carried out in the juice clarifier in various tenures.

i. In 1992, the basic design of juice clarifier (FCB design) was changed into "Decanter Type" to increase the crushing capacity of the plant up to 125 TCH.

- The result of the modification was negative in the coming season.
- To overcome the problem, a new SRI clarifier (6M dia., Clarifier No.2) having capacity of 95 cubic meter was inducted in 1993.
- Both clarifiers remained in circuit to cope up crushing rate up to 125TCH.

ii. In year 2000, 8 meter dia. Clarifier (clarifier No.1) was modified as SRI clarifier to cope up the crushing rate of 145 TCH.

iii. In season 2009-2010, it was tried to maintain crushing rate with single juice clarifier, it was observed:-

- That up to the juice flow of 145M³/Hr, the performance of the juice clarifier remained satisfactory.
- That the juice flow increased from 145 M³/Hr to 160 M³/Hr, the feed box of the clarifier overflowed.
- It became compulsory to take clarifier No.2 in line.
- The retention time rose up to 90 minutes at juice flow of 160 M³/Hr.
- In season 2009-2010, the working of Juice Clarifier No.1 (modified FCB design) strictly observed and thoroughly studied for capacity enhancement with some modifications.

- After detailed study, management of Rani pur Sugar Mills in the light of study results, decided to modify the clarifier.

- Table No.1 shows the details of modifications carried out in the clarifier No.1.

Table No.1

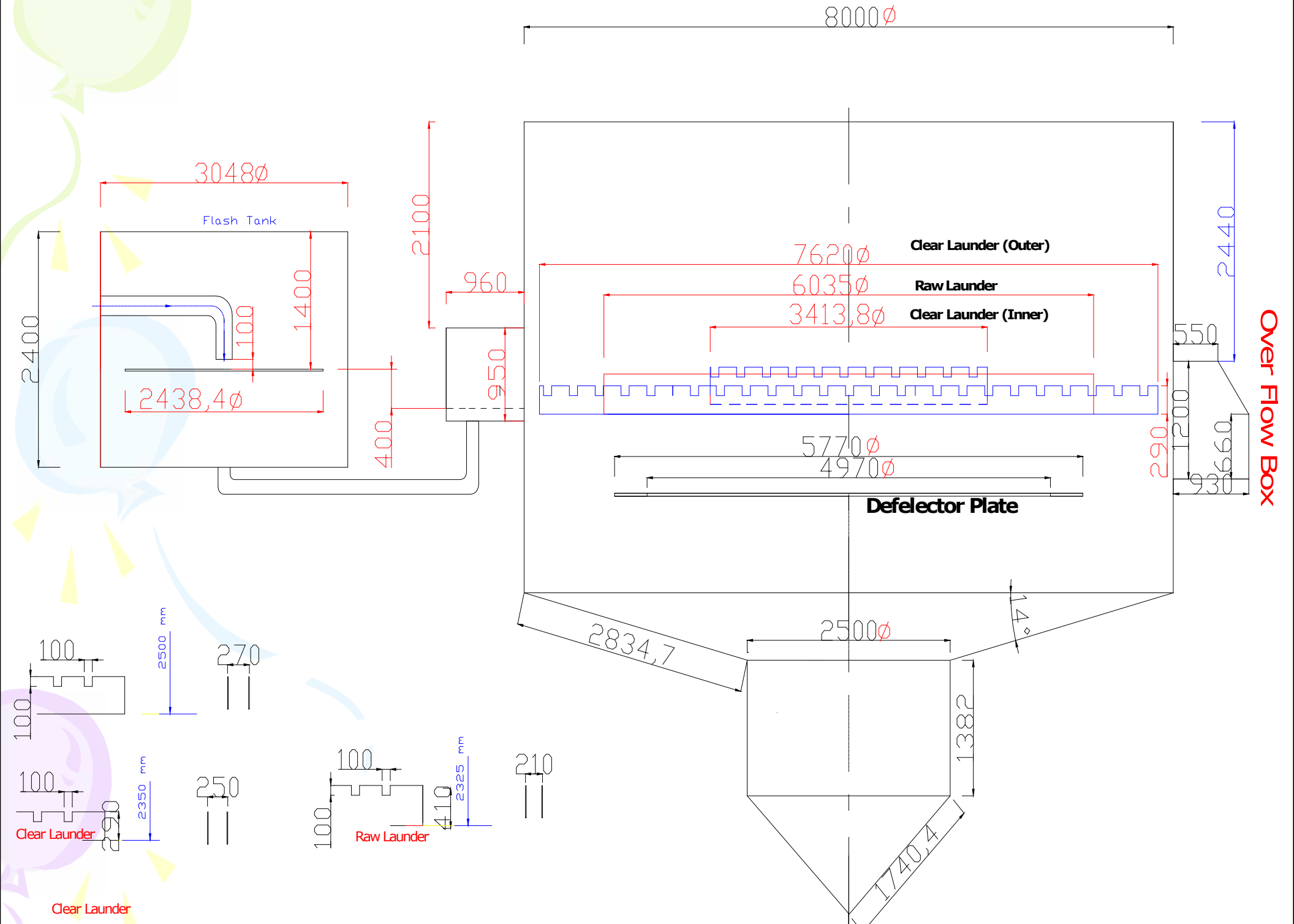
S #	Particulars	Before modifications	After Modifications	Remarks
1.	Working volume of clarifier	140 cub.M	166 cub.M	Working volume was increased by 26 Cub.M
2.	Juice Flow	160 Cub.M/Hr	200 Cub.M/Hr	-
3.	Retention Time	87 Minutes	50 Minutes	
4.	Line from flash tank to juice clarifier	**300 mm**	**350 mm**	Line was replaced with larger dia.
5.	Raw juice distribution line	200 mm	200 mm	-
6.	Velocity of juice in flash line	2.042 ft/sec	1.708 ft/sec	-
7.	Depth of raw juice launder from top of clarifier	**2325 mm**	**1725 mm**	Existing launder was raised by 600 mm
8.	Dimensions of raw launder	H = 410mm W = 210 mm Slot size = 100mmx100mm	H = 410mm W = 350 mm Slot size = 100mmx100mm	Width of existing launder was increased by 140 mm

S #	Particulars	Before modifications	After Modifications	Remarks
9.	Velocity of juice in raw launder	0.55 ft/sec	0.539 ft/sec	-
10	Depth of clear juice launder from top of clarifier	**2500 mm and 2350 mm**	**1900 mm and 1750 mm**	Existing launder was raised by 600 mm
11.	Dimensions of clear Launder	H = 380mm **W = 270 mm** Slot size = 100mmx100mm and H = 290mm **W = 250 mm** Slot size = 100mmx100mm	H = 380mm **W = 350 mm** Slot size = 100mmx100mm And H = 290mm **W = 350 mm** Slot size = 100mmx100mm	Width of existing were increased by 80 mm and 100 mm.
12.	Velocity of juice in clear launder	1.519 ft/sec	1.235 ft/sec	-
13.	Inner dia. Of deflector plate	**4970 mm**	**4870 mm**	Inner dia. Of deflector plate was decreased by 100 mm.
14.	Outer dia. Of deflector plate	**5770 mm**	**5870 mm**	Outer dia. Was increased by 100 mm
15.	Mud Settling Area	35M²	35M²	-

- In season 2010-2011, the clarifier No.1 after modification set for trial.
- juice flow rate was increased gradually with keen observations of technical results.
- After successful trial , clarifier No.1 taken in line for routine operation.

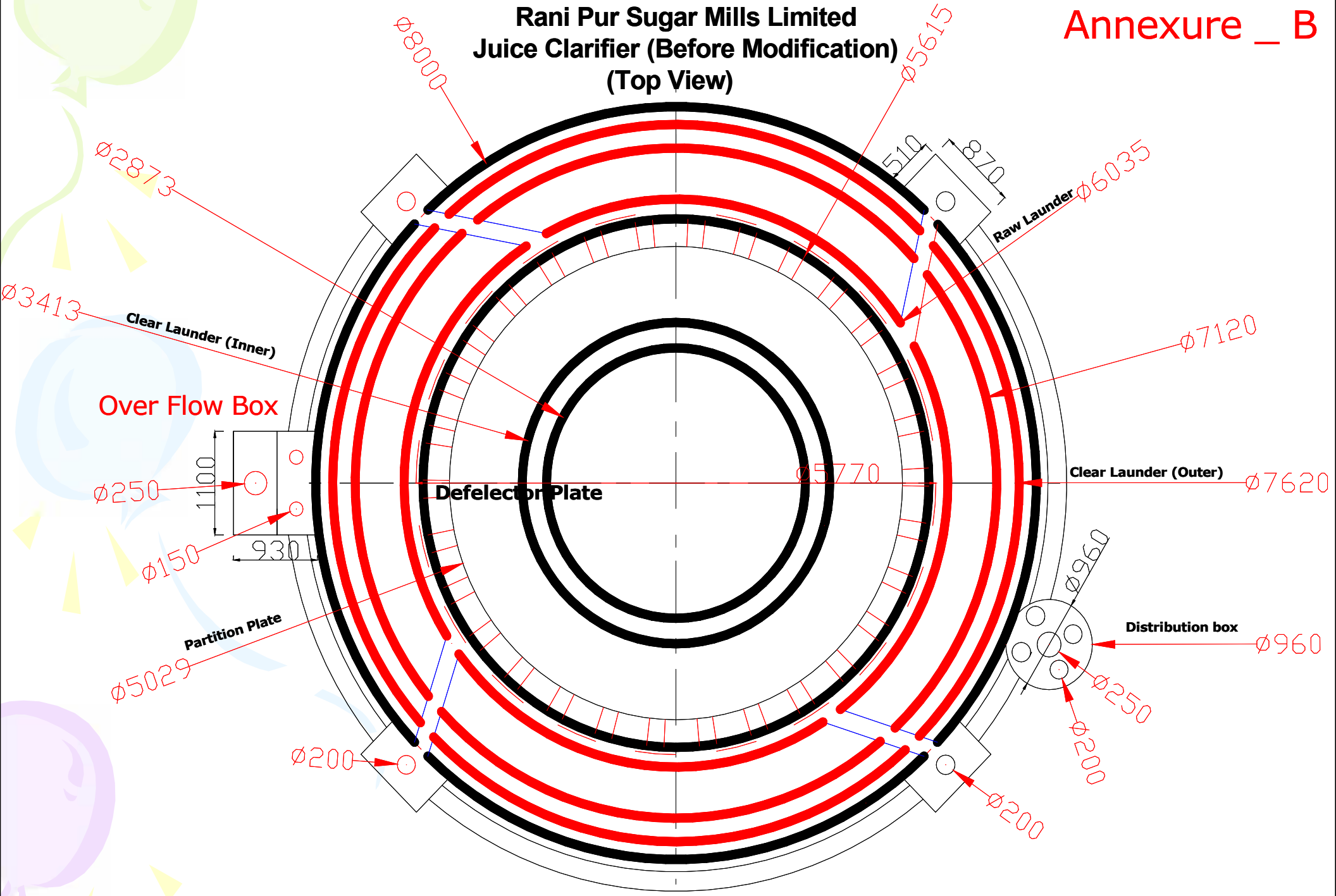
Annexure _ A

Juice Clarifier (Before Modification)
(Side View)



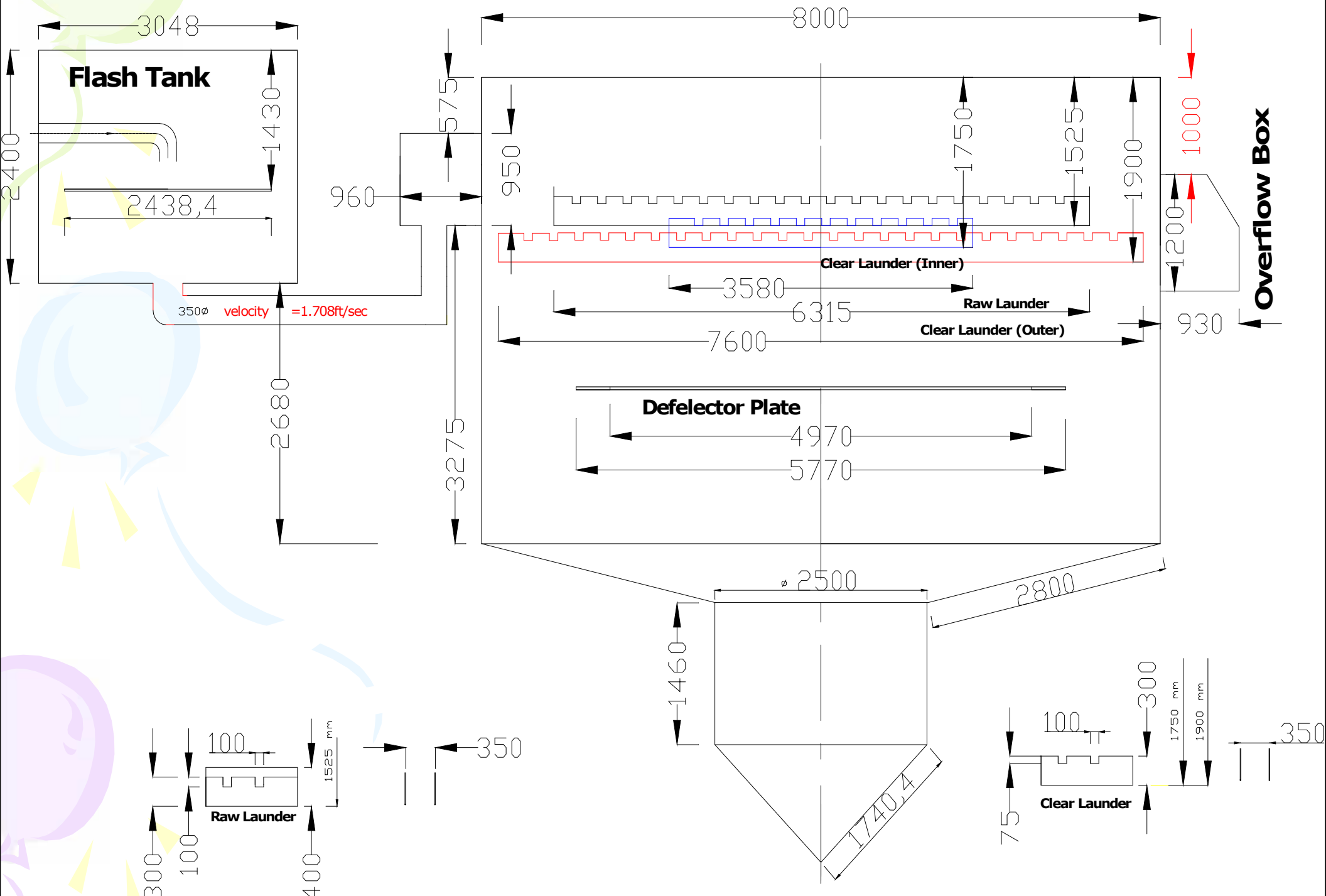
Annexure _ B

Rani Pur Sugar Mills Limited
Juice Clarifier (Before Modification)
(Top View)

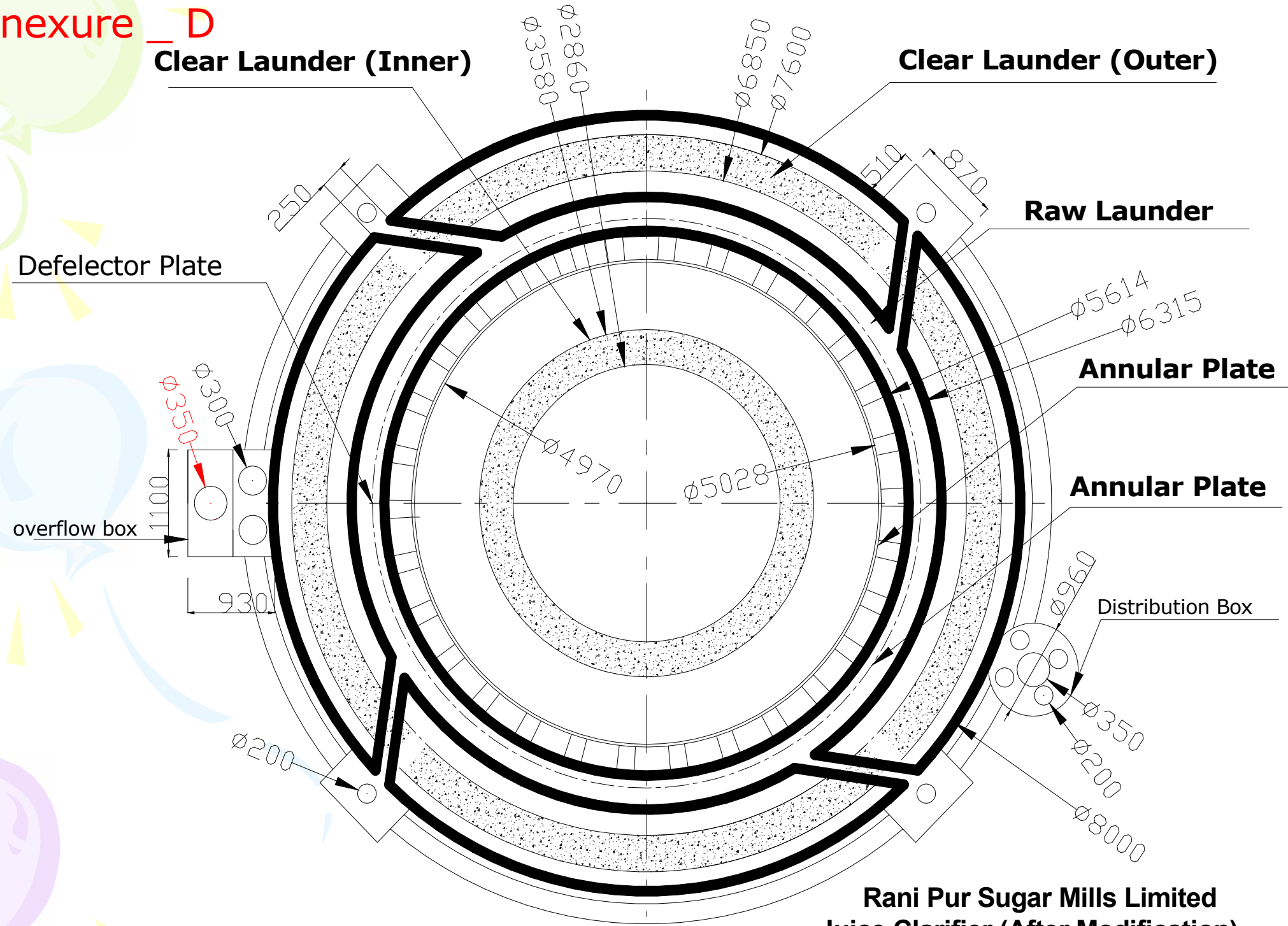


Annexure _ C

Kanpur Sugar Mills Limited
Juice Clarifier (After Modification)
(Side View)



Annexure _ D



Rani Pur Sugar Mills Limited
Juice Clarifier (After Modification)
(Top View)

Laboratory Data

Comparison of total Slid load at Juice Clarifier

Table No.2

S. No	Particulars	Season 2009-2010 (with Two Clarifiers)	Season 2010-2011 (with single modified clarifier)	Season 2011-2012(with single modified clarifier)
1.	Juice Flow Rate	160 M^3/Hr	180 M^3/Hr	200 M^3/Hr
2.	Imbibition % fiber	192	220	250
3.	Total solid Load at clarifier	**13.152 Tons/Hr**	**14.11 Tons/Hr**	**14.79 Tons/Hr**

Comparison of results.

Table No.3

S. No	Particulars	Season 2009-2010 (with Two Clarifiers)	Season 2010-2011 (with single modified clarifier)	Season 2011-2012(with single modified clarifier)
1.	Purity of clear juice	78.62	78.59	78.69
2.	Purity of Syrup	78.99	78.81	78.76
3.	**Purity rise in syrup**	**0.3786**	**0.222**	**0.0744**
4.	Reducing sugar in Clear juice	0.673	0.602	0.731
5.	Reducing sugar in syrup	3.245	2.894	3.492
6.	**Consumption of polyelectrolyte (ppm)**	**4.30**	**4.47**	**4.45**
7.	**Clarification Effect**	**8.52**	**9.37**	**9.45**
8.	Lime consumption % Cane	0.064	0.061	0.064

Comparison of final molasses characteristics.

Table No.4

S. No	Particulars	Season 2009-2010 (with Two Clarifiers)	Season 2010-2011 (with single modified clarifier)	Season 2011-2012(with single modified clarifier)
1.	Final Molasses Production %cane	4.68	4.45	**4.42**
2.	Purity of Final Molasses	32.87	31.81	**31.77**
3.	Reducing sugar in final molasses	14.85	13.97	**13.06**
4.	Loss of sugar in final molasses	1.36	1.26	**1.24**

Results and Discussions

1. After carrying out modifications, retention time of juice decreased from 87 minutes to 50 minutes at same crushing rate.

2. Clarifier No.2 remained as standby through out the seasons. Cleaning of clarifier No.1 become possible without taking any mill stoppage.

3. After modifications, single clarifier operated successfully at 11% more total solid load and gave best results.

4. Purity rise in syrup than clear juice after modification is lesser, which indicates lesser inversion rate in clarification, as shown in Table No.5

Table No.5 *

Retention time in minutes	Clarified juice pH (measured at 20°C)		
	6.70	7.0	7.30
180	0.83	0.42	0.21
40	0.19	0.09	0.05

* ***Sucrose inversion losses in clarifiers in g per 100g sucrose in juice (cane sugar engineering by Dr. Albert Barten page 236)***

Results and Discussions

5. Maintainability of RS levels in syrup is more accurate after the modification then before modification.

6. The consumption of polyelectrolyte enhanced by 0.15 - 0.17 ppm after modification then before modification of clarifier. But the cost of enhanced consumption of polyelectrolyte is negligible as compare to saving in sugar due to lesser inversion rate.

7. Clarification effect improved by 0.58% to 0.93 %.

8. Final Molasses production % cane decreased by 0.23 % to 0.26 %cane.

9. Due to lesser inversion rate in clarification, less viscosity was observed during season 2010-2011 and 2011-2012 (after modification), resulted better exhaustion of molasses. That impacted on lesser final molasses purity by 1.06 to 1.10 then season 2009-2010 (before modification).

10. Reducing sugar levels reduced in final molasses after modification by 0.88% to 1.40%.

11. After modification of juice clarifier, loss of sugar in final molasses decreased by 0.10% to 0.12 % cane.

Conclusion;

The practical evidences and available Laboratory Data revealed that after modification of the juice clarifier No.1 (modified FCB), Ranipur Sugar Mills could cope up its crushing by taking only single clarifier in line and got success in reducing retention time in juice clarification.

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THANK YOU