Steam Jigging System, A Sure Way To Increase Batch Pans Performance.

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Abstract.

Circulation in Massecuite boiling pan is the most important parameter, determining efficiency and capacity of the pan, especially for batch pans. Natural circulation is caused by buoyancy effect and has its limitations. To increase Massecuite circulation assistance is provided, by mechanical circulator or jigging steam system, thus to improve pans performance and capacity. Steam jigging system is a common and essential component of continuous pans. It equally works well for batch pans with substantial benefits. We at Mehran Sugar Mills Limited provided steam jigging system to all the batch pans, including A, B, C & Refine pans. The results were very encouraging. Circulation is improved through a combination of the rising bubbles and the increased heat transfer that results from the increased velocity of massecuite through the tubes. The jigger system offers benefits to the pan's performance throughout the entire pan cycle. The installation of the jigger system shows substantial performance improvements including reduced calandria pressure, improved heat transfer coefficients, increased circulation velocities, shorter batch pan cycle times and production of massecuites at higher brix. Additional advantages of the steam jigging system include relatively cheap and low maintenance, reduced need for balance water and the use of surfactants, and the pipe-work system does not block with massecuite.

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Introduction.

- At MSM batch pans capacity has been increased to meet 11,000 tcd crushing with same number of pans. Previously it was difficult to meet 9,000 tcd.
- There were various factors which contributed for this achievement;
    - Increased vapor pressures.
    - Automation of Refine Pans.
    - Improved massecuite circulation due to the Steam Jigging System.
- Massecuite circulation in pan is the most important parameter determining the capacity of the pan.
- Most of the batch pans in Pakistan are central down take with flared shell above the calandria, low head pans. Certainly these are the most inefficient design of the pans.

"Conical enlargement (flared pans) was largely discredited after a negative effect on circulation was recognized (van der Poel et al., 1998)"

"Numerous comparisons have shown that straight-sided pans perform better than "low-head conically-enlarged" pans (Chen and Chou, 1993)".

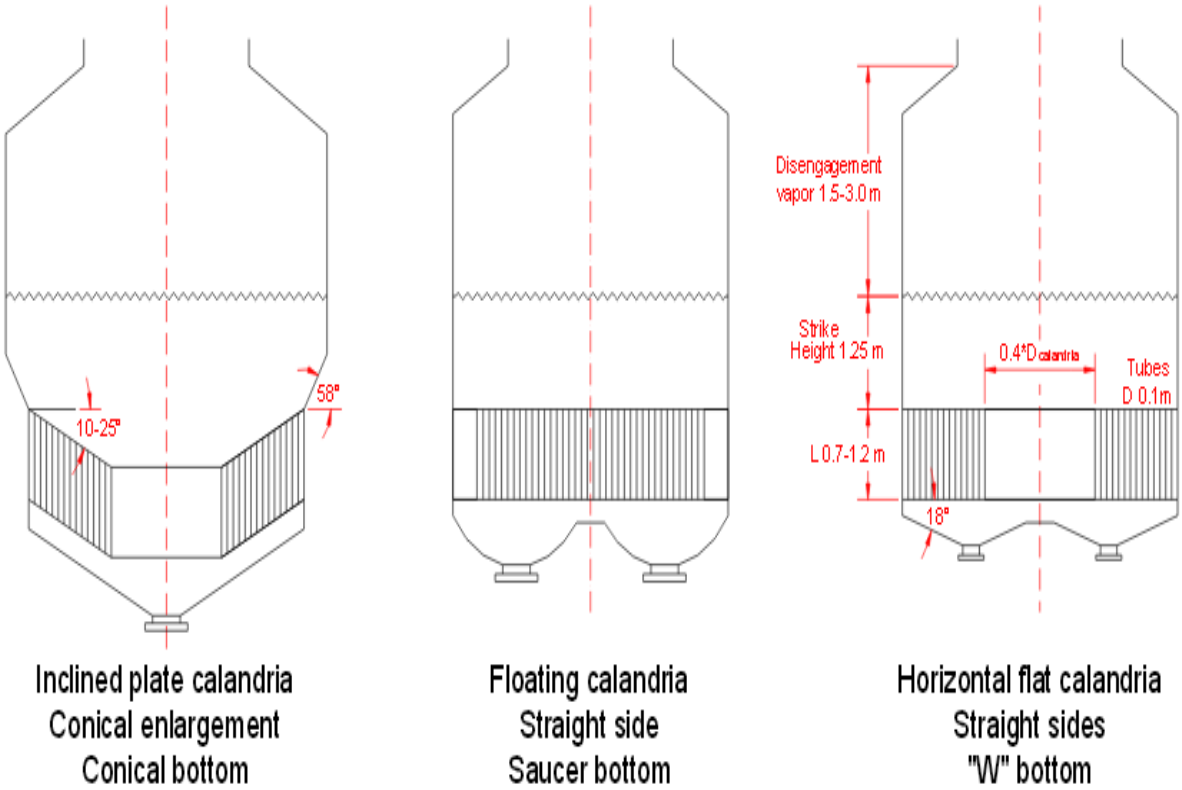


Figure 1. Vacuum pan designs.

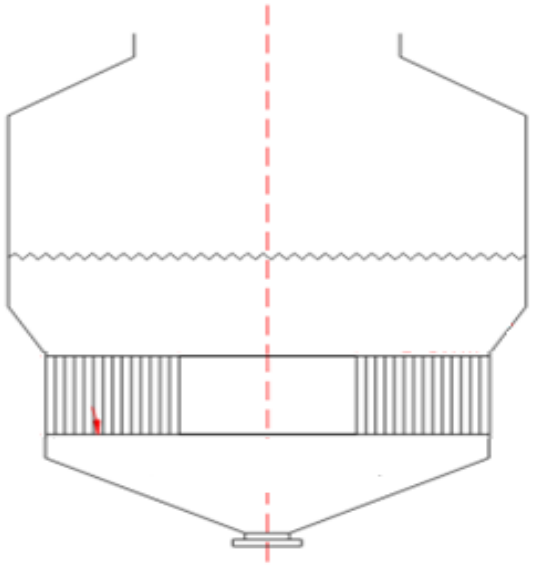
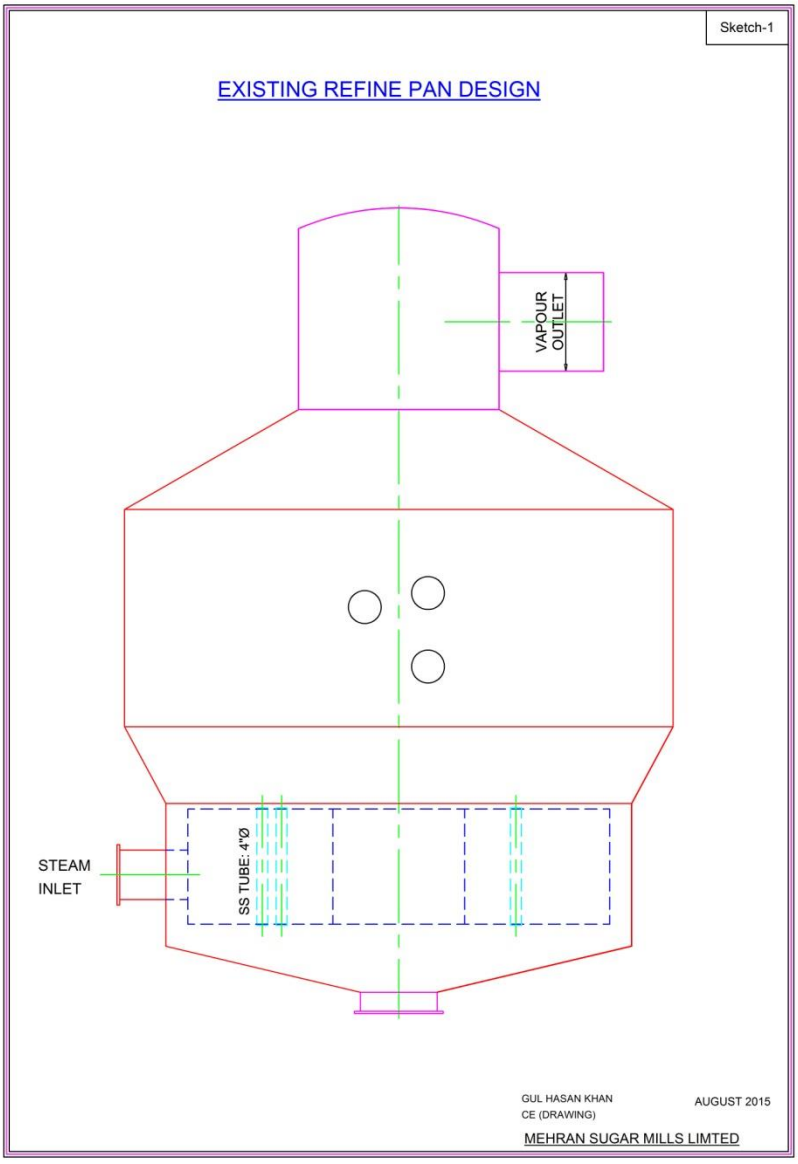


Fig-2, above.

- Some of the common designs of pans are shown at Fig-1 & Fig-2. At MSM we have flared shell pans, central down take for raw and floating calandria with central down take for refine, see pic-1.


Sketch-1
EXISTING REFINE PAN DESIGN
VAPOUR OUTLET
STEAM INLET
SS TUBE: 4"Ø
GUL HASAN KHAN
CE (DRAWING)
AUGUST 2015
MEHRAN SUGAR MILLS LIMTED

Pic-1, above

- To increase pan's capacity it was decided to assist massecuite circulation by jigging steam system.

Steam Jigging System.

"The installation of a spurge pipe under the calandria to blow low pressure steam to assist the circulation, reducing the massecuite specific gravity in the calandria and reducing the effect of hydrostatic head. The simplicity, low cost and absence of moving parts of this alternative make it particularly straight forward to put into practice. Venting of incondensable gases into the jigger arrangement can be done to reduce the consumption of vapor".

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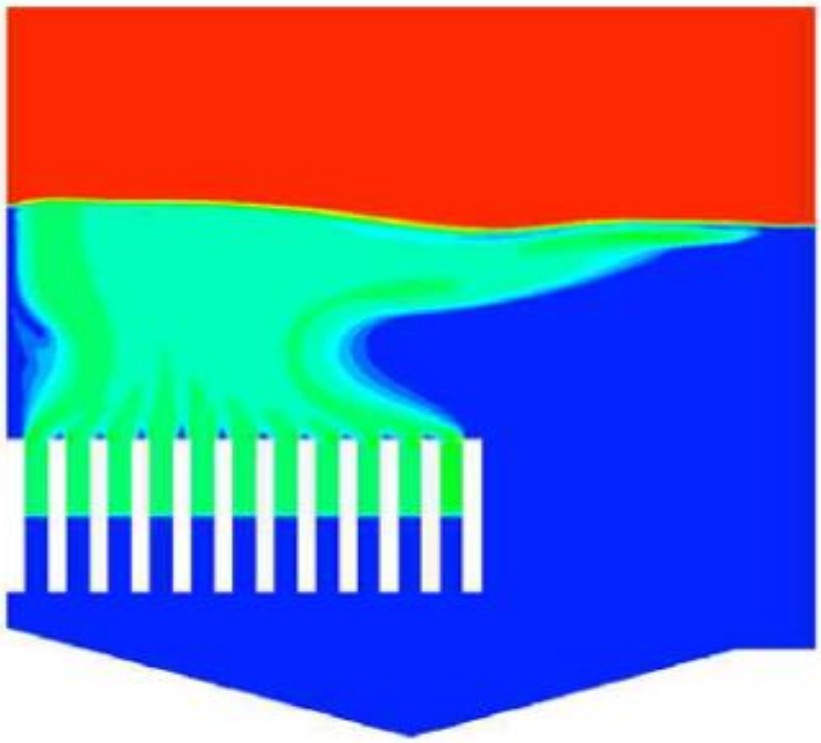


Fig (a) above, Pan without steam jigging system.

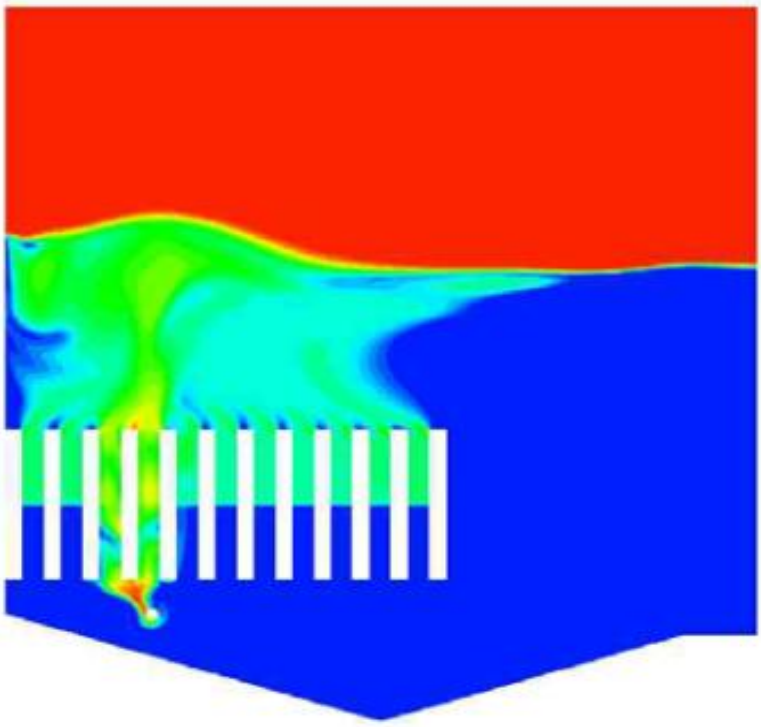
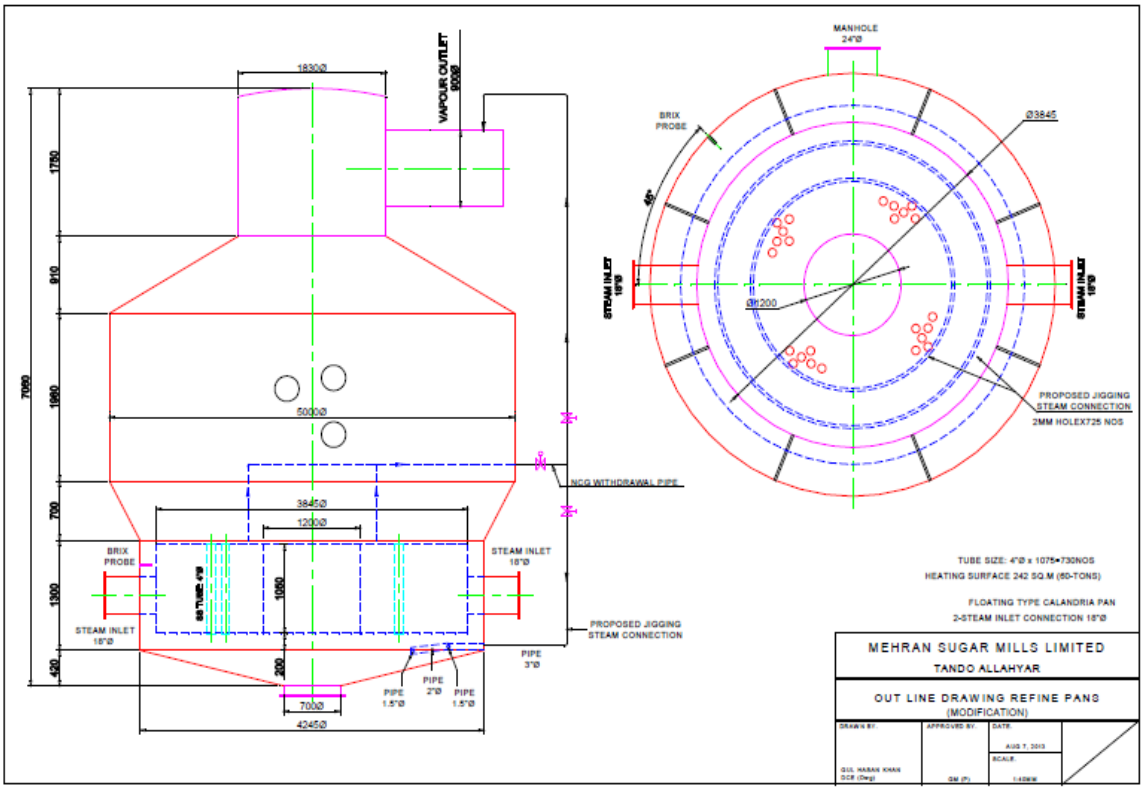


Fig (b) above, Pan with steam jigging system.

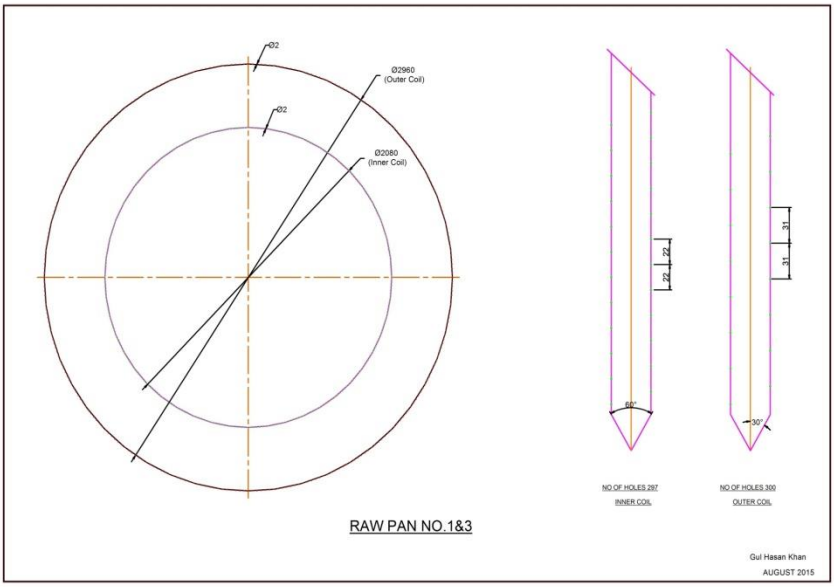
Steam Jigging System at MSM.

1- Batch Pans.

At MSM double coil jigging system provided at all the raw and refine pans. Two coils, having 725 number holes of 2mm in each coil, were placed below the calandria and about 75mm above the bottom plate of the pan. Coils were made from used tubes of juice heaters having 36.5 mm inside diameter. Non condensable gases were used for jigging steam, NCG arrangement is described at pic-2a, 2b, 2c, 2d & 2e for details. As the NCG were used for jigging, which facilitated the complete removal of NCG, thus pan performance not only increased due to better circulation but also due to better heat transfer. The results were very encouraging and are discussed at the end of this paper. Due to the improved pan performance we operated all the 4 batch (C & B grain) pans with 2^{nd} vapor, this is important considering that we are operating quadruple effect evaporator sequence, where use of 2^{nd} vapor for batch pan is bit difficult.



Pic 2a, above.



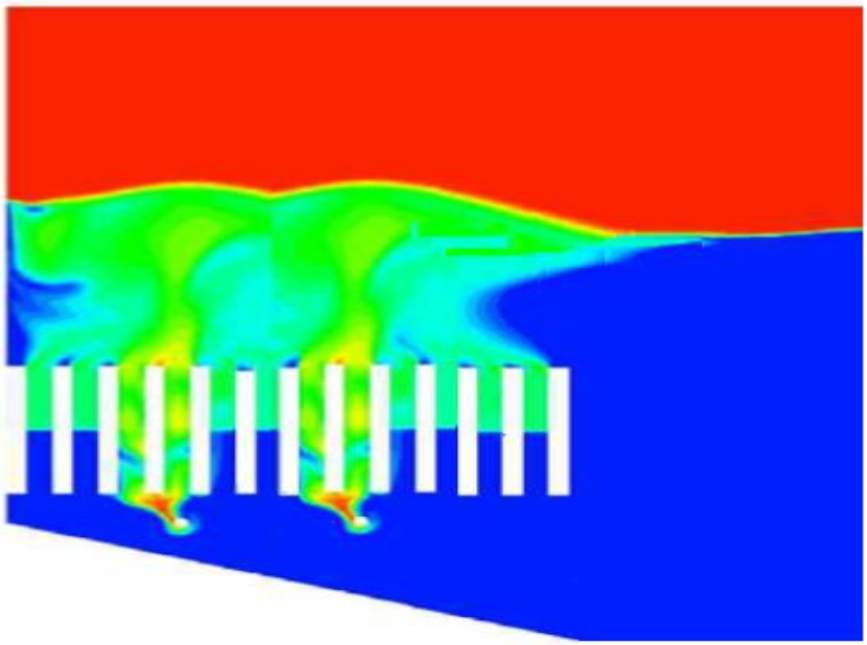
Pic 2b, above

Pic 2c, above

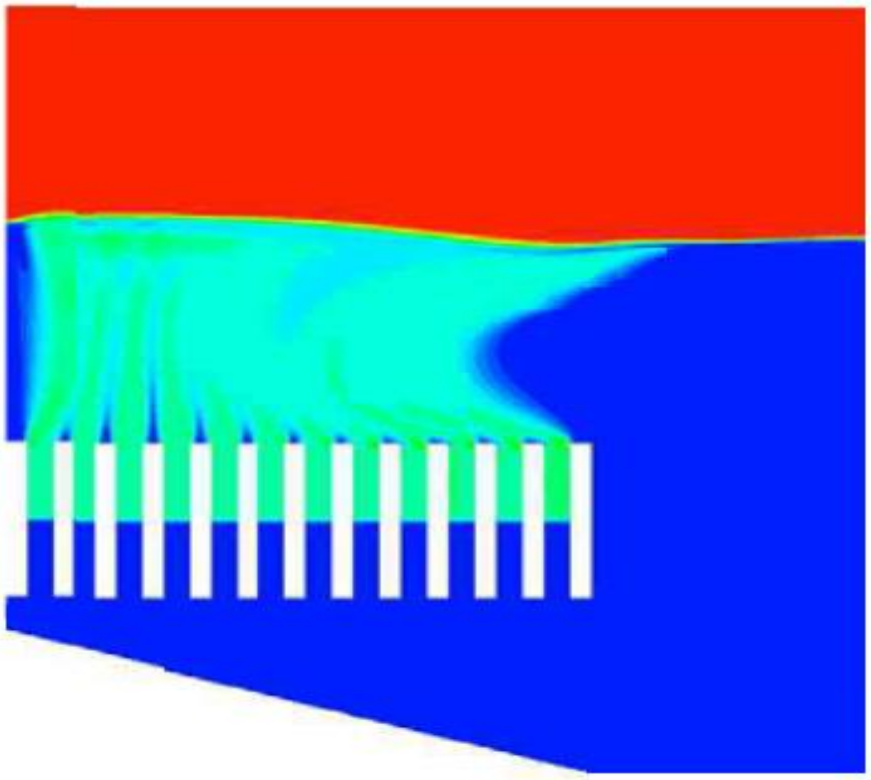
Pic 2d, above.

Pic 2e, above.

After introduction of Steam Jigging System massecuite circulation improved a lot. Following pics 3a & 3b shows the momentum of circulation with & without steam jigging system;



Pic 3a, above

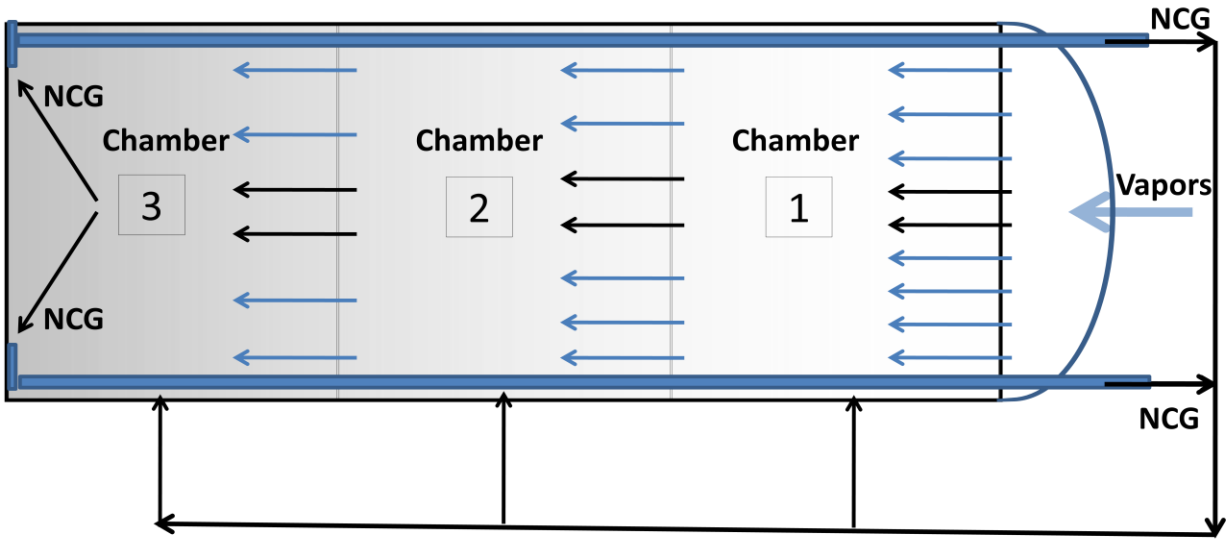


Pic 3b, above

Continuous Pans.

MSM have two continuous pans, one for B & one for C massecuite boiling. 1st vapors were used for jigging system. This has been replaced with NCG gases of calandria 2nd vapor. Usually 01 % vapors flow of pan is required to be vented for proper removal of NCG, this amount to 0.12-0.18 t/h for Conti pans. Whereas for jigging, vapors requirement is about 1.5 to 2.5 t/h @ 15 to 25 kg/m³-h of massecuite. As the quantity of jigging steam is about 14-20 times of NCG removal, hence use of NCG, for jigging, removes more NCG and considerably reduces the concentration in the farthest chambers of the Conti pan, thus improving the performance of these chambers along with steam economy.

NCG removal and its arrangement for use as steam jigging system is described at pic 4a & 4b.



Pic 4a, above

Pic 4b, above.

Results & Discussions

Performance of Jigging assisted pans increased in terms of;

- Lower boiling time, thus more strikes/day.
- Increased volume/strike.
- Higher brix of massecuites.
- Steam economy due to the replacement of 1st vapors with 2nd for C & B Grain pans, with quadruple effect evaporator sequence.
- Processing capacity of pan station increased to 11,000 tcd from base case of 9,000 tcd.
- Lower final molasses pty, this is important to note that losses reduces even crushing rate was increased by about 22 %.
- Sugar quality also improved and a fair reduction of 10 ICUMSA unit in refined sugar achieved. Details of result are appended in the following tables;

Results & Discussions

Raw Pans for A massecuite, C & B grain boiling

S.#	Description	Unit	Before Jigging System	After Jigging System
1.	Number of pans operated (Avg: 233 m² H.S/Pan)	No	12	11
2.	Bleeding vapors for C & B grain pans	-	1st	2nd
3.	Cane crushing	Tcd	9,000	11,000

Results & Discussions

Molasses Pty & Bagasse Saving

S.#	Description	Unit	Before Jigging System	After Jigging System
1.	Final molasses pty	Pty	33.65	33.34
2.	Steam % Cane	%	56.80	53.03
3.	Fiber % Cane	%	14.09	13.73
4.	Bagasse Saving	Tons	10086	18016
5.	Bagasse Saved % Fiber (Fiber % cane reduced to14.0 %)	%	**7.27**	**17.83**
3.	Cane crushing	Tcd	9,000	11,000

Conclusion

Steam assisted jigging system is a sure way to improve batch pan performance and enhancing capacity of this station with added benefits of reduced final molasses losses and improved sugar quality. Further, use of NCG for jigging steam also improves pan performance, by reducing concentration of NCG in pan vapors, this effect is more pronounced in conti pans.

Acknowledgment.

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Reference;

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