Journal of Engineering Sciences
Vol 11, Issue 6,June/2020
ISSN NO:0377-9254

Thermal Sand Reclamation

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Abstract:

The main idea of the paper is to reduce PNG (Pressurised Natural Gas) consumption, overall cost reduction. This process can be carried out by eliminating several cooling components further mentioned in the paper. The high temperature sand is directly used into the Reclamation tower for cleaning, filtering and separation process of MR Sand. Thus, this MR Sand can be used for further processes. To maintain the temperature of excessive MR Sand that is stored, several changes to silo are mentioned.

Keyword: PNG, Reclamation Tower, MR Sand, Silo, Pressure vessel Conveyor.

Introduction:

Sand is an important aspect of the foundry industries. From recent years the foundry industry has been leaned towards reclamation of sand for reuse. Several problems are faced by the industry, mainly one of it is not obtaining required amount of sand that is to be used for the casting process. Mainly this sand is used for moulding and core making process. Some other problem faced by the foundry industries are, storage of sand used for this process.

The main basic reason of sand reclamation is to maintain economical, technical and environmental aspects. Through this reclamation process the main aspect regarding economical expense can be reduced Such as buying and transportation of huge amount of sand as well as the discharge cost.

There are several miscellaneous expenses as well such as unloading and loading, labour cost, transportation charges to the dumping centres as well as environmental penalties included.

Environmentally, the difficulties for disposing the sand used for the casting that too in excessive quantity of material in barren land. Several chemicals are sometimes disposed into the ground along with the sand that discharges/secrete harmful fumes in the environment. This can cause harmful environment for population around the dumping sites as well as several residents surrounding such foundry industries. Reclamation of sand can reduce such effects on the environment.

Technically, through reclaiming of sand for casting can be beneficial for the better quality of casting as well as it reduces the screen process also called quality check of the sand that is to be used for casting. Thus the sand used after reclamation process can be as pure as being used initially.

Main aim of the sand reclamation plant is to process used foundry sand at a maximum yield and return the sand in such a state as to be suitable for the reuse with any combined system with least defects on the casting that also in return will be beneficial economically. The expected approach towards sand reclamation is to obtain the similar grade/quality of sand as obtained initially, reduce residual binders and contaminants as highly as possible, and return the sand at an acceptable temperature.

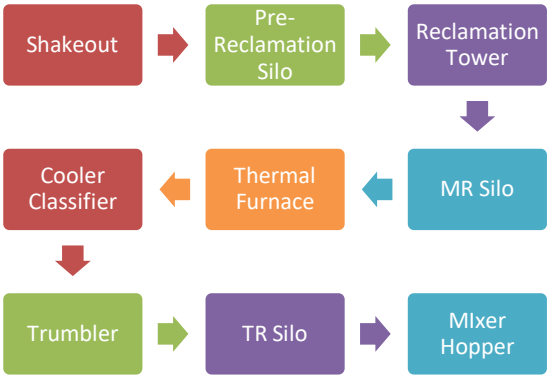
Reclamation and its types: Reclamation as per American Foundry Standard 4S-sand reclamation and Re-Use Committee is: The Physical, The chemical or thermal treatment of a refractory aggregate to allow its re-use without significantly lowering its original useful properties as required for the application involved.

The primary and secondary grades:

- Primary reclamation has several techniques such as vibration, rotation or blasting.
- Secondary reclamation includes process to remove the residual binders formed due to casting process.

Through this processes the sand reclaimed is similar or better in quality than initial or the new sand.

General process of Sand Reclamation: There are several common process for reclamation of sand, mainly there is a common process followed by several foundry companies.



[Fig.1 Process Flow Chart]

Here is shown the common layout of several companies

Firstly the sand is poured into the Shakeout, from shakeout the sand is transferred to Pre-Reclamation Silo. Where the pre heated Sand is stored. MR Sand is transferred to Reclamation Tower; reclamation tower consists of Dust Section Point, Magnetic Separator and Tray for Filtering, etc. With the help of PV Conveyor the MR Sand is transferred from Reclamation tower to MR Silo. The process continues through MR silo to Thermal Furnace and proceeds further

Secondly, Sand is transferred to cooler classifier where temperature is dropped. Then the process is passed on to tumbler and TR silo. Finally MR Sand is sent to Mixer hopper.

Objective: The main objective is to reduce the use of PNG consumption for heating the sand to desirable temperature. Thus to reduce the consumption several measures are to be calculated.

Some measures that have been cumulatively designed to reduce PNG consumption:

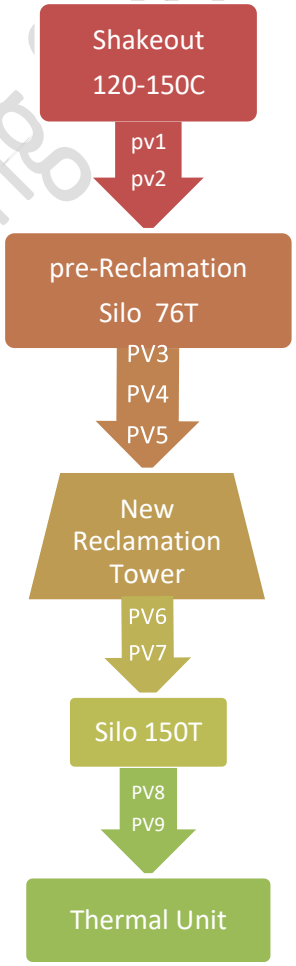
- As we have observed in working of plant 1 and 5, it was required to clean the MR Sand for mere purpose of cleaning the MR Sand and using the fraction of MR Sand to convert it into TR sand. Another enhanced process of the converser of TR sand can also be laid out as follows:

- MR Sand from the shakeout which was at 200-300 degrees temp from atmospheric temp can be passed through the new silo which only comprises of dust section point, magnetic separator and filtering tray.

- Secondly, the filtered MR sand can now be transferred to the thermal furnace skipping the infusion step of condensation and fresh sand .

- The enhancement which can be achieved via this solution is the reduction in the consumption of gas required to achieve the threshold temperature of 600 degrees in the thermal furnace.

Here, simple layout of the changes has been laid out:



[Fig. 2 Layout of Changes occur]

As per Suggested Design working of Thermal Reclamation plant:

- **AIM/IDEA**: - To use shakeout hot sand directly in thermal plant so that hot

temperature of sand can be used for PNG reduction.

- The starting process would be the same as present like the sand comes into the shakeout, but now the temp. of sand would be around 150 degree's due to not letting the sand to be cool down. Now the sand from shakeout is transferred to the pre-reclamation silo through PV1 and PV2 ports.
- Now from here the further process differs like now the hot sand from pre-reclamation silo (measured % quantity) goes to new reclamation tower through a new PV installed below pre-reclamation silo.
- Now that hot sand from silo goes to the new reclamation tower which contains dust section, magnetic separator & tray for filtering of hot sand so that MR sand gets cleaned and also temp doesn't go down.
- From here, the hot MR sand is transferred to the new silo for storage of hot sand which contains exothermic liners layer around the silo on inner side so that the temp. of hot sand can be maintained & heat loss can be prevented.
- Now the hot sand is transferred to the thermal unit & further process is same as that of the present process explained previously.

Additional Requirements:

- Reclamation Tower of 15-20 TPH.
- Pre-thermal silo of 150T capacity with heat insulating material or exothermic liners layer material.
- Transport vessel for conveying hot sand with 700ltr. Capacities (5 PV's) with 200 degree's withstand capacity sensors.

Conclusion:

As mentioned changes if followed, there can be several observable reductions in the consumption of PNG as well as making the process economically efficient.

Saving of PNG by using hot input sand of shakeout:

Avg. input sand temp.	35 degree's
PNG budget	31.26 scm/ton.
1st zone set temp. (BT1 & BT2)	550 degree's.
New hot sand input temp.	150 degree's.
Reduction of temp. of input sand	150-35 = 115 degree's.
Last zone set temp.	650 degree's.
Actual thermal running capacity	4TPH
Actual saving of PNG	(3.1+3.2+2.7+3.3+3.1)/4 = 15.4/4 = 3.85 scm/ton.
Cost of PNG	32.5 Rs/scm.
Saving of PNG	3.85*32.5 = 125.125 Rs/Ton.
Saving per month	0.9634 Lac/month.
Saving per year	**11.56 Lac/year**.

As per new design PNG consumption will **decrease 3.85 scm/ton**. Therefore, 3.85 scm/ton of PNG reduction can be done.

Hence, it can be concluded that as per new design (additional design) in thermal plant we could be able to do reduction in PNG consumption per ton by **12.3%.**

Acknowledgement:

The motivation behind developing the thermal sand reclamation process and its key feature for reduction of the consumption of PNG. This research undertook under the guidance of **Prof. Mudit Saxena** who provided the insights and helped us with their knowledge. The team worked on different areas of the research which helped in yielding the best results.

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