



Steam



Specialist in process efficiency & energy conservation

Reaching World Class Levels of Steam consumption

What do Indian paper mills need to do ?

A decorative graphic consisting of a grid of squares on the left, transitioning into a wavy, ribbon-like shape on the right. The word 'Steam' is written in a large, light blue, sans-serif font across the center of the graphic.

Steam

- Datta Kuvalekar

Overview of session



- Definition of What's concept of World Class levels of Steam consumption?
- Observations on Current Situation
- Factors Affecting Steam consumption
- What Should be the approach of Indian mills ?
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Whats Really World Class ?

A large graphic with the word 'Steam' in a light blue, sans-serif font. The background of the graphic is a mix of a blue and white checkered pattern on the left and a blue wavy shape on the right, all set against a background of white steam or clouds.

Steam

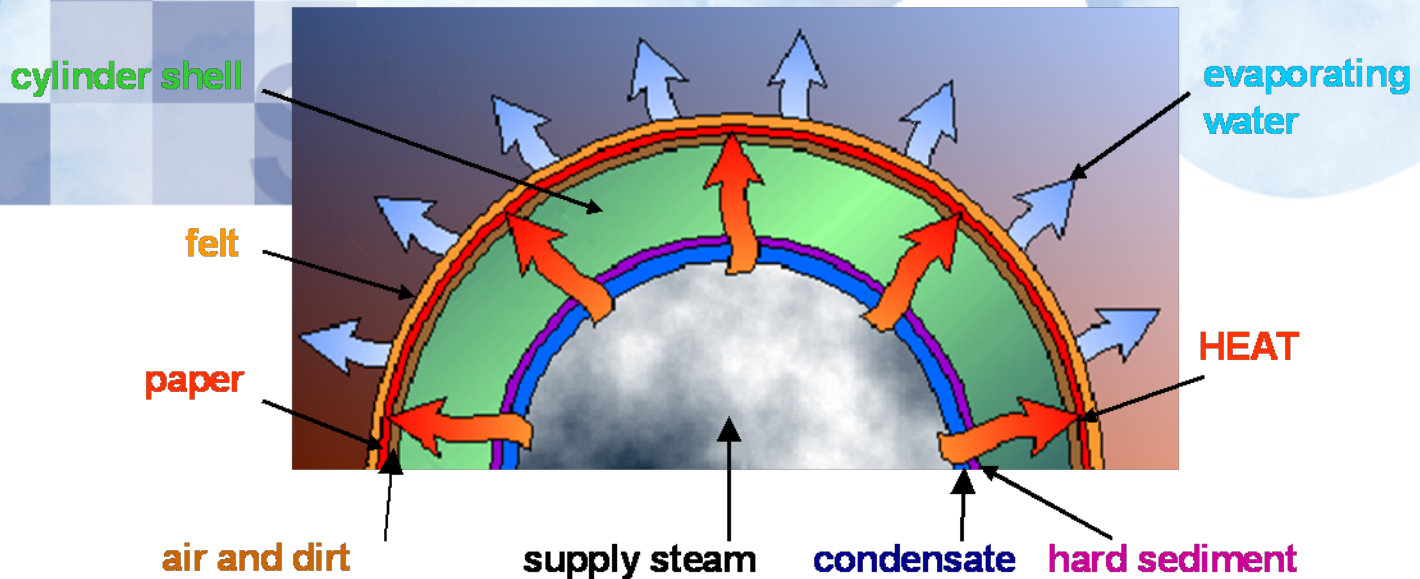
- Close to theoretical predictions ?
- Close to TAPPI number of 1.3 kg /kg of H₂O
- Or is there no such concept ?
- Or a number for every Machine ?

Observations on Current Situation ?

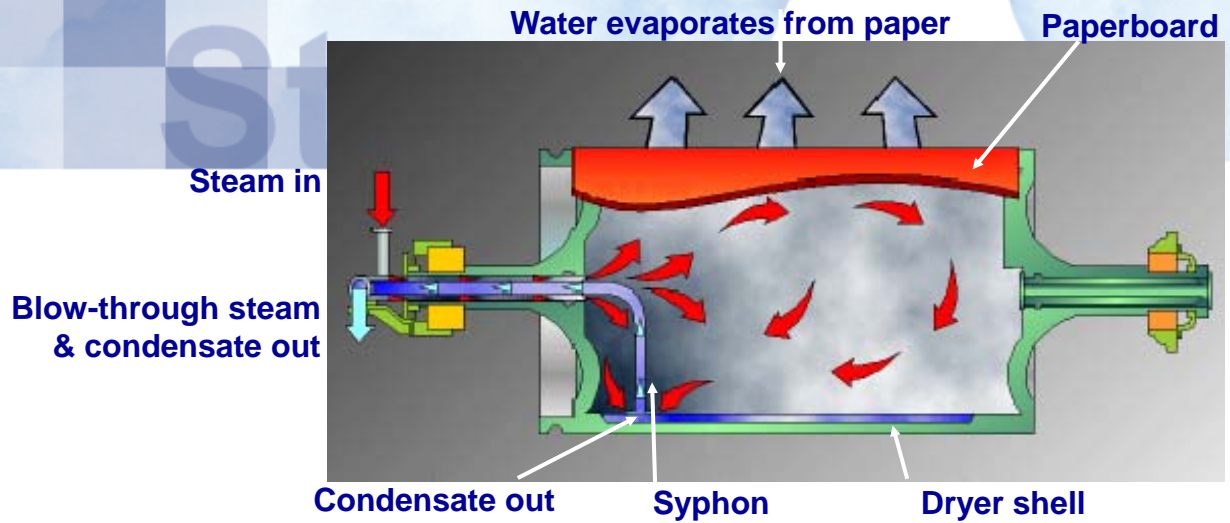
- Many Machines do not accurately report steam consumption
- Specific steam consumption per kg of finished paper is generally known or assumed
(Varies between 1.4 to 4.5 !)
- The practice of measuring the steam consumed per unit water evaporated is still not widely prevalent
(Varies between 1.35 to 1.85)
- There are different perceptions of whats possible to achieve !
- The Net Heat required per unit water evaporated is quite some distance away.
- Steam demand in paper machines is still a less understood , but widely talked about topic.
- It is not one BIG thing that will change the number--- But several small things.

Key to lower steam – Enhancing Heat Transfer in and around drier !

- Its an indicator of efficient drier operation and Heat Transfer
- Helps assess Drying capacity



Various Aspects of the drier



The Heat Transfer Equation

The heat transfer from the steam to the paper can be expressed by means of the formula:

$$Q = U \cdot S \cdot (T_s - T_p)$$

- Q: Flow of heat
- U: Coefficient of heat transfer
- S: Drying surface
- T_s: Temperature of the steam
- T_p: Temperature of the paper

The most important factor affecting heat transfer :

- the thickness of the layer of condensate
- Cylinder wall thickness
- The layer of air between the dryer and the paper
- Properties of the paper
- Dirt
- Incondensable gases
- Superheated steam

Condensate – The Main Bottleneck in Drying rate

Condensate is a barrier to heat transfer and hence should be minimised

The thickness of the condensate inside the dryer depends on:

- The quantity of condensate
- The rotation speed
- The condensate drainage device.
- Amount of blowthrough steam
- Dissolved Air circulation

Condensate behaviour depends on the velocity of the cylinders and the Condensing rate.

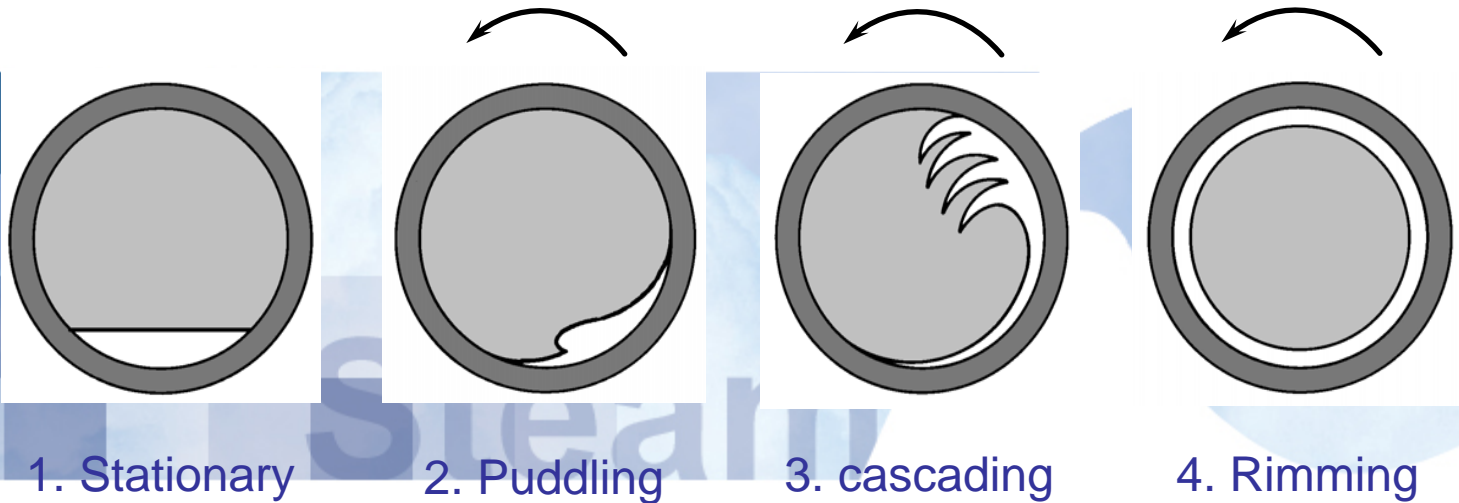


Fig. 1
Steam in dryer, but no rotation. Condensate shown in blue colour at the bottom of dryer.

Fig. 2
1st, Stage: Puddle. As dryer begins to move up dryer shell. Some rimming-thin film-occurs

Fig. 3
2nd Stage: Violent cascading action occurs as speed increases and more condensate moves farther up the dryer shell. Film of rimming condensate increases in thickness.

Fig. 4
3rd. Stage: Complete Rimming. When sufficient speed is reached cascading action stops and complete rimming occurs.

Condensate –The most critical element of the smooth drier operation



- Removing Condensate effectively and continuously is key to machine runnability
- Condensate removal depends on :
 - Machine speed
 - Type of Siphon and clearance
 - Differential Pressure between steam and condensate side.
- Good Condensate removal generally leads to better heattransfer and lower steam.

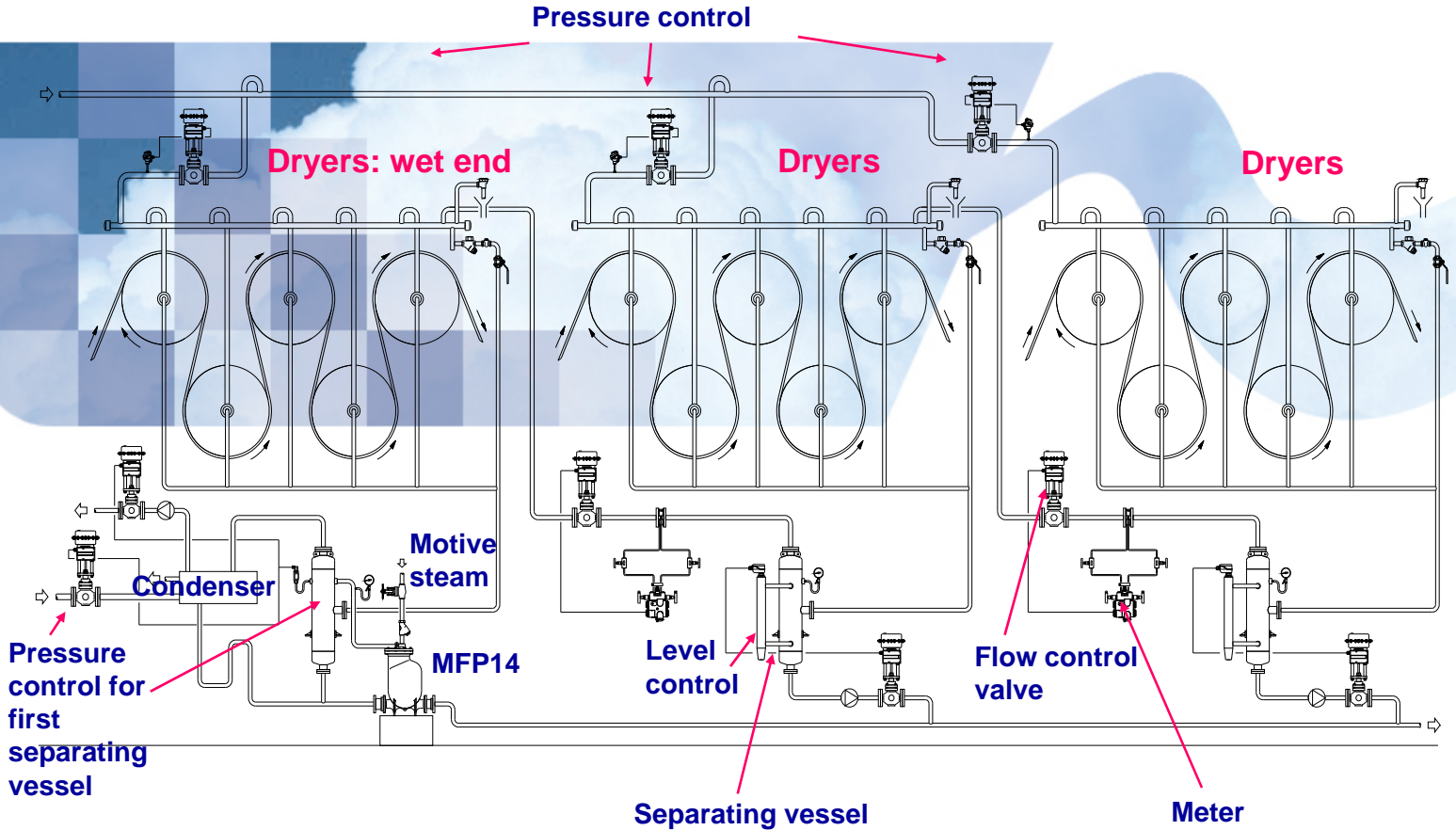
Other Factors that affect Steam Consumption

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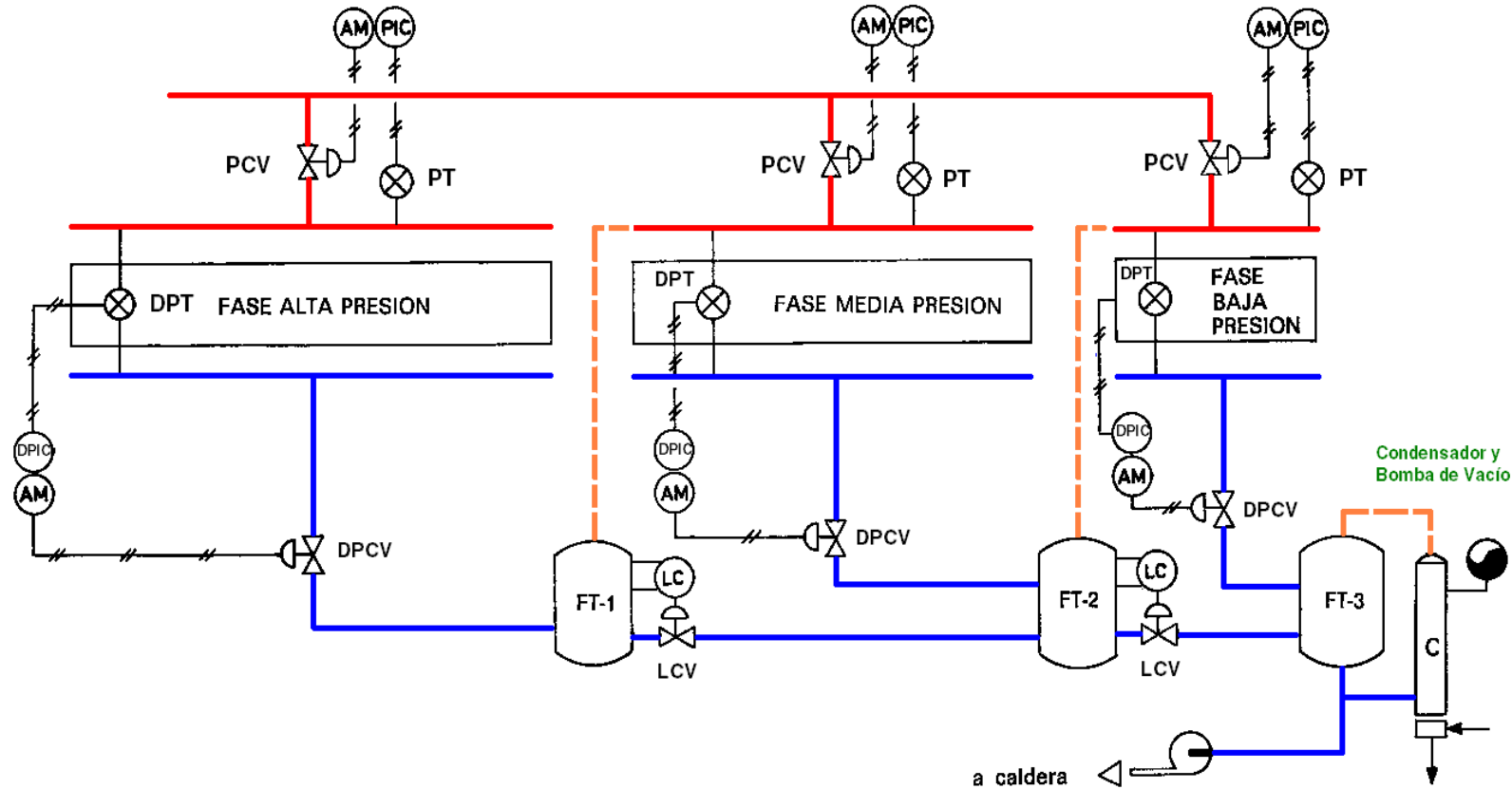
- Type of siphon and clearance
- contact of sheet with drier surface
- Felt tensions
- Thickness of Paper and internal microstructure
- Pocket Humidity
- Inside hood temperature (pocket)

Steam and Condensate system

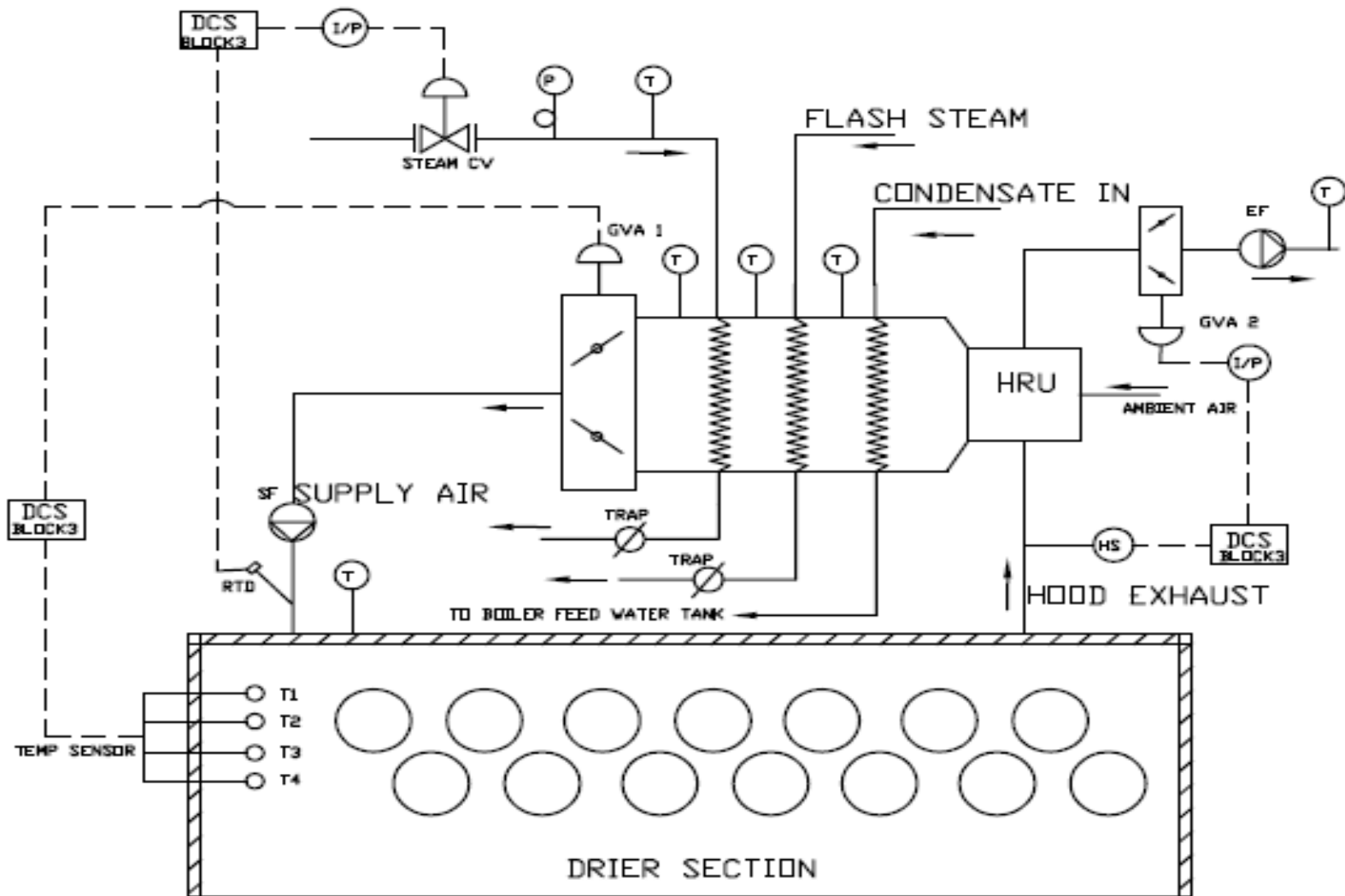


ZOOM IN FOR DETAIL

Differential pressure control– Key to condensate removal




Drying Environment control – The Automated Hood and PV system



Where do Indian Mills begin ?

- The Small Things
 - Check for leaking traps and replace immediately
 - Check Syphon tips and clearances
 - Check for Rotary Joint seal failures /leakages
 - Check for excessive DP set points
 - Check for obvious leakages
 - Check Excessive Steam pressure
 - Install Airvents and sightglasses
 - Install Steam meters. You cannot control what you cannot measure !
- The Larger things Leading to Automation
 - Control Exit moisture from Presses
 - Installing Thermocompressors
 - Control Valve and DP automation
 - Changeover to correct syphons
 - Install Drier Diagnostic systems

Conclusion

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- Steam Economy can be maximised through various Interventions
 - Condensate removal is the key element.
 - Start with measuring the Steam rate on your machine and cross check dependent parameters.

Start by making 1.3 kg of steam/kg of water evaporated as your benchmark.

Lets reach there and then probably argue on whats actually possible lower!

Thank you



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