ACC Performance Improvement

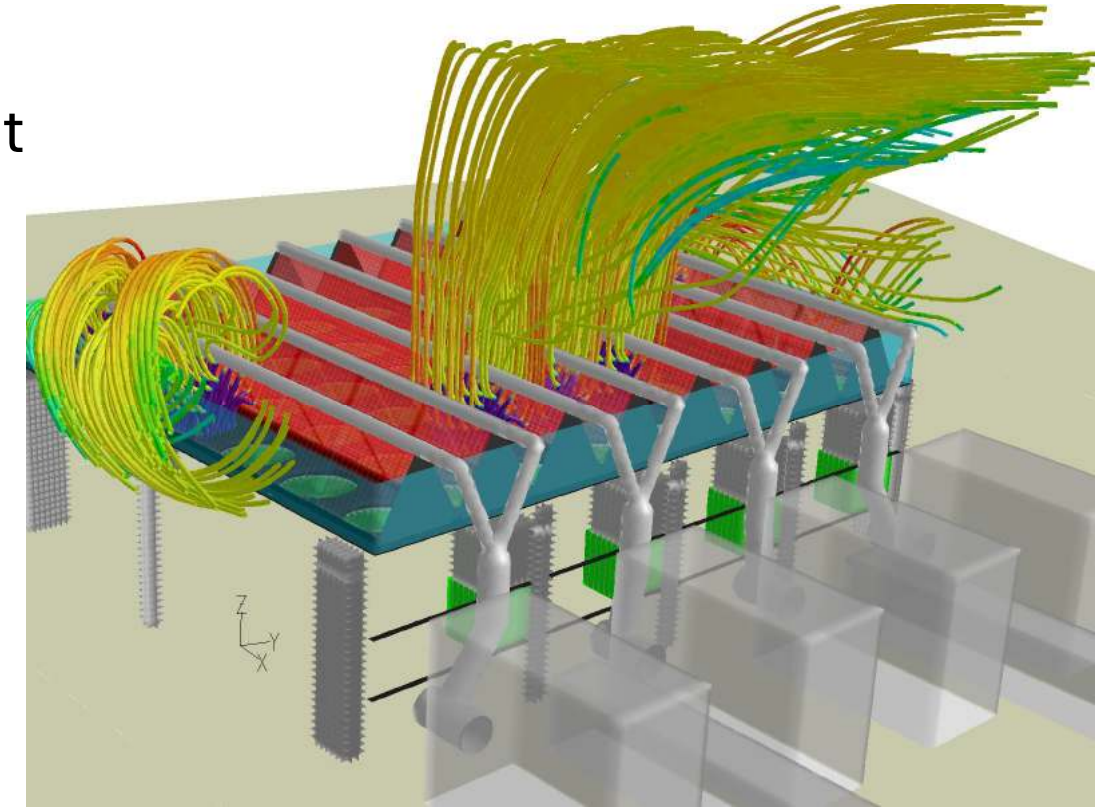
One of the most important issues Is the performance of the ACC

Good performance means high efficiency and less power

ACC Performance

Depends on:

- Heat transfer coefficient
- Quantity air
- Temperature air



What is HTC, heat transfer coefficient

- HTC – heat transfered= MTD x Heat transfer surface
- MTD = Temperature Steam in and out and Temperature air in out
- HTC is a property of the heat exchanger measured in the lab
- Values range from 25 to 38 W/KxS

Parameters that influence the performance

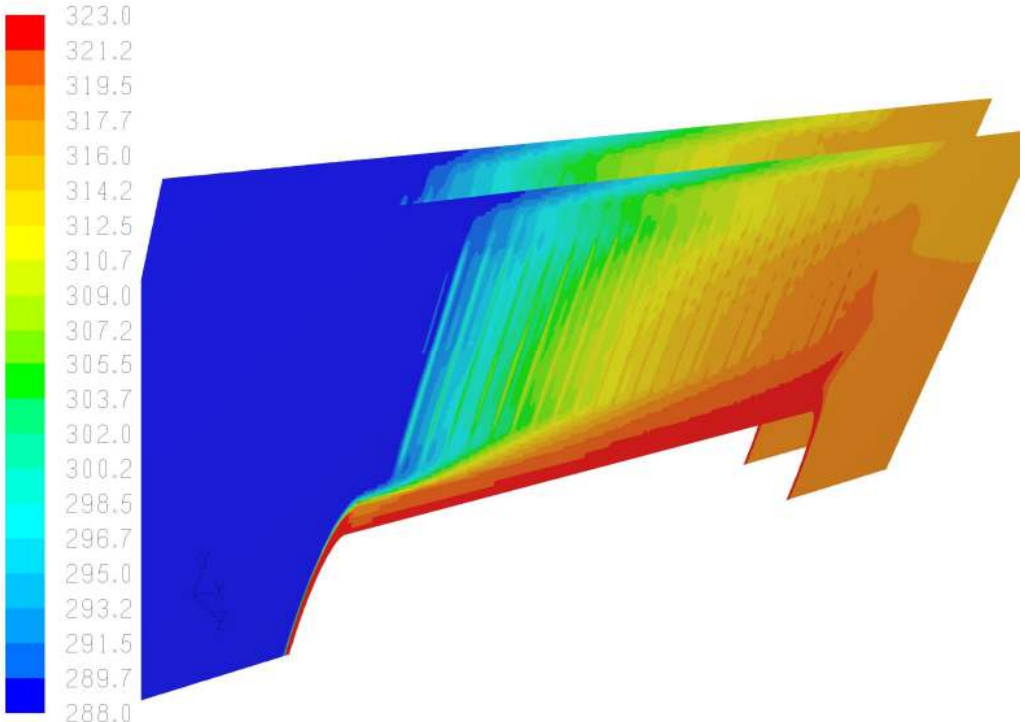
- HTC, depending on design of heat exchanger
- Air flow, depending on fan performance
- Air temperature, ambient temperature

HTC improvement.

This is dependend on the design.

Studies have shown that improvements are possible, but they have not been built.

In this study the heat
Transferred at the end of
The tube is much lower
than in the beginning.
Solution tube narrower
Less static pressure.

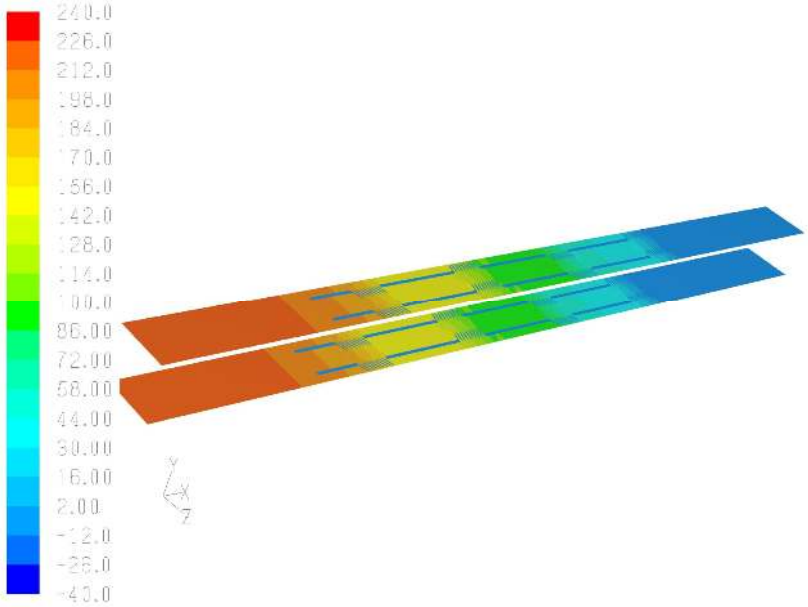


Louvres in fins

As the airflow is laminar louvres are mixing the air and give a beter Heat transfer.

This is done in the automotive industry.

Louvres give a better mix of air Temperature, however fins are Less strong



Air flow improvement

This is depending on the fan performance.

Factors that influence the performance are:

- Fan design
- Fan speed
- Motor Power
- Blade angle

90% of all fans have problems with the above.

How to optimise fans.

It is important to determine the setting of the fans.

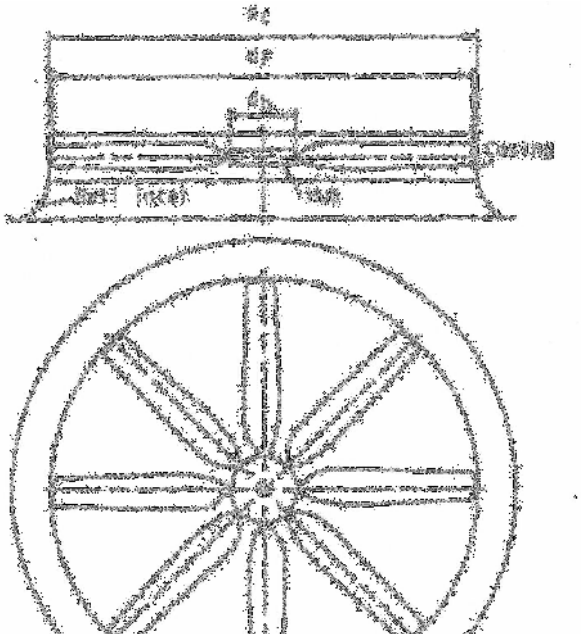
This to determine where improvements are possible.

The fan suppliers can give the tools, based on measurements of the present situation.

What must be measured:

- Fan speed
- Blade angle
- Power
- Air flow.

With this data the fan can be analised so improvements to be made.



Air flow optimisation

Fan speed, must be above a certain level to avoid stall, 32 m/s

Blade speed is considered a minimum, depending on the available power

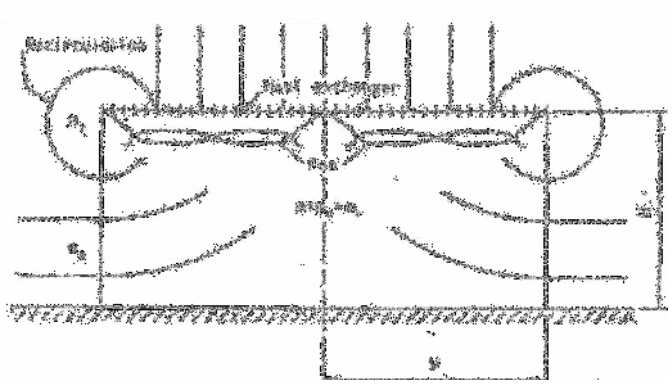
Power absorbed should be 80% of the maximum motor power

- 10% loss by motor and gearbox
- 10% due to higher air density during winter

Inverters could be set higher as they can be programmed

- not to go above the maximum power level.

Airflow measured as per ASME to check if the right fan is used.

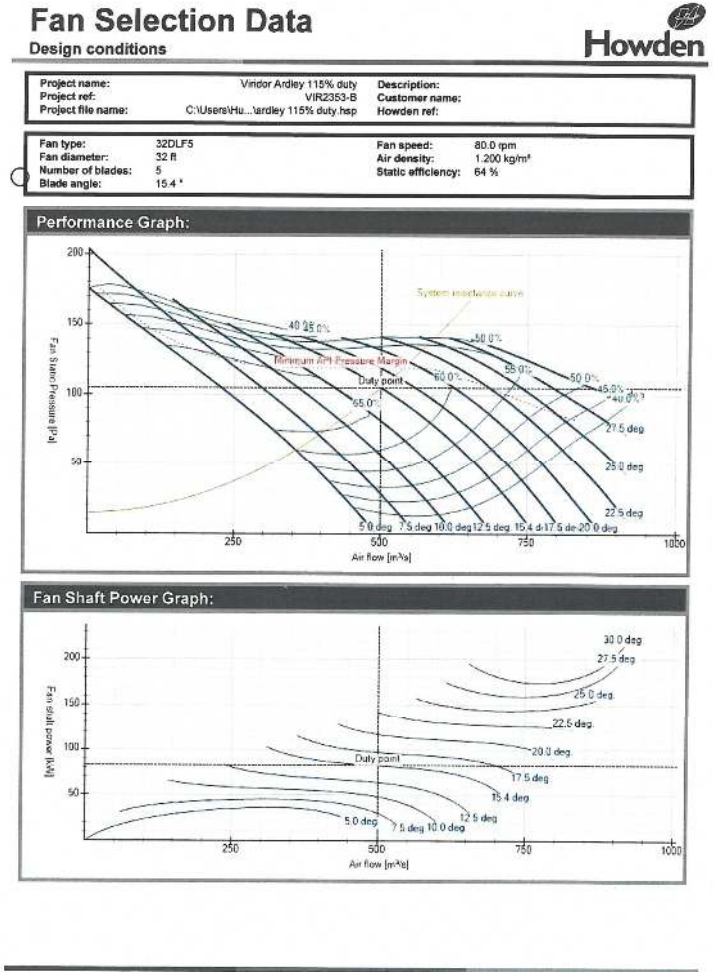


Fan Performance Graph

The performance graph gives the Fan settings for a combination of data

Such as Speed
Blade angle
Motor power

It is during design recommended to Make this graph for several combinations And select the highest efficiency, in this Case 64%. This to achieve the best performance



Recirculation of air

Recirculation means loss of performance.

Hot air is used again for cooling

Thanks to modern wind-walls this

Not a great problem. But it can happen due to nearby buildings.

example, Belgium, temperature rise

7 degree C. After closing the space

between ACC and building it was OK

Air temperature

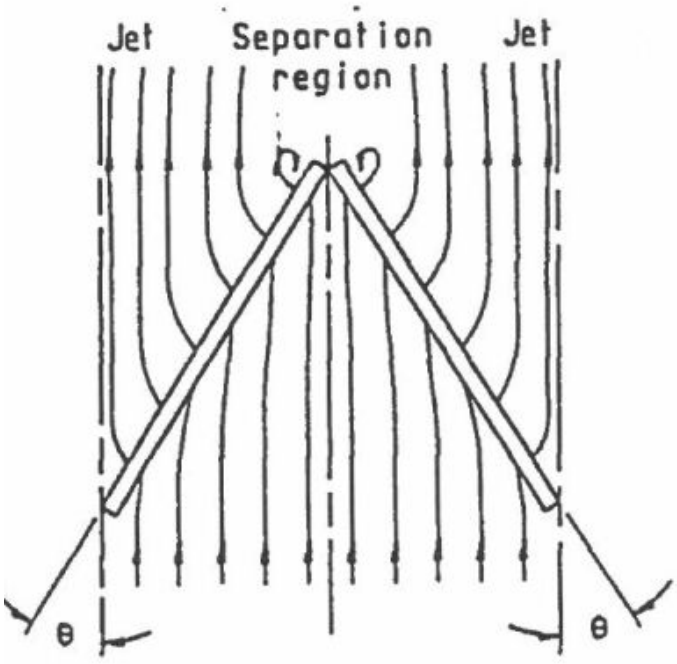
Air temperature is standard the ambient air temperature.

This temperature can be increased due to hot air recirculation.

Air recirculation occurs when heated air from the heat exchangers is sucked down and used for cooling.

This is often the case when neighbouring buildings create a suction channel.

Example: Belgium, after the construction of the plant a building was built next to the ACC on a distance of approx. 6 meters. This created a hot air recirculation of an extra 7 degrees. Result one boiler could not be used in summer. After closing of the space between the AC and the building air temperature dropped to allow the second boiler to operate again.

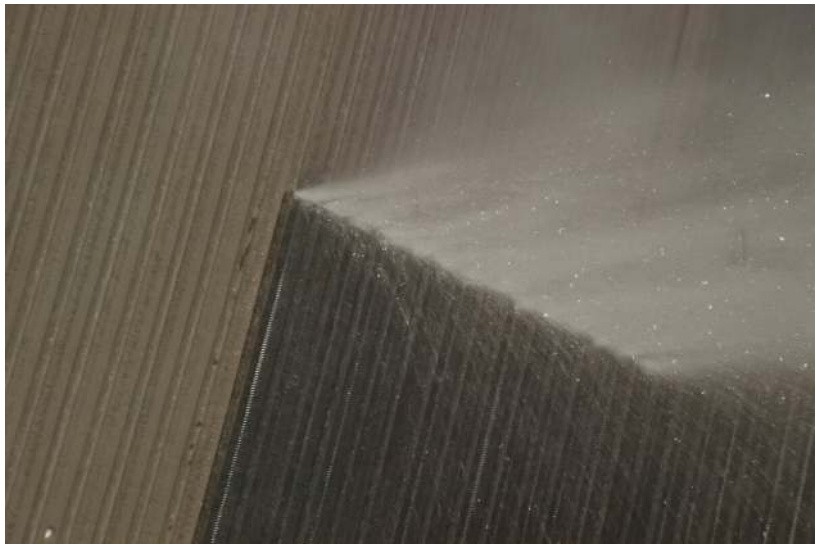


Fouling

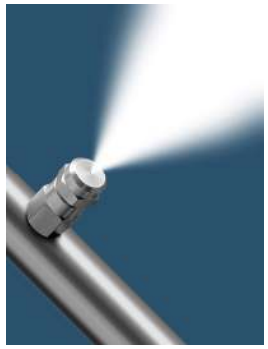
Fouling can restrict the airflow and reduce the heat transfer , resulting in performance loss.

There are two ways to remove the fouling:
High pressure water clean for loose fouling. This will improve the
The air flow and reduce the pressure loss

Blasting with powder for sticky fouling. This will improve the
Flow resistance, static pressure and the heat transfer coefficient



Ambient temperature drop



The ambient air can be dropped in temperature by adiabatic cooling

The is done by injecting fog into the cooling air.

Fog consists of many very small droplet, <20 microns, that evaporates very fast.

For this evaporation the relative humidity must allow water to evaporate. Normaly RH is say 60%, allowing 40% of water to be absorbed by the air.

The evaporation heat of the water approx. 2000 kj/kg is taken from the air, this will drop the air temperature with between 6 and 8 degree C

What kind of water to be used

The water to be used is demin water or softened water.
As you do not have water enough for fogging.
Townwater can be used, but that has to be softened to 2 degrees

This is a big softener for a 25 cell ACC

The reason the water has to be soft is that the fogging nozzle has an opening of 0.2 mm
This will clock-up with hard water

Thank you

Reference to professor Kröger, Stellenbosch and Howden

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