HOW IT REALLY WORKS

DRYMATIC HEAT DRYING AUSTRALIA

Drymatic
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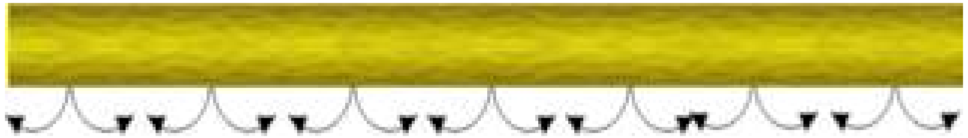
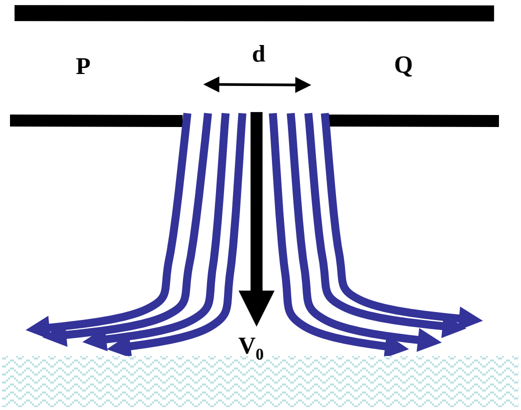
DRYMATIC HEAT DRYING MATS

- Impingement heat drying directly on to the surface is more effective than warm air blown across the surface.
- This technique is used extensively in heat drying materials such as paper and board.
- The main reason for the improved effectiveness is considered to be that the turbulence prevents the build up of a static boundary layer that can insulate the surface from the drying medium.

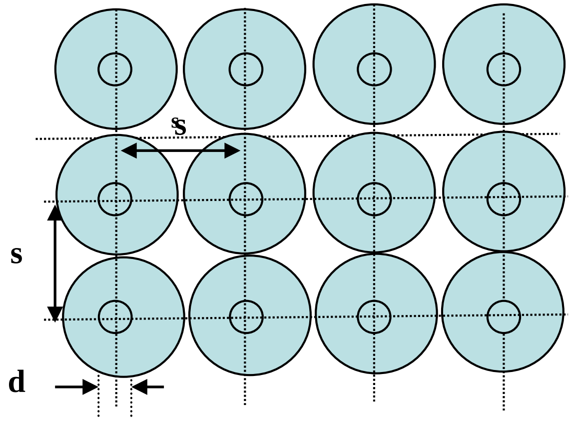


AIR VELOCITIES



- Each hole projects a jet of warm air directly on to the wet surface.
- The warm air is deflected along the surface after striking it.
- The velocity of this warm air jet depends almost entirely on the pressure inside the mat.

- The warm air jets from each hole interact at a boundary defined by their spacing.
- Further turbulence occurs at the edges when the warm air streams mix.
- The warm air is slowing down whilst traversing these regions and therefore the average speed of the warm air depends on the hole spacing, as does the area swept by the individual warm air streams.



HEAT DRYING RATES

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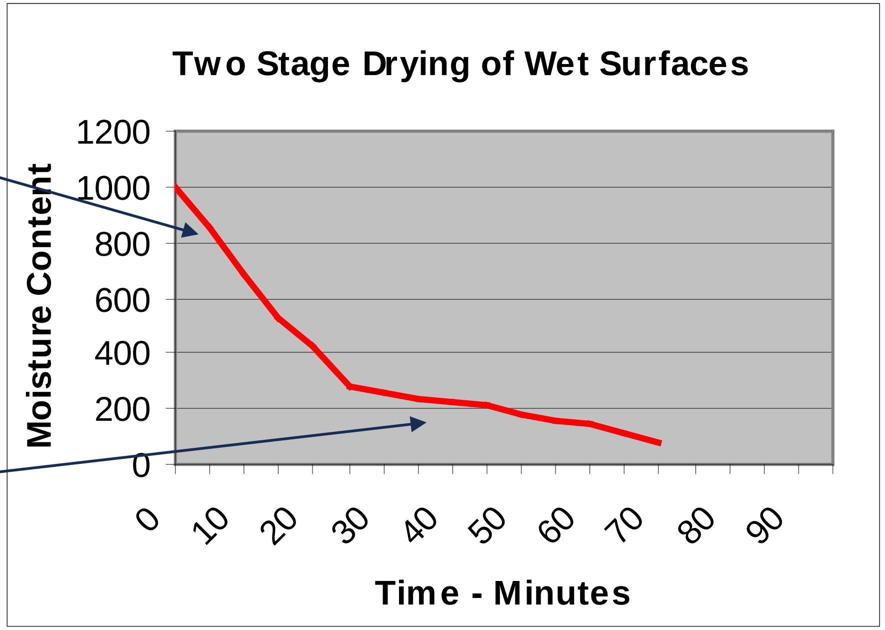
- In this region the surface remains wet and the surface vapour pressure remains constant.
- If the warm air speed and other factors are also constant then the rate of drying will also be a constant value.
- Heat drying rates can be predicted in this region because they do not significantly depend on the material being dried.



- In this region the surface is starting to dry and the surface vapour pressure is changing.
- The rate of heat drying will depend on the rate at which moisture diffuses through the underlying surface and on the instantaneous vapour pressure. (Like Newton's law of cooling for heat).
- Accurately predicting heat drying rates in this region depends on a knowledge of the material being dried.

In either region it is important to maintain turbulence at the surface to prevent the build up of a saturated layer of air that will slow down drying.

HEAT DRYING RATE PREDICTION

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- In the constant drying rate region the drying rate is given by this formula.

$$E = k \times Xs \times v^{0.78} \times s^2$$

- The constant k embodies a range of factors such as the water viscosity and diffusivity.
- Essentially it needs to be derived by experiment.
- Xs is the difference between the saturated vapour pressure at the surface and the vapour pressure, or relative humidity, of the drying air
- v is the velocity of the warm air and depends on the mat internal pressure and the hole spacing
- s is the spacing of the holes.

Temperature	20	Svp	2325.98
RH	kg.m³	kg/kg	Vp
10	0.0017	0.0014	232.60
20	0.0034	0.0029	465.20
30	0.0052	0.0043	697.79
40	0.0069	0.0058	930.39
50	0.0086	0.0072	1162.99
60	0.0103	0.0087	1395.59
70	0.0120	0.0102	1628.18
80	0.0138	0.0116	1860.78
90	0.0155	0.0131	2093.38
100	0.0172	0.0146	2325.98

- Xs is difference between these two values.
- The SVp of the surface remains constant when it is wet.

MOISTURE REMOVAL RATES

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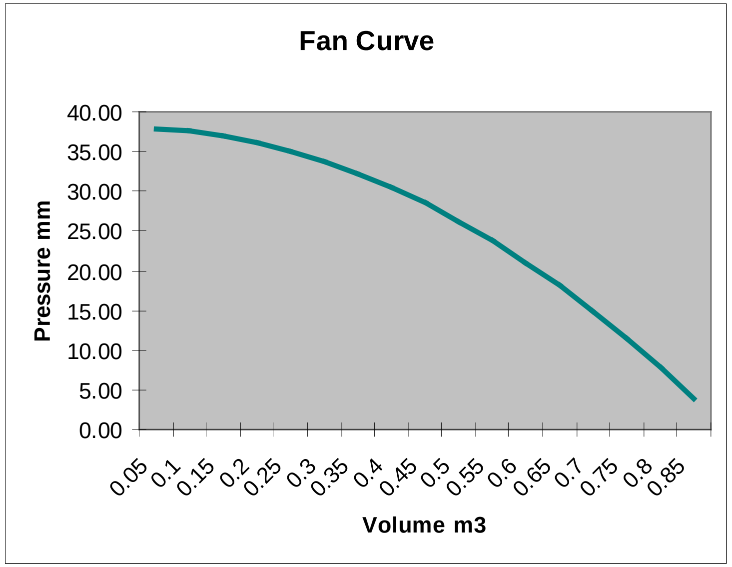
- Using the formula combined with some other measurements we can derive this table showing the rate of drying of wet surfaces per m2 of mat surface.
- The same formula can be used to derive the amount and pressure of air required from the air mover to achieve the required drying rate.
- The drying rate is proportional to the square root of the mat pressure.
- Therefore doubling the mat pressure increases the drying rate by 40%.

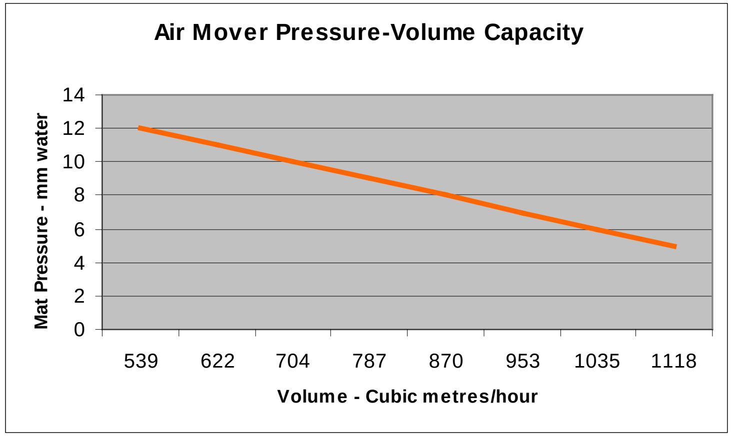
Moisture removed for 4mm holes at 50 mm spacing at 8mm water pressure				
Mat m^2	holes	kg per hour	kg per day	Airmover $m^{3.h-1}$
1	400	0.45	10.84	124
2	800	0.90	21.67	248
4	1600	1.81	43.35	497
6	2400	2.71	65.02	745
8	3200	3.61	86.69	993
10	4000	4.52	108.37	1242
12	4800	5.42	130.04	1490
14	5600	6.32	151.71	1738
16	6400	7.22	173.39	1987

AIR MOVER PERFORMANCE

- Air movers like other fans have a performance curve that shows as volumes increase the static pressure falls.
- Air movers are optimised to work into free air without restriction and the normal operating point would be set by the system back pressure.
- When the air mover output is restricted the performance curve changes significantly.



- The second curve shows the measured static pressure versus volume output of a small air mover.
- It cannot sustain a pressure of 8 mm of water if the volume demand is greater than about 900 m^3 per hour.
- By referring to the previous table we can see that this air mover could not drive a mat larger than 6 m^2.



CONCLUSIONS

- Mat heat drying performance can be predicted for wet surfaces.
- Performance depends on the mat internal pressure and mat geometry.
- The air-mover and the mat dimensions need to be matched to optimise the performance of the system.