

# 環控水簾舍相關細節

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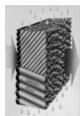
# 蒸發冷卻法

Evaporative cooling is poor man's air conditioner

# 窮人的冷氣機

## 兩種蒸發冷卻方法

- Pad and Fan System
- Fog and Fan System



## 兩種系統均適用於動物與植物



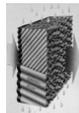
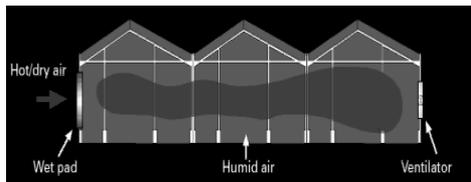
Pad and Fan system is Powerful

But require careful design, install and maintenance.

設計，施工，維護



## Pad and Fan System



負壓系統



## 關鍵參數

降溫極限：濕球降 WBD

水牆效率與壓降

溫室：外來熱量；畜舍：內生熱量

風量

氣密性

## 水牆效率



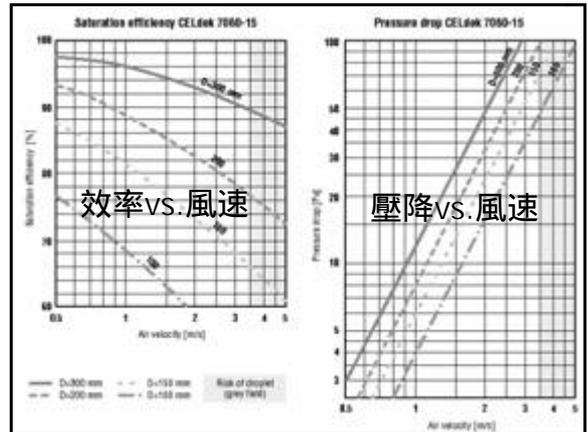
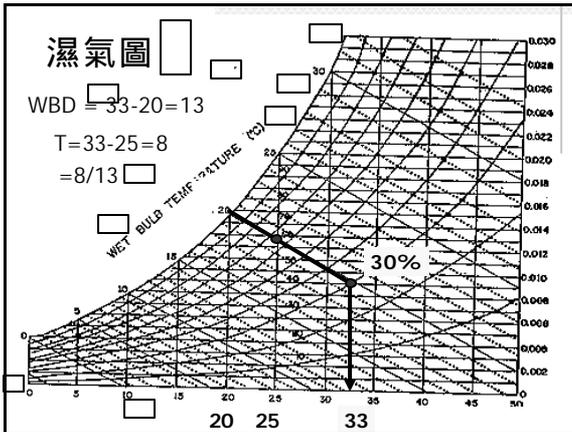
Tdb

$$WBD = Tdb - Twb$$

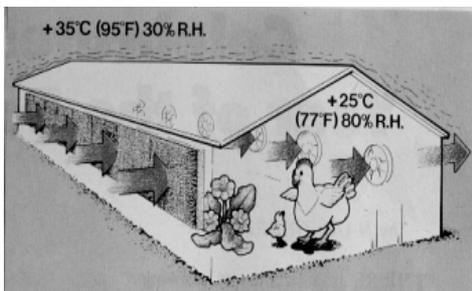
濕球降 = 乾球溫度 - 濕球溫度

Tdb - T

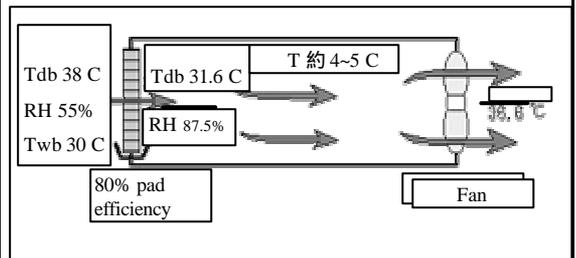
$$= T / WBD$$



## 盲點與迷思

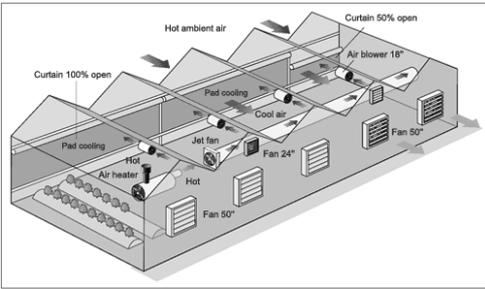


## 實際情況

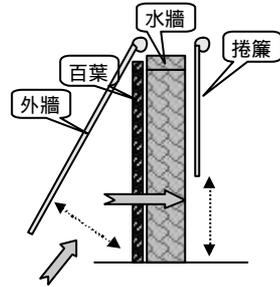


## 水簾開口大小應隨風量調整

調整方式：外牆，捲簾，百葉



調整水簾開口之目的在保持  
通過水簾時的**最佳風速**



水簾外防蟲網  
錯誤安裝方式

## 水簾外防蟲網 廉價做法



防蟲網降低通風口面積且提高壓降，  
應加大使用面積

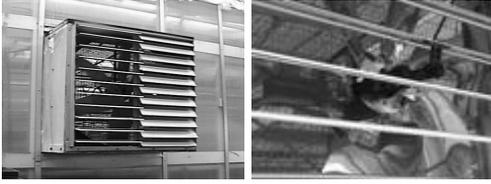
## 水簾外防蟲網 適當做法



## 水簾外防蟲網 適當做法



風扇百葉



較佳

氣密問題  
決定成效

風扇馬達週邊開口不宜過大



馬達週邊未密封，空氣走短路



風扇馬達週邊開口不宜過小  
影響馬達散熱



風扇操作時，所有開口應封閉



建築施工不當，氣密性差



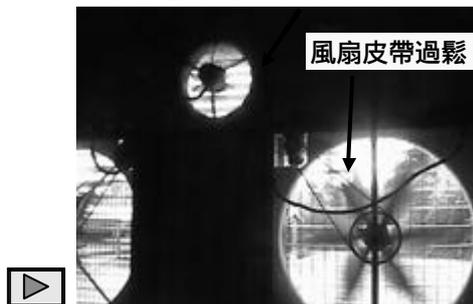
水簾牛舍內自動餵飼系統



自動餵飼系統操作不當  
造成氣密性差



上方風扇未轉，但百葉卡住未關



刮糞設施設計不當，造成氣密性差



環控禽舍施工不良，氣密性差



氣密性差



給水不均 (設計或維護不當)



給水不均 (設計或維護不當)



水簾面積不足



水簾片安裝太低



使用太多小風扇



風扇小，效率 (VER) 差

**VER單位**

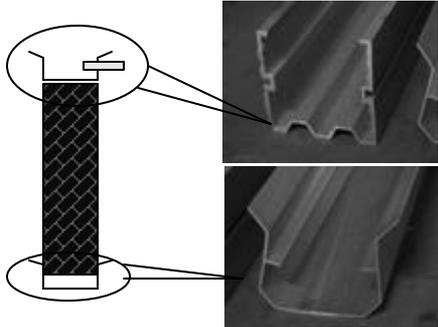
$(\text{m}^3\text{風量}/\text{s})/\text{kW}$

$(\text{m}^3\text{風量}/\text{度})$

風扇對衝，上方密閉



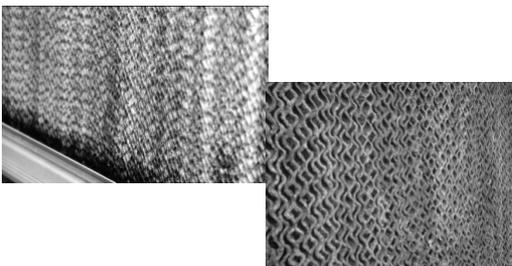
不夠好的水簾片導水槽設計



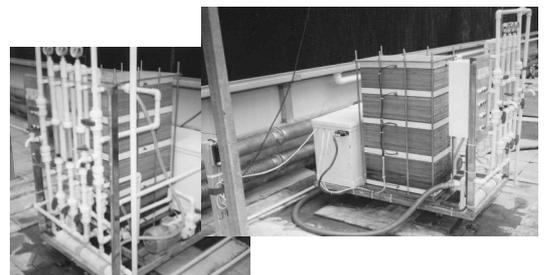
給水槽易阻塞



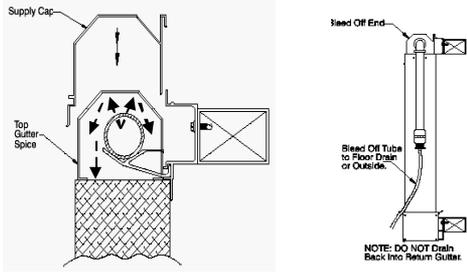
長藻與積垢



電解方式處理水垢與除藻



### 正確的水簾片導水水管與洩水管



### 至少須具備洩水閥允許局部排水

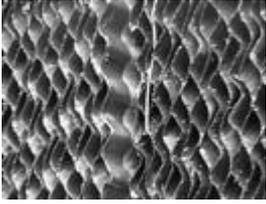


### 控制策略

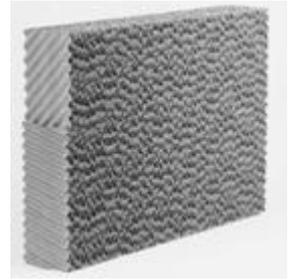
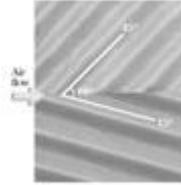


### 其他種水簾與替代品

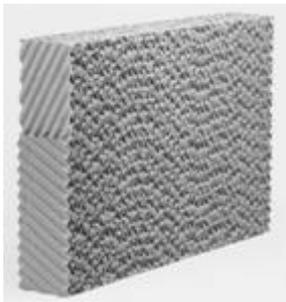
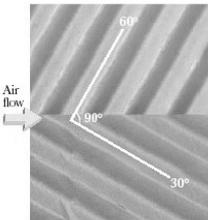
Coated Pad



Flute Angle: 7060



Flute Angle: 7090



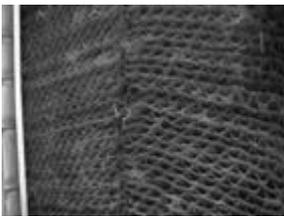
Pad substitutes - Palm tree fibers



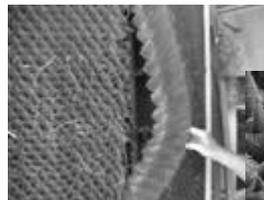
科威特



Pad substitutes - Rolling Nets I



Pad substitutes - Rolling Nets II



**Pad substitutes - Multi-layer Nets**



**View from outside**



**View from inside**

**Fogging** is better than spray

**Pad substitutes - Multi-layer Nets**

菇舍



**Pad substitutes - Multi-layer Nets**

牛舍

