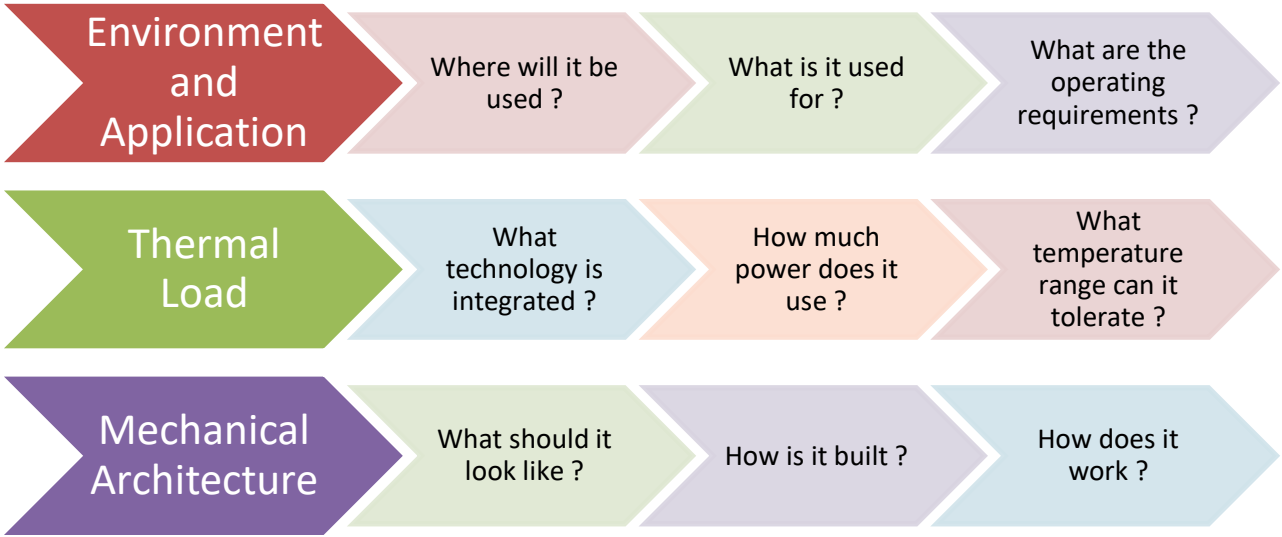
praevar

Direct Air Cooling Systems [DACS]

for Outdoor Displays

The Design and Definition Process Explained

System Overview.. Information Required



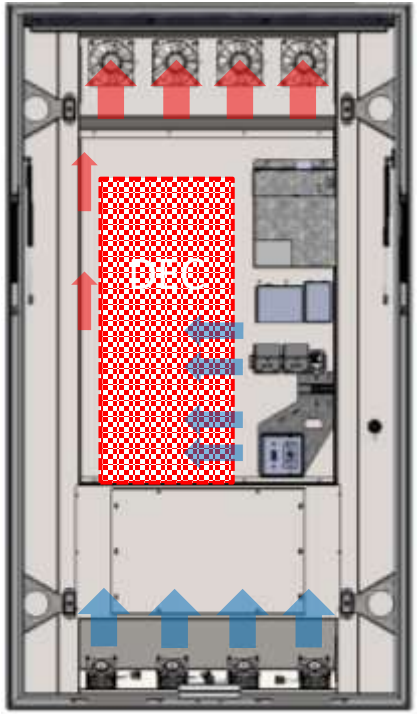
Environment and Application..

Weather	Feature requirement
Is it in direct sunlight ?	Display luminance and contrast
Will it get rained & snowed on ?	IP / NEMA sealing level
How hot & cold does the temperature get ?	Ambient range selection in degrees Celsius
Installation	**Feature requirement**
Is it in a public environment ?	Air intake and exhaust, access and safety, noise, vandalism and security
Is it used for advertising, information, entertainment ?	Portrait or landscape format
Is it interactive ?	Touch, audio, payment, tokens / receipts
Configuration	**Feature requirement**
Does the display stand alone ?	Floor-standing, high level, single or multiple faces
Is the display part of something else ?	Street furniture, kiosk, building
Is the system multi-usage ?	More than one application, a range of integrated systems

Thermal Load..

Heat calculation	
Equipment load in Watts	Heat dissipation within the system
Surface area of front, top and one side x 750W/m^2	Solar load applied to the system
Maximum temperature tolerance of the weakest component	Delta t allowance [min difference between max ambient and max internal temp]
Airflow calculation	
Internal volume of enclosure	Flow rate [capacity of air required for replacement per unit time] cfm
Intake air [volume and pressure]	Filter size [calculated for end of life]
Type of flow [axial, cross flow, radial]	Fan selection
Configuration	
For pressurized systems & balanced systems	Intake fans
For balanced systems	Exhaust fans
Division of internal airflow into multiple chambers, air-curtain & selective flow	Re-circulation fans

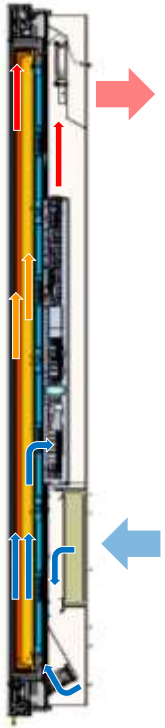
Example Schematic..



Fan Group 2 [Optional – Secondary]
Low pressure / capacity exhaust fans run at a speed calculated to match the volume intake of feeder fans, and balance airflow through the system..
These fans help to spread and equalize airflow across the width of the enclosure..

Fan Group 3 [Optional – Internal]
Directional fans draw a calculated %age of the internal air into the DEC [deported electronics chassis] and ensure heat is dissipated to an internal exhaust channel up one side ..

Fan Group 1 [Primary]
High pressure / capacity intake fans provide all the incoming air through the hydrophobic filter, and feed the system from the bottom..
An assumption is made of "volume reduction / filter back pressure" to calculate speed against internal temperature, and define operational profile..



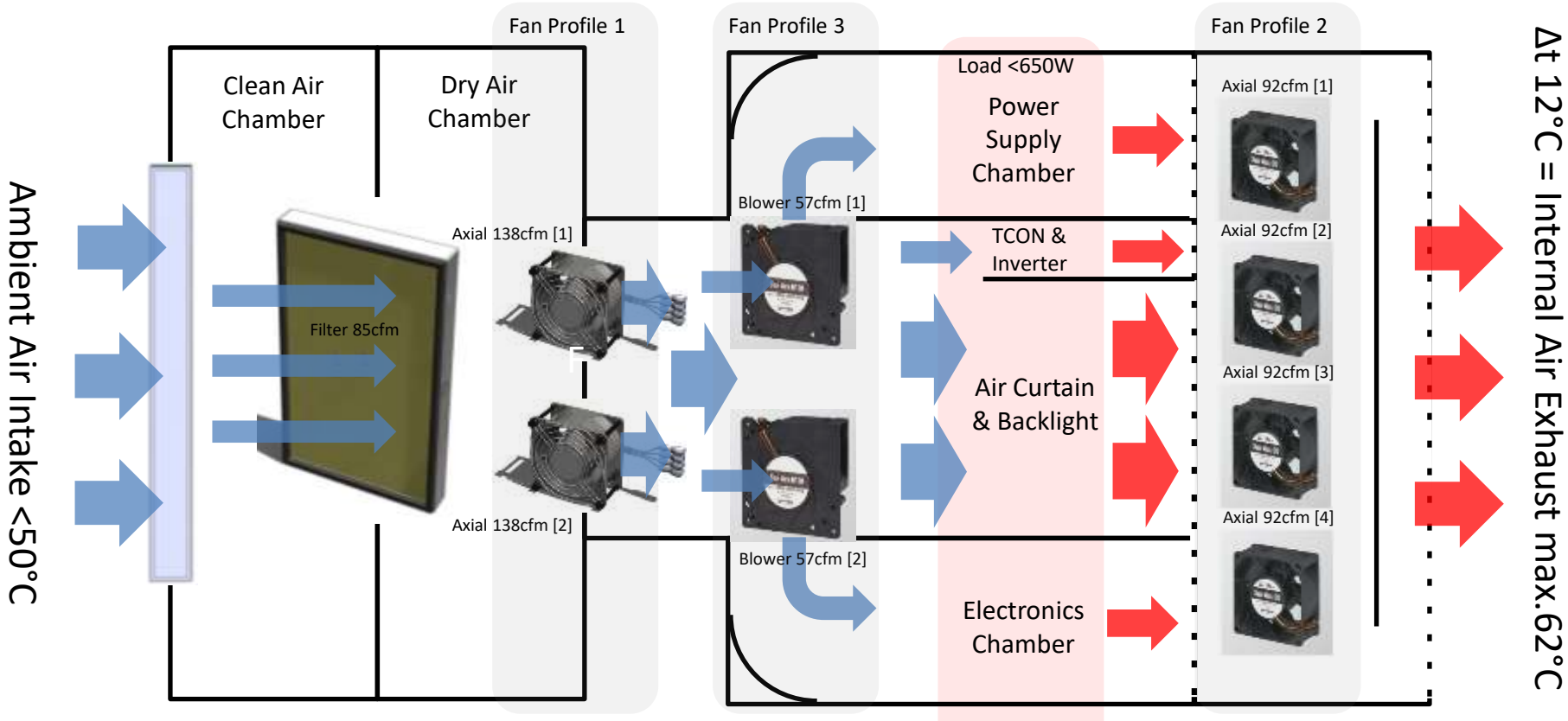
Exhaust air is blown through an integrated baffle out of the rear of the enclosure..
Depending upon the installation variant, air is further ducted and baffled to prevent water ingress, using external covers..

Within the central portion of the back-box, air is forced horizontally through the DEC housing to remove local heat and dissipate within the main vertical exhaust flow..

All incoming air enters the system via hydrophobic filter from the back..
Depending upon the installation variant, air is ducted to the filter via a sacrificial dirt filter from the back or underside..

Intake air is forced from beneath to supply both air-curtain and backlight cooling, backlight flow is further divided mid-height to generate equipment cooling in the back-box..

Example Configuration..



System Configuration..

Configuration	

Airflow	• Vertically for Portrait systems
	  ○ Down-flow
	  ○ Up-flow
	• Horizontally for Landscape systems

Intake	• Top Rear - single face system • Bottom Front or Rear – through support plinth • Sides - either or both
Exhaust	• Top [via weather baffle] or Top Rear [single face system] • Bottom Front or Rear – through support plinth • Sides – either or both
System Filter	• 75(m3/h) 44CFM = c.300W Heat dissipation • 145(m3/h) 85CFM = c.600W Heat dissipation • 315(m3/h) 185CFM = c.1300W Heat dissipation

Features and Benefits..

Feature	Benefit
Ambient air is used as cooling medium	• %age efficiency benefit over cross-flow HEX systems, where heat transfer internally typically costs 15 Celsius between flows. • Higher external ambient temperatures can be accommodated.
A single airflow loop is used to cool the system	• Less fans are required to control airflow. • Less power required to drive the mechanical elements of the system. • Reduced chance of system blockage.
Hydrophobic [System] filters are used at the intake	• Airborne moisture and particles are removed from the cooling flow – filtration efficiency 99 % (@ 0.3 µm, 1 cm/sec) • Harmful pollutants and magnetic particles cannot enter the internal chambers of the system. • System filters are designed for the operational life of the display, without the need for replacement, 2 to 5 years dependent upon configuration.

Sacrificial filters protect the System filter	• A replaceable / washable filter strategy is adopted, specific to the environment of the installation:
	  ○ Dirt and particle filters..
	  ○ Electrostatic filters..
	  ○ Oil mist filters..
	○ These are low cost and re-usable [in many cases] designed for easy access and maintenance.