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Calculation of Airflow Required for a Given Heat Load

In a data center, heat loads are known for different computers or server racks. From this information, we need to obtain the cooling airflow rate in CFM required for satisfactory cooling of the electronics equipment. The objective of the data center airflow design would then be to supply this flow rate through the perforated tiles located in the immediate vicinity of the server.

The cooling air will normally be supplied at 55°F. An acceptable temperature rise through the server is about 20°F. Thus, the air will exit from the server at 75°F. The controls on the air-conditioning units are normally set to maintain the return air at 75°F.

Therefore, for a given heat load dissipated by the server, the correct airflow rate should lead to a 20°F temperature rise as the cooling air travels through the server. This requirement can be expressed by the following formula:

Cooling airflow rate in CFM = 154 × Heat load in kW × (Reference Pressure/Local Pressure)

(In this expression, the reference pressure is 1 atmosphere and the local pressure depends on the local altitude. Local pressures at selected altitudes are given in the table below.)

When the arrangement of perforated tiles and air-conditioning units in a data center delivers this airflow rate at the foot of each server, proper cooling of the electronics equipment is assured. If this cannot be done, the equipment will overheat.

Table: Local Pressure at Selected Altitudes

Altitude (ft)	2000	4000	6000	8000	10,000
Pressure (atm)	0.93	0.86	0.80	0.74	0.69