A PRACTICAL SYSTEM FOR COOLING HIGH POWER ELECTRONIC INSTALLATIONS

L. Bonet, C. Daum, L. Hubbeling and B. Hyams

ABSTRACT

This note describes a simple arrangement for removing the heat from electronic racks, computers, etc. at a power dissipation of up to 5 kW per unit.

The system has many practical advantages. It is cheaper and safer than a room air conditioning system, it improves the cooling of high power electronics, and dispenses with the gales of cold air that are currently used.
1. THE SYSTEM

Figs. 1a,1b show the system as used for electronics in a standard SPS rack. The rack houses 5 kW of CAMAC electronics. It is closed everywhere except for air intake vents at the front, and an opening at the back housing a 120 W fan and a water-cooled heat exchanger. The air leaves the rack at room temperature, having heated cooling water from $14^\circ$C to $19^\circ$C.

Figs. 2a,2b show the adaptation of the system to cooling a NORD-10 computer.

It is intended that such a system be used in conjunction with a low power (office type) air conditioning system so that under humid summer conditions, or ultra dry winter weather a comfortable relative humidity is maintained, and water is not condensed inside the room.

2. EXPERIENCE

We are now cooling some 12 racks and one NORD-10 computer.

So far the system works satisfactorily.

While it will take some months of experience to ensure that no difficulties arise with the system, we describe it now so that groups setting up new installations can consider its use.

3. ADVANTAGES

Costs

The system costs $\approx\text{SF} 1,500$ per 5 kW cooling power installed. This is about one third of the price for an air conditioning system. (The cooling stays with the racks, and moving to a new location only requires the installation of a new water supply, which is significantly cheaper than the installation of new air ducts for an air conditioning system). The running costs with $14^\circ$C cooling water cooling $35^\circ$ air are in principle lower than with $6^\circ$C water cooling $22^\circ$ air.
Safety

The rack contains a temperature sensing switch. It cuts off the rack if the air temperature in the rack reaches 45°C. In an air conditioned barracks, by the time a fire has overcome the air cooling sufficiently to raise the air temperature, great damage has been caused.

This system compels the user to bring all electrical connections into the rack via plugs and sockets. Thus cable fires are very unlikely.

**Increased Power Per Rack**

Due to the added forced ventilation of the fan it is practical to dissipate 5 kW power per rack without overheating CAMAC electronics. Due to the poor air circulation inside ordinary racks this is not possible for some existing CERN electronics.

**Versatility**

Tap water can be used for cooling in any small laboratory, rather than installing a high power air conditioning unit. Adaption to a wide range of power dissipation is simple.

**Comfort - Health**

The system only moves room temperature air in the room, and the volume moved is a factor 2.5 times smaller than in an air conditioning system.

The increased comfort in not having cold drafts is very evident.

The noise of each supplementary fan has been measured to be approximately equal to that of one standard CAMAC crate. Thus the noise level in the working area is increased by ~20%, which is not perceptible.

4. **POSSIBLE IMPROVEMENTS**

We are testing out individual thermostatic taps on each heat exchanger to automatically match the water consumption to the heat dissipated in each rack.

We have demonstrated that our fans are capable of cooling ~4.5 kW of CAMAC electronics with all the CAMAC fans removed. This would give a working noise level reduction of a factor 5. However this mode of operation requires that all but two or three CAMAC slots in the rack be filled so as not to by-pass
the air flow to the units in operation. Dummy units have been made to block air passage. A simple pressure sensing switch has been operated to protect against fan failure or the removal of too many CAMAC units. So far we have not attempted to run a rack in this mode in an experiment. But for permanent installations it appears that it could be a practical arrangement to reduce the noise.

5. ACKNOWLEDGEMENTS

We are grateful to M.G. Leskens for the positive interest he expressed in the safety aspects of this system while it was under development.
TECHNICAL DATA

Heat exchanger : K 320 WNOO
Manufacturer : Jäggi - Bern
Outside dimensions : 395 × 467 × 160 mm
Active area : 320 × 360 mm
Airflow : ≈1100 m³/h
Airspeed : ≈2.6 m/sec
Air at intake cooler : 35°C
" " outlet cooler : 20°C
Water at intake of cooler : 13-14°C
" " outlet " " : 19-20°C
Waterflow at 5 kW dissipation : ≈720 l/h
Pressure drop of air : ≈8 mm W = 0.8 mBar
" " of water : ≈800 mm W = 80 mBar

Fan : Xpelair GX12
Power : 120 watts
Flow : 1600 m³/h max down to ≈1100 m³/h due to air resistance

Filter material : P15/150 SCSM 26 24 32 170.1
Dimensions : 580 × 450 mm

Overheat protection : Bimetal switch in holding circuit of main circuit breaker opening at 45°C

Thermostat : Danfoss AVTA-15 0-30°C adjustable code no. 3N2132
Fig. 1a  Sketch of installation in standard SPS electronics rack

Fig. 1b  Rear view looking up at a row of racks with cooling units installed
Fig. 2a  Sketch of cooling hood for NORD 10 computer

Fig. 2b  Twin NORD 10 with cooling unit attached