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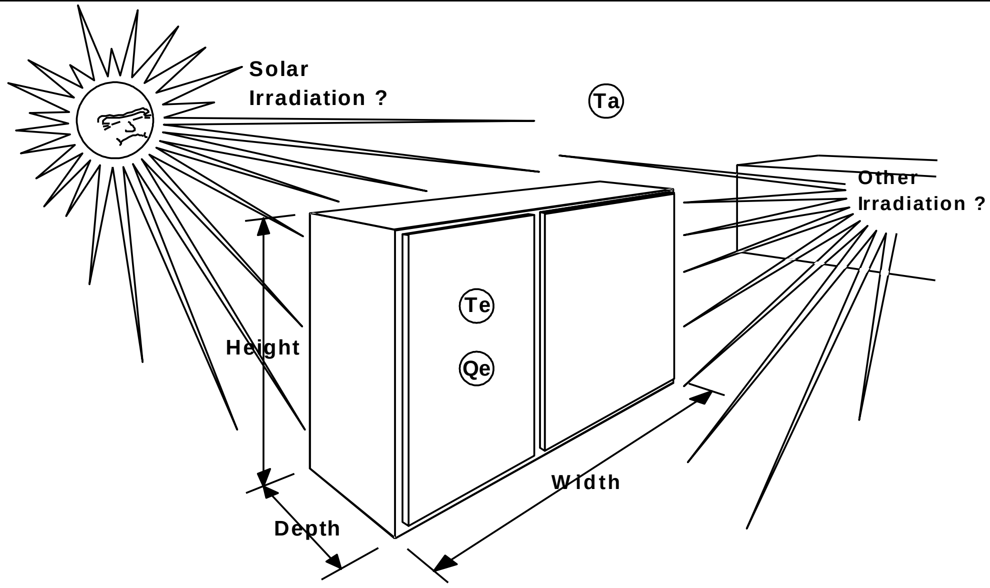
Estimation of Required Cooling Duty for Industrial Enclosures



The parameters indicated in the diagram above represent the information required in order to effect an optimum selection of a cooling system for an electrical/electronic enclosure; please refer further to the attached notes.

ENCLOSURE DATA

Enclosure Dimensions:

Height =...mm
Width =...mm
Depth =...mm

Enclosure Construction:

(Sheet Steel, etc.)

....
....
....

Enclosure Layout:

Is the enclosure divided into individual compartments? If so, are they completely partitioned/ isolated from each other? Please provide sketch if necessary

....
....
....
....
....
....
....
....
....
....

TEMPERATURE DATA

Design Temperatures:

Ta= maximum ambient/surrounding temperature
.... °C
Te= maximum design enclosure temperature
.... °C

ENCLOSURE HEAT LOAD DATA

Enclosure Heat Load:

Qe=.. Watts

Please refer to attached notes for estimation procedures.

Is this heat load continuous or intermittent? Please provide details.

Irradiant Heat Load:

Is the enclosure subject to sunlight or heat irradiation from other external sources (eg. furnaces)? If so, please identify the source, and indicate the colour of the enclosure.

OTHER DATA What is the general state of the environment in which the enclosure is installed? Dusty? Corrosive environment? etc.

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Estimation of Electrical/Electronic Enclosure Heat Load

Various procedures are available for estimation of enclosure heat loads, including those described below, in decreasing order of accuracy:

MANUFACTURERS' DATA:

Some manufacturers may quote heat output figures, in Btu/hr or Watts. Alternatively, the power input rating of a device will suffice as an estimate of heat output, assuming all the power is consumed within the enclosure, and assuming the device is electrically resistive (if inductive, power factor may need to be considered).

MEASUREMENT OF NET POWER INPUT:

In some cases, it may be possible to measure the difference between power supplied to the enclosure, and power leaving the enclosure, with a "tong" or clamp tester. For example, the heat generation in an enclosure with total power supply of 240 V, 2 Amps and power output of 12 V, 30 Amps will be (240 x 2) - (12 x 30) = 480 - 360 = 120 Watts (assuming no inductive load). This procedure may become complicated and inaccurate for multiple power inputs and/or outputs.

POWER SUPPLY OUTPUT:

Some systems have electronic equipment suppied by a common power supply, with all such power being consumed within the enclosure; in such a case, knowledge of the power supply voltage and current (and power factor if inductive) will allow estimation of heat generation by equipment.

EQUIPMENT EFFICIENCY DATA:

Heat output can often be estimated from knowledge of the efficiency of the device(s). For example, a device with power consumption of 1000 Watts and efficiency 97% will generate heat of 3% of 1000 W = 30 Watts, assuming fully resistive, and assuming the output power from the device is not consumed in other devices within the enclosure.

TEMPERATURE RISE OF ENCLOSURE:

Information in relation to temperature rise of the enclosure air above the surrounding ambient temperature will allow estimation of enclosure heat load; the estimation process, however, depends on whether the enclosure is sealed or not:

(a) ***for sealed (airtight) enclosures***, temperature measurements should preferably be taken at three heights (bottom, middle, top) within the enclosure, ensuring that the temperature sensor is neither touching hot devices, nor directly influenced by radiant heat from high temperature devices. These internal temperatures are to be compared with ambient (surrounding) air temperature, which should ideally be measured in the vicinity of all sides of the enclosure. For long enclosures, internal temperatures should be measured in each compartment, to highlight "hot spots". **Please note** that temperature measurements are to be taken with the enclosure in equilibrium, ie. if the enclosure is opened to allow insertion of a temperature sensor, the internal temperature will drop. The door must be left closed for a long enough time to allow temperature to rise to the maximum level again.

(b) ***for forced-air ventilated enclosures***, the difference between the temperature of ambient air entering the enclosure, and exhaust air leaving the enclosure needs to be determined; in addition, the air volume flow rate of the fan(s) or blower(s) providing the forced-air cooling is required. If manufacturers' data on this air volume flow rate is unavailable, a comprehensive description of the fan or blower is required.

(c) ***for naturally ventilated (unsealed) enclosures***, ideally, temperature rise information is required for the enclosure when sealed, to allow emulation of the sealed enclosure procedure described in (a) above. All ventilation penetrations should be sealed to prevent air from entering or leaving the enclosure. **Please note**, however, that this procedure may lead to an unacceptable rise in temperature within the enclosure, resulting in damage to heat-sensitive equipment. If the enclosure is unable to be sealed, the ambient and enclosure temperatures may be measured and used for the heat load estimate, however this will be quite inaccurate, and extra "conservative" factors will need to be added.

For Further Information, Contact BERTECH Industrial Environments Pty.Ltd.