AMPLIFIER OPERATING TEMPERATURE DEFINITIONS

The BASEPLATE of an amplifier is the face of its enclosure used to mount the unit against a HEAT DISSIPATING SURFACE.

The HEAT DISSIPATING SURFACE can be a solid metal plate with fins on its back side, or just one of the walls of a large metal enclosure. The user must decide which type of heatsink structure is required after performing thermal analysis by simulation, or by taking experimental BASEPLATE temperature readings with the amplifier mounted in the same way it will be used.

The amplifier BASEPLATE and the HEAT DISSIPATING SURFACE it is mounted on, must be in intimate contact to optimize the heat transfer between them, reducing the thermal resistance of the contact area Rc. This is ensured by having flat surfaces that are machined to a fine finish, by using multiple screws that bring the two surface in close contact, and by using a very thin layer of thermal compound to fill small interstitial air pockets, giving preference to the metal-to-metal contact that will always provide lower thermal resistance than the thinnest layer of thermal compound.

The BASEPLATE normally operates at a higher temperature Tbase than the surrounding AMBIENT temperature Tamb (refer to FIG. 1). The difference between Tbase and Tamb is a function of the power dissipated in the amplifier Pdis and of the thermal resistance between the heatsink mounting surface and ambient Ra-a.

When amplifiers are mounted in cabinets, they are attached directly to external heatsinks, by having the amplifier housing protrude through a cut out in the cabinet. This approach prevents having the cabinet wall and associated surface contact resistance added to the thermal dissipation path.

With a good thermal design, most heat dissipated by an amplifier mounted inside a cabinet, is transferred to ambient through the heatsink attached to the amplifier BASEPLATE side, so as to minimize the heat transferred internally to the cabinet itself. Assuming that the main heat contributor in the cabinet is an amplifier, the cabinet temperature (T cabinet), as shown in FIG. 1, will be higher than the AMBIENT temperature, but should be significantly lower than that of the amplifier BASEPLATE. The lower the heatsink Ra-a is, then the lower T cabinet will be.

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Finned heatsinks with forced air cooling, extracting heat and transferring it to an ambient external to the cabinet, provide the best mechanism to reduce T cabinet.

Ra-a has two main components, Rc, the Thermal Resistance of the contact area between the amplifier BASEPLATE and the HEAT DISSIPATING SURFACE, and Rh-a, the Thermal Resistance between the HEAT DISSIPATING SURFACE and AMBIENT.

Amplifier vendors control Pdis, but have no control over the nature and efficiency of the heatsinks opted for by users. For this reason, amplifier vendors specify **Maximum Baseplate Operating Temperature**, and users must provide adequate heat dissipation capability by specifying a heatsink and by using a suitable mounting scheme to ensure that the resulting thermal resistance Ra-a satisfies the **HEATSINK THERMAL RESISTANCE** equation in the box below.

HEATSINK THERMAL RESISTANCE

$$\text{Ra-a [K/W]} \leq \frac{(\text{T base max - Tambient max})}{\text{Pdis}}$$

$$\text{Ra-a [K/W]} = \text{Rc [K/W]} + \text{Rh-a [K/W]}$$

Rc	:	Thermal Resistance of the contact area between the amplifier BASEPLATE and HEAT DISSIPATING SURFACE in [K/W]. Assume Rc = 0 for an amplifier in tight and intimate contact with a heatsink, having thermal compound on the baseplate interface.
Rh-a	:	Thermal Resistance between the HEAT DISSIPATING SURFACE and AMBIENT in [K/W]. This parameter is provided by heatsink vendors.
Tbase max	:	maximum baseplate operating temperature as specified by the amplifier vendor in [K]. This parameter is provided by the amplifier vendor.
Tambient max	:	maximum ambient operating temperature in [K]. This parameter is defined by he environment the amplifier will operate in.
Pdis	:	power dissipated in the amplifier in {W]. This parameter is provided by the amplifier vendor.

AMPLIFIER OPERATING TEMPERATURE DEFINITIONS

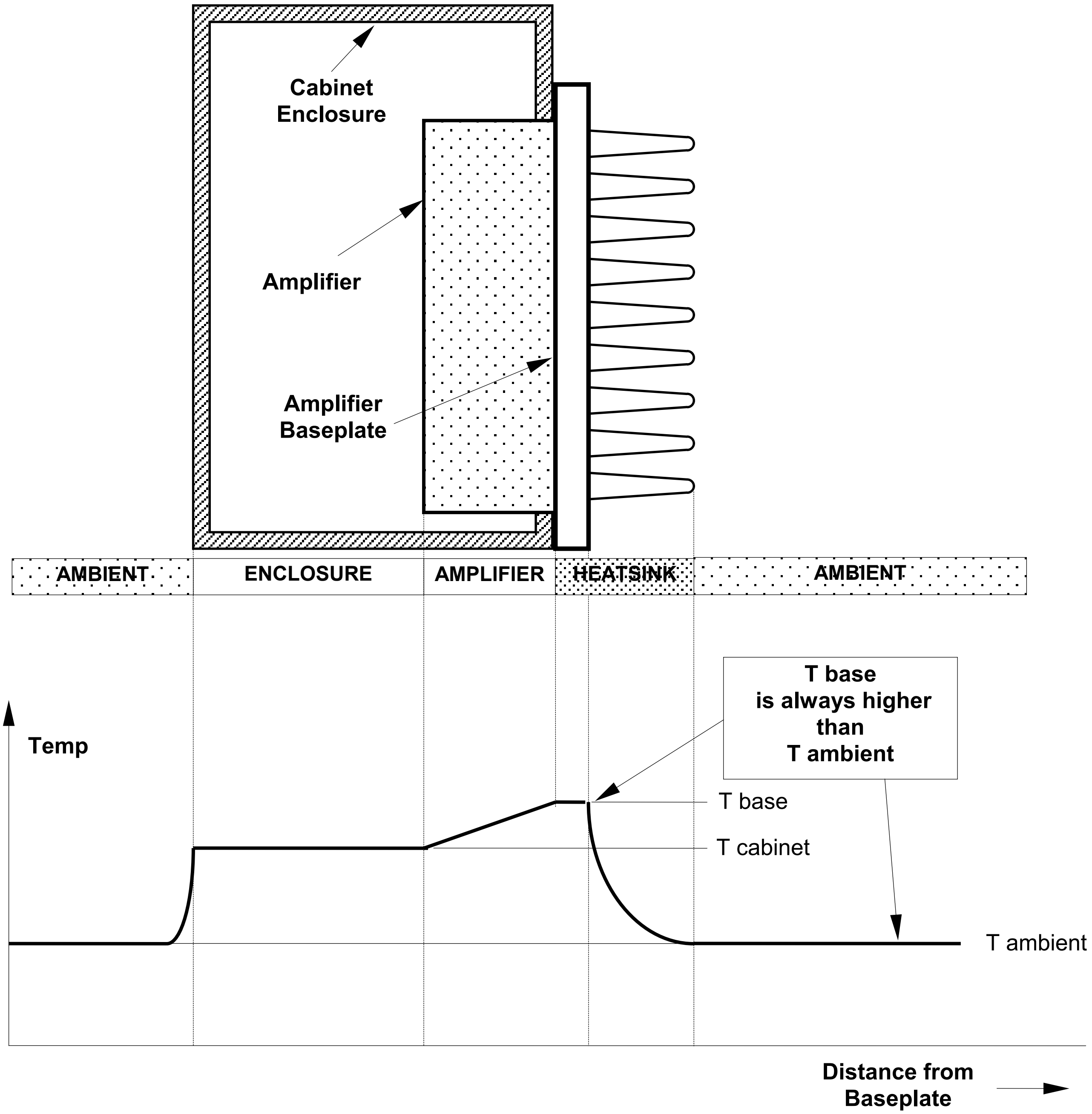

FIG. 1