

Heat Temperature issues in Vacuum Motors

Frequently Asked Questions

How much heat do the motors generate?

This is a complicated question to answer. The variables that contribute are: drive voltage, current in the windings, drive type, winding configurations, motor speed, switching speed of the drive, duty cycle and the amount of work being done.

Having said this, a rough estimate is that 20% of the input power to the motor may be converted into heat. This figure is typical of a positional type application. The actual figure will vary depending on the application.

How do I get rid of the motor heat in a vacuum chamber?

Motors that do work generate heat. It is not possible for the motor supplier to eliminate the heat source. Therefore it is up to the user to provide a method of removing the heat.

In a vacuum the primary means of heat transfer is conduction from the motor into the mounting structure or into active cooling coils. Generally speaking, the addition of cooling fins is not very effective. However, a few turns of copper or stainless steel tubing with cooling gas or fluid running through them is usually sufficient. Assistance from a mechanical engineer with experience in thermal calculations is recommended.

Why is motor heating a problem in a vacuum?

Without the fluid medium of air to provide convection cooling, the heat transfer is limited to the less effective mechanisms of conduction through the mounting surface and thermal radiation. Since outgassing rates increase with temperature, high temperatures lead to shortened motor life.

How much heat must be dissipated to avoid overheating in a vacuum?

This varies depending on the motor and the drive (among other factors) but as a first order estimate, 20%-30% of the electrical energy going into the motor may be assumed to convert into heat. To obtain more accurate data testing will be required.

Is there a way to monitor the motor temperature inside a vacuum?

Yes, Empire Magnetics offers a resistive temperature device (RTD) to monitor the motor temperature.

What can be done to overcome the heating problem?

The provisions for overcoming the heating problem in a vacuum are as follows:

- 1) Permit the motor to withstand higher temperatures— Empire Magnetics laboratory, standard and commercial grade vacuum rated motors are made to withstand internal

temperatures of 180° C, 155° C, and 130° C, respectively.

2) Select the appropriate drive electronics— a low voltage drive and a series connection will reduce motor heating. The reduced standby current option offered by many drives may also be employed to reduce motor heating.

3) Limit the duty cycle— when possible, reduce or turn off the current to the motor when it is not being used. this is a simple and effective way to reduce motor heating.

4) Improve the heat transfer mechanisms— conduction through the mounting surface can be improved by creating a simple heatsink consisting of metal tubing with cool fluid running through it.