Strain Gage Selection

Introduction

The initial step in preparing for any strain gage installation is the selection of the appropriate gage for the task. It might at first appear that gage selection is a simple exercise, of no great consequence to the stress analyst; but quite the opposite is true. Careful, rational selection of gage characteristics and parameters can be very important in: (1) optimizing the gage performance for specified environmental and operating conditions, (2) obtaining accurate and reliable strain measurements, (3) contributing to the ease of installation, and (4) minimizing the total cost of the gage installation.

Gage Parameters

The installation and operating characteristics of a strain gage are affected by the following parameters, which are selectable in varying degrees:

- strain-sensitive alloy
- self-temperature-compensation number
- backing materials (carrier)
- grid resistance
- gage length
- options
- gage pattern

Test Parameters

Basically, the gage selection process consists of determining the particular available combination of parameters which is most compatible with the environmental and other operating conditions, and at the same time best satisfies the installation and operating constraints. These constraints are generally expressed in the form of requirements such as:

- accuracy
- test duration
- stability
- cyclic endurance
- temperature
- ease of installation
- elongation
- environment

The cost of the strain gage itself is not ordinarily a prime consideration in gage selection, since the significant economic measure is the total cost of the complete installation, of which the gage cost is usually but a small fraction. In many cases, the selection of a gage series or optional feature which increases the gage cost serves to decrease the total installation cost.

Selection Compromises

It must be appreciated that the process of gage selection generally involves compromises. This is

because parameter choices which tend to satisfy one of the constraints or requirements may work against satisfying others. For example, in the case of a small-radius fillet, where the space available for gage installation is very limited, and the strain gradient extremely high, one of the shortest available gages might be the obvious choice. At the same time, however, gages shorter than about 0.125 in (3 mm) are generally characterized by lower maximum elongation, reduced fatigue life, less stable behavior, and greater installation difficulty. Another situation which often influences gage selection, and leads to compromise, is the stock of gages at hand for day-to-day strain measurements. While compromises are almost always necessary, the stress analyst should be fully aware of the effects of such compromises on meeting the requirements of the gage installation. This understanding is necessary to make the best overall compromise for any particular set of circumstances, and to judge the effects of that compromise on the accuracy and validity of the test data.

Selections for Transducers

The strain gage selection criteria considered here relate primarily to stress analysis applications. The selection criteria for strain gages used on transducer spring elements, while similar in many respects to the considerations presented here, may vary significantly from application to application and should be treated accordingly. The Vishay Measurements Group's Transducer Applications Department can assist in this selection.