Creep Code of BCM Strain Gauges

All the class-A strain gauges are manufactured of multiple creep compensation choices. The last letter of gauge part number (P/N) is the creep code of the concerned P/N strain gauges. Here we discuss some more on the creep compensation.

1. Creep Phenomenon and Creep Level

Creep is mechanical characteristics of materials. For instance, due to elastic-after-effect, the output signal of strain gauges or load cells under loading increases with time though the strain sustains constant. This phenomenon is called creep (positive creep). On the other hand, it is found that both the backing material of strain gauges and the adhesive that is used to bond the gauges onto the substrate, cause a decrease in the output signal of strain gauges or load cells. This is called negative creep and is due to so-called viscoelasticity effect of the polymers used.

Thus, due to both the elastic-after-effect and the viscoelasticity effect, strain gauges may exhibit either negative creep or positive creep and the creep could be set at different levels (values) by changing gauge design, foil and backing materials.

For given foil and backing material, the creep variation of stain gauges is achieved by varying the width-ratio of the end loop to strand of the gauge grid: a larger ratio results in a more positive creep while a smaller ratio leads to a more negative creep. The length of gauge grid can also influence the creep level. Therefore, a delicate designing and manufacturing of grid pattern, and careful preparation of backing material, can result in a desired creep for the concerned strain gauge over a certain range of creep levels. The strain gauges possessing such creep characteristic are known as creep-compensated strain gauges.

The creep-compensated strain gauges are especially important for load cell manufacturing because the creep error of load cells under loading can be corrected by using a proper type of creep-compensated strain gauges.

2. Considerations in Choosing Strain Gauges of a Proper Creep Code

Though spring element materials under load exhibit positive creep, the total creep error of a particular type of load cells depends on several variables, such as spring element material, heat treatment, distribution of strain field, the type and thickness of the adhesive used to bond strain gauges, and operating temperatures. Therefore, without testing it is hard to choose in advance a proper creep-compensated strain gauge that is necessary to achieve the best creep result of the transducer.

To determine which creep code is the proper creep, a practical way is to do the test by bonding the gauges onto the load cell spring element. In practice, it is smart to start this creep test with the gauges of at least two different creep codes. According to the test results of those two creep gauges, a strain gauge of most proper creep will be selected for achieving a better creep result.

It is very necessary to do such creep tests before going to high volume production of transducers.

3. Creep Code of BCM Class-A Strain Gauges

BCM class-A strain gauges are creep-compensated gauges, and manufactured of multiple creep codes (N7 through P7). For a certain type of load cell of given capacity and made from given material, its initial creep may appear either positive or negative. With the creep-compensated strain gauges one can obtain a desired creep result for the load cell as long as a proper creep code of the strain gauges is selected in application.

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Creep Code of BCM Strain Gauges

In BCM class-A gauge group, there are as many as 15 standard creep codes available for selection, especially for the most common used single element gauges (bending-gauges). Those 15 standard creep codes are designed and manufactured to the following order according to the gauge creep levels:

(-) N7 < N6 < N5 < N4 < N3 < N2 < N1 < O < P1 < P2 < P3 < P4 <P5 < P6 < P7 (+)

The N7 is the most negative creep code (for smaller capacity load cells), while the P7 the most positive creep code (for bigger capacity load cells). The letter O stands for a moderate creep, and the related strain gauge may exhibit a neutral creep character for a certain type of load cell of moderate capacity.

Among those 15 creep codes, the difference in creep error is 0.01 ~ 0.015%FS/30min between any two adjacent creep codes.

One can achieve an even fine adjustment in creep if one applies creep combination techniques. For instance, to build the full Wheatstone bridge circuit one can combine 2 pieces of gauges of the particular creep code with the other 2 pieces of gauges of the neighboring creep code. This way, one can obtain an even finer creep adjustment of 0.005 ~ 0.007%FS/30min.

To attain this creep specification on a high production basis, it is necessary to select high-quality spring element material for the transducer production. In principal, if the creep characteristics of strain gauges matches to that of the spring element material, that is, if the creep of the strain gauges is the same in magnitude as that of the spring element material, but opposite in polarity, the total creep error of the transducer can be, to some extend, compensated to a very small limit, such as 0.006%FS/30min.

4. Selection of Creep Code

4-1. Most of BCM class-A strain gauges for transducer application are available in stock over a number of standard creep codes. Since it is impossible to predict in advance the creep characteristics of a particular transducer, it is suggested that the gauges of at least two standard creep codes be selected and ordered in quantities for creep tests, so as to be able to evaluate the creep errors on a number of constructed transducers.

4-2. Based on the results of the creep tests, one could predict a proper creep code for further test. If the creep of other code is available (either more negative or more positive) and enough to correct the obtained creep error, this creep code may be the proper code to use for a better creep result in transducer production.

4-3. After selection of the proper creep code, a big quantity of the strain gauges of this creep code may be purchased for transducer production.

In selection of a creep code it is worth to notice that though different gauge patterns may list the same creep code, they may not necessarily exhibit a same creep. This is because, as mentioned before, many factors such as the gauge-grid geometry, gauge backing and gauge encapsulation, can influence the gauge creep characteristics. But we would guarantee a same creep for different batch gauges of the same gauge pattern.

It should also be noted that this type of creep correction is generally limited to transducers exhibiting a creep error less than ±0.1%FS/30min. Higher positive creep levels are often due to the poor quality of spring element material, while higher negative creep levels result mostly from poor installation in gauge bonding process.

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