Gage Life: Advantages & Disadvantages of Coatings

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Most gage users would agree that wear resistance is one of the most important characteristics they consider when purchasing a gage. Wear resistance can be defined as the ability to resist change in critical size and dimension. When studying wear resistance of tool steel there are two types of wear to be considered, adhesive wear & abrasive wear.

Adhesive wear occurs when two components are in intimate contact on smooth surfaces and there is a relative movement between them.

Abrasive wear occurs when a component comes into sliding contact with either a flowing stream of loose abrasive particles or a solid which contains abrasive particles.

Both of these types of wear have an effect on gages. The basic and most common type of wear thread gages experience is adhesive wear due to the constant contact and sliding motion that occurs on the flank angles of the threads. Abrasive wear of thread gages must also be considered because users often fail to properly clean both the product and the gage; leaving dirt, grit and metallic particles on the threads which will then act as an abrasive when the gage and product are mated together.

We often intuitively expect that a harder tool will resist wear better than a softer tool. However, different grades used at the same hardness, provide varying wear resistance. For instance, 01, A2, D2 and M2 would be expected to show increasingly longer wear...
performance, even if all were used 60 HRC. In fact in some situations, lower hardness, high alloy grades may outwear higher hardness, lower alloy grades.

Hardness is an indication of a steel’s ability to resist penetration and deformation, and therefore not the only or the most important indicator of wear resistance. There are several elements that determine the wear resistance of a gage, these elements include: surface finish, surface coating, hardness, chemical composition of the steel, proper cleaning and care for the gage.

A precision ground thread gage manufactured using state of the art equipment should have a high quality surface finish which will reduce friction, thereby reducing adhesive wear.

The chemical composition of a tool steel is another important factor in determining a tool steel’s wear resistance. Different grades of tool steel are composed of many different elements. Carbide is the element found in tool steel with the greatest relevance to wear resistance. The types of carbide, and amounts of these carbides found in the tool steel will determine a tool steel’s level of wear resistance.

Proper care, storage and use of gages are factors of a gage’s life and wear resistance often overlooked. A gage is a precision measuring device and should be cared for in the same
manner we care for other laboratory equipment. When possible, gages should always be stored in a temperature and humidity controlled environment; doing so will help prevent chemical changes in the steel such as rust. It is critical that both the gage and the product are thoroughly cleaned prior to being mated. It is recommended that a light lubricant be used with the gage to lower friction and reduce adhesive wear during use. Once finished with the gage, it should be cleaned again. A light coating of oil should be applied to the gage to help protect from corrosion during storage. Following these few simple procedures can greatly increase the life of any gage.

The surface coating of a gage is another factor which can greatly affect the wear resistance of a gage. PMC Lone Star offers three different coating options which provide unique advantages over uncoated gages.

PMC Lone Star offers chrome plating as an option for users looking for increased wear resistance. Chrome plating has a surface hardness of Rc 72. One benefit of chrome plating is that it provides a greater resistance to wear than plain steel gages. One of the disadvantages of chrome is that it has a tendency to deposit unevenly on complex profiles such as threads, sometimes resulting in poor or unacceptable thread form. Chrome plating provides a less desirable surface finish that is known to gaul and seize. Chrome
plating does not provide significant improvement in corrosion protection. The inherent porous nature of chrome results in a shift in the mechanism of corrosion from surface corrosion to galvanic corrosion. Galvanic corrosion initially occurs underneath the chrome surface giving the appearance of corrosion protection. The resulting rust spots will interfere with the function of the gage in the same way as rust resulting from surface corrosion.

PMC Lone Star offers TiN (Titanium Nitride) coating as an option for users seeking a gage with greater wear resistance than plain steel or chrome plated gages. TiN coating has a surface hardness of Rc 80. TiN coating will provide a significant increase in wear resistance over a chrome plated gage. TiN coating has a unique advantage over chrome plating: with proper care and maintenance a TiN coated gage has the potential to last forever. Because there is no limit on the number of times a gage can be stripped and re-coated, if the user at the first sign of wear on the coated surface, returns the gage for a strip and re-coating service, that user has a gage that could last a lifetime. The disadvantage of TiN coated gages is the cost of the initial coated gage. TiN coating requires the use of more expensive sub-straight material. The high cost of this material combined with the added difficulty of machining and grinding results in a significantly
more expensive gage, on average 2.5 times more expensive than standard steel gages.

Finally, PMC Lone Star offers a proprietary coating which far exceeds the wear resistance of plain steel, chrome plated, and TiN coated gages. In addition to the superior wear resistance of this proprietary coating, it also has the ability to be stripped and re-coated an unlimited number of times resulting in a gage that has the potential to last a lifetime. This proprietary coating can be applied to standard tool steels, lowering material and production cost, thereby lowering the cost of the gage to an average of only 1.4 times the cost of standard steel gages.
Bibliography
