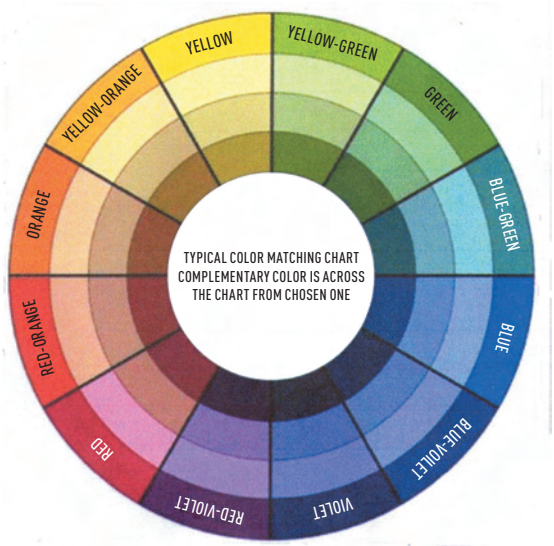
Cosmetic Fasteners
探討扣件上色

by Thomas Doppke



COLOR CHART

The way products are viewed today has changed. Where once a mammoth juggernaut of steel and iron was the size of a small house and appliances sturdy with cast iron bases, the customers now want compactness; small in size, quiet in running, and pretty in appearance. This extends to fasteners also. Where once a visible hex bolt stood out as a symbol of strength and toughness, now it is considered too "trucky" (truck-like) by designers. They want the fastener to blend in with the surrounding surfaces or even better yet, not be visible at all. Doing this has presented some problems and has generated some solutions.

Obviously a wide spectrum of matching colors is impossible. The sheer economics of duplicate parts in 15 or so colors would bankrupt most companies. The first attempt at a solution was to select a limited number of colors which could blend harmoniously with most other tints. This was immediately a problem. While standard color matching charts show complementary matches for any chosen color, the availability of that color in an available fastener finish was usually not possible. Also the nature on the colorant greatly affected the final tint.

To investigate this concern, let's review the present situation; the basic colors for standard fasteners are black (generally phosphate and oil finished) and silver from zinc plating. Zinc, depending upon the degree of surface polish and cleanliness, may range from dull argent to a bright, almost blue-white silver. And yellow from dichromate treatment. Again, depending upon surface finish and pre-treatment, the yellow ranges from a dull straw to a brilliant gold. The use of dyes to attempt coloring was tried but the dyes rubbed off easily and stain surrounding areas. An early attempt to color coordinate fasteners with matching surfaces resulted in the introduction of a paint-like top coat over the basic finish. This was generally unacceptable because the paint was oily and also rubbed off on the surrounding surfaces, fingers of the operators and customers. Also the oil had an effect on certain types of common plastics (stress cracking). Unfortunately, the plastics most prone to petro-chemical stress cracking are those most used in visible components such as dashboards and most interior trim. The colors obtained were very dark and hard to distinguish, appearing more like a tinted shade of black. Where paint was applied over zinc the color was better but the paint filled threads and recesses, making installation difficult.

STANDARD FINISHED PARTS

In some applications where the substrate was a soft plastic, the use of aluminum fasteners with anodized surfaces was tried. While the colors were acceptable (gold, silver and black are generally considered standard), other problems occurred. Aluminum screws are soft and easily broken or stripped, especially when the assembly line was used to running steel screws with air tools. The screw recesses were reamed out and the hex corners on hex shaped parts were rounded. Aluminum fasteners are very expensive and hard to procure as there were, and still are, few companies making any aluminum fasteners at all and almost no one is interested in small screws.

ALUMINUM SCREWS

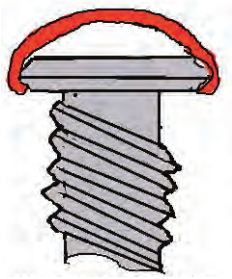
HEAD COATS

The problem of color matching had rapidly become a topic of concern for many companies. Did the color have to match? Really match? Or was some median acceptable. Today it seems that most applications settle for either a black or silver color, depending upon the background. Although in most applications there does not appear to be much controversy, certain areas are still pointed out in customer surveys. The comment "the screws look too truck-like" and "visible screws not acceptable" has caused some design changes. Again, the fasteners in the highly visible areas were the culprits. Furniture, appliance, and automotive requirements led to the development of specially finished fasteners. The standard fastener manufacturers looked at various colors of top coats, especially since the requirements for corrosion had been increased to 5 years corrosion resistance for outside parts and two years under hood for most applications in the automotive industry. Interior parts still required a one-year minimum. PTFE and FEP based colors and other propriety organic top coats were available for long life and are used, among other places, in areas exposed to seawater as well as automotive applications. This was acceptable although the negatives of using thick coatings existed- thread fill, recess fill, hard to start, very costly with special handling to avoid scratching and coating surface intrusions. The high cost has deterred usage in all but the most desperate situations. However a wide range of colors were available.

Rather than spend the time and effort in coating the entire part, the idea that perhaps the part could be manufactured with only a colored head was explored. This would reduce the problems with coating interference with assembly and allow a variety of parts to be made from a single base fastener.

There were a few ways that this could be done; parts were placed in a fixture and the heads only were painted with a colored substance (paint or plastic) colored to match the requirement (Part 1 on the illustration). This was, of course, very expensive due to the handling of screws 'one at a time' as opposed to the bulk coating methods of other processes. This met the color match requirement but other concerns arose. Misuse of the screws when the line operator used one that wasn't the right color occasionally happened (if more than one color was available in plant), shortages of the particular part (a condition which occurs with parts everywhere), the large inventory of the several colored parts required if multiple colors are used, and the cost of small lot manufacture (mainly due to the one at a time coloring as opposed to bulk handling of standard plated parts).

A second method employed molding a plastic, colored head onto a special headed screw (Screws 2 on illustration). The color could be as desired, but many of the same concerns were present. The need for a special driver (parts 4 shown) was an additional problem, as the soft plastic could not be tightened effectively without damage to the appearance surfaces. This meant repair, service, dealerships, and so on would require one of the special drivers also. The problems with this are self-evident; remember the problems when the six lobe star drive was introduced.


SNAP ON CAP SCREW

The invention of a special system solved some of the problems for one company.

They made a special headed screw with a lip. A cap of color plastic could be snapped over the circumferential lip, producing a domed, color matched fastener. Parts 3 in the previous illustration are two caps, one chrome colored and one black. The cost of the special head with its exact dimensional tolerances was high but only one part needed to be made. The colored caps, made of plastic and injection molded in quantity, were very cheap and easily installed. Negatives were that they could be knocked off and lost. But for that application, it was a solution. Since the product was not subjected to extremes of environmental or thermal conditions, it was an ideal answer.

While the parameter of cost affects every decision sooner or later, this one was no different. If a fastener was needed; its strength paramount to its function and cost a consideration, then why not use a standard part and hide the fastener? Or at least, make it as unobtrusive as possible. Two ways are used today. First, the fastener is installed through a recessed section in the component into the substrate (think dash or A pillar of a car, the A pillar is the first vertical section in the car, adjacent to the windshield). Then a matching plastic plug is inserted to cover up the hole. The picture shows a typical grab handle on an automobile. The screws are covered by the colored matched plugs.

GRAB HANDLE

Furniture manufacturers have used this idea for hundreds of years with a dowel plug stained to match the other wood. In this way an exact color match can be obtained and the fastening site hidden. The negatives of using colored plugs are the inventory of colored plugs and the increased labor to install (double effort; screws then plug).

Finally the thought of why not just use a plastic fastener in place of a steel one was discussed. As is evidence by the myriad of plastic fasteners in the market today, this idea has merit. Below are a small selection of some typical plastic fasteners.

TYPICAL PLASTIC FASTENERS

With a little effort, many joints could be designed using a plastic fastener of some sort in place of a tapping screw or other attachment. Many of the automotive applications are internal and basically cosmetic in nature. They do not really have to support much load. Trim moldings, covers, and various bezels need little besides placement attachment. Similar conditions exist with non-automotive applications also. Plastic fasteners attach but have little strength against pull-out forces. They are excellent for retaining parts against sliding loads. They were the subject of many articles here in Hardware World and other trade magazines. Where service and repeated removal and re-installation were a condition a plastic fastener with an integral plastic screw was invented. The screw was easily pushed into place and could be removed with a standard screwdriver.

The ultimate solution was, and still is, to delete the fastener entirely. Many applications employ molded ribs unto which metal clips are attached. These are located on the backside of the trim pieces (usually of plastic). The parts snap into slots and holes for easy assembly and present no visible mountings to the eye. The obvious drawbacks are that these types of attachments are not very strong and most mountings are usually not very reusable beyond a single time or two. Where strength is needed a metallic fastener is still required.

Several of these ideas are used today in many applications. The choice of black or silver/argent is used in many outside and under hood areas as the need for strength overcomes most of the other considerations. Trim utilizes hidden fasteners and plugged hole solutions for interior trim and on other components which are not subjected to large, shock, or cyclic loading. Plastic and hidden clipping are also predominant.

Where strength is required, a steel fastener is still the answer; where color is the concern and the application does not require strong joining, other solutions are possible. A quick table of the pros and cons is shown below.

PART	RANGE OF COLOR	COST*	AVAILABILTY	CONCERNS
Standard Part	Limited	Low	Standard	Matching
Standard Colored	Limited	Moderate	Limited Sources	Poor matches, oily, plastic cracking
Special Coating	Most Colors	Moderate to High	Very Limited Sources	Thread fill, misuse, recess fill, hard to Install
Head Coat Only	Most Colors	High	Extremely Limited	May need special driver, misuse, low volume, shortages
Snap On	Most	High	Extremely Limited	One of kind. No substitute
Aluminum Screw Anodized	Basic plus Dyes	High	Few Sources	Soft, strippage, dye rubs off.
Hide with Plug	Most Colors	Low	Many Sources	Extra labor to install. Double Installations (screw + plug)
Plastic Fastener	Most Colors	Low	Many Sources	Labor, design Low Strength
Hidden Clipping	N/A	Moderate to High	Many Sources	Labor, design Low Joint Strength

*Cost is of basic coating or part. Labor to install, extra operations, special fitting not included.