

## Causes for Off-Colored Black Oxide Finishes

“Activated” Black Magic™ “Plus”  
Black Magic™ Special  
Black Magic™ Classic

Liquid Black Magic™ Plus  
Black Magic™ Liquid  
Black Magic™ Liquid Classic

If a black oxide bath drops below boiling for longer than two minutes when a load of parts is immersed, the parts may have a loose red oxide film over the black oxide. The red oxide film is easily wiped off revealing the desired black oxide finish. When this happens, more heat is required to prevent a drop below a rolling boil for more than two minutes when a load is introduced or the weight of each load must be reduced.

The same type of loose red oxide (which wipes off) can be developed over the black oxide if electric heaters or hot gas flues are used which scorch the solution. This can be overcome by adding a stirrer to the solution to increase movement during heating or by an increase in the number of electric immersion heaters. If the tank is heated with a hot gas flue, the area of the flue running through the solution should be increased.

A red oxide can develop on top of the desired black oxide from a high level of colloidal iron oxide in the bath. This red oxide can be rubbed off easily. This problem can be resolved by desludging and skimming or by addition of Rectifier L-2 to the bath, which removes the excess red iron oxide in the solution. This is seldom required with a Hubbard-Hall bath because of our unique rectification system. If parts are dropped in the bath and allowed to remain or if finely divided iron is carried into the bath on the surface of parts from polishing and buffing operations, the cleaning step must be improved.

A red oxide or red tint to the black which cannot be wiped off can be developed by removing heavy parts from the rinse water following blackening, before they have completely cooled or from too long a transfer time between the black oxide bath and the cold water rinse. Reduce the transfer time until the problem is eliminated. If the transfer time cannot be reduced enough, a fine mist water spray rinse on the parts can be effective.

An excessive transfer time can also cause a splotchy reddish/brown oxide, which can be rubbed off to reveal a discolored thin grayish black oxide underneath. This discoloration is caused by the hot parts flash-drying the black oxide solution and leaving a salt deposit on the surface before the parts are water rinsed. The dried salts are very corrosive and will cause discoloration.

A red oxide, red tint or mahogany tint which cannot be wiped off, can develop on certain steel alloys and especially with some of the high chrome content steels with too short an immersion time or when introduced to a hot black oxide bath which is at 290°F or higher. The temperature is too high to start the proper reaction to develop a black oxide with a resulting red oxide. This problem may be corrected by running the black oxide bath at 285°F boiling or below and immersion of the parts for 45 minutes to over an hour. Other black oxide systems solve this



problem by using two hot black oxide baths with the first bath less than 285°F and the second bath above 290°, allowing twenty minutes or longer in each bath. We prefer to use a single bath with a longer immersion time.

A red cast or off-color may also develop on a black oxide finish from bi-metallic corrosion (also known as galvanic corrosion) by having common steel alloys in contact with stainless steel in a hot black oxide solution. A galvanic cell can be set up between the stainless steel and the common steel alloy. Because of this possibility, we never build a hot black oxide process tank out of stainless steel. If a hot black oxide process includes an acid pickle, acid brite or acid salt step, a stainless steel rotating barrel or stainless steel dip baskets or racks must be used to prolong their life. When a stainless steel rotating barrel is used in the black oxide bath, it is recommended that the saddles for the stainless steel barrel be insulated from the mild steel tank with wood or rubber underneath the saddle and mounting bolts. If a stainless steel dipping basket is being used, it is recommended that a wooden bar be used to suspend the basket in the solution rather than a steel or stainless steel rod to avoid galvanic currents between the stainless steel basket and mild steel tank. The off-color red developed from bi-metallic or galvanic reactions can be inconsistent between loads. Construction of rotating barrels, baskets or racks with a combination of stainless steel and mild steel is not recommended.

A green cast on the parts results temperature -- 275°F or less.