Product Bulletin
Product Name: Black-Magic Infusion 6040
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Black-Magic® Infusion 6040

Black Oxide Finish for Steel. Black-Magic™ Infusion 6040 contains a unique blend of oxidizers and alkali to produce a black oxide conversion on steel with minimum stress induced caustic embrittlement.

Features & Benefits

Dry Powdered concentrate	Use to reduce embrittlement
RoHS Compliant	Compliant with Textron Spec No 498D

Typical Applications

- Aircraft Piston Engine Cylinders
- Aerospace
- Heat Treated High Stress Steel Parts
- Heavy Duty Hand Tools

Instructions

Black-Magic™ Infusion 6040 oxidizing salts are a free-flowing, dust-free granular mixture which is combined with water to a concentration of 7.2 lbs. of salts diluted to one gallon of working bath. The solution is operated at a temperature of range 280F to 290F to blacken a wide range of carbon steels, alloy steels and hardened tool steels. It will not blacken stainless steel or cast iron, which are readily blackened with Hubbard-Hall's Black-Magic™ SS formulation.

SOLUTION MAKEUP

Rectangular Tank – solution level 6" from top.

Black-Magic™ Infusion 6040 L"xW"x(D"-6")x 7.2 lbs. per gallon

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Salt required for initial solution 231 cubic inches per gallon

Compute the amount of salts required by using the above equation. Fill the tank a little less than half full with cold water. Do not apply heat at this time, it is not safe to add large amounts of caustic salts to hot water, localized boiling and splash-back may result in injury. Start adding the salts to the water with continuous stirring to avoid the formation of lumps. When the required amount of Black Magic salts has been added, continue to stir and fill the tank with water to within 6" from the top. As the salts dissolve the bath temperature will rise to approximately 170F.

Heat is applied to the solution, and as the temperatures rises, it should be stirred frequently to ensure thorough mixing and a uniform temperature throughout. When the temperature reaches 280F. Black Magic is used as a supersaturated solution, and it should be allowed to boil for at least one hour before additional salt is added to ensure that the true boiling point has been reached with all of the salts thoroughly dissolved. Skim off the film of material on the surface. It is a dust dampening material and should be removed from the tank.

When the Black Magic solution is boiling a range of 280-290F, it is ready for processing work. Although the temperature of the solution can be maintained by manually adding water, we recommend that an automatic indicating temperature controller be used. With no addition of salts, the only reason for boiling point rise is due to the evaporation of water. The automatic temperature controller will replenish this water as needed to maintain the correct boiling point and concentration. It will also protect against the undesirable and detrimental overheating of solution. An automatic controller also relieves the operator of the responsibility for maintaining the temperature; and it ensures consistent, uniform, high-quality finishes.

BATH MAKEUP

Do not introduce water below the surface of the solution. The water should trickle in slowly. We recommend that an automatic indicating temperature controller and motor operated water inlet valve be used to safely control the additions of water. The automatic controller will replenish evaporated water as needed to maintain the correct boiling temperature and concentration. It will also protect against the undesirable and detrimental overheating of the solution. Automating the water additions will relieve the operator of the responsibility for maintaining the temperature and ensures consistent, uniform, high-quality black finishes. Hubbard-Hall can supply the automated temperature controller and water inlet valve with the preferred drilled piping to introduce the water along the rear wall of the tank above the solution level. Consult us for advice prior to installing a water inlet to a tank.

FINISHING PROCEDURE

Pieces to be blackened may be processed in mild steel baskets, tumbling barrels, hung on racks or hooks, depending upon the shape and weight and production requirements.

1. Thoroughly clean and degrease pieces with Hubbard-Hall's Mi-Clean™ 14 or 31 hot (180°F.) alkaline soak cleaners or with Hubbard-Hall's Mi-Clean™ 100, a heavy-duty, low temperature (70-160°F) alkaline soak cleaner. A typical cleaning time is five to ten minutes.
2. Rinse in bottom-fed, overflowing cold water rinse.
3. Immerse in Black-Magic™ Infusion 6040 solution (boiling at 280-290°F) until a uniform, deep black color is developed. Immersion time will be from 15 to 30 minutes, depending upon the mass of parts and type of steel alloy and condition of the surface.
4. Transfer the parts quickly from the blackening tank to the rinse. Some parts require a 3 second maximum transfer time.
5. Rinse in bottom-fed, overflowing cold water rinse.
6. Hot rinse water will remove stubborn salts but a small amount of sodium nitrite of 0.1% will help prevent discoloration of the black.
7. Seal the finish by immersing for one minute in Hubbard-Hall's Metal Guard® 510 for an oil finish; Metal Guard® Soluble 310 for a soft, dry film; or Metal Guard® 600 for a hard, dry film.

NOTE: If the pieces to be blackened have scale or rust on the surface, it must be removed by bead blasting or other mechanical techniques. Avoid acid which will impact embrittlement. Light surface rust will be removed in the black oxide tank although pitting and corrosion of the surface by the rust is not reversible. Different alloys will have slightly different optimal temperatures for blackening. Some alloys will blacken at 280°F, others will blacken at 282°F or higher. Run test parts to determine the lowest optimal temperature for blackening.

Operating Tips

Problems will rarely arise with a properly maintained and controlled Black-Magic™ Infusion 6040 solution. Its unique rectification eliminates the necessity for frequent sludge cleanout as is required with conventional formulations. Most problems can be traced to insufficient cleaning of the work or an incorrect boiling temperature. Other tips would include:

1. A Teflon coated glass mercury thermometer should be used to check the accuracy of the automatic temperature control.
2. Frequent small additions of replenishment solution will produce more uniform results than large amounts added less frequently.
3. Ideally, the temperature of the solution should not drop below boiling when work is introduced. Sufficient heat should be maintained to ensure that the solution does not drop below the boiling point for more than a few minutes, even with the heaviest loads.
4. Maximum loads should not exceed one pound of work per one-half gallon of solution. Optimum loads would be approximately one pound of work to one gallon of solution including the weight of barrels, baskets or racks.
5. Operating the bath at temperatures approaching 295°F or over will cause the buildup of red iron oxide, which can cause a red smut or an off-color on the surface of the blackened parts.
6. The bath should continuously have the sludge removed; sludge is the accumulation of sodium carbonate, iron oxide and soils. To remove sludge on a daily basis place a fine wire mesh stainless steel basket into the tank. Convection of the boil will cause sludge to collect in the basket. Remove the fine mesh basket full of sludge, let cool and dispose. In addition, the surface of the solution should be periodically skimmed with a flat fine meshed screen tool to remove hydrated iron oxide from the surface.
7. Avoid removing sludge form the bath when it is cold. Black-Magic™ Infusion 6040 is a slushy paste when cool and needed chemistry solidifies and attaches to the bottom and wall of the tank. Reheating the tank or idling at 170F should keep all materials in solution. Keep the tank covered when idle to prevent water loss.
8. Transfer time from the Black-Magic™ Infusion 6040 bath to the rinse water should be as short as possible to avoid the development of an off-color on the metal surface.

Equipment

The Black-Magic™ Infusion 6040 tank must be constructed of mild steel. The cleaning and rinse tanks may also be constructed of mild steel. Gas-heated tanks are preferred and should be under-fired with pipe burners and insulated. Immersion electric units should be constructed of mild steel and also be insulated. Racks, hooks and baskets must be constructed of mild steel. Non-ferrous metals such as galvanized iron, bronze, copper, tin or aluminum should not be used for racks or baskets as these materials will contaminate the Black-Magic™ Infusion 6040 solution.

Your Hubbard-Hall representative will be pleased to assist you in selecting and installing the proper controls as well as the complete tank system required for the process.

Alkaline cleaning, acid pickling and the Black-Magic™ Infusion 6040 solutions must be exhausted. The ductwork may be of the same materials as recommended above for the tanks. Galvanized steel should not be used.

NOTICE: Before using this material, read and understand OSHA MATERIAL SAFETY DATA SHEET for Black-Magic™ Infusion 6040 powder. Specific instructions and precautions should be followed to assure correct use and personal safety.

Caution

This material contains Caustic Soda. Causes severe burns.

Avoid contact with eyes, skin and clothing. Do not take internally. When handling the solution and working near the bath, wear goggles or face shield, rubber gloves and rubber apron. While preparing solutions and making additions, take care to avoid violent spattering.

In case of contact, immediately flush skin or eyes with plenty of water for at least fifteen minutes. For eyes, call a physician.

Avoid contact of Black-Magic™ Infusion 6040 solutions with any other chemicals or solutions.

OPERATING SOLUTION CONTROL PROCEDURE

TEST FORMAT	SPECIFICATION
1. Caustic Titration	8.2 – 9.3 ml
2. Nitrite Content	30.9 – 36.0 ml
3. Boiling Point	280 – 290F

REAGENTS AND EQUIPMENT

1.) 1 N hydrochloric acid
2.) 0.2 N potassium permanganate
3.) Standard Laboratory Equipment
4.) 6N sulfuric acid

TEST PROCEDURES

1.) Sampling: carefully remove 150 grams of solution with heatproof container from the Black Magic Infusion 6040 tank while boiling at 285F. Cover the hot solution to prevent water loss. Weigh out 30 grams ± 0.1 gram. Dilute the sample accurately to 10% by weight with water and adjust to 70F. e.g. if the sample weight is 30.0 grams add water to 310 gram total solution weight.
2.) Alternative method: Pour approximately 100 grams into a pre-weighed plastic sample bottle while submerged in cool water to avoid melting the bottle. Allow the sealed bottle to cool in water. Dilute the sample to 10% by weight with water and adjust to 70F. e.g. if the sample weight is 120.5 grams, add water to 1205 grams total solution weight.
3.) Nitrite: Take a 10 ml aliquot of 10% solution and dilute with 50ml of hot tap DI water and heat to 120F. Add 10 ml of 6N sulfuric acid (168 ml H2S04/L) and titrate with 0.2N KMn04 to a purple endpoint that persists 30 seconds. Determine if the solution is within range: 30.9 to 36.0 ml 0.2N KMn04.
4.) Caustic Content: Take a 10 ml aliquot of the 10% solution. Place in a 225 ml Erlenmeyer flask and add 50 ml of water and 10 drops of phenolphthalein indicator. Titrate with 1N HCI from purple to clear point endpoint. Titration between 8.2 and 9.3 ml.

5.) Boiling Point: Check the solution boil point with a glass thermometer. Temperature controllers frequently go out of calibration. Use a 0- 400F Teflon coated temperature Mcalister Bicknell Cat No 39743 0300.

WARRANTY: THE QUALITY OF THIS PRODUCT IS GUARANTEED ON SHIPMENT FROM OUR PLANT. IF THE USE RECOMMENDATIONS ARE FOLLOWED, DESIRED RESULTS WILL BE OBTAINED. SINCE THE USE OF OUR PRODUCTS IS BEYOND OUR CONTROL, NO GUARANTEE EXPRESSED OR IMPLIED IS MADE AS TO THE EFFECTS OF SUCH USE, OR THE RESULTS TO BE OBTAINED.

Our People. Your Problem Solvers.

For more information on this process,
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