SBX™ HT

SBX™ HT is an alkaline salt and oxidizing agent mixture containing penetrants, catalysts, activators, rectifiers and wetters which, when dissolved in water and heated, will produce a black oxide (Fe_3O_4 - magnetite) finish on steel. The oxide finish is normally top-coated and sealed with rust preventive oils, waxes or clear lacquers to enhance the depth of black and impart corrosion resistance to the finish. The SBX™ HT solution is maintained at a temperature of 141°C (285°F) to blacken a wide range of carbon steels, alloy steels and hardened tool steels.

Product Advantages

- SBX™ HT is used at a low concentration of only 689 g/L (5.75 lb./gal) of water which means a lower make up cost and much lower maintenance costs with reduced drag-out.
- The lower viscosity of the wetted solution further reduces drag-out by 20% to 30%.
- The thinner and wetter solution wets down passive steel surfaces resulting in a more uniform black finish.
- The solution is rectified to tolerate contamination with copper, colloidal red iron, oxides, zinc, etc. which reduces maintenance.
- Finish meets military specification MIL-DTL-13924D Class 1.
- Produces an economical black chemical conversion finish with added corrosion protection.
- Produces essentially no dimensional change - only 1.3×10^{-5} cm. Items such as gauges, cams, bolts, precision machined surfaces or other close-tolerance parts, which cannot tolerate a build up of a plated or painted finish, can be finished with SBX™ HT.
- The black oxide finish has good wear resistance and excellent adhesion and will not flake, chip or peel.
- The black finish reduces light glare on moving tools and machine parts. Thus, safety is improved and eye fatigue is reduced. A black finish also improves the performance of many optical surfaces for the same reason.
- The porous oxide film has the ability to absorb a final sealant or rust preventive, hence keeping the sealant in intimate contact with the steel surface longer than if the preventive were applied directly to the bare metal.
- Has a very low production cost on small parts since the process lends itself to bulk handling.
- The anti galling surface achieved through blackening allows the outer lubricating layer to be sacrificed during contact and abrasion; therefore, it is excellent for break-in.
- The pleasing decorative black finish enhances the saleability of many steel objects.

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Operating Procedures

1. Clean and degrease in a hot 71°C (160°F) - 82°C (180°F) solution of an alkaline soak cleaner such as Spotless™ EFS.

2. Rinse in a bottom-fed overflowing cold water rinse tank.

3. Optional acid salt solution at room temperature.

4. Rinse in a bottom-fed overflowing cold water rinse tank.

5. Blacken parts in a boiling SBX™ HT solution at 689 g/L. (5.75 lb/gal) of salts at 141°C (285°F) - 143°C (290°F). Immersion times of 5 to 20 minutes depending upon the mass of the parts, type of steel and condition of the surfaces. Ideally, the temperature of the solutions should not drop below the boiling point for more than a few minutes, even with the heaviest loads. Loads should be approximately 0.12 kilogram of work to one liter of blackening solution including the weight of the baskets, barrels and racks. 0.12 kg/L is preferred and loads should not exceed 0.24 kg/L. A rolling boil must be obtained before work is introduced and then maintained. Operating the solution at temperatures approaching 149°C (300°F) or higher will cause the build-up of red iron oxide, which can cause a red smut or an off-color on the surfaces of the blackened parts.

6. Rinse in bottom-fed overflowing cold water rinse tank. Transfer time from the SBX™ HT solution to the rinse water should be as short as possible to avoid the development of a red tint off-color on the metal surface. Removing heavy parts from the rinse before they have cooled completely may also produce a red tint to the finish. On an automatic machine, if the transfer time cannot be reduced enough, then a fine mild water spray rinse should be applied while the parts are being transferred. If parts flash dry during transfer, the dried salts, which are very corrosive, will cause a splotching discoloration. A spray rinse during transfer will also eliminate flash drying.

7. Seal the finish by immersing the parts while still wet from the preceding rinse in a water displacing solution of GuardCoat™ Oil.

Maintenance

The concentration of salts in the solutions is maintained by the boiling point of the solution. The SBX™ HT salts are mainly lost from the solution by drag out and must be replenished by additions of replenishment salts. Frequent additions of small amounts of salts will produce more uniform results than large amounts added less frequently. Water will be lost only by evaporation.

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If the boiling point drops below 141°C (285°F), salts are slowly added until the boiling point reaches 141°C (285°F). If the boiling point exceeds 143°C (290°F) water is added slowly and safely until the boiling point is reduced and the heat is lowered to provide a gently rolling boil.

Salts are added only to raise the level of the tank or raise the boiling point. If the solution level falls below the desired working level, water is slowly added until the solution level reaches the desired point, then the salts are slowly added to produce the desired boiling point.

Rectification

Occasionally a red oxide can develop on top of the black oxide finish due to an excess of red iron oxide or copper in the bath. If skimming the surface of the bath does not solve the problem, then **Aqua SBX Rectifier™** solution must be added. Excess iron oxide usually occurs when parts are dropped in the bath or finely divided iron is on the surface of the steel parts from polishing and buffing operations. Aqua SBX Rectifier™ is added at 4 - 8 mL/L. Add slowly to avoid spattering and eruptions.

Safety Precautions

When salts are added to a cold or hot solution they should be added slowly by sprinkling them over the entire surface while stirring the solution. Large shovelfuls or buckets of salts **should never be just dumped** in mass into the solution as this could cause a violent eruption of the hot solution.

Although the temperature of the solution can be maintained by manually adding water, an automatic indicating temperature controller is recommended for the safe addition of water. The only reason for the boiling point to rise is due to the evaporation of water. The automatic temperature controller will replenish the water as needed on a continuous basis to maintain the correct boiling point and concentration. It will also guard against the undesirable and detrimental overheating of the solution.

Water should only be added automatically to the solution when it is boiling so that the fresh water is rapidly and thoroughly dispersed throughout the solution from the boiling action. If water is added to the solution when it is not boiling, the water will lie on the surface of the solution and can be suddenly drawn in mass below the surface upon the first boiling action and this could cause a violent eruption of the solution. Stirring the solution is satisfactory if water is added manually when the solution is not boiling.

The bath should be periodically de-sludged to remove accumulation of sodium carbonate, iron oxide and soils at the bottom of the tank. In addition, the surface of the solution

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should be periodically skimmed with a dust pan-type tool to remove hydrated iron oxide from the surface.

Sludge must not be allowed to build up on the bottom of underfired gas heated tanks because this could lead to a violent eruption of the solution due to a sudden overheating from the insulating effect of the sludge. The sludge could also become overheated and suddenly crack, allowing water to penetrate below the sludge causing the sudden formation of steam and the violent eruption of the solution. When heat is applied to a cold SBX™ HT solution, the solution must be stirred until the operating temperature is reached to avoid overheating and the violent eruption of the solution.

The sludge in an SBX™ HT solution will consist mainly of Soda Ash (Sodium Carbonate - Na_2CO_3), with inclusions of Iron Oxide (Fe_2O_3) and Sodium Hydroxide (NaOH). The Soda Ash is produced from the reaction of the Sodium Hydroxide and Carbon Dioxide in the water and air. The Soda Ash is not soluble in the solution, thus producing the major part of the sludge. The white, crusty accumulation on the tank walls above the solution level is also predominately Soda Ash. It will not go back into solution and should be scraped off, caught in a pan and disposed of properly.

Equipment

The SBX™ HT tank must be constructed of mild steel. The cleaning and rinse tanks may also be of mild steel. The acid salt solution should be contained in plastic or rubber (Koroseal) lined steel tanks.

The Cleaning stages and the SBX™ HT solutions must be ventilated. Galvanized steel should not be used for the duct work.

Gas heating units are preferred for producing the most rapid heat up and maintenance of the solution temperature--with rapid recovery when a load is introduced into the solution. The gas pipe burner units should be mounted evenly along the bottom of the insulated tank with the flue gases allowed to rise evenly around all four sides of the tank encased in an insulated steel housing with a 2.5 cm air space between the insulation and tank walls. The flue gases exit through one or two openings at the rear of the tank.

The bottom of underfired gas heated tanks should be 0.64 cm thick for tanks up to 75 x 75 x 100 cm, 2 cm thick for up to 120 x 120 x 150 cm tanks. A 3 cm tank bottom should be used for larger sizes.

A single 15 cm outlet for hot flue gases is recommended for tanks up to 100 cm wide. With tanks wider than 130 - 150 cm, two (2) 15 cm outlets at each end should be used. A damper should be provided on the flue pipe outlets.

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An automatic butterfly valve should be provided to the gas supply to throttle back gas to burners when tank is idling with no work, but will supply gas when work is introduced and temperature drops. Gas heat should never be turned off completely between loads.

Gas fired pipe burner assemblies should be sized to provide a minimum heat up time of two hours from room temperature to 141°C (285°F). This will require 333 BTU per liter of SBX™ HT solution and will provide for heat losses and provide sufficient recovery when parts are introduced into the solution.

Electric immersion heaters may be used and 0.084 KW will be required per liter of SBX™ HT solution for a two hour heat up time. Care should be taken to avoid scorching the solution with electric heaters by providing enough heaters to evenly heat the solution. A mechanical stirrer should be used during heat up to avoid scorching which will produce a loose red oxide on the parts.

Water must not be allowed to enter tank unless solution is boiling or is being stirred. At shut down time, the electricity to the motor operated water inlet valve can only be shut off when the valve is in the closed position to avoid the introduction of water when tank is not in operation. Do not turn on power to the water valve until solution is boiling or being stirred. The main supply valve to the system should also be shut off when tank is not in operation.

Bi-metallic corrosion which can cause a red cast on parts must be avoided with SBX™ HTsolutions by not having common steel alloys in contact with stainless steel. A galvanic cell will be set up between the metals. Therefore, if dip baskets, hooks, or rotating barrels must be constructed of stainless steel because an acid pickle issued, they must be insulated from the mild steel SBX™ HT tank with rubber or wood.

Make Up

1. Clean tank of all debris, rust or loose scale to avoid off color reddish parts when parts are first processed.

2. Fill tank half full with cold water. Do not turn on heat.

3. With the exhaust system turned on, add the SBX™ HT salts to the cold water while stirring to dissolve the chemicals. Heat will be generated and solution temperature may reach 82°C (180°F). Do not add all of the salts at once as this could cause a violent eruption.

4. When all the salts have been added and dissolved, add cold water to bring the solution level to within 5 cm of the final desired level.

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5. Turn on the heat and stir as the temperature rises. Do not have the power turned on to the motor operated water inlet valve.

6. When the solution reaches a boil, the motor operated valve may be turned on. If the boiling temperature exceeds 143°C (290°F) water may be added slowly to lower the temperature. If the boiling temperature is less than 141°C (285°F), additional SBX™ HT salts can be added slowly to raise the boiling point or the solution may be allowed to boil to evaporate water and raise the boiling point. Adding salts, adding water or evaporating water is used to make the final adjustment of the solution to the desired operating level where it is then maintained.

7. The heat may be turned on when the solution reaches a boil. A gently rolling boil is then maintained while blackening parts.

Caution

This material contains caustic soda - causes severe burns.

Do not get in eyes, on skin or on clothing. Avoid breathing dusts or solution mists. Do not take internally. When handling powder or working near the SBX™ HT solution, a full face shield or goggles must be worn along with protective rubber gloves, rubber apron and rubber boots.

In case of contact with powdered SBX™ HT material or SBX™ HT solution immediately flush skin or eyes with plenty of water for at least fifteen minutes. For contact with eyes, immediately call a physician.

Do not introduce zinc or aluminum objects into SBX™ HT solutions as this will cause a violent reaction and eruption of the solution.
Avoid contact with all acids, aluminum, tin, lead, zinc and their alloys.

Do not mix SBX™ HT or its solutions with other chemicals or solutions.

Troubleshooting

Red Oxide Which Wipes Off

If an *S*BX™ HT bath drops below boiling for longer than 2 or 3 minutes when a load of parts is introduced the parts will come out of the bath with a loose red oxide on top of the desired black finish. This red oxide is easily wiped off to reveal the desired black oxide finish. When this happens, more heat must be applied to the bath so that it does not drop below a rolling boil for more than 2 or 3 minutes when a load is introduced or the weight of each load can be reduced. Ideally, a black oxide tank should be sized with 8.3 Liters

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of solution for 1 kilogram of iron or steel parts. The maximum load to go into a hot black oxide tank should be 0.24 kg/L.

Loose Red Oxide Which Wipes Off

A loose red oxide which wipes off easily can also be developed over the desired black oxide finish if the tank is being heated with electric immersion heaters or a hot gas flue. These two types of heating can scorch the solution producing red iron oxide in the solution. This can be overcome by putting a stirrer in the solution to keep it moving during heating, by increasing the number of electric heaters or by increasing the area of the flue running through the solution.

Loose Red Oxide Which Wipes Off

A loose red oxide can also develop due to a high level of red iron oxide in the solution. This is seldom a problem with the rectified SBX™ HT solution but excess iron can be dragged into the bath where it reacts to form red iron oxide. This excess iron can develop from dropping parts into the bath or by carrying finely divided iron into the bath on the surface of steel parts from polishing and buffing operations. In addition, iron can be dragged into the bath from acid pickles high in iron concentration and this iron will readily react to form red oxide. If iron is being dragged into the bath, then the problem can be eliminated by a more thorough cleaning and a more thorough rinsing prior to immersing the parts in the black oxide bath. This is frequently a problem with all other competitive black oxide baths which are not rectified to the extent that SBX™ HT is. If, by chance, this does happen to an SBX™ HT bath, then the bath should be de-sludged and the surface should be periodically skimmed to remove the red iron oxide as it floats to the surface of the bath. Aqua SBX™ Rectifier may be added to the bath to clean out the red iron oxide.

A Red Tint To The Black Finish Which Cannot Be Wiped Off

This most often happens when heavy parts are removed from the rinse water following the blackening before they have completely cooled. This can also be caused by too long of a transfer time between the blackening bath and the cold water rinse. If it is a transfer time problem, the operator should transfer the parts from the blackening solution to the rinse as fast as possible. With automatic blackening machines the time of transfer should also be kept to a minimum. If the problem cannot be eliminated with transfer time, then a fine mist of water spray should be impinged on the parts while they are being lifted out of the blackening solution and being transferred to the cold water rinse.

Reddish/Brownish Splotchy Oxide Which Can Be Rubbed Off

This discoloration can be caused by too long of a transfer time when the hot parts flash dry leaving solid salts of the solution on the surface prior to the parts being immersed in a cold water rinse. The dried salts are very corrosive and leave a discolored or thin gray-black oxide underneath. This problem is solved by reducing the transfer time or with the impinging spray rinse.

A Red Mahogany Tint Which Cannot Be Wiped Off

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This may happen with certain steel alloys and especially with chrome steels when too short of an immersion time is used in the black oxide solution. It also can happen when the steel parts are introduced into a black oxide solution when the temperature is above 143°C (290°F). The temperature is too high to start the proper reaction and a red oxide results. This problem can be solved by lowering the temperature to 141°C (285°F) or below and immersing the parts for 45 minutes to one hour. This is very seldom a problem with SBX™ HT which is formulated to blacken a wide range of alloyed steels.

A Red Cast Or Other Off Colors Which Cannot Be Wiped Off

Bi-metallic corrosion (galvanic) can happen when common steel alloys are in contact with stainless steel while in the hot black oxide solution. A galvanic cell is created between the steel and stainless steel. It is because of this type of problem that black oxide tanks are constructed of mild steel. However, stainless steel barrels or stainless steel dip baskets are frequently used in a black oxide line because acid dips are used prior to blackening and stainless steel is used to prolong the life of the baskets and/or barrels. When a stainless steel barrel is being used with SBX™ HT, it is recommended that the saddles that the barrel rest on be insulated with rubber from the mild steel tank. The rubber and/or wood should be under the mounting bolts as well. 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 bar to avoid the formation of galvanic cells. This off color due to galvanic reaction may show up sporadically, being present with one load and not the next load. It is never recommended that a rotating barrel be constructed of a combination of mild steel and stainless steel and the same goes for dipping baskets.

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READ THE SDS BEFORE USING THIS PRODUCT.