Advice & Counsel

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Training "Colombo"—Part VII

Columnist's Note: *This month's column is a continuation of "Training Colombo—Part VI," which concerned high-temperature black oxide processes. Part VI appeared in the August issue of* P&SF *and references are listed both months.*

Oil Quality Issues

A number of cases of poor corrosion resistance on parts coated with black oxide and oil have been solved by simply replacing the oil with a superior product. Poor salt spray performance should be investigated along the lines of process parameters/chemistry and oil quality. The salt spray testing of black oxide and oil parts must be carefully conducted on parts that have been handled as little as possible (preferably with plastic gloves). Also, the parts should not be tested after prolonged storage (more than 2-5 days) or if packaged in absorbent media, such as paper.

Solution Contamination

Because the blackening solution is highly alkaline, zinc, aluminum, cadmium and copper contamination should be avoided, because sufficient amounts of any of these contaminants will affect the color of the finish.

Post Coating Processing

After the black oxide coating is formed, parts are rinsed. Corrosion resistance is enhanced by an immersion in 0.06 to 1 oz/gal chromic acid or sodium dichromate solution to neutralize the alkaline film. A hot-water rinse follows the cold rinse, after which the parts are dried. Clean, compressed air may be used to reduce the drying time. Agitation (air or mechanical) during rinsing and chromic acid dipping helps wash the trapped salts from blind holes and crevices. The parts may then be oiled (at least two min with frequent agitation) or finished with lacquer or enamel by dipping or spraying.

Finished parts that are to be stored in excess of seven days after treatment should be protected with a soft film corrosion-preventive compound and wrapped in greaseproof material. Finished parts that are to be stored in excess of 60 days after treatment should be protected with a soft film corrosion-preventive compound and wrapped in greaseproof material.

Quality Control Tests

Coating requirements specified in AMS 2485G and other internal corporate specifications include the following tests.

Smut Test

The smut test is performed by wiping the coated part with a clean, white cloth. A part passes the smut test if no indication of reddish-brown or green smut appears on the cloth. The smut test is to be performed on coated parts before oiling, or on oiled parts after vapor degreasing.

Humidity/Salt Spray

Humidity resistance is performed on completely processed parts, or panels processed with parts. The parts are exposed to no less than 120 hr of humidity, with the temperature in the humidity cabinet being 120 ±5 °F. Parts pass if, after exposure, there is no evidence of corrosion.

Parts coated with black oxide and oil are typically tested per ASTM B-117 (Salt Spray). Typical salt spray resistance varies from 12 to 40 hr and more, depending upon the quality of the oxide and oil.

Appearance

The appearance of the coating is evaluated by the uniformity of the color and luster on polished surfaces. When coatings are applied to non-polished surfaces, the uniformity of color is based on surfaces that have equivalent surface roughness. The coating should also be free of spots of red oxide or an overall reddish-brown color. An exception is the permissible overall reddish-brown cast on a basically black color. There should also be no measurable dimensional changes that result from the processing.

Dimensional Change

The application of the black alkaline finish should not produce any major modification of the initial dimensions (variation by ± a few microns, dependent on steel type and pickling conditions).

Oxalic Acid Test

To run the test, apply three drops of a five-percent oxalic acid solution onto a thoroughly degreased, flat, coated surface. After an eight-min contact, rinse in water and check the color of the residual stain. The

surface coloration should remain close to the original. Heavy alteration from the original color is an indication of a poor finish.

Equipment

All high-temperature black oxide tanks and tank fixtures should be made of 300 Series stainless steel or cold-rolled steel. Plastics are unsuitable because of the solution's high temperature operating conditions. Heated tanks are to be equipped with steam plate coils or other heat source capable of heating the solution to the specified temperature. All such tanks should be provided with suitable thermostatic control devices to maintain solution at the proper temperatures.

The black oxide processing tank may be constructed of steel plate. Gas burners need to be of sufficient size to create a temperature rise from 65–300 °F in about one hr, and should be located below the tank.

The hot air chamber is equipped with a flue pipe connection at one end of the tank and an ignition door at the opposite end. The outside of this chamber should be insulated and protected with a steel sheet outer casing.

The tank should have an automatic temperature control to regulate any necessary water addition. Water addition in a slow, diffused state is important to prevent steam pockets that can cause catastrophic accidents, because the steam can force boiling-hot solution out of the tank! The tank should also be fitted with an adequate exhaust system to remove fumes and protect workers against irritating or corrosive contaminants.

Part Handling

To simplify handling and processing, parts may be strung on wires, placed in baskets or hung on racks made of 300 Series stainless steel.

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References

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