**CHECKLIST FOR BLACK OXIDE COATING IAW MIL-DTL-13924D, Class 1**

1. Identify the drawing; specification or document that invokes the requirements for black oxide coating. Specify:
2. Do the acquisition documents specify the number of samples to be used for lot testing? If not, file a Contract Deficiency Report (CDR) in EDA for a contract modification to include this information. NOTE: Most of the lot tests are nondestructive, but it should be conveyed to the Procurement Contracting Officer that the oxalic acid spot test, and the hydrogen embrittlement relief test for parts 40 HRC and above, are destructive.
3. Does the supplier have written processing instructions?

Identify procedure number and revision:

1. Are cleaning solutions analyzed and adjusted to maintain them within established parameters?

Are records of these analyzes and adjustments maintained?

Are the cleaning baths at the proper temperature, and are the temperature regulators calibrated?

1. Does the cleaning process utilized effectively remove all soils from the parts as evidenced by a water-break free surface (water from the final rinse in the cleaning cycle flows freely down the surface of the parts without breaks)?
2. Do processing instructions specify stress relief baking for steel parts 40 HRC & above? If not, does the supplier have objective evidence that the process does not cause embrittlement (such as embrittlement test records of unbaked tensile bars that have been processed in the same way and passed testing)?
3. Is stress relief baking, when required, performed in accordance with AMS 2759/9 Table 1?
4. Is the black oxiding bath maintained within the specified operating temperature (typically 285 -290F, or as otherwise specified by the manufacturer of the black oxiding salts – see manufacturer’s technical data sheet)?

Is the temperature regulator for the black oxiding bath calibrated?

Are parts black oxided within the specified time limits noted in the supplier’s processing instruction (should be 5 – 60 minutes, or as otherwise specified by the manufacturer of the black oxiding salts – see manufacturer’s technical data sheet)?

1. Are parts immersed for a minimum of 30 seconds in the chromic acid dip?

Is the chromic dip at the proper temperature (150-190F), and is the temperature regulator calibrated?

Is the chromic dip analyzed and adjusted to maintain it within required parameters (0.06%:

8 oz chromic acid/100 gal water, and pH of 2 to 3)?

Are records of these analyzes and adjustments maintained?

If control is solely by maintenance of pH, how does the supplier determine when the bath should be dumped?

1. When hydrogen embrittlement relief is contractually specified, are parts baked in accordance with AMS 2759/9 Table 1?
2. A lot is defined as a maximum of 8 hours continuous production consisting of parts of the same class, same basis metal, and approximately the same size and shape, coated under similar conditions. Is the following lot testing performed and properly documented:
3. Coverage and color (3.7)
4. Workmanship (3.12)
5. Visual inspection at 10X magnification for surface attack (4.3.1)
6. Smut test (4.4.1)
7. Oxalic acid spot test (4.4.2)
8. Hydrogen embrittlement relief testing, when applicable (4.4.4.1)
9. Is the supplementary preservative treatment material in accordance with contractual requirements?

Is the preservative material used listed in the Qualified Products List, when applicable, for the specification called out in contractual documents?

Is the preservative material applied in accordance with the manufacturer’s technical data sheet?

Note: Black oxide coatings on iron and steel should produce no appreciable dimensional change of the treated piece. The dimensions shown on the drawings are, therefore, the dimensions after the application of the coatings. (6.3.1)

When stress relief and/or hydrogen embrittlement relief baking of parts is a requirement, a review of the processing oven and auxiliary equipment should be performed as follows (ref. AMS 2750D):

1. Are temperature uniformity surveys (TUS) performed quarterly on processing ovens?

(Note: Frequency may be reduced to twice/year after 4 consecutive successful surveys.)

2. Are system accuracy tests (SAT) performed twice/month on temperature control and recording systems?

3. Is the SAT performed using a test instrument meeting the requirements of Table 3, and a test sensor meeting the requirements of Table 1 (3.4.1.1)?

Table 3 excerpt:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Instrument | Instrument Type | Maximum  Calibration  Period  (Months) | Standard | Calibration Accuracy | Use |
| Field Test  Instrument | SAT/TUS Portable potentiometer or digital instrument, electronic data recorder, or data  acquisition system | 3 | Primary or  secondary  standard | ±1 °F (±0.6 °C) or  ±0.1% of reading in °F, whichever is  greater | Limited to controlling,  monitoring, or recording  instrument calibration,  performance of system  accuracy tests, and  temperature uniformity  surveys |

Table 1 excerpt:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Sensor | Sensor Type | Use | Calibration | | Maximum Permitted  Error |
| Period | Against |
| System  Accuracy  Test | Base or  Types B, R,  and S noble  metal | System  accuracy tests | Before first use.  Recalibration:  6 months - Types B, R, & S  3 months - Types J & N  not permitted - other base metal | Primary or  secondary  standard | Base metal ±2 °F (±1.1 °C)  or ±0.4%  Noble metal ±1.0 °F (±0.6 °C)  or  ± 0.10%, Type R, S  ± 0.25%, Type B |

NOTE: Recalibration of any expendable base metal test thermocouples (SAT or TUS) is prohibited. Reuse is permitted so long as "U" in the following formula does not exceed 30. A “use” for test thermocouples is defined as one cycle of heating and cooling the thermocouple. U = Number of uses below 1200 °F + 2 times number of uses between 1200 °F and 1800 °F. Expendable base metal test thermocouples shall be limited to a single use above 1800 °F. (3.1.1.10)

1. Do sensors have a certificate of compliance that identifies the source of the calibration data, nominal test temperature, actual test temperature readings, calibration technique, and correction factor for each calibration temperature traceable to NIST or other recognized National Standard; and does the calibration technique comply with ASTM E 220, ASTM E 207, or other national standard? (3.1.1.1)
2. Is there a written procedure for controlling the replacement of temperature sensors, including limits on maximum life and/or number of uses? (3.1.1.4.1)

6. Do system accuracy test records contain the following information (3.4.6.1):

Identification of the sensor being tested

Identification of the test sensor

Identification of the test instrument

Date and time of day of the test

Observed control or recording instrument reading

Observed test instrument reading

Test sensor and test instrument correction factors

Corrected test instrument reading

Calculated system accuracy difference

Indication of test acceptance or failure

Identification of technician performing the test

SAT company (if not performed in-house)

Signature of the calibration company representative (if not performed in-house)

Quality Organization approval.

7. Does the oven chart recorder have a maximum resolution of 250F per inch of chart paper, and a maximum chart recording increment of 10F? (3.2.2.1)

8. Is the chart recorder (circular and strip) speed verified annually, and is it accurate within ± 3 minutes per hour (3.2.5.4)?