

NickelCote™ Process Overview

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1. Silver Fox offers three NickelCote™ versions.

- 1.1.1. NC500 – High Phos, as plated
- 1.1.2. NC720 – High Phos, diffused
- 1.1.3. NC910 – High Phos, heat treated

2. Flowchart of NC500 Process



3. Customer Part received

- 3.1. Inspect all parts upon receipt for mechanical damage (e.g. Threads) and advise customer if any observed.
- 3.2. Part is compared to Customer's Order Entry Form to ensure proper quantity, part description and if possible part material.
- 3.3. NickelCote™ version and required thickness of plating is confirmed. All versions of NickelCote™ require NC500 as a starting point. NC720 and NC910 are differing heat treatments that are applied to NC500 to provide the mechanical properties required.

4. Stamping Run Log

- 4.1. If required part is stamped with "NickelCote" run date and run number (eg. NickelCote™ Run 110410-1)
 - 4.1.1. Run date is set as Year/Month/Day

5. Cleaning and Inspection

- 5.1. Areas requiring NickelCote™ must be free of slag or scale. Surface finish of 64µin or better is recommended to ensure proper coating of part.
- 5.2. Verify ID tolerances of all Silver Fox flow control product such as Nipples and Slick Joints by drifting seal bores.
- 5.3. Part must be cleaned and dried prior to NickelCote™ process. All areas subjected to NickelCote™ process must be cleaned using Burn off oven, pressure washer, and bead blaster.

6. Preparation

- 6.1. Specific areas that do not require plating are masked off. This is accomplished using platers tape, plugs, or other masking agents.
- 6.2. The parts are hung using appropriate hanging methods depending on the geometry of the parts, ensuring no gases will collect inside or on the parts causing improper plating coverage.
- 6.3. Test panels are marked A, B, C, etc. and their thickness is measured with a micrometer and recorded on the NickelCote™ Run Log.
 - 6.3.1. Final measurement panel should be of similar material if possible.
 - 6.3.2. If any parts are having secondary processing (NC720 or NC910) then extra final panel must be run for each secondary process. These panels can be tagged as to what condition there are meant to be in the finished state.
- 6.4. Test panels are initially measured and recorded for thickness then processed in the same manner as parts.
- 6.5. The hanging rack is moved to the staging area where it is hung from the gantry.

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7. Snapshot of Plating Procedure

- 7.1. The hanging rack is sequentially moved through the plating tank process.
- 7.2. Samples of the nickel solution are analyzed automatically to check the Nickel content and pH level; chemicals are replenished as they are used in the plating of the parts
- 7.3. One test panel is removed from the tank every 30-45 minutes and is re-measured with a micrometer to determine plating rate on the parts. Measurement is recorded on NickelCote™ Run Log, where plating thickness and plating rate are confirmed.
- 7.4. After the sufficient thickness of NickelCote™ is reached as per the order entry form (within tolerance of +/- 0.0002") the hanging rack is raised out of the solution.
- 7.5. The hanging rack is then moved to the final rinse stage where it is processed through hot and cold de-ionized water rinse tanks

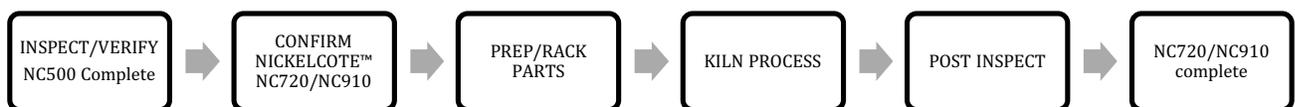
8. Inspection

- 8.1. The parts rack is moved back to the staging area where inspection of the final test coupon is done.
- 8.2. The final panel that is removed out of the solution at the same time as the parts is bent from the middle to at least 180° and checked for flaking or separation of the plating; as per ASTM B733-04. This test is used to confirm sufficient adhesion to the material.
 - 8.2.1. If a test panel does not pass ASTM B733-04 then the entire batch must be stripped and reprocessed
- 8.3. A 100% visual inspection of part is performed to make sure there is no pits, cracks, spalling or blistering in the coating; this includes areas that required and did not require plating as well as any mechanical damage that may have occurred.
 - 8.3.1. If a part fails the visual inspection, it is isolated and the part is stripped and reprocessed.
- 8.4. Verify ID tolerances of all Silver Fox flow control product such as Nipples and Slick Joints by drifting seal bores to ensure part still conforms to Silver Fox standards

9. Final sign off/Further processing

- 9.1. All NC500 paperwork is to be completed at this time, if final process step parts are then marked complete
- 9.2. Parts requiring NC720, NC910 or other treatments are tagged and continue on, along with respective test panels.

1. Flowchart of NC720 & NC910 Process



2. Process note

- 2.1. NC720/NC910 are a secondary process of NC500

3. Inspect & Verify

- 3.1. Inspect the NC500 coated parts to ensure proper coverage and surface thickness was attained prior to further processing.
- 3.2. Verify process for parts, as both NC720 & NC910 utilize a gas or electric kiln to complete process.
 - 3.2.1. NC720 is a Diffusion treatment of NC500. This process requires high heat and several hours for the diffusion to take place.
 - 3.2.2. NC910 is a Heat treatment of NC500. This process requires moderate heat and few hours for transformation to take place.

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4. Preparation

- 4.1. The parts are prep and racked using appropriate methods depending on the geometry of the parts.
- 4.2. Test panel marked NC720 or NC910 that was carried through same NC500 process as parts, is processed same manner as parts

5. Snapshot of Kiln Procedure

- 5.1. The racked parts are placed in a retort inside a gas or electric kiln
- 5.2. Kiln computer is programmed to increase temp at set rate and soak parts at set temperature for set time.
- 5.3. After the run is complete the parts are allowed to slow cool in kiln
- 5.4. Parts are then removed from kiln and placed on inspection table

6. Inspection

- 6.1. A 100% visual inspection of part is performed to make sure there is no pits, cracks, spalling or blistering in the coating; this includes areas that required and did not require plating as well as any mechanical damage that may have occurred.
- 6.2. Gaseous colors may be present which is acceptable.
- 6.3. Verify ID tolerances of all Silver Fox flow control product such as Nipples and Slick Joints by drifting seal bores to ensure part still conforms to Silver Fox standards

7. Final sign off/Further processing

- 7.1. All NC720/NC910 paperwork is to be completed at this time, if final process step parts are then marked complete
- 7.2. Parts requiring TA10 or other treatments are tagged and continue on.