User and Trouble Shooting Guide
Black Oxide Coatings

STEEL AND STAINLESS STEEL

- Soak Clean – 5 minutes
- Rinse well
- Acid pickle:
  - o Steel – only when scale, rust or oxides are present, 3-5 minutes or until rust, scale, and oxides are removed.
  - o Stainless Steel (all alloys) – 2-7 minutes
- Rinse well
- Blacken:
  - o Steel - @285°F. rolling boil
  - o Stainless Steel - @255°F. rolling boil

Steel/Stainless Steel

Low carbon – 10 min.
High carbon – 10-15 min.
Tool steel – 30-60 min.
Examples: A-3, H11,S7, etc.

Heat Treated Steel – 15-20 min.

Need contact with mild steel
300 series – 5-7 min. max
400 series – 5-7 min. max
Note: too long = “edge effect”
“pH” (precipitation hardened)
2-5 min. typical
Ductile and cast iron, 2-7 min.

- Rinse well
- Post treatments:
  1) Water displacing oil
  2) Water soluble oil
  3) Water soluble wax
  4) Chromic dip

Notes:

1. Time must be the same from batch to batch for consistent results. This includes cleaning, acid and black bath.
2. Agitate parts in all steps.
3. Keep bath temperatures correct.
4. Keep black baths skimmed and clean.

50% muriatic acid, room temperature, 3-5 minutes typical.
Stainless should be on steel wire or in steel baskets.

TROUBLE SHOOTING HOT BLACK OXIDE BATH

PROBLEM	CAUSES AND CORRECTIVE ACTION
Loose, red oxide that wipes off	1. Loose scale present 2. Transfer time too long 3. Rectifier needed (too much coloidal iron present. 4. Temperature too high 5. Solution dries on
Red oxide that does not wipe off	1. Transfer too long 2. Temperature too high 3. Heat treat scale present 4. High silica alloy (>3%) 5. High carbon alloy (>1%)
Red cast / background	1. Galvanic problems 2. High chrome alloy 3. Need longer immersion time 4. Temperature too high
Green cast / brown	1. Temperature too low 2. Add salts 3. Increase temperature at boil 4. Rust present prior to black
Blotchy black uncoated areas	1. Poor cleaning 2. Nesting 3. Increase agitation 4. Cleaner not enough 5. Transfer time too long
Smutty black (rubs off)	1. Carbon on surface 2. Smut on surface prior to blackening 3. Too much pickle time 4. Return to clean to desmut
No blackening	1. Chrome or other metal contamination 2. Oxidizer depleted

TROUBLE SHOOTING BLACK MAGIC SS, AND SS L

PROBLEM	CAUSES AND CORRECTIVE ACTION
No blackening	1. Add mild steel wire or baskets 2. Surface not active 3. Increase pickle time 4. Pickle too weak 5. Bath damages by prolonged overheating 6. Light scale – need passivation
Smutty black	1. Too much pickle time 2. Over activation 3. Bath needs skimming 4. Bath needs desludging 5. Parts need passivation 6. Temperature too high
Iridescent colors	1. Temperature too low 2. Temperature too high 3. Need contact with steel 4. Bath damaged by prolonged overheating
Blotchy and uncoated	1. Poor cleaning 2. Nesting 3. Agitate parts 4. Poor surface finish 5. Needs contact with mild steel

BASE METAL EFFECTS

STEEL

Rust	Must be removed. Rust in equals rust out.
Scale	Must be removed. Scale in equals scale out.
Smutty Surfaces	Must be desmutted prior to blackening.
Other Oxides	Must be removed.
Previously Plated Parts	Must be stripped prior to blackening.
Matt Finish	Matt black result.
Bright Finish	Bright black result.
Heat Treated Steels	Usually has surface scale. Usually high carbon and are prone to smutting.
Induction Hardened	May produce off-color results. Blue, etc., typical. May require added activation. May require extended black time.
Tool Steel – High Strength Low Alloy – HSLA	Requires added activation. Usually requires extended black time. (40-60 minutes). Smooth finishes are slower to blacken. When welded, it is more difficult to descale and adjacent areas will be discolored.

CAST AND MALLEABLE IRON

Castings Other Than Stainless Alloys	Must be blackened in Black Magic®SS or Black Magic SS-C. Use minimum acid contact time. May require second cleaning to remove acid from pores. Should blacken in 2-5 minutes. Required extended rinsing after blackening. May require alternating hot and cold rinses. When oiled confirm water is displaced. ***Look carefully!***

STAINLESS STEELS

200 and 300 Series	Non magnetic. Activation is important, 3-5 minutes. Blackens best when in contact with mild steel. Typically blackens in 5-7 minutes.
302 and 303 Series	Usually a machined part. Sometimes require special activation, i.e. sulfuric, copper strip or phosphoric.
309 and 310 Series	Requires 3-hour activation, 10 minute blackening.
400 and pH Series	Magnetic. May require pre-passivation. Typical activation, 2-7 minutes. Blacken – 5-7 minutes.

Note: All stainless alloys should contact mild steel in blackening bath. Mild steel wire for “rack” parts, chain added to basket or barrel work.

QUALITY INSPECTION

LOOK FOR:

1. Uniform color.
2. Degree / richness of black. Blue vs. Black - Brown vs. Black
3. Smutty rub-off. There should not be any rub-off.
4. Rust
5. Red color of any degree is not acceptable.
6. Water packed with parts, parts not fully oiled.
7. Alkaline bleed-out / white streaks.
8. Residue in blind holes or threaded areas.

PERFORMANCE TESTING

1. Black color analysis – Outside lab.
2. Taber Abrader – Outside lab.
3. Oxalic acid test per MIL C-13924
4. Salt spray test per ASTM B117