



**CHEMEON™**  
**SURFACE TECHNOLOGY**

Replace Hex Chrome Now with an  
Environmentally Friendly/Drop-In  
Replacement

February 2017

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## REPLACE HEX CHROME NOW WITH CHEMEON TCP-HF

### Hexavalent Chrome

Hexavalent Chrome a.k.a. Sodium Dichromate / Cr<sup>+6</sup> is used for corrosion protection as a chromate and is also found in: Inks, polymer pigments, plastics, stainless steel, textile dyes, wood preservatives, leather tanning.

Cr<sup>+6</sup> is **prohibited** for use in the EU or import into the EU after September 21, 2017. Cr<sup>+3</sup> and Cr<sup>+0</sup> **are acceptable**. An average vehicle contains 4-8 grams of Cr<sup>+6</sup>. 2002 Data shows that ELV in EU community generate 8 to 9 million tons of Cr<sup>+6</sup> waste. Also Zinc chromate & chromium chromate are carcinogenic substances.

### Hexavalent Chrome Characteristics

- ▶ Wet, gelatinous film, drying at the surface. Subsurface moisture (dehydrating ~ 48 hours) provides self-healing and lubricity
- ▶ Hard coating surface (as compared to Cr<sup>+3</sup>)
- ▶ Offers torque and tension to meet fastener finishing requirement (fasteners ~ 45% of Cr<sup>+6</sup>)
- ▶ The permissible exposure limit (PEL) for Cr<sup>+6</sup> and all other Cr<sup>+6</sup> compounds is 5 micrograms/M<sup>3</sup> (for 8 hour time weighted average) per Occupational Safety and Health Administration (OSHA, 02/2006)

### Available options to replace Hexavalent Chrome

- ▶ Trivalent chromates with a topcoat or a sealer to enhance corrosion protection performance (some recent developments offer no-sealer/topcoat)
- ▶ No-Chrome coatings with zinc and/or aluminum flakes by different applications:
  - ✓ Spray
  - ✓ Dip
  - ✓ Spin
  - ✓ Immersion
- ▶ Unique Military Specified Trivalent Chromium Pretreatment, CHEMEON TCP-HF suite of products for overall superior performance without any topcoat or a sealer
- ▶ Other options include ceramic based coating

### Alternative Option: Cr<sup>+3</sup>

- ▶ Most conventional Cr<sup>+3</sup> baths require a topcoat or a sealer to enhance corrosion resistance performance (some offer equal performance without any sealer or a topcoat)
- ▶ Typical color is pale greenish yellow (compared with Cr<sup>+6</sup> gold yellow color)
  - ✓ Colors available (Dye)
- ▶ Deposits are not as hard (Cr<sup>+6</sup>) and not self-healing
- ▶ Heated bath (typical 140° F / 60°C)

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- ▶ Shorter bath life (requires drain & recharge)
- ▶ Non-conductive (unless applied over zinc alloy)

### Available Option: No Chrome Finish

- ▶ Most coatings are zinc/aluminum based
- ▶ Typical application is spray/spin
  - ✓ Recent development includes immersion
- ▶ Requires more than one coat application to achieve customer's engineering specification
- ▶ Color
  - ✓ Silver
  - ✓ Gray
  - ✓ Black
- ▶ Can not be used for finer thread fasteners
- ▶ Conductive due to its metal content (Zn, Al)
- ▶ Excellent corrosion resistance
  - ✓ Can be enhanced with a (plus) sealer

### Available MIL-SPEC Option: CHEMEON TCP-HF

- ▶ Trivalent Chromium Pretreatment (TCP) was originally developed by the United States Navy (NAVAIR) following extensive research
  - ✓ +2.5 years
  - ✓ 15,000 + test panels

CHEMEON TCP-HF is a simple drop-in replacement for hex chrome. Attributes include:

- ▶ Operates at room temperature with long bath life
- ▶ No sealer or a topcoat is required to enhance its performance (as compared to other alternatives)
- ▶ Harder deposit than conventional Cr<sup>+3</sup>
- ▶ Electrically conductive & excellent adhesion
- ▶ Can be subject to heat

What is CHEMEON TCP-HF?

- ▶ Trivalent Chromium (Cr<sup>+3</sup>) "HF" = Hexavalent Free
- ▶ Pre-treatment designed for aluminum (and other metals)
- ▶ CHEMEON has further developed and optimized
  - ✓ Over 10 years and 6,000+ test panels
- ▶ Replaces conventional hexavalent chrome (Cr<sup>+6</sup>) treatments
- ▶ Complies with ALL European Union's Directives

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- ▶ CHEMEON TCP-HF has passed all QPL testing for MIL-DTL-81706B for immersion and spray application, Class 1A and Class 3
- ▶ QPL approved May 15, 2006

CHEMEON TCP-HF can be used on various materials:

- ▶ Bare aluminum
- ▶ Anodized aluminum
- ▶ Zinc and zinc alloys
- ▶ IVD
- ▶ Cadmium
- ▶ Silver
- ▶ Brass
- ▶ Steel and Iron alloys
- ▶ Magnesium
- ▶ Zirconium

Application of TCP on Aft Section and Rinsing



- Paint system: TCP + self-priming topcoat (SPT)
- Fully non-chromated coating system



Full S-3 Airframe processed with TCP



S-3 with full TCP/SPT Coating System

CHEMEON TCP-HF on bare aluminum

- ▶ Meets or exceeds corrosion resistance of similar conventional Hexavalent chrome coatings
- ▶ Results of 168 to 500 hours can be achieved in salt spray testing (ASTM B117), depending upon the alloy tested
- ▶ Paint bonding properties are often dramatically improved compared to similar coatings
- ▶ CHEMEON TCP-HF is used to replace high and mid-temperature anodize seals

Extreme Temperature Exposure

- ▶ CHEMEON TCP-HF can be dried at temperatures exceeding 800°F (426°C), for most applications
- ▶ CHEMEON TCP-HF can be baked for hydrogen relief in excess of 500°F (260°C) for 24+ hours without loss of performance
  - ✓ Hexavalent chromates cannot be baked above 140°F (60°C) without loss of performance
- ▶ CHEMEON TCP-HF is an ideal undercoat for cured coatings and overcoat for plated materials that require subsequent hydrogen relief

Contact Resistance (Conductivity)

- ▶ Also known as (LER) Low Electrical Resistance
- ▶ Typically used in electric and electronic equipment where surface resistivity is required and critical
- ▶ Meets or exceeds electrical resistance per MIL-DTL-81706

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### Adhesion

- ▶ CHEMEON TCP-HF is an excellent chromate replacement for paint, rubber, and other material. Can be applied to magnesium, zirconium, steel, stainless steel as well as most other metals
- ▶ Meets or exceeds dry tape adhesion requirements for ASTM D 3359 method A & B
- ▶ Test results rated 5 out of 5 for tests on all substrates

<u>Material</u>	<u>Force (lbs.)</u>	<u>C/F max</u>	<u>D 3359</u>
Powder Coated Steel	.6121	8.17	Pass
Powder Coated Copper/Brass	.408	12.25	Pass
Powder Coated Aluminum	.7517	6.65	Pass
Wet Painted Steel	2.405	2.08	Pass
Wet Painted Copper/Brass	2.523	1.98	Pass
Wet Painted Aluminum	2.974	1.68	Pass

### CHEMEON TCP-HF as an anodize seal

- ▶ CHEMEON TCP-HF excels as a replacement for different seal applications on anodized aluminum:
  - ✓ boiling hot water
  - ✓ nickel acetate
  - ✓ chromic acid sealers
- ▶ 500 to 1000 hours of salt spray on thin film sulfuric vs. current technology corrosion failures at 500 + hour
- ▶ NO FAILURE after 1000 hours on 6000 and 7000 series alloys-conventional Type II anodize
- ▶ Has eclipsed 3000 hours in independent testing per ASTM B117

### CHEMEON TCP-HF EPA: "EPA" = Extended Protection Additive

- ▶ Developed for enhanced performance, offers better corrosion resistance
- ▶ Designed for consistent results specially for difficult alloys such as 2024
- ▶ Contains 25% CHEMEON TCP-HF plus 25% EPA additive
- ▶ QPL Approved

### CHEMEON TCP-HF EPA Application

- ▶ Same pre-treatment as CHEMEON TCP-HF
- ▶ Cleaning in mild alkaline detergent at 120°F(49°C)
- ▶ Etch in appropriate chemistry
- ▶ Corrosion resistance better with etch for 2024
- ▶ Surface activation in Nitric Acid @ 50%
- ▶ CHEMEON TCP-HF EPA @ 25% for 5 minutes
- ▶ CHEMEON TCP-HF EPA contains 25% CHEMEON TCP-HF plus 25% EPA additive

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### In Conclusion

- ▶ CHEMEON TCP-HF & CHEMEON TCP-HF EPA and CHEMEON TCP-HF SP (Spray) are viable alternatives to replace hexavalent chromate
- ▶ Performance is equal or better than conventional trivalent chromate
- ▶ It is conductive, harder deposit and cost effective
- ▶ It complies with **ALL** European Union Directives
- ▶ It conforms to MIL-DTL-81706B and MIL-DTL-5541F
- ▶ It conforms to ASTM D3359 and B921
- ▶ CHEMEON TCP-HF and CHEMEON TCP-HF EPA are QPL approved
- ▶ Our Trivalent chromium and zirconate chemistry provide superior performance and efficiency

**About CHEMEON Surface Technology**

CHEMEON Surface Technology is the only Woman Owned Small Business in the world that is licensed by the US Navy to manufacture and provide MIL-SPEC QPD/QPL Hex Free/Trivalent Chromate Conversion Technology. CHEMEON's patented and proprietary chemistries are internationally recognized for providing environmentally responsible hard material, surface engineering treatments and solutions.

Learn more at: [www.chemeon.com](http://www.chemeon.com)

If you would like further information on the content of this article/document, please contact us at [info@chemeon.com](mailto:info@chemeon.com) or call (888)782-8324, or, contact a CHEMEON partner of your choice from the list below:

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