CHEMEON TCP-HF*
A Environmentally Friendly & Drop-In Replacement To Hex Chrome

CHEMEON Surface Technology, LLC
2241 Park Place, Suite B
Minden, NV 89423
775.782.8324 | 888.782.8324
www.CHEMEON.com

(*formerly Metalast TCP-HF)
Cr\(^{+6}\) (Hexavalent Chrome) Background

- **Cr\(^{+6}\)** used for corrosion protection as a chromate and is also found in:
  - inks
  - polymer pigments
  - plastics
  - stainless steel
  - textile dyes
  - wood preservatives
  - leather tanning, etc.
- **Cr\(^{+6}\)** is **prohibited**
- **Cr\(^{+3}\)** and **Cr\(^{+0}\)** are **acceptable**
- Average vehicle contains 4-8 grams
- ELV in EU community generate 8 to 9 million tons of waste (**‘02 data**)
- Zinc chromate & chromium chromate are carcinogenic substances
Cr$^{+6}$ 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$^{+3}$)
- Offers torque and tension to meet fastener finishing requirement (fasteners ~ 45% of Cr$^{+6}$)
- The permissible exposure limit (PEL) for Cr$^{+6}$ and all other Cr$^{+6}$ compounds is 5 micrograms/M$^3$ (for 8 hour time weighted average) per Occupational Safety and Health Administration (OSHA, 02/2006)
Available Options To Replace Cr⁺⁶

- 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 Trivalent Chromium Pretreatment (TCP) developed by the United States Navy (NAVAIR) for overall superior performance without any topcoat or a sealer
- Other options include ceramic based coating
Alternative Options - Cr$^{+3}$

- Most conventional Cr$^{+3}$ 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$^{+6}$ gold yellow color)
  - Colors available (Dye)
- Deposits are not as hard (Cr$^{+6}$) and not self-healing
- Heated bath (typical 140° F / 60°C)
- Shorter bath life (requires drain & recharge)
- Non-conductive (unless applied over zinc alloy)
Available Options
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 Options “TCP”

- Trivalent Chromium Pretreatment (TCP) developed by the United States Navy (NAVAIR) following extensive research
  - +2.5 years
  - 15,000 + test panels
- Simple **drop-in replacement** for hex chrome
- 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 Cr³⁺
- Electrically conductive & excellent adhesion
- Can be subject to heat
What is CHEMEON TCP-HF?
- Trivalent Chromium (Cr\(^{+3}\))
  - “HF” = Hexavalent Free
- Pre-treatment designed for aluminum (and other metals)
- Developed and licensed by the United States Navy (NAVAIR)
  - Over 2.5 years and 15,000+ test panels
- CHEMEON has further developed and optimized
  - Over 3 years and 2,000+ test panels
- Replaces conventional hexavalent chrome (Cr\(^{+6}\)) treatments
- Complies with ALL European Union’s Directives
- CHEMEON TCP-HF has passed all QPL testing for MIL-DTL-81706-B for immersion and spray application, classes 1A & 3
- QPL approved May 15, 2006 and listed
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
CHEMEON TCP-HF

• 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
CHEMEON TCP-HF

- 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
CHEMEON TCP-HF

- **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.

<table>
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<th>Material</th>
<th>Force (lbs.)</th>
<th>C/F max</th>
<th>D 3359</th>
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<tbody>
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<td>Wet Painted Aluminum</td>
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<td>1.68</td>
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</tbody>
</table>
CHEMEON TCP-HF-Seal

- 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
“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
Conclusion

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

info@chemeon.com

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