

## **Electrochemical Cleaning (ECC)<sup>SM</sup> of Stainless Steel in Situ**

Electrochemical Cleaning (ECC)<sup>SM</sup> is a proprietary process unique to UltraClean Electropolishing Inc. and was developed specifically in response to the needs of the Pharmaceutical and Biotech industries. The need for a surface cleaning method that addressed the industries stringent surface cleaning requirements and a method of cleaning a wide array of substances, which often are encountered prove problematic to clean from the surface by conventional clean in place (CIP) methods. These substances may appear as stains, rouge or blotches, the composition of which could be organic or inorganic. More aggressive methods both chemical and mechanical can degrade the surface of the vessel in the process of removing these substances. Electrochemical Cleaning (ECC)<sup>SM</sup> not only addresses these cleaning issues but also prove to offer the additional benefit of enhancing the physical surface and improving the performance of stainless steels and higher alloys in aggressive service.

**(ECC)<sup>SM</sup> exhibits qualities of electropolishing, chemical cleaning and passivation. It is cost comparable to chemical passivation services and less expensive than full onsite electropolishing. It has been theorized if preformed on an aggressive preventive maintenance schedule that the vessel would eventually achieve the benefits of a completely electropolished process. This hybrid process offers a cost and turn around time similar to CIP methods but is not a replacement for performance of a properly prepared, executed and maintained electropolished surface.**<sup>1</sup>

The process of (ECC)<sup>SM</sup> works by exposing the surface to an electrolyte and current via highly specialized/propriety equipment. This process skims the surface removing  $\mu\text{m}$  (micrometers) of metal. The exposed surface is virgin to the bulk environment having never been exposed. Consequently all contaminates are removed leaving a clean surface. (ECC)<sup>SM</sup> can be performed effectively on vessels that have never been electropolished as well as those which

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<sup>1</sup> The ASME Biotech Pharmaceutical Equipment (BPE) Surface Committee is at present in the process of writing a specification and procedure for electropolish equipment. Keith Raney contributed the initial specification and procedure.

have a complete factory electropolish. In the later instance (ECC)<sup>SM</sup> can maintain an electropolished vessel within specified set of parameters given that the vessel is not allowed to deteriorate beyond the scope of (ECC)<sup>SM</sup>.

(ECC)<sup>SM</sup> cleans the surface microscopically, removes stains and brightens the surface. Passivation as specified in ASTM B 912 suggests metal removal between 5-10µm or .00019 to .0004 is required for passivation. Data has confirmed that our (ECC)<sup>SM</sup> process metal removal can be adjusted to fall in that range. When followed by proper rinsing techniques, Ultraclean can provide documentation certifying passivation to ASTM B 912 eliminating the need for follow-up passivation procedures.

**Verification of (ECC)<sup>SM</sup> is the same as with other conventional cleaning processes**

- 1) Visual (Absence of stains, rouge and surface contaminates)
- 2) Swab test for both organic and inorganic substances
- 3) Modified “Ferroxyl” Test A 380

It has been observed that (ECC)<sup>SM</sup> enhances the performance of vessels in that it facilitates cleaning and retards formation of rouge especially in Dionized / WFI vessels there by reducing the frequency of cleaning which favorably reduces operating cost and down time.

By nature of the (ECC)<sup>SM</sup> process procedure requiring in most instances that a operator physically enter the vessel an additional benefit is that the vessel surface can be closely inspected for pits and other surface defects. If encountered a corrective procedure can be discussed and if approved can be corrected by the same crew onsite reducing the necessity of a cost of a return visit or additional down time to correct. If defects are encountered the problem can be corrected which UltraClean personnel that are onsite, eliminating the need for a separate visit to correct these problems.